Penobscot River Habitat Focus Area *Implementation Plan*

March 2016

Penobscot River Watershed Habitat Blueprint Mission

NOAA programs and their partners will work together to restore diadromous fish populations in the Penobscot watershed to support healthy freshwater, coastal, and marine ecosystems and vibrant coastal communities.

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Part 1. Executive Summary

In 2011, the National Oceanic and Atmospheric Administration (NOAA) launched a new initiative called the NOAA Habitat Blueprint.[1] The Habitat Blueprint is a framework designed to increase the effectiveness and efficiency of the Agency's habitat protection and restoration efforts by facilitating strategic planning and action across NOAA line offices and with partner organizations. Key to this framework is identifying habitat focus areas: priority areas where NOAA and partner organizations and agencies work together to restore and protect regionally important habitats. To date, NOAA has designated ten habitat focus areas across the country. NOAA selected the Penobscot River as one of these areas in May 2014.

The Penobscot is Maine's largest river and the second largest in New England. The Penobscot watershed covers approximately 22,254 square kilometers - about a third of the state of Maine. Twelve diadromous fish species can be found in the Penobscot watershed including three species listed under the Endangered Species Act (Atlantic salmon, Atlantic sturgeon, and shortnose sturgeon) and three species recognized by NOAA as Species of Concern (alewife, blueback herring, and rainbow smelt). All twelve species serve unique and important ecological functions by connecting the marine environment to freshwater and terrestrial ecosystems and all twelve have been heavily impacted by a variety of human uses over the past 250 years, most notably by dam construction and resulting habitat loss.

NOAA has worked with many partner organizations on several restoration projects throughout the Penobscot watershed. This work has already resulted in major improvements in habitat quality and fish abundances. The potential to build on previous work and to leverage existing partnerships to restore and protect ecologically important fish habitats and threatened and endangered species made the Penobscot River an ideal Habitat Focus Area under NOAA's Habitat Blueprint Framework.

NOAA has five broad goals for the Penobscot River Habitat Focus Area:

1. Restore multiple diadromous species including river herring, rainbow smelt, and endangered and threatened species (i.e., Atlantic salmon, Atlantic 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 resilience of coastal communities.

5. Increase collaboration across NOAA to meet the needs of constituents for products and information.

[1] More information on NOAA's Habitat Blueprint can be found at http://www.habitat.noaa.gov/habitatblueprint

NOAA will address the Penobscot Habitat Focus Area goals through several targeted objectives. In order to effectively address the goals, the implementation of the Penobscot HFA is divided into three collaborative initiatives:

- Habitat Protection and Restoration
- Research and Science
- Communications and Outreach

Table 1: Summary of Objectives and Activities

Initiative	Objective	Goals Supported	Activities
Habitat Protection and Restoration	**Habitat Objective # 1 –** Identify priority areas for habitat protection and fish passage to increase access of diadromous fish to high quality habitat.	**1-5**	Barrier prioritization tool Prioritize diadromous species restoration projects
	Habitat Objective # 2 – Protect diadromous fish habitat using NOAA's regulatory authorities.	**1-3**	FERC hydropower relicensing ESA and MSA (EFH) consultations
	Habitat Objective #3 – Promote resilient infrastructure, remove dams, replace culverts, and construct fishways.	**1-5**	Dam removals Culvert replacements Fishways
Research and Science	**Research and Science Objective # 1 –** Support and promote monitoring or habitat protection and restoration projects to assess the effects on fish populations, habitat and water quality, and apply lessons learned for use in future restoration and protection efforts.	**1-5**	Fish counts @ Milford dam Penobscot River restoration monitoring Estuarine and marine fish studies Monitor diadromous fish populations
Communications and Outreach	**Communications and Outreach Objective # 1 –** Provide accurate and timely forecasts for river-based recreational activities	**4-5**	NWS Penobscot recreational forecast online
	Communications and Outreach Objective # 2 – Communicate the benefits of habitat protection and restoration for fish populations, water quality, recreation, and the resilience of coastal communities.	**4-5**	Websites Project fact sheets Stream Smart training
	Communications and Outreach Objective # 3 – Develop and enact a plan for targeted partner and stakeholder outreach.	**1-5**	Stakeholder outreach

Part 2. Background

NOAA's Habitat Blueprint

NOAA is charged with protecting, restoring, and maintaining coastal and marine habitats and the many species that rely on them. Abundant fish populations and resilient ecosystems require clean, productive, and accessible coastal and marine habitats. These habitats also provide economic and cultural benefits by supporting commercial, recreational, and sustenance fisheries; recreational opportunities such as boating and swimming; storm protection; tourism; and more.

In 2011 NOAA developed the Habitat Blueprint to guide the agency's habitat protection and restoration efforts. The Habitat Blueprint Framework was designed to increase the effectiveness and efficiency of NOAA's habitat work by facilitating strategic planning and action across NOAA line offices and with partner organizations.

Through the Habitat Blueprint NOAA aims to:

- Prioritize resources and activities across NOAA line offices.
- Implement innovative place-based habitat solutions to address coastal and marine resource challenges.
- Make natural resource management decisions and recommendations in an ecosystem context that considers competing priorities.
- Foster and leverage internal and external partnerships to increase the effectiveness and efficiency of habitat restoration and conservation efforts.
- Integrate and improve the delivery of habitat science across disciplines to facilitate conservation actions.
- Anticipate and address changes to coastal and ocean habitats due to development, climate, and other pressures.

NOAA aims to meet the goals of the Habitat Blueprint by:

- Establishing Habitat Focus Areas for long-term science and conservation.
- Implementing a strategic approach to habitat science to inform decision-making.
- Strengthening policy and legislation to enhance NOAA's ability to achieve habitat conservation.

Habitat Focus Areas are places selected by NOAA for implementation of the Habitat Blueprint. They represent priority areas where NOAA and partner organizations and agencies work together to restore and protect regionally important habitats.

NOAA designates Habitat Focus Areas through an internal process of nomination and review of potential sites. Stakeholder input is solicited and incorporated throughout the selection process.

Habitat Focus Areas are selected based on their potential to support:

- Healthy and abundant fish populations
- Recovered threatened and endangered species
- Protected coastal and marine areas and habitats at risk
- Resilient coastal communities
- Increased coastal and marine tourism, access, and recreation

As of January 2015, NOAA has designated ten Habitat Focus Areas throughout the United States (Figure 1).

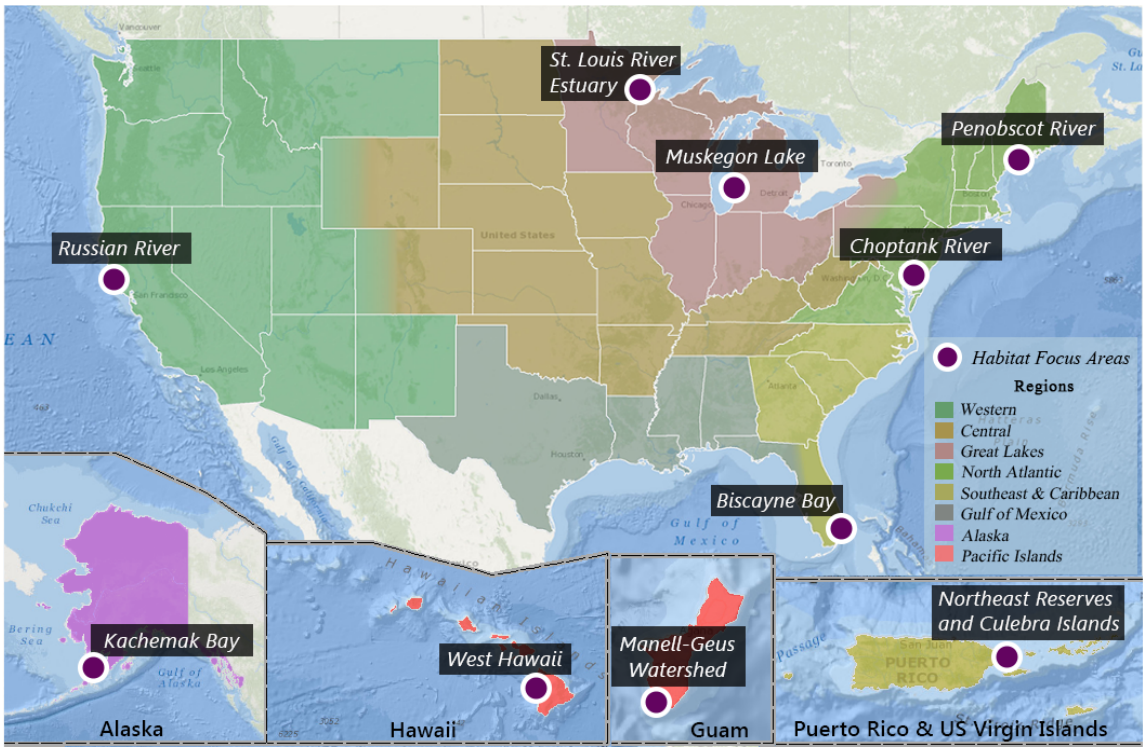

Figure 1: NOAA's Habitat Focus Areas.

The Penobscot River

NOAA designated the Penobscot River as a Habitat Focus Area in May 2014. The Penobscot is Maine's largest river and the second largest in New England (Figure 2). The Penobscot watershed covers approximately 22,254 square kilometers—about a third of the state of Maine. It encompasses 111 towns and 183 unorganized territories. The watershed is home to the Penobscot Indian Nation. Tribal territory extends from Indian Island north and includes islands in the Penobscot River in addition to fee and trust lands in the watershed. Population density and related urban development in most of the watershed is relatively low.

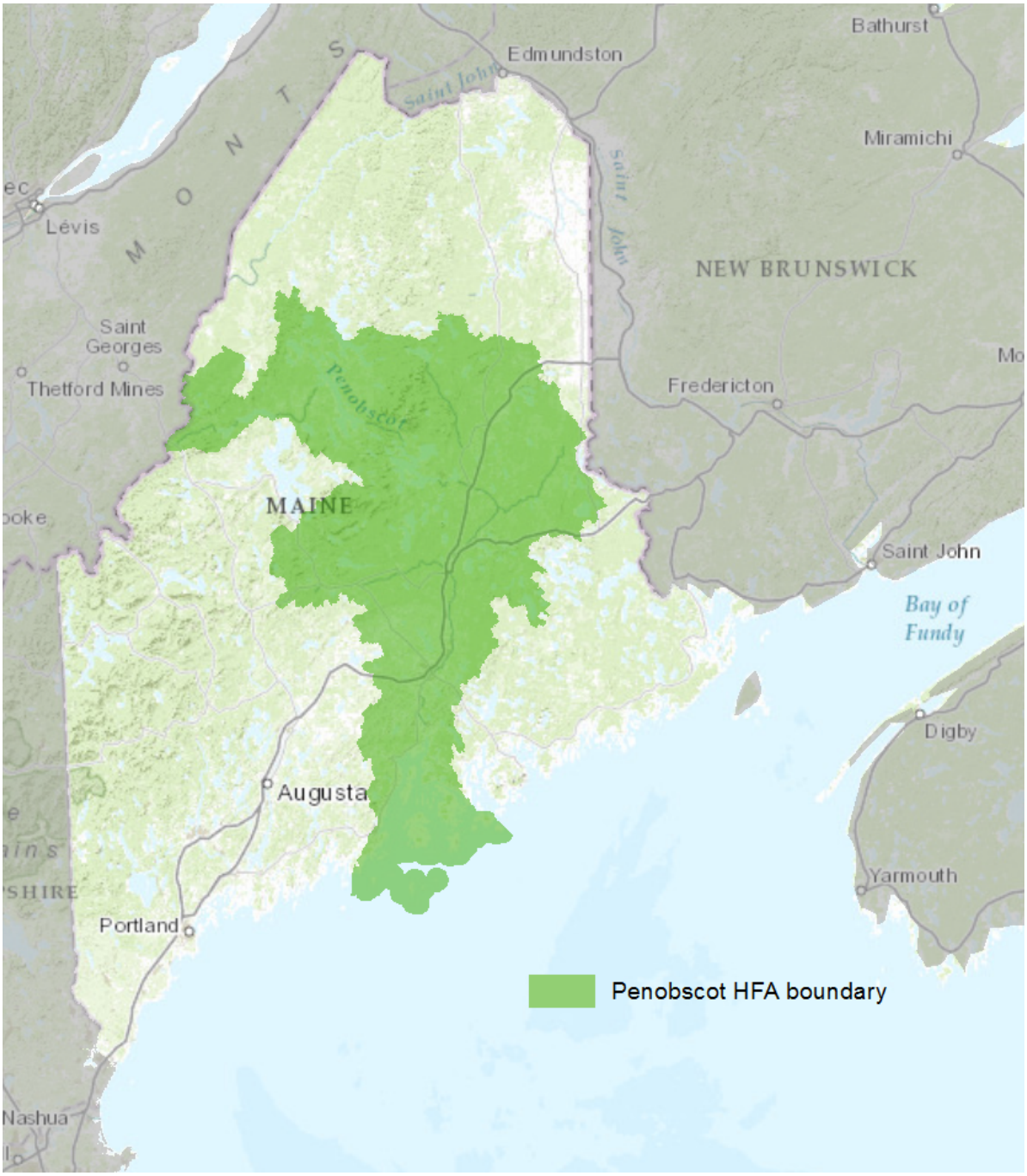

Figure 2: The Penobscot River Habitat Focus Area.

Twelve diadromous fish species can be found in the Penobscot watershed including Atlantic salmon, Atlantic tomcod, American shad, American eel, alewife, blueback herring, striped bass, Atlantic sturgeon, shortnose sturgeon, rainbow smelt, sea lamprey, and sea-run brook trout (Appendix A, Table 11). The term "diadromous" refers to species that spend part of their life cycle in freshwater and part at sea. Most of these species are born in fresh water but spend most of their juvenile and adult lives at sea (a life cycle known as anadromy). The American eel is unique among the river's diadromous species in that is born at sea but spends the majority of its life cycle in fresh water (a life cycle known as catadromy). Diadromous species serve unique and important ecological functions by connecting the marine environment to freshwater and terrestrial ecosystems, delivering marine-derived nutrients to inland ecosystems and providing food for a variety of predators.

Many of the river's diadromous species historically supported commercial, recreational, and sustenance fisheries and have great cultural significance. American eel, alewife, and blueback herring continue to support commercial fisheries. Recreational fishing occurs for striped bass, sea-run brook trout, and rainbow smelt.

Three of the diadromous fish species in the Penobscot watershed (Atlantic salmon, Atlantic sturgeon, and shortnose sturgeon) are listed under the Endangered Species Act (ESA) and three (alewife, blueback herring, and rainbow smelt) are Species of Concern. The Species of Concern designation indicates that for those species, NOAA has concerns regarding the current status and/or threats, or has insufficient information available to indicate whether listing under the Endangered Species Act is warranted.

The Penobscot River has been designated as Essential Fish Habitat (EFH) for Atlantic salmon by the New England Fishery Management Council. EFH is designated for all federally-managed fish and shellfish species.

Abundances of all twelve of the Penobscot's diadromous species declined greatly after centuries of habitat loss, fishing pressure, and pollution. Accurate estimates of the historic and current abundances of many of these fish are lacking; however, it is clear that abundances of most have dramatically declined over the past two hundred years (MDMR and MDIFW 2008). For example, throughout the nineteenth century millions of alewives, blueback herring, and American shad were harvested from the Penobscot River each year (Foster and Atkins 1869). Although historic population sizes are very difficult to estimate, Laser (2009) estimate the current production potential for alewives along to be greater than 17 million returning adults annually if access to all lake and pond habitat were available in so-called Phase 1, 2, and 3 lakes and ponds. Today there are fewer than one million river herring returning to the watershed, although the runs are increasing. Similarly, annual salmon runs were estimated to be between 40,000 and 100,000; today fewer than 1,000 adult salmon have returned in recent years, and the species is supported by a conservation hatchery program led by the U.S. Fish & Wildlife Service.

The Penobscot watershed and its fish populations have been heavily impacted by a variety of human uses over the past 250 years. Timber had been harvested from all corners of the watershed by the mid 19th century. Many dams were constructed throughout the watershed to aid in the transport of timber and to power saw mills and other industries. The first dam on the main stem of the river was built in the 1820s between the towns of Old Town and Milford. The first dam to span the entire length of the river was built near the town of Veazie in 1834. It was built without a fishway despite legal requirements to do so (Maine DMR and IF&W 2008). Dams have taken a heavy toll on the diadromous fish communities in the watershed. They have greatly diminished the access of fish to spawning and nursery areas, changed river flow rates, altered water temperatures, changed sedimentation patterns, and changed the shape of rivers and streams in the watershed (Hall et al. 2010, Enterline et al. 2012). There are currently 139 documented dams throughout the Penobscot River watershed.

By the middle of the twentieth century, water quality had greatly declined as a result of pollution from pulp and paper mills, other manufacturing facilities, and municipal wastewater. Wastewater treatment facilitated by the Clean Water Act led to significant improvement in water quality.

Fortunately, ongoing habitat restoration work exhibits promise for reversing the declines of many diadromous fish species in the Penobscot River. Future restoration work carried out in the watershed will build on the major habitat gains achieved by previous projects in which NOAA played a role. The largest restoration project to take place in the Penobscot River, the Penobscot River Restoration Project, was implemented by members of the Penobscot River Restoration Trust (including the Penobscot Indian Nation, American Rivers, the Atlantic Salmon Federation, Maine Audubon, the Natural Resources Council of Maine, the Nature Conservancy, and Trout Unlimited) with NOAA supporting the project with technical and financial assistance. With removal of the Veazie Dam in 2014, Great Works Dam in 2013, and construction of a fish bypass system at Howland Dam in 2016, the project is nearly complete.

The removal of the Great Works and Veazie dams and the installation of the new fish lift at the Milford dam have already benefited the river's diadromous fish species. Once the Penobscot River Restoration Project is complete, six of the twelve diadromous species in the river will have access to their entire historic range in the watershed (Trinko Lake et al. 2012). However, many barriers still remain in the watershed, including approximately 31 power-generating dams, 108 non-generating dams, and more than 2,100 culverts.

NOAA has invested in several other restoration projects in the Penobscot River watershed. For example, in 2009 NOAA, the U.S. Fish and Wildlife Service, and many other partners installed a fishway at Blackman Stream, a tributary of the Penobscot. This fishway allowed river herring to access Chemo Pond for the first time in over a century. In 2013 a second fishway allowed river herring to pass upstream of Chemo Pond into Davis Pond. In 2014 more than 140,000 river herring returned to Chemo Pond to spawn. Additional projects in which NOAA had a role include:

- installation of a fishway at Pushaw Lake in 2012, which improved access to almost 5,500 acres of alewife spawning habitat.
- removal of a dam on Marsh Stream in Winterport in 2010. This dam removal restored access of river herring, American eels, and Atlantic salmon to approximately 80 miles of stream habitat.

- installation of a fishway at Coleman Pond, a tributary to the Ducktrap River, which empties into Penobscot Bay. The fishway was installed in 2013 and Coleman Pond was stocked with alewives in 2014.

NOAA is interested in a sustainable model to continue the important work of habitat restoration.

The Penobscot Indian Nation

The Penobscot Indian Nation is a federally-recognized tribe whose ancestral lands include the entire Penobscot River Watershed. Their primary reservation is on Indian Island near Old Town, Maine, upstream of the Milford hydroelectric project. The tribe has a deep cultural history with their namesake river, and a tradition of sustenance fishing for diadromous fish that stretches back for millennia. The Penobscot Indian Nation was a member of the Penobscot River Restoration Trust and continues to work with NOAA on fish passage and barrier removals. Many potential projects within the Penobscot River watershed exist on tribal lands, which comprise over 67,000 acres and include some of the basin's largest alewife lakes, such as Mattamiscontis Lake (1,300 acres), East Branch Lake (1,122 acres), South Branch Lake (2,035 acres) and Salmon Stream Lake (659 acres). As a federal agency, NOAA has a federal trust responsibility to the tribe, and is required to fulfill government-to-government consultation per NOAA policy (NOAA 2013).

Part 3. Implementation Planning

This plan was developed by the Penobscot Habitat Focus Area implementation team, which is made up of an Executive Team and three sub-teams: Research and Science; Habitat Protection and Restoration; and Communications and Outreach. Below are brief descriptions of the roles and responsibilities of each team:

The **Executive Team** is charged with setting the overall strategic goals of the plan, specifying the roles and responsibilities for each sub-team, overseeing the development of the implementation plan, and identifying staffing and resource needs for successful implementation of the plan over the next three to five years.

The **Research and Science Team** outlines goals and strategies for monitoring and other research that can address the objectives of the Habitat Focus Area, outlines current and future activities that relate to these objectives, identifies data gaps and resource needs related to research/monitoring activities proposed in the plan, and recommends appropriate metrics for tracking progress.

The **Habitat Protection and Restoration Team** outlines goals and strategies for habitat restoration and protection within the Penobscot watershed, with a focus on restoring fish passage and protecting habitat for multiple diadromous species; outlines current and future activities that relate to these objectives; identifies resource needs related to habitat restoration and protection activities proposed in the plan; and recommends appropriate metrics for tracking progress.

The **Communications and Outreach Team** outlines goals and strategies for communications and outreach with multiple audiences, including strategies for identifying target audiences. In addition to outlining current and future communication and outreach activities, this team is tasked with providing guidance and recommendations for stakeholder engagement and identifying related stakeholder training tools (i.e., webinars, workshops, online mapping tools). This team also identifies resource and staff needs and metrics to measure progress in stakeholder engagement and outreach efforts.

Appendix B includes the names of all implementation team members.

These four teams, whose members span across various NOAA line offices, met regularly to discuss the ideas outlined in this implementation plan. These teams will continue to provide guidance and assist with the implementation of projects relevant to the Penobscot Habitat Focus Area.

Key NOAA Partners

Four line offices are working collaboratively on the Penobscot River Habitat Focus Area Blueprint (Figure 3).

National Marine Fisheries Service (NMFS) – NMFS is responsible for the management, conservation, and protection of living marine resources and the habitats they rely upon within the U.S. Economic Exclusive Zone (water 3 to 200 miles offshore).

National Ocean Service (NOS) – NOS is responsible for providing commitment to navigation services, coastal research and observations, emergency response, and place-based conservation programs such as coastal zone management.

National Weather Service (NWS) – NWS has the responsibility to provide weather, water, and climate information to protect life and property and enhance the national economy.

Oceanic and Atmospheric Research (OAR)/National Sea Grant College Program/Maine Sea Grant– The University of Maine is the state's designated Sea Grant College. Sea Grant supports marine and coastal research, education, and extension (constituent engagement).

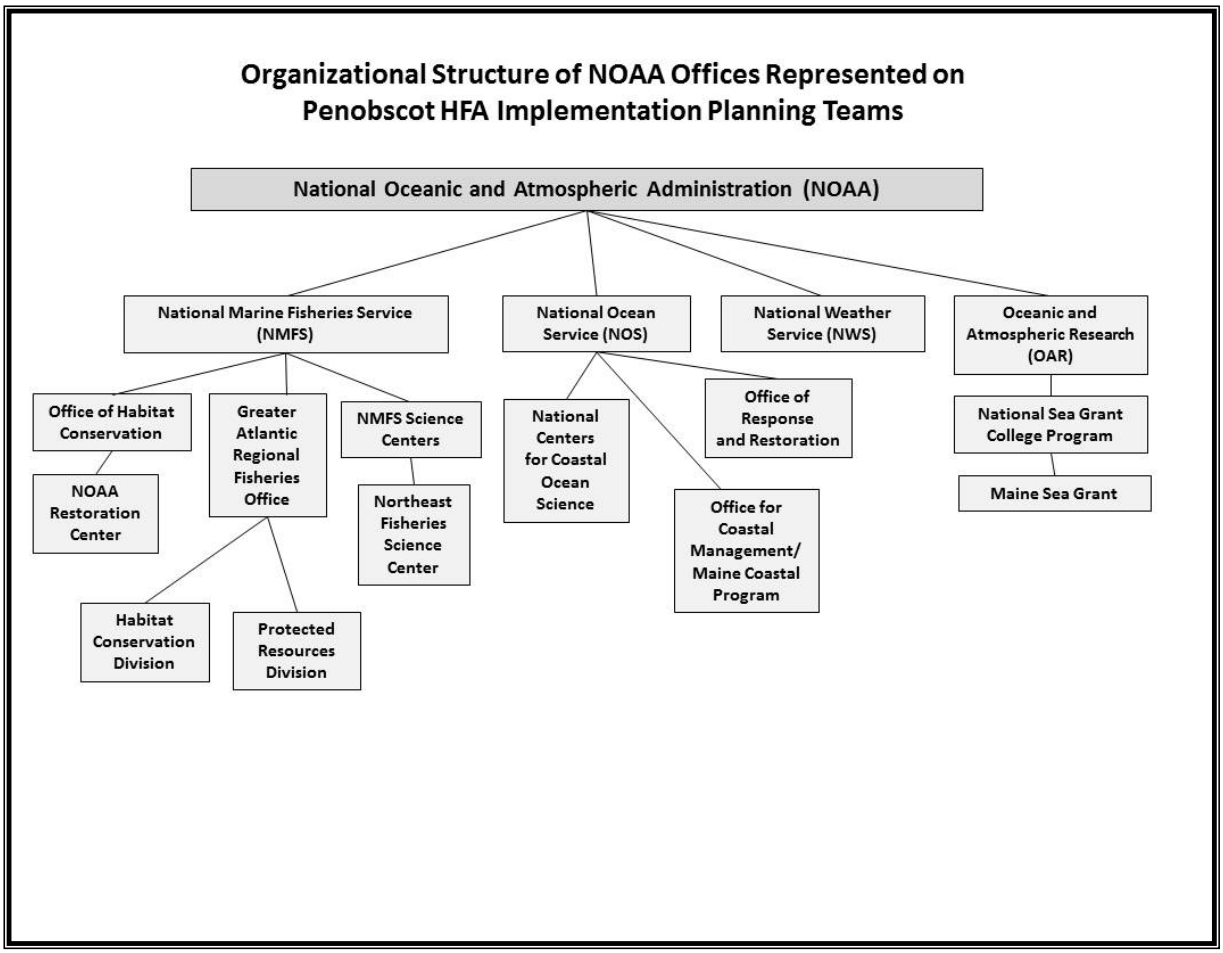

Figure 3. Organizational Structure of NOAA Offices Represented on Penobscot Habitat Focus Area Implementation Team

Part 4. Penobscot HFA Goals and Objectives

NOAA has already worked with many partner organizations on restoration projects throughout the Penobscot watershed, with resulting improvements in habitat access, habitat quality, and fish abundances. The potential to build on previous work, and to leverage existing partnerships to restore and protect ecologically important fish habitats and threatened and endangered species, made the Penobscot River an ideal Habitat Focus Area under NOAA's Habitat Blueprint Framework.

NOAA has five broad goals for the Penobscot River Habitat Focus Area:

1. Restore multiple diadromous species including river herring, rainbow smelt and endangered and threatened 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 resilience of coastal communities.
5. Increase collaboration across NOAA to meet the needs of constituents for products and information.

Restoration of the full suite of diadromous species in the Penobscot River represents an ecosystem approach to restoring the threatened and endangered species that use the river, including Atlantic salmon, shortnose sturgeon, and Atlantic sturgeon. "Diverse, abundant assemblages of native fish communities" and the ecological processes to which they contribute are considered essential to the recovery of endangered Atlantic salmon in the Gulf of Maine (Saunders et al. 2006, USOFR 2009).

Increased abundances of juvenile diadromous fishes, especially alewives and blueback herring, may also provide an increased prey base for many species throughout the Gulf of Maine, including Atlantic cod and other commercially important groundfish species. Centuries of fishing pressure have depleted groundfish populations in the Gulf of Maine. Commercial fishing not only greatly diminished the abundances of many groundfish species, but also sequentially depleted local subpopulations of Atlantic cod, haddock, pollock, and white hake. Local groundfish subpopulations were likely once supported by high abundances of young alewives that entered the sea at the mouths of several rivers, including the Penobscot. Recovery of these groundfish species may be hindered by the loss of their metapopulation structures which were supported by an abundance of alewives (Ames and Lichter 2013).

Restoration of the full suite of diadromous fish species in the Penobscot River will provide many indirect benefits to human communities in the watershed. Dam removals and culvert replacements will not only improve fish passage, but they are expected to improve water quality, provide enhanced storm protection to coastal communities, and create new opportunities for river-based recreation.

Increased NOAA collaboration with external partners, as well as internally, will provide stakeholders with information about the Penobscot watershed ecosystem and diadromous fish in order to increase awareness and interest in habitat restoration and protection activities.

In order to track and report progress on meeting these objectives in the next 3 to 5 years, each goal of the Penobscot Habitat Focus Area has a primary associated performance measure (Table 2).

Table 2. Goals of the Penobscot HFA and Primary Performance Measures

Goal	Primary Performance Measure
1. Restore multiple diadromous species including river herring and endangered and threatened species such as Atlantic salmon, Atlantic sturgeon, and shortnose sturgeon species.	Abundance and distribution of diadromous fish including river herring, rainbow smelt, American eel, and Atlantic salmon.
2. Improve the prey base for multiple offshore species including Gulf of Maine groundfish to support recreational, commercial, and sustenance fishing.	Presence of river herring in the gut contents of fish in estuarine, bay and Gulf of Maine waters.
3. Increase the quantity and quality of accessible habitat in the watershed.	Acres/stream miles/salmon habitat units of freshwater and estuarine habitat protected, enhanced, or restored as a result of Habitat Focus Area activities.
4. Promote habitat restoration that results in indirect benefits to water quality, watershed-based recreation, and the resilience of coastal communities.	Public education about the ancillary public benefits of habitat restoration.
5. Increase NOAA collaboration to meet the needs of constituents for products and information.	Number of inter-NOAA collaborative projects.

NOAA will address the Penobscot Habitat Focus Area goals through targeted objectives associated with three collaborative initiatives: Habitat Protection and Restoration, Research and Science, and Communications and Outreach (Table 3).

Table 3: Summary of Objectives and Activities

Initiative	Objective	Goals Supported	Activities
Habitat Protection and Restoration	**Habitat Objective # 1 –** Identify priority areas for habitat protection and fish passage to increase access of diadromous fish to high quality habitat.	**1-5**	Barrier prioritization tool Prioritize diadromous species restoration projects
	Habitat Objective # 2 – Protect diadromous fish habitat using NOAA's regulatory authorities.	**1-3**	FERC hydropower relicensing ESA and MSA (EFH) consultations
	Habitat Objective #3 – Promote resilient infrastructure, remove dams, replace culverts, and construct fishways.	**1-5**	Dam removals Culvert replacements Fishways
Research and Science	**Research and Science Objective # 1 –** Support and promote monitoring or habitat protection and restoration projects to assess the effects on fish populations, habitat and water quality, and apply lessons learned for use in future restoration and protection efforts.	**1-5**	Fish counts @ Milford dam Penobscot River restoration monitoring Estuarine and marine fish studies Monitor diadromous fish populations
Communications and Outreach	**Communications and Outreach Objective # 1 –** Provide accurate and timely forecasts for river-based recreational activities	**4-5**	NWS Penobscot recreational forecast online
	Communications and Outreach Objective # 2 – Communicate the benefits of habitat protection and restoration for fish populations, water quality, recreation, and the resilience of coastal communities.	**4-5**	Websites Project fact sheets Stream Smart training
	Communications and Outreach Objective # 3 – Develop and enact a plan for targeted partner and stakeholder outreach.	**1-5**	Stakeholder outreach

Part 5. Habitat Protection and Restoration – Objectives and Activities

Habitat Objective #1 - Identify priority areas for habitat protection and fish passage to increase access of diadromous fish to high quality habitat.

Through funding from NOAA's Habitat Blueprint, The Nature Conservancy (TNC) is working closely with NOAA, Maine Sea Grant, and other partners to implement a three-tiered approach to improve habitat and connectivity to diadromous fish and other aquatic organisms in the Penobscot watershed by removing dams and replacing impassable culverts. This approach includes: 1) planning and prioritizing key restoration activities; 2) outreach and education in key communities where these restoration activities are being considered; and 3) implementation of these projects.

The Nature Conservancy is currently working on completing a barrier prioritization tool. NOAA and TNC are convening experts to review existing data that can be used for prioritization, identifying data gaps, and gathering other information that would help guide habitat restoration projects in the three primary habitat zones in the watershed: lakes, lower river, and headwaters. Priority restoration projects will be chosen based on the proximity of valuable, abundant fish spawning and rearing habitat, type of barrier to fish passage, and project feasibility. The barrier prioritization tool will be available online, along with supporting educational materials discussed in greater detail below. Ideally, this tool can be synthesized with the Maine Stream Habitat Viewer, which is currently used by the restoration community to access available digital information on aquatic habitat across the state, but does not currently have any ranking or prioritization capability. As part of the communications and outreach initiative, Maine Sea Grant will work with TNC to develop an outreach plan for the prioritization tool.

Habitat Objective #2 - Protect diadromous fish habitat using NOAA's regulatory authorities

NOAA protects and restores diadromous fish habitat, including for threatened and endangered species, in the watershed through several existing authorities. NOAA's habitat protection and restoration work in the Penobscot River watershed is guided by a number of statutory authorities. The following four are of particular importance:

Magnuson-Stevens Fishery Conservation and Management Act (Magnuson-Stevens Act)

The Magnuson-Stevens Act supports the conservation and management of the nation's fishery resources by requiring the development and implementation of fishery management plans for federally managed species, a coordinated effort between NOAA Fisheries and regional Fishery Management Councils.

Under the Magnuson-Stevens Act, each plan must identify and designate essential fish habitat (EFH). Atlantic salmon EFH has been designated within the Penobscot River watershed. Federal agencies must consult with NOAA Fisheries on any action that it has authorized/permitted, funded, or undertaken that may adversely affect EFH. For example, if a project (such as a new bridge, road, or culvert) is proposed by a federal or state agency that may adversely affect EFH

and requires a federal permit, then NOAA Fisheries must be consulted. If NOAA Fisheries determines that an action would adversely affect EFH (i.e., reduce quality or quantity of such habitat), it is required to provide conservation recommendations to avoid and minimize adverse effects to EFH.

In addition, the Magnuson-Steven Act authorizes the Community-based Restoration Program to implement and support the restoration of fishery and coastal habitats. This program provides federal financial and technical assistance for local restoration projects and promotes stewardship and conservation values for NOAA trust resources.

Endangered Species Act

The Endangered Species Act provides for the conservation of endangered or threatened species of fish and wildlife and the ecosystems that they occupy. The Penobscot watershed provides habitat for two species listed under the Act as endangered (i.e., Atlantic salmon and shortnose sturgeon), as well as one species listed as threatened (i.e., Gulf of Maine Distinct Population Segment of Atlantic sturgeon). Under the Endangered Species Act, NOAA Fisheries is responsible for most marine, estuarine, and anadromous species. This responsibility includes the development of biological opinions to federal agencies for actions that may adversely affect listed species, prosecuting take violations, and issuing permits to states, local governments, and private landowners for activities that might harm listed species. The permitting review process is a way for NOAA Fisheries to be involved in minimizing dam impacts and improve environmental conditions for listed species and their critical habitat.

Fish and Wildlife Coordination Act

The Fish and Wildlife Coordination Act requires that all federal agencies coordinate with NOAA Fisheries, U.S. Fish and Wildlife Service, and state wildlife agencies when they are proposing actions that might alter (e.g., physically, chemically, etc.) a natural stream or body of water, potentially resulting in impacts on fish and wildlife.

Federal Power Act

Under the Federal Power Act, authority to license non-federal hydropower projects (dams) on navigable waterways rests with the Federal Energy Regulatory Commission (FERC). The Federal Power Act gives NOAA Fisheries, on behalf of the Department of Commerce, the authority to require safe, timely, and effective fish passage and recommend conservation measures to address negative effects to fish and wildlife resources at hydropower projects. The process of licensing and relicensing hydropower projects is protracted and may include years of negotiations between multiple stakeholders, resulting in the issuance of 30 to 50 year conditional licenses that oversee operations at each project. In addition, FERC issues licenses which are exempt from the relicensing requirements for the life of the project. NOAA Fisheries has the authority to issue terms and conditions that define the mitigation measures for the life of the project during the development of the original license. Once licensed, the opportunity to modify or require new mitigation measures is onerous. Therefore, influencing the conditions of an exempt license is considered to be a one-time opportunity.

These regulatory tools allow NOAA Fisheries to have a role in improving fish passage, requiring new passage, minimizing impacts to passage, and monitoring fishways. These regulatory authorities have played a part in barrier removal projects and habitat restoration to date, and will continue to be important parts of the Penobscot Habitat Focus Area objectives and future restoration projects. In particular, the relicensing of hydropower projects through FERC gives NOAA once-in-a-generation opportunities to improve fish passage protection at major barriers in the watershed. NOAA Fisheries is currently working with stakeholders on relicensing or post-license settlement monitoring on a number of hydropower projects in the Penobscot, and will continue to use its statutory authorities to request fish passage and habitat improvements (Table 4).

Table 4. FERC-Licensed or Exempted Hydroelectric Projects, Penobscot River Watershed.

Project (FERC No.)	Licensee	Expiration	Issuance	Water-way[1]	Description[2]	Proposed NOAA Action
Howland (2721)	Penobscot River Restoration Trust	09/30/00	09/12/80	PQ	Surrendered license; post-construction monitoring	Evaluating structural stability and passage of all diadromous fish
West Enfield (2600)	Bangor-Pacific Hydro Associate	05/31/24	06/26/84	PR	L; P	Evaluating passage of all diadromous fish
Mattaceunk (2520)	Great Lakes Hydro America, LLC.	08/31/18	09/30/88	PR	L; P	Evaluating passage success of Atlantic salmon; fully engaged in relicensing; supporting improved passage for all diadromous fish
Stillwater (2712)	Black Bear Development Holdings, LLC.	03/31/48	04/20/98	STW	L; P	Monitoring downstream passage effectiveness for diadromous species; recommending improvements
Milford (2534)	Black Bear Hydro Partners, LLC.	03/31/38	04/20/98	STW	L; R	Evaluating passage effectiveness for diadromous species; recommending improvements
Medway (2666)	Black Bear Hydro Partners, LLC.	03/31/29	03/29/99	WBPR	L; P	Ensure compliance with Biological Opinions, listing determinations and recovery objectives (Atlantic salmon).
Orono (2710)	Black Bear Development Holdings, LLC.	03/31/48	12/08/05	STW	L; P	Monitoring fish presence and attraction to fish trap; recommending improvement
Frankfort (6681)	Town of Frankfort	Exemption revoked	09/20/82	MS	Exemption revoked; town-owned dam.	Working with Town of Frankfort on feasibility study for fish passage improvements

[1] PN = Penobscot River; STW = Stillwater Branch; PQ=Piscataquis River; MS = Marsh Stream; WBPR = West Branch, Penobscot River
[2] L = License, E=Exempt, P=Post-license/settlement monitoring, R=Relicensing

In addition, there may be opportunities for restoration work with four hydropower projects within the Penobscot watershed that will be undergoing FERC relicensing within the time period of this implementation plan:

1. Goose River Dam, FERC project number 2804: License expires 2/29/20
2. Lowell Tannery Dam, FERC project number 4202: License expires 9/30/23
3. Ripogenus Dam, FERC project number 2572: License expires 9/30/26
4. Penobscot Mills Dam, FERC project number 2458: License expires 9/30/26

These relicensings, which typically begin five to ten years prior to license expiration, include opportunities for negotiated settlements that would support efficient fish passage and other potential restorative measures not typically captured in the FERC license. The proposed NOAA actions for project relicensings are still to be determined.

Maine Sea Grant will provide assistance to NOAA Fisheries as they develop public communications and outreach regarding agency involvement in hydropower licensing, especially for key gains such as requirements for new or improved fishways.

Habitat Objective #3 - Promote resilient infrastructure, remove dams, replace culverts, and construct fishways

Habitat restoration, including fish passage, is an important tool for addressing all of the goals for the Penobscot HFA. Restoration through the HFA will build on a legacy of past and ongoing projects in the watershed, and continue the cooperation between NOAA and other federal agencies, state agencies, local municipalities, and non-governmental organizations.

Existing Restoration Plans

At the core of the Habitat Blueprint framework is the idea that a Habitat Focus Area will be a place where NOAA's various programs can cooperatively work together to leverage each other's resources and expertise, as well as those of our partners, to achieve regional goals. In that light, it is important to recognize other plans that are in line with the Penobscot Habitat Focus Area objectives. There are four plans in various stages of development that should be highlighted:

State of Maine's Operational Plan for the Restoration of Diadromous Fishes in the Penobscot River (Laser 2009)

As the name suggests, this plan's overarching goal is to restore and guide management of diadromous fish population, aquatic resources, and their ecosystems for use by the public, with a focus on specific activities located upstream of Milford Dam. The Penobscot Habitat Focus Area implementation plan supports prioritizing habitat restoration projects that would assist in this overarching goal, specifically by supporting projects that enable efficient and successful upstream and downstream passage for diadromous fish at barriers that currently restrict access

between their historical habitats in the Penobscot watershed. In particular, this implementation plan strongly supports barrier removal and restoration activities focused on restoring and monitoring alewife habitat throughout the watershed.

NOAA Fisheries' Recovery Plan for Atlantic Salmon (in development, anticipated 2016)

In line with this recovery plan, the Penobscot Habitat Focus Area implementation plan supports activities that focus on removal or abatement of threats to Atlantic salmon and their habitats and provide access to areas that support the highest quantity and quality of diverse habitat for Atlantic salmon. The goal of the recovery plan is to recover Atlantic salmon to the point at which they can be delisted and no longer considered an endangered species. To do so would require a minimum of 30,000 units (1 unit = 100^2 meters) of good quality spawning and rearing habitat be accessible to salmon to allow for both survival and recovery. This implementation plan supports activities in the Penobscot that support the recovery of Atlantic salmon and identifies activities that restore access to salmon spawning and rearing habitat.

NOAA Fisheries' "Species in the Spotlight" Action Plan for Atlantic Salmon

To draw attention to this iconic species and our plan for saving it from extinction, NOAA Fisheries recently launched a "Species in the Spotlight—Survive to Thrive" initiative. Atlantic salmon are one of eight highly at-risk species in the nation that we have identified as needing special attention. These endangered species have declining populations, but also have a high probability of survival if we can marshal the resources to reverse the declining trends.

As part of the Species in the Spotlight initiative, we developed a five-year roadmap to aid the recovery of Atlantic salmon. The plan, released in early 2016, outlines specific actions to save this species, and involves our regional partners in conservation. The primary focus of the plan is to reconnect the Gulf of Maine with headwater streams.

NOAA Fisheries' Conservation Plan for River Herring

River herring (alewife and blueback herring) have been listed as a NOAA species of concern, and NOAA Fisheries and the Atlantic States Marine Fisheries Commission have recently developed a coast-wide proactive conservation plan for these species. In the Penobscot watershed, many of the 108 non-hydropower dams are located at the outlet of lakes or ponds, and have a particularly adverse effect on alewife populations. This implementation plan supports the overarching goals of this river herring conservation plan, particularly as they relate to restoring river herring habitat in the far reaches of the watershed.

In addition to these plans, the Penobscot Habitat Focus Area Implementation Plan supports restoring access to historical habitat of shortnose sturgeon, as part of the long-term recovery strategy of the 1998 shortnose sturgeon recovery plan. Although a recovery plan has yet to be drafted for Atlantic sturgeon, this plan is supportive of measures to restore habitat for that species as well.

Proposed Habitat Restoration

Habitat restoration is proposed to occur in all three primary zones of habitat, including headwaters, lakes, and lower river. As described previously, through NOAA Habitat Blueprint funding, The Nature Conservancy is working to improve habitat and connectivity to diadromous fish and other aquatic organisms in the Penobscot watershed by removing dams and replacing impassable culverts. Habitat restoration is also anticipated to involve other partners, such as the Penobscot Indian Nation, using other potential sources of NOAA and outside funding.

The strategy for habitat restoration in the Penobscot HFA, summarized by habitat zone, is as follows.

Headwaters

The Penobscot HFA seeks to restore access to high quality diadromous fish habitat in the headwater streams of the Penobscot River watershed. The primary beneficiary will be Atlantic salmon, which rely on cold, oxygenated streams and rocky substrates for spawning and rearing. Other beneficiaries include brook trout, a native coldwater species, and diadromous fish such as American eel and alewife that might use these streams as migration corridors to lake habitat. Headwater streams provide resilience to increasing water temperatures, and can contribute positively to the overall water quality of a basin.

Headwaters habitat also consists of mainstem and tributary riverine habitat upstream of the Milford hydroelectric project, which sits on falls that were the historic upstream limit of migration for several "lower river" species such as Atlantic sturgeon and shortnose sturgeon. By this definition, instream spawning diadromous fish species, such as American shad and blueback herring, also occur in headwaters habitat.

The primary threats to headwaters that will be addressed through the Penobscot HFA are barriers to fish migration, including dams and road crossings. Some of the dams in headwater streams date back to the Penobscot River's log-driving era, when timber and stone dams were constructed to manage streamflow and help transport logs to downstream mills. This legacy infrastructure, even when in poor condition, can block fish migration and create backwaters that increase water temperatures and fill in the interstices of gravel, cobble, and boulder substrates with fines and organics. Road crossings often consist of small diameter culverts, much less than the natural bankfull width of a stream, which become perched and create barriers through vertical drops, shallow depths and high velocities that preclude fish passage. Some road crossings also inundate stream habitat and create warmwater ponds that favor non-native predator species, such as chain pickerel and smallmouth bass.

Restoration tools for dams include complete removal, nature-like fishways, and technical fishways. Fish passage at road crossings can be restored through complete removal (i.e., road decommissioning) or the replacement of undersized culverts with "stream smart" fish-friendly designs such as open-bottom arch culverts, embedded culverts, or bridges that span the

bankfull width of the stream. Fish-friendly culverts and bridges have inverts of natural substrates (gravel, cobble, and boulder) that facilitate passage for multiple native fish and wildlife species. Sometimes barrier removals require additional restoration techniques such as the instream placement of large woody debris, streambank stabilization (including bank plantings), and the restoration of key habitat features, such as large boulders removed during the log-driving era, to streams. Restoration under the Penobscot HFA will follow recommendations in the Atlantic salmon recovery plan for the Penobscot Bay Salmon Habitat Recovery Unit (SHRU), which is under development (anticipated 2016) and build on the success of previous barrier removals undertaken by the NOAA Restoration Center and other partners.

The primary challenge for restoring habitat in headwater streams is the sheer number of barriers that exist. Most of the Penobscot River watershed has been surveyed for barriers, which include an estimated 2,100 road crossings, many of them moderate to severe barriers on headwater streams. The Nature Conservancy's barrier prioritization tool for the watershed will be used to identify and prioritize barrier removal projects in the headwaters. Since the Penobscot Indian Nation (PIN) has expressed interest in removing all fish passage barriers on their tribal lands in the watershed, the Penobscot HFA will work with PIN to identify barriers (mostly road crossings), develop a strategy for barrier removals, and assist the tribe with activities such as the design, permitting, construction, and monitoring of restoration projects.

The current status of habitat accessibility underscores the importance of the Penobscot HFA working in headwater habitats. Out of an estimated 16,000 km (9,942 mi) of rivers and streams in the Penobscot River watershed, an estimated 1,237 km (769 mi) of rivers and streams, or less than 8%, were considered free flowing and fully accessible in 2015 (Dan Kircheis, personal communication). In the Penobscot SHRU, there are an estimated 323,740 Atlantic salmon habitat units (NOAA 2009), of which only 8,432 habitat units, or less than 3%, are considered fully accessible. The recovery plan for Atlantic salmon is anticipated to call for at least 30,000 habitat units, or more than 9% of the total, to be suitable and fully accessible.

To date, barrier removals in the headwaters of the Penobscot River watershed have largely been opportunistic. TNC's barrier prioritization tool, anticipated to be online in 2016, will guide future fish passage improvement projects. Projects will benefit Atlantic salmon and other diadromous fish, be located within highly suitable habitat, likely occur within designated critical habitat, exhibit resilience to increasing streamflow and water temperatures, have few barriers downstream, have adjoining land use (e.g., forested conservation land) that is favorable to long term sustainability, and be accessible and feasible for restoration. The actual number of projects per year will depend on available budget, but based on past performance could number two to four projects per year. Priority projects are anticipated to include barrier removal projects on tribal land owned by the Penobscot Indian Nation (PIN). PIN has approximately 67,000 acres of land within the Penobscot River watershed that includes habitat for multiple diadromous fish including Atlantic salmon. Most of the land is undeveloped and managed for sustainable forestry, and has fewer barriers than elsewhere in the watershed. Using resources such as the TNC barrier prioritization tool, NOAA will work with PIN to develop a strategy for barrier removals on their lands, including for the remainder of the 5-year period

of the implementation plan. Depending on resources, NOAA will assist PIN with the design, permitting, construction and monitoring of barrier removals such as culvert replacements, and track the acres, stream miles and Atlantic salmon habitat units restored.

Lakes

The primary beneficiary of lake and pond habitat restoration is the alewife, which swims upstream to these still waters in the spring for spawning. However, lakes can offer habitat for other diadromous species such as the American eel, which can grow to adulthood in large bodies of water over the course of several years. Lakes also offer overwintering habitat for kelts (post-spawn Atlantic salmon). On many lakes, outlet dams block passage for diadromous fish, and in some cases water levels are managed for flood protection and power production. Lake and pond restoration projects are primarily related to fish passage for species such as alewife, and include dam removals and fishways, with habitat gains usually counted as acres restored.

The Penobscot HFA seeks to restore access for alewife to historic spawning habitat in lakes and ponds in the Penobscot River watershed. The State of Maine's *Operational Plan for the Restoration of Diadromous Fishes to the Penobscot River* (Laser 2009) provides a summary of the lakes and ponds upstream of the Milford hydroelectric project, which is outfitted with a Denil fish ladder and fish lift and now represents the lowermost dam on the mainstem of the Penobscot River. See Appendix C for the list of lakes and ponds, excerpted from the state study. In the state's plan, the lakes and ponds were divided into Phase 1, Phase 2, and Phase 3 waters with corresponding priorities for stocking and restoration (i.e., fish passage). Not all historic alewife lakes have barriers (dams or culverts) at their outlets, but most do. Barrier removal tools will likely include dam removal, culvert replacements or fishways. The state's goal was to work through the phases in order: Phase 1, then Phase 2 and finally Phase 3. A rule of thumb often used by the state is 235 returning adult alewives per acre, which can be used with surface area to calculate a potential run size for each lake. This is not a predicted or targeted run size per se, since adult returns depend on many complicated life history factors, including the mortality during juvenile outmigration, marine survival, predation, harvest (including bycatch), and passage effectiveness. A summary of the lakes and ponds in each phase, with surface areas and potential run sizes (based on 235 adults/acre), is as follows.

Table 5: The State of Maine's plan for alewife lake restoration (Laser 2009)

Phase	No. of Lakes and Ponds	Surface Area (acres)	Potential Run Size
Phase 1	13	16,337	3,839,195
Phase 2	31	25,863	6,077,805
Phase 3	12	32,405	7,615,175
Total	***56***	***74,605***	***17,532,175***

The timeline for the state's plan (up to 50 years) suggests that the Penobscot HFA's 5-year implementation plan might be little more than a down payment towards long-term alewife restoration in the watershed. In fact, alewife restoration has been underway in the Penobscot River basin for the last decade. Several projects were supported by NOAA. Of the 13 Phase 1 lakes in the state plan, most are accessible, with the NOAA Restoration Center planning to help fund two remaining fish passage projects, at East Branch Lake (1,122 acres) and South Branch Lake (2,035 acres), in 2016-2017.

Of the Phase 2 lakes, one fish passage project has already occurred with NOAA funding (Davis Pond, 417 acres). That leaves 30 lakes for restoration in Phase 2, which will likely require more than the 5-year timeframe of the Penobscot HFA implementation plan. This suggests that the Penobscot HFA should develop a strategy for continued alewife restoration. The strategy, and its relation to the alewife goals in the State of Maine plan for diadromous fish restoration, is described below. Key goals of the Penobscot HFA in regards to alewife restoration including the following:

- Restoration of alewife population sizes to historic numbers (e.g., 14 million to 20 million) should be supported. Fish passage projects should be supportive of run sizes that would occur naturally. While historic population sizes will not be restored within the 5-year time frame of the implementation plan, it is expected that there will be an upward trajectory in adult alewife returns during this period for the Penobscot River overall.
- Restoration of alewives to their historic distribution in the Penobscot River watershed (including all 56 lakes in the state's operational plan) should be supported, with returns to large and small lakes with differing trophic states. While impressive alewife returns could result from accessible passage to just a few large lakes, geographic distribution is thought to be important for promoting long-term resiliency and genetic diversity in alewife populations.
- While the state's plan is focused on the Penobscot River watershed upstream of the Milford project, alewife restoration in the lower Penobscot River and Penobscot Bay tributaries is of continued importance to the HFA, including tributaries such as the Orland River, Sedgeunkedunk Stream, Souadabscook Stream, Marsh Stream, and Ducktrap River.

The barrier prioritization tool being developed by The Nature Conservancy (TNC) will be used to prioritize fish passage projects for the 5-year time frame of the implementation plan. Tools for fish passage include technical fishways, nature-like fishways, dam removals, and culvert replacements, and will involve partners already in cooperative agreements with the NOAA Restoration Center, including the Atlantic Salmon Federation and The Nature Conservancy.

The state's plan for restoration (Laser 2009) focused on alewife habitat upstream of the Milford hydroelectric project, which is now the lowermost (most seaward) dam on the mainstem of the Penobscot River. However, significant alewife spawning habitat exists in the lower Penobscot River watershed, and not all of it is currently accessible. The Penobscot HFA will identify and prioritize potential projects in the lower watershed, and implement potential fish passage

projects in years 2 through 5. The Orland Village dam, with a feasibility study currently being undertaken by The Nature Conservancy through a cooperative agreement with NOAA, is a good example of a project that could improve passage in a subwatershed with 5,301 lake acres. Patrick and Saunders (2009) provides some perspective on the significance of the lower watershed to potential alewife production, listing the top ten subwatersheds by lake area and calculating the potential alewife production using 235 adults per acre.

Table 6: Alewife Lake Area in Penobscot Subwatersheds (after Patrick and Saunders, 2009)

Subwatershed	Lake Acres (total)	Potential Alewife Production
Piscataquis[1]	22,637	5,319,695
Mattawamkeag[1]	17,963	4,221,305
Passadumkeag[1]	15,939	3,745,665
Pushaw[1]	6,656	1,564,160
Orland[2]	5,301	1,245,735
Mattamiscontis[1]	3,324	781,140
Blackman[2]	2,232	524,520
Sedgeunkedunk[2]	1,476	346,860
Souadabscook[2]	940	220,900
Ducktrap[2]	814	191,290
Total	***77,282***	***18,161,270***

[1] Subwatershed upstream of Milford.
[2] Subwatershed downstream of Milford, tributary to lower river or bay.

Eighty-six percent of the total lake area (66,519 acres of a total 77,282 acres) is in the upper watershed, above Milford, with 10,763 acres (14%) in the lower watershed. Thus, the alewife habitat in the lower watershed is also important and can contribute significantly to the abundance, distribution, and resilience of the overall population.

Two important fish passage projects are already contemplated for the remaining Phase 1 lakes including East Branch Lake (1,122 acres) and South Branch Lake (2,035 acres). Both projects occur on Penobscot Indian Nation (PIN) tribal land and will consist of nature-like fishways. Funding is being provided by the NOAA Habitat Restoration Center through cooperative agreements with the Atlantic Salmon Federation (Community-based Restoration Program) and The Nature Conservancy (NOAA Habitat Blueprint). South Branch Lake construction is anticipated to be completed in Year 1 of the implementation plan (FY16), with East Branch Lake design and permitting anticipated for Year 1 and construction in Year 2 (FY17).

Using the barrier prioritization tool and assessing the accessibility of habitat in the lower watershed, the HFA will eventually be able to set some targets for restoration (i.e., alewife lake acres). As a preliminary target, it is assumed that improved fish passage at the Orland Village dam could occur within the 5-year timeframe of the implementation plan, which would improve access to upstream lakes such as Alamoosook Lake (1,133 acres) and Toddy Pond (1,987 acres).

Lower River

The lower river includes habitat used by the largest number of diadromous species, either as spawning or rearing habitat, or as a migratory corridor. For purposes of the Penobscot HFA, the lower river is defined as the Penobscot River and tributaries downstream of the Milford hydroelectric project. The lower river habitat includes the Penobscot River estuary and bay, as well as tributaries such as the Ducktrap River, and is comprised of both tidal and non-tidal habitat. Some of the habitat, such as the estuary, can seasonally support an overlapping assemblage of freshwater fish, diadromous fish, and even marine fish like Atlantic herring. Restoration projects typically include dam removals and culvert replacements for species such as rainbow smelt, which spawn in freshwater just above the head of tide in small tributaries to the estuary and bay, with many tributaries also occupied seasonally by river herring and Atlantic salmon. Restoration projects such as the removal of tidal barriers can provide resilience to sea -level rise and the increasing frequency of storm surges. The habitat gains of lower river restoration projects can include stream miles and/or acres restored. Lower river species are important recreationally, with a rich tradition of angling for Atlantic salmon (now listed as endangered), striped bass, rainbow smelt, and sea-run brook trout. While not a focus of the Penobscot HFA, lower river habitat also contains marine mammal species managed by NOAA, such as harbor seals, gray seals, and harbor porpoises.

While the amount of lower river habitat is collectively smaller than the amount of habitat upstream of the Milford hydroelectric project, the lower river historically has been very important to the Penobscot River watershed. While some diadromous species, such as alewives, were all but extirpated from historic habitat upstream of the Veazie dam, runs persisted in lower river tributaries such as the Ducktrap River, Orland River, and Souadabscook Stream. A commercial fishery for alewives still exists on the Orland River, and formerly existed on the Souadabscook. Some diadromous species—such as rainbow smelt, a NOAA species of concern—only exist in lower river habitat, which is also home to the Atlantic sturgeon (threatened) and shortnose sturgeon (endangered).

To date, barrier removals in the headwaters of the lower Penobscot River watershed have largely been opportunistic. Using TNC's barrier prioritization tool, a list of priority projects will be developed for the remainder of the 5-year period of the implementation plan. Until this exercise is performed, it is difficult to estimate the number of projects, stream miles and acres restored. It is anticipated that there will be a specific restoration plan developed for rainbow smelt by a NOAA-led team that includes other federal and state agencies and non-governmental partners.

NOAA has a significant ongoing investment in feasibility studies for two municipally-owned dams on tributaries to the lower Penobscot River, including the Frankfort dam on Marsh Stream and the Orland Village dam on the Orland River. The feasibility studies will be continued in the 5-year period of the implementation plan for the Penobscot HFA, with an eye to moving one or both projects to implementation. These two projects are described below.

Orland Village dam, Orland River.

Orland Village Dam. Located below the head of the tide on the Orland River, a tributary of the lower Penobscot River, the Orland Village dam was transferred to the Town of Orland in 2010, which still supports a commercial harvest of alewives at the site. The dam appears to be very vulnerable to climate change effects, particularly sea level rise and damaging storm surges, and will likely become a major expense to the small town to structurally maintain. Although the dam has two existing fish ladders, they are not accessible at all tide levels, and some lower river species such as shortnose sturgeon, striped bass and rainbow smelt will not use them. There is no dedicated downstream passage. The dam blocks 2.5 miles of river, submerges over 90 acres of historic tidal wetlands, and impedes access to over 3,120 acres of alewife spawning habitat. With the support of NOAA and others, the Town of Orland conducted an initial feasibility study in 2013 and the town will soon decide whether to maintain or remove the dam. NOAA, The Nature Conservancy, and others have been working with the town to answer outstanding feasibility questions (e.g., determining any other major fish passage barriers upstream of dam, forecasting projected water levels post-dam removal, etc.). If the Town ultimately determines to remove the dam, future funding activities will likely include final removal design and permitting, construction, as well as baseline (pre-removal) monitoring, including for intertidal habitat. The feasibility study will continue in Years 1 and 2 of the implementation plan, and include related outreach by NOAA, TNC and Maine Sea Grant. Outreach will include attending meetings of the Orland Dam Committee to assess stakeholder information needs; sponsorship of an educational booth at an annual local festival (Orland River Day); and development of information on fisheries history, feasibility study summaries, dam removal visualizations, and maps of the subwatershed and projected restored habitat.

Frankfort dam, Marsh Stream.

Frankfort Dam. Located at the head of tide on Marsh Stream, also a tributary of the lower Penobscot, the Frankfort Dam is owned by the Town of Frankfort and was formerly leased to a private company for hydropower production. This dam is currently the only barrier on the mainstem of the Marsh Stream, blocking 117 miles of stream and tributaries. After years of non-compliance on fish passage and under pressure from federal agencies, including NOAA, the Federal Energy Regulatory Commission revoked the dam's license exemption in May 2014, effectively ending hydropower generation at the site. In Years 1 and 2 of the implementation plan, the Town of Frankfort will be working with NOAA, The Nature Conservancy, and other partners to develop a feasibility study to determine options for the future of this dam, including removal. If the Town ultimately determines to remove or otherwise alter the dam, future activities under the cooperative agreement with TNC through the NOAA Habitat Blueprint grant will include final design and permitting, construction, as well as baseline monitoring.

NOAA, TNC and Maine Sea Grant will be conducting related outreach in Years 1 and 2 of the implementation plan, including the development of information on historic and potential fisheries , habitat restoration, and resiliency to climate change. A feasibility study summary will be developed in Year 2, along with any other information needs identified during Year 1.

Part 6. Research and Science – Objectives and Activities

Research and monitoring are critically important for understanding "what works" in regards to habitat restoration. There is a single objective of the research and science initiative:

Research and Science Objective # 1 - **Support and promote monitoring of habitat protection and restoration projects to assess the effects on fish populations, habitat and water quality, and apply lessons learned for use in future restoration and protection efforts.**

Many of the ongoing research and science initiatives predate the Habitat Blueprint, and are important to maintain in order to evaluate habitat restoration activities under the Penobscot HFA. These ongoing activities provide essential "before" snapshots that can be compared to "after" snapshots to evaluate the impacts of HFA-related restoration activities on a variety of metrics.

Current and Ongoing Research and Monitoring Efforts

Fisheries data collected at Milford hydroelectric facility to assess long term trends in fish populations.

A significant research activity ongoing within the Penobscot River that could be used to inform activities related to the Habitat Blueprint is the operation of the new Milford dam fish lift by the Maine Department of Marine Resources (DMR). Concurrent with the removal of the Veazie and Great Works dams (part of the Penobscot River Restoration Project), a modern fish lift was installed at the Milford dam. The Milford dam is currently the lowermost mainstem dam in the system and serves as a checkpoint for fishes migrating upriver of this area. Although many of the native diadromous species in the Penobscot River are constrained to the lower river below the Milford dam, many species undertake extensive migrations into the upper reaches of the watershed. The Milford dam fish lift provides an opportunity for the capture, sampling, and enumeration of migrating fishes and can provide a relative measure of the effectiveness of upriver restoration efforts. There can be some biases associated with the abundance measures estimated from the Milford fish lift, since passage at this facility is not 100% effective. Also, the natural range of some species does not extend upriver of the Milford dam area and therefore they are unlikely to be captured there. The species that do range upriver also have some quantity of spawning habitat below Milford dam. As an example, historic ranges of Atlantic salmon, alewife, blueback herring, and American shad extend beyond Milford dam, but there is some spawning habitat for each of these species below Milford dam. As such, estimates of abundance for these species derived from Milford dam should be considered minimal estimates. All four of these upriver species have been captured at the Milford dam fish lift since its installation. As noted above, the operation of the Milford dam fish lift and assessment of Atlantic salmon and other diadromous fish is currently undertaken by Maine DMR, with cooperation from Brookfield (dam owner), and supported by funding from NOAA through a cooperative agreement with the Northeast Fisheries Science Center separate from the Habitat Blueprint.

Ongoing monitoring related to the Penobscot River Restoration project.

Perhaps the most notable research currently occurring in the Penobscot watershed is focused on pre- and post-restoration monitoring of the removals of the Veazie and Great Works dams in the lower river. From the beginning of the Penobscot River Restoration Project, the Trust, NOAA and its partners recognized the importance of documenting the effectiveness of a project from which ecosystem-scale benefits were expected. NOAA has invested in nine long-term studies related to the Penobscot River Restoration Project. Each of these projects collected at least two years of data prior to the removal of the Veazie and Great Works dams and continue in their post-restoration monitoring efforts. Six of the nine studies are focused on migratory fish response, which is a level of fisheries monitoring not matched at a dam removal site anywhere else in the country. Two of the other studies focus on the chemical and physical responses of the ecosystem and another evaluates changes to wetland communities along the river. Cooperating investigators for these studies are from the University of Maine, University of Southern Maine, Gulf of Maine Research Institute, U.S. Geological Survey, Penobscot Indian Nation, and a local consulting firm. Funding partners with NOAA include the Penobscot River Restoration Trust and the Nature Conservancy. Collectively, these projects fall under the larger project entitled, "Rebuilding Sea-Run Fisheries of the Penobscot River by Removing Veazie Dam; Implementing Long-term Project Monitoring," which began in 2009. See Table 7 for more details.

Work on these projects is ongoing, and it is essential that funding is available to continue supporting this post-monitoring work well into the future if the expected ecosystem-scale benefits are to be properly understood and characterized.

Table 7: Nine Studies Comprising the Project Entitled "Rebuilding Sea-Run Fisheries of the Penobscot River by Removing Veazie Dam; Implementing Long-term Project Monitoring."

Number	Name of project	Goals of project	Principal Investigators and Collaborators
1	Channel Geometry, Bed Sediments and Photographic Monitoring	Surveys of channel elevation, sediment characterization, and repeat photographic monitoring at permanent cross sections representing important river features.	University of Maine and USGS
2	Water Quality, Water Temperature, and Benthic Macro-invertebrate Monitoring	Water quality/chemistry, water temperature, and benthic macro-invertebrate monitoring at numerous sites throughout the Project area to determine if and how water quality and benthic invertebrate community composition changes as restoration proceeds.	Penobscot Indian Nation
3	Fish Passage: Upstream Passage of Salmon and Other Diadromous Species (PIT tag methods)	Pre-removal and post-removal assessments of fish passage and migration timing/movements via PIT tags. Focus on salmon, but shad tagged as surrogate and other species as opportunities allow.	University of Maine, USGS, Maine DMR
4	Fish Passage: Seaward Migration of Salmon Smolt (active tag methods)	Monitoring the movement rates and survival of downstream passage for wild-reared juvenile salmon smolts captured and tagged with acoustic pingers, and released in the Piscataquis drainage. Movements of these fish downstream passively tracked using an array of acoustic receivers cooperatively maintained by USGS, University of Maine and NOAA.	University of Maine, USGS, Maine DMR
5	Fish Passage: Shortnose Sturgeon Habitat Use and Spawning	Conduct baseline monitoring of shortnose sturgeon in the Penobscot River to identify preferred habitat, to determine whether this population is spawning within the Penobscot River system, and to contribute toward population size estimates for this species.	University of Maine
6	Fish Passage: Diadromous Species Assembling Below Lowest Dam (hydroacoustics)	Using hydroacoustic technology to continuously record the presence and direction of travel of diadromous fish moving through the lower Penobscot River.	University of Maine
7	Fish Community Monitoring at the Reach Level (electrofishing and seining methods)	Quantify and characterize fish assemblages in the lower ~70 kilometers of the Penobscot River system using electrofishing and other methods.	University of Maine
8	Wetland and Riparian Habitat Mapping	The baseline phase of this investigation included monitoring of wetland and riparian plants and habitat and is scheduled to be repeated one year and five years following dam removals.	Boyle Associates
9	Marine-Derived Nutrients and Ecosystem Function (stable isotope methods)	This study explores the extent to which marine-derived nutrients and organic matter are incorporated into riverine food webs following restoration of diadromous spawning runs.	University of Southern Maine, Gulf of Maine Research Institute

Interpretation of ongoing estuarine and marine fisheries studies for possible information about ecosystem recovery in the Penobscot HFA.

In addition to the nine projects focused on long-term monitoring of the Veazie and Great Works dam removals, two additional projects are focused on the Penobscot River estuary and bay. Both studies overlap with the Penobscot HFA, and may provide insights into ecosystem recovery as diadromous fish populations rebound.

Project Name: The Penobscot Estuarine Fish Community and Ecosystem Survey
Principal Investigators: NMFS, University of Southern Maine, Darling Marine Center
Project Goal: Describe changes in species composition and pelagic fish density (using hydroacoustic methods) over time and space in the Penobscot estuary. Knowledge gained from the study will improve our ability to: 1) manage estuaries in the future; 2) understand ecosystem services (e.g., nursery habitat for river herring and American shad) that estuaries provide; 3) describe the environmental and biological conditions experienced by Atlantic salmon smolts as they transition to life at sea.
Status: Project began in 2010 and is ongoing (funding by NMFS).

Project Name: Quantifying alosine prey in the diets of marine piscivores in the Gulf of Maine
Principal Investigators: NMFS
Project Goal: Quantify the spatial and temporal distribution of the occurrence of anadromous fishes in the stomachs of groundfishes in Maine coastal waters.
Status: An earlier part of the study (2010-2011) was completed (McDermott et al. 2015). Sampling continued in 2012 and is ongoing (funding by NMFS).

Future Potential Activities

Monitor diadromous fish restoration on a watershed scale.

Another major monitoring needed is a comprehensive monitoring plan to evaluate the abundance and distribution of diadromous fishes as a result of Penobscot HFA funded restoration initiatives. Ultimately, the Habitat Blueprint initiative for the Penobscot is about restoring sea-run fish and the ecological services that they provide. As such, a temporally and spatially explicit comprehensive monitoring plan is needed to track our progress towards reaching that goal.

Diadromous fishes historically accessed all areas of the Penobscot River drainage. With the installation of passage impediments (dams, road crossings, culverts etc.), connectivity within the Penobscot drainage was drastically reduced. Ongoing restoration efforts and this Penobscot HFA aims to increase connectivity within this system to the benefit of all diadromous species with the goal of increasing populations. To effectively monitor these processes, a comprehensive watershed scale monitoring plan is needed to ensure that connectivity improvements are realized throughout the entire Penobscot watershed.

We want to ensure that the benefits of restoring the sea-run suite of fish to the Penobscot Basin occur throughout the basin. From a population standpoint, it is essential to assure that recovery is distributed geographically to ensure that the risks of population declines due to environmental stochasticity (i.e., random variability common in natural systems) are spread out. Simply put, populations as a whole are more resilient to environmental variation if they are spread out across large areas (i.e., more eggs in more baskets). Additionally, from an ecological process standpoint, it is desirable to have the benefits that diadromous fishes provide occurring throughout a watershed rather than in one confined area. Finally, having restoration occur in a sizable portion of the watershed is necessary to increase population abundances to levels that may be large enough to provide benefits outside of the watershed (i.e., increasing the forage base in the marine environment).

A comprehensive monitoring plan focusing on the lower river, upper river, and lakes habitats could provide information on the restoration of diadromous species at the watershed scale. Focusing on these three habitats will provide the spatial converge needed to provide specific assessments for individual species as well as general assessment for other related species.

Given the varied range of diadromous species within the Penobscot drainage, it makes sense to tailor monitoring plans to be area and species specific. As an example, some species are restricted to the lower river (e.g., rainbow smelt) where as other species migrate through the entire drainage to the upper most reaches and some spawn exclusively in lake habitats (i.e., alewife). Additionally, some species whose range spans the entire drainage, such as American eels and Atlantic salmon, pose particular challenges and have substantial drawbacks when attempting to base a monitoring program around them. American eels, for example, pose a particular problem in establishing effective monitoring and/or capture platforms. Atlantic salmon have been experiencing a significantly reduced marine survival regime since the early 1990's and therefore adult abundance and distribution estimate may prove to be an unreliable metric to gauge efficacy of habitat improvements.

As such, the proposed monitoring plan would focus on three primary areas and three primary species:

- Lake habitat - alewife
- Lower river habitat - rainbow smelt
- Upper river habitat - American eel (*tentatively*)

Below we propose an overview of what the individual components of the monitoring plan would entail.

Lake habitat - alewife

River herring (alewife and blueback herring) monitoring is being conducted by Maine DMR at the Milford fish lift and the fishway at Blackman Stream (lower river below Milford dam). At Milford dam, river herring monitoring is also used to determine the relative proportion of

alewives to blueback herring throughout the season. The morphology of alewife and river herring is very similar and it can sometimes be difficult to distinguish the two species. The two species have different habitat preferences with alewife spawning in lake habitats and blueback herring spawning in riverine habitats. Given this, monitoring that occurs at a lake outlet would be a targeted effort towards alewife only.

Additional counts of alewife at sites other than Milford dam and Blackman Stream will ensure that recovery is occurring throughout the Penobscot Basin. Alewife counts can be obtained by a number of methods depending on the specific of each location: volunteer counting stations, electronic fish counters, or video monitoring conducted at lake outlets or other constrictions in the river.

A series of monitoring locations would be chosen throughout the drainage to ensure a broad geographical representation. Considering that active alewife restoration is occurring within the drainage area through stocking in concert with habitat improvement efforts, it would be important to select locations that can monitor the effectiveness of these restorations efforts as well as the dynamics of natural recolonization. Obtaining information on the pace of natural recolonization of alewives will also have major benefits to future restoration efforts particularly in considering the costs and benefits of stocking program.

Roughly six additional monitoring sites (in addition to the Milford fish lift and Blackman stream sites) would be needed to effectively monitor the restoration of alewife within the Penobscot watershed as a result of Penobscot River HFA initiatives. In some instances, additional monitoring sites may be required for localized monitoring associated with a specific habitat restoration project.

We estimate that monitoring six additional sites throughout the drainage would cost approximately $46,000 annually. Most of this funding would be used for seasonal technician salary and travel support to run the monitoring program with some funding dedicated in year one to purchase the necessary monitoring equipment. However, final costs may vary substantially depending on the locations chosen, proximity of monitoring locations chosen (i.e., more proximate location may result in reduced funding), need to purchase or replace monitoring equipment in year one or subsequent years. Whenever possible, the monitoring program will be expanded upon to collect data all non-target species to help inform the larger effort. In Year 1, the Research and Science Team (in collaboration with Maine DMR, the Penobscot Indian Nation, and The Nature Conservancy) will develop a detailed comprehensive monitoring plan as outlined above, with specific monitoring locations identified, clear objectives, and proposed detailed budgets.

Lower river habitat - rainbow smelt

Currently there is only a single location where counts of rainbow smelt are occurring on the Penobscot River. Tannery Brook in Bucksport has been monitored annually since 2008 and has yielded some useful information. However, Tannery Brook is not adequate to monitor the restoration of rainbow smelt populations within the Penobscot drainage as a result of the Penobscot River HFA initiative. Additional counts of rainbow smelt are needed.

Rainbow smelt counts are typically obtained via fyke nets. It is envisioned that upwards of six monitoring sites (locations to be determined) would be needed to effectively monitor the restoration of rainbow smelt within the lower Penobscot watershed as a result of Penobscot River HFA initiatives. In some instances, additional monitoring sites may be required for localized monitoring associated with a specific habitat restoration project.

Ballpark funding estimate to monitor six sites throughout the lower river would be approximately $40,000 annually. Most of this funding would be used for seasonal technician salary and travel support to run the monitoring program with some funding dedicated in year one to purchase the necessary monitoring equipment. However, final costs may vary substantially depending on the locations chosen, proximity of monitoring locations chosen (i.e. more proximate location may result in reduced funding), need to purchase or replace monitoring equipment in year one or subsequent year, etc. Whenever possible, the monitoring program will be expanded to collect data for all non-target species to help inform the larger effort.

Upper river habitat - American eel (tentative)

American eel monitoring is currently not conducted on the Penobscot River. American eels pose particular challenges for a monitoring program given their wide distribution throughout the drainage and difficulty to capture and sample. There is a small amount of American eel research currently occurring within the Penobscot River and initial discussions have begun with these researchers as to the logistical requirements for setting up an effective American eel monitoring program. These conversations will continue and an American eel monitoring plan will be developed over the next year. If a suitable monitoring plan can't be developed or isn't logistically feasible, the Research and Science Team will address this deficiency and provide a suitable alternative if applicable.

<u>Additional studies to assess Penobscot HFA efforts.</u>

In addition to the above detailed monitoring needs, numerous other specific projects were identified that may be helpful in supporting and promoting the monitoring of habitat protection and restoration projects associated with the Penobscot River HFA. These projects are identified in Table 8.

This "wish list" of future activities was generated through discussions within the Research and Science Team. The details of these projects need to be fully fleshed out, particularly descriptions of actions, leads, partners involved, expected start and completion dates, performance measures, and resources required. This list will continuously be reviewed and updated with more information by the team annually.

Table 8: Future Potential Activities to Support and Promote Monitoring of Habitat Protection and Restoration Projects.

Name of project	Goals of Project	Potential Researchers and Collaborators	Potential Budget
Sentinel fishery (Penobscot East Resource Center)	Explore linkages between sea run fish restoration and groundfish population dynamics	To Be Determined	To Be Determined
Measuring the physical environment in lower river (e.g., tide gauges, modelling)	To support a variety of ecological monitoring and modeling purposes.	To Be Determined	To Be Determined
Summary of research & monitoring studies to date	The results of science and monitoring studies to date should be shared with stakeholders in a "State of the River" or similar report written for non-technical audiences.	Sea Grant, NOAA, Penobscot River Restoration Trust	~ $10,000 for staff to write, edit, and design the report. ~ $5,000 for printing.
Organizing one-day meeting focused on lower river for partners to share their work	Bring partners together who have been doing work on the lower Penobscot to present and share findings from various research; identify a mechanism for continued information exchange.	To Be Determined	To Be Determined

Part 7. Communications and Outreach – Objectives and Activities

While NOAA's previous restoration activities garnered a lot of press and public acclaim, outreach was mainly tied to local projects after completion, and consisted of press releases, web postings, and dedication events. The Penobscot HFA provides an opportunity to educate an even wider audience about the value of habitat restoration and coastal resilience. Hopefully this will inspire local communities to think about habitat in their day-to-day planning, and begin to line up the next generation of restoration projects including dam removals and culvert replacements. For many communities, the cultural shift to thinking about habitat and a Penobscot River teeming with sea-run fish will come through an interest in other community benefits, such as improved water quality and recreation such as watching wildlife, walking and picnicking in waterfront parks, boating, and fishing. Therefore, the outreach will not only consist of telling the good stories that come out of the Penobscot HFA's restoration activities, but also communicating the science of restoration.

The three communications and outreach objectives are as follows:

Communications and Outreach Objective #1 - Provide accurate and timely forecasts for river-based recreational activities.

Communications and Outreach Objective #2 - Communicate the benefits of habitat protection and restoration for fish populations, water quality, recreation, and the resilience of coastal communities.

Communications and Outreach Objective #3 – Develop and enact a plan for targeted partner and stakeholder outreach.

Communications and Outreach Objective #1 - Provide accurate and timely ecological forecasts for river-based recreational activities

Currently, NOAA's National Weather Service supplies recreational weather forecasts of the upper and lower Penobscot River on their website, but there would be utility in making this information more user friendly by incorporating it into a map. The recreational forecast grew out of another popular forecast for Mount Katahdin, Maine's highest mountain, which is in the Penobscot River watershed and is an extremely popular hiking destination. In Year 1 Maine Sea Grant will work with NWS to identify appropriate places to share the forecast URL, work with the NWS on a "roll out" of the forecast, and explore the possibility of a river climate fact sheet. The Penobscot HFA may also explore other potential tie-ins to NWS products, such as predictions of river stage, and explore the feasibility of ecological forecasting for parameters such as salinity and temperature.

Communications and Outreach Objective #2 - Communicate the benefits of habitat protection and restoration for fish populations, water quality, recreation, and the resilience of coastal communities.

This objective is described by both current activities and future potential activities.

Current Activities

TNC Barrier Prioritization Tool and Restoration Projects
Currently, Maine Sea Grant is contracted by The Nature Conservancy to develop outreach material in support of the TNC barrier prioritization tool. Funding for this work is part of current the NOAA Habitat Blueprint multi-year grant. Maine Sea Grant is establishing a web presence and is compiling educational information about the ecological and social benefits of barrier removal and fish passage projects, project successes to date, and descriptions of what work remains to be accomplished. In addition, Maine Sea Grant is compiling and publishing information specific to communities participating in feasibility studies for future restoration efforts (i.e., Orland and potentially Frankfort). This information, informed by assessments of various stakeholder needs, will include fisheries history, summaries of likely impacts of restoration efforts on various fish species, history of dams under consideration, and other frequently asked questions. Information will be available in multiple media (e.g., web content, handouts, newsletters, videos, kiosks, etc.). Sea Grant is also organizing site tours to connect stakeholders to the restoration sites.

Also part of the Nature Conservancy's grant, Maine Audubon is offering at least three Stream Smart workshops for public and private road managers and restoration practitioners responsible for road-stream crossings. The goal of these workshops is to educate states, towns, and private landowners/managers in how to construct crossings that maintain fish and wildlife habitat while protecting roads and public safety.

Community Outreach Events and Educational Programs
NOAA is involved with a number of community outreach events along the Penobscot, such as annual multiple day events such as Endangered Species Day, and local riverfront festivals. In addition, NOAA is involved with informal K-12 education programs, such as the Penobscot River Keepers and a program called Salmon in Schools. Outreach about these events to date has been ad hoc and informal, but outreach for future activities could be bolstered to garner awareness.

Future Potential Activities

Development of project- and topic-specific fact sheets are within the scope of Sea Grant's existing contract with TNC and role on the Executive Team. The Outreach & Communications Team has identified the following activities as desirable and/or necessary, but additional funds would be required.

Table 9: Future Potential Activities for Communications and Outreach.

Name of project	Goals of project	Potential Researchers and Collaborators	Potential Budget
Outreach and communication focused on Penobscot River Restoration Trust's post-monitoring studies	Explain to the public what these studies show about the impacts on large dam removals in the lower Penobscot River	Maine Sea Grant, NMFS	$15,000 for printed report, more for sustained outreach and web presence.
Outreach and communication to commercial fishermen in the Gulf of Maine about efforts taken to promote groundfish species	Better communicate the connection between river herring and groundfish, support work conducted by Sentinel fishery (Penobscot East Resource Center)	NMFS, Maine Sea Grant	Fact sheet in development; $500 for printing
Summarize water quality/mercury pollution in Penobscot River and Bay	Educate public of current status of water pollution	To Be Determined	To Be Determined
Identify additional weather or water forecast needs	Support recreational activities within the watershed	NWS, NMFS, NOS, Sea Grant	To Be Determined
Bring back Penobscot River Revival Festival	Bring attention to the waterfront and show public what is going on in the water	NMFS	To Be Determined
Develop "fish friendly" road crossing/culvert signs	Bring community awareness to sustainable activities	NMFS	To Be Determined
Support diadromous fish-related sculpture/ outdoor art on Bangor waterfront	Bring community awareness to sustainable activities	NMFS	To Be Determined
Create short videos of Penobscot HFA	Highlight Penobscot HFA nationally	NOAA HQ Communications, NMFS	To Be Determined
Improve coordination with Baykeepers Group	Broaden coordination on estuary and bay issues	NMFS Penobscot Watershed Conference planning committee	$20,000 total conference budget; Sea Grant has already committed support

Communications and Outreach Objective #3 – Develop and enact a plan for targeted partner and stakeholder outreach

While the outreach in the previous objective is relevant to how the Penobscot HFA communicates with key partners and stakeholders, some partners and stakeholders might like to engage NOAA in deeper and more detailed conversations about activities such as restoration and scientific research. For purposes of outreach, we are defining "partners" as agencies, tribes or non-governmental organizations that have ongoing collaborations with NOAA, such as cooperative agreements. The broader category of "stakeholders" consists of organizations that may have interests that intersect with the Penobscot HFA--interests such as environmental restoration, recreation, environmental education or research--but whose potential collaboration has only been tentatively explored. Eventually, many of these stakeholders might collaborate with NOAA on research, apply for funding for local restoration projects, or advocate for fisheries restoration on a local or regional level.

External Partners

The Nature Conservancy – Founded in 1951, this non-profit organization's mission is to conserve the land and waters on which all life depends. The Nature Conservancy has worked very closely with NOAA on various restoration projects in Maine for years, and currently has a three-year cooperative agreement with NOAA though the Habitat Blueprint for the Penobscot HFA.

Penobscot Indian Nation – The Penobscot Indian Nation (PIN) is a federally recognized tribe in Maine whose ancestral lands include the Penobscot River watershed. They are a close partner with NOAA on diadromous fisheries restoration, including projects on the 67,000 acres of tribal land in the watershed.

Maine Department of Marine Resources (DMR) – A state agency overseeing coastal and estuarine resources in Maine waters, including the Penobscot River, DMR works closely with NOAA, using federal funding through cooperative agreements for activities such as the scientific assessment of Atlantic salmon and other diadromous species.

Maine Coastal Program – The Maine Coastal Program, part of the Maine Department of Agriculture, Conservation and Forestry, "works with various partners toward the shared goal of a healthy coast and vibrant coastal communities". The 1972 Coastal Zone Management Act, administered by NOAA, authorized funding for state coastal programs like Maine's, which was established in 1978. The Maine Coastal Program works closely with NOAA on coastal zone management issues, mapping, and a grants program for planning and implementation projects to help promote the resiliency of coastal communities.

U.S. Fish & Wildlife Service – The U.S. Fish & Wildlife Service (USFWS), part of the Department of Interior, works closely with NOAA on diadromous fish restoration. As outlined in a statement of cooperation, the USFWS and NMFS are jointly responsible for the recovery of the endangered population of Atlantic salmon within the Gulf of Maine Distinct Population Segment, which includes the Penobscot River watershed. USFWS and NMFS collaborate on the planning, design, permitting, and funding of restoration projects, as well as Endangered Species Act consultations.

Penobscot River Restoration Trust – The Trust is a non-profit organization established to implement the core goals of the Penobscot River Restoration Project. The Trust members include the Penobscot Indian Nation, American Rivers, Atlantic Salmon Federation, Maine Audubon, Natural Resources Council of Maine, The Nature Conservancy, and Trout Unlimited.

Stakeholder engagement will take place throughout the planning and implementation process for the Penobscot Habitat Focus Area. This will be done internally within NOAA and externally with partners, stakeholders, and others. Outreach will be targeted toward particular communities and/or stakeholder groups on a project-specific basis. Maine Sea Grant will play major role in external communications. Audiences are internal and external and include:

- state, federal, and tribal resource management agencies
- organizational partners with an interest in the Penobscot
- communities participating in funded restoration projects (e.g., Orland and Frankfort)
- communities potentially involved in restoration/users of prioritization tool

Meaningful stakeholder engagement will require additional capacity. One example of how this could be fulfilled is to create a new position for an extension professional at the University of Maine with expertise in diadromous fisheries and/or coastal ecosystem restoration. The new hire could join the already established 10-member University of Maine Marine Extension Team (MET) and will bring intellectual resources from the University of Maine School of Marine Sciences and NOAA Fisheries Orono Field Station to communities. Already viewed as a trusted and unbiased convener and information source, Maine Sea Grant and the MET are positioned to help Maine communities understand the implications of restoring regional ecosystems and food webs. Partners working in the Penobscot watershed have no single bay-focused organization or entity to contact for information about sea-run fish, marine food fish populations, results of ongoing restoration projects, and infrastructure issues that incorporate both climate resilience (sea level rise, increased flooding) and fish passage (culvert design, fish passage engineering). For example, managers and communities doing work in diadromous species habitat often submit requests for information on species presence/absence/population size to UMaine researchers, who have the information but no designated person to respond to such requests. We can envision the Marine Extension Team hire as a point of contact for such requests, with an additional responsibility to synthesize and report on the monitoring results. The estimated cost is $100,000 per year, for a minimum of three years, to ensure longevity of the position. Sea Grant would work to identify an additional 2-3 years of funding.

In the meantime, additional outreach capacity exists through a contract position with NOAA's Protected Resources Division at the Maine Field Station in Orono, Maine. The position supports NOAA's efforts to promote the recovery and sustainability of Atlantic salmon and other diadromous fish in Maine, including the Penobscot River watershed. The initial performance period for this position is one year, and the position was filled in December 2015.

Part 8. Plan for Measuring and Reporting Progress

The Penobscot HFA Executive Team will be responsible for reporting interim progress on a quarterly basis, with a report summarizing annual progress prepared no later than 30 days after the end of each fiscal year (September 30). The Restoration and Conservation Database (RCDB), which is continuously maintained by the NOAA Restoration Center, will track restoration projects implemented under the Habitat Blueprint, with metrics measured in stream miles or acres restored, as well as Atlantic salmon habitat units as appropriate. Prior to the preparation of the annual report, there will be an "all teams" meeting to review activities for the past year, discuss overall progress under the 5-year implementation plan, and develop a work plan for the coming year.

Metrics for measuring progress will be as summarized below.

Table 10: Objectives, Activities and Performance Measures

Initiative	Objectives	Activities	Performance Measures
Habitat Protection and Restoration	**Habitat Objective # 1 -**Identify priority areas for habitat protection and fish passage to increase access of diadromous fish to high quality habitat	Barrier prioritization tool Prioritize diadromous species restoration projects	Track use of barrier prioritization tool
	Habitat Objective # 2 -Protect diadromous fish habitat using NOAA's regulatory authorities	FERC hydropower relicensing ESA and MSA (EFH) consultations	Track regulatory actions
	Habitat Objective #3 - Promote resilient infrastructure, remove dams, replace culverts, and construct fishways	Dam removals Culvert replacements Fishways	Document number and locations of projects and restored habitat
Research and Science	**Research and Science Objective # 1 –** Support and promote monitoring or habitat protection and restoration projects to assess the effects on fish populations, habitat and water quality, and apply lessons learned for use in future restoration and protection efforts	Fish counts @ Milford dam Penobscot River restoration monitoring Estuarine and marine fisheries studies Monitor diadromous fish populations	Document, synthesize and and interpret studies
Communications and Outreach	**Communications and Outreach Objective # 1 –** Provide accurate and timely forecasts for river-based recreational activities	NWS Penobscot recreational forecast online	Track use of online NWS Penobscot recreational forecast
	Communications and Outreach Objective # 2 – Communicate the benefits of habitat protection and restoration for fish populations, water quality, recreation and the resiliency of coastal communities	Websites Project fact sheets Stream Smart training	Document and summarize communications and outreach
	Communications and Outreach Objective # 3 – Develop and enact a plan for targeted partner and stakeholder outreach	Stakeholder outreach	Track stakeholder interactions (meetings, presentations)

Part 9. References

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Part 10. APPENDICES

APPENDIX A

Diadromous Fish Species Profiles

Table 11: Diadromous Fish Species Found in the Penobscot River

Species (Pictures not to scale)	**Status in Gulf of Maine**	**Historical range in the Penobscot watershed**
Atlantic salmon ***Salmo salar***	Endangered	Headwaters, reaching as far inland as Penobscot Brook, over 350 km from the sea (Saunders et al. 2006).
Tomcod ***Microgadus tomcod***		Lower river below Milford Dam (Trinko Lake et al. 2012).
American shad ***Alosa sapidissima***		Approximately 145 km inland, using many lakes and ponds in the watershed (Saunders et al. 2006, Trinko Lake et al. 2012).
Alewife ***Alosa pseudoharengus***	Species of concern (NOAA)	Up to 320 km inland, using many lakes and ponds in the watershed (Saunders et al. 2006, Trinko Lake et al. 2012).
Blueback herring ***Alosa aestivalis***	Species of concern (NOAA)	Approximately 145 km inland (Trinko Lake et al. 2012). Mostly in the main stem of rivers and streams, unlike alewives, which prefer to spawn in still water.
Striped bass ***Morone saxatilis***		Lower river below Milford Dam (Trinko Lake et al. 2012).
Atlantic sturgeon ***Acipenser oxyrhynchus***	Threatened	Lower river below Milford Dam (Trinko Lake et al. 2012).
Shortnose sturgeon ***Acipenser brevirostrum***	Endangered	Lower river below Milford Dam (Trinko Lake et al. 2012).
Rainbow smelt ***Osmerus mordax***	Species of concern (NOAA)	Lower river below Milford Dam (Trinko Lake et al. 2012).
American eel ***Anguilla rostrata***		Widely distributed throughout the watershed (Trinko Lake et al. 2012).
Sea lamprey ***Petromyzon marinus***		Poorly documented, but likely widely distributed throughout the watershed (Saunders et al. 2006, Trinko Lake et al. 2012).
Sea-run brook trout ***Salvelinus fontinalis***		Poorly documented. Known to occur in the Passagassawakeag River, a tributary to Penobscot Bay (Kocik and Freidland 2002). Likely also found in other lower-river tributaries.

Appendix B

Implementation Team Members

Penobscot River Habitat Focus Area
Implementation Planning Team Members

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Team members:
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Tara Trinko-Lake, NMFS Protected Resources Division

Appendix C

Table 12: Phase 1, 2 and 3 Lakes in the State of Maine's *Operational Plan for the Restoration of Diadromous Fishes to the Penobscot River* (2009)

River/Stream	Waterbody	Phase	Surface Acres
Blackman	Chemo Pond	1	1,146
Pushaw	Pushaw Lake	1	5,056
Pushaw	Little Pushaw Pond	1	411
Pushaw	Mud Pond	1	366
Pushaw	Boyd Lake	1	1,005
Passadumkeag	Saponac Pond	1	922
Passadumkeag	Madagascal Pond	1	790
Sebois	Endless Lake	1	1,499
Sebois	Cedar Lake	1	685
Sebois	East Branch Lake	1	1,122
Mattamiscontis	Mattamiscontis Lake	1	1,025
Mattamiscontis	Little Mattamiscontis Lake	1	275
Mattamiscontis	South Branch Lake	1	2,035
Blackman	Parks Pond	2	124
Blackman	Davis Pond	2	417
Passadumkeag	Eskutassis Pond	2	876
Passadumkeag	Number Three Pond	2	659
Pleasant	Ebeemee Lake	2	940
Pleasant	Upper Ebeemee Lake	2	196
Pleasant	Silver Lake	2	305
Piscataquis	Harlow Pond	2	595
Penobscot	Mattanawcook Pond	2	832
Penobscot	Crooked Pond	2	220
Penobscot	Folsom Pond	2	282
Cambolasse	Snag Pond	2	160
Cambolasse	Center Pond	2	192
Cambolasse	Cambolasse Pond	2	211
Cambolasse	Long Pond	2	153
Cambolasse	Egg Pond	2	128
Cambolasse	Caribou Pond	2	544
Mattakeunk	Silver/Mattakeunk Lake	2	570
Molunkus	Molunkus Lake	2	1,050
Molunkus	Plunkett Pond	2	435
Molunkus	Flinn Pond	2	269
Wytopitlock	Wytopitlock Lake	2	1,152
WBr. Mattawamkeag	Mattawamkeag Lake/Upper Mattawamkeag Lake	2	3,330
WBr. Mattawamkeag	Rockabema Lake	2	339
EBr. Mattawamkeag	Skitacook Lake	2	435
Baskahegan	Upper Hot Brook Lake	2	912
Baskahegan	Lower Hot Brook Lake	2	713

River/Stream	Waterbody	Phase	Surface Acres
Baskahegan	Crooked Brook Flowage	2	1,645
Baskahegan	Baskahegan Lake	2	6,944
Mattaseunk	Mattaseunk Lake	2	576
Salmon	Salmon Stream Lake	2	659
Passadumkeag	Cold Stream Pond	3	3,628
Passadumkeag	Upper Cold Stream Pond	3	186
Passadumkeag	Nicatous Lake	3	5,165
Passadumkeag	West Lake	3	1,344
Passadumkeag	Duck Lake	3	256
Passadumkeag	Gassabias Lake	3	896
Sebois	Seboeis Lake	3	4,201
Schoodic	Schoodic Lake	3	7,168
Sebec	Sebec Lake	3	6,803
Kingsbury	Piper Pond	3	420
Penobscot	Upper Pond	3	506
EBr. Mattawamkeag	Pleasant Lake	3	1,832