Annual Report for the Penobscot Bay Recovery Unit – Calendar year 2019 activities

The goal of the annual report is to summarize progress toward achieving recovery goals for the Penobscot Bay Salmon Habitat Recovery Unit (Penobscot SHRU). The 2020 Annual Report for the Penobscot SHRU includes activities that were conducted prior to the implementation of the Collaborative Management Strategy. As the Penobscot SHRU team develops the 5-year work plan in 2020 and identifies actions that can be implemented moving forward, future annual reports will more appropriately reflect collaborative activities and include greater partner and public involvement in Atlantic salmon recovery.



Section 1 – Abundance and population trends

Figure 1a. Adult returns of Atlantic salmon from 1999 to 2019. Black shaded area represents naturally reared origin salmon (redd, egg, or fry). Grey shaded area indicates hatchery origin salmon (fall parr, smolt, adult). (USASAC 2020).



Figure 1b. Replacement rate of naturally-reared salmon in the Penobscot SHRU from 1999 to 2019. Solid horizontal reference line indicates a spawner to spawner replacement rate of 1 based on a 5-year lifecycle. (USASAC 2020)

Table 1a. The number of returns to the Penobscot SHRU and their origin (hatchery or naturally reared) for the past ten years.

Return Year	Number hatchery reared	Number of naturally reared
2010	1239	88
2011	2878	247
2012	547	77
2013	334	54
2014	239	29
2015	670	61
2016	429	78
2017	761	105
2018	711	61
2019	1028	177

Narrative - Summary of adult returns for the last 10 years.

Although fewer returns were observed earlier in the past 10-year time frame, the total number of adult returns within the Penobscot SHRU has increased since 2016, and the 10-year mean replacement rate of naturally reared fish is 1.075 between 2009 and 2019. This replacement rate would satisfy the productivity requirement of the recovery criteria for reclassification of the Penobscot SHRU, however the composition of the returning fish is predominantly hatchery origin (stocked parr, smolts or adults). The current total number of returns for 2019 is less than the total of at least 1,500 originating from wild or hatchery origin, and the number of naturally reared in 2019 is less than the required minimum annual escapement of 500 naturally reared adults in at least 2 of the 3 SHRUs (USFWS and NFMS 2018). In addition, habitat criteria is also required for reclassification (Section 2).

River	Adult returns	# Naturally reared	# Smolt stocked
Cove Brook	0		
Ducktrap	0		
Penobscot (Above Milford)	1196	168	1028
Kenduskeag	6*	6	
Souadabscook	3*	3	

Table 1b. Summary of adult returns for the Penobscot SHRU. (Table 2.2.1 from USASAC 2020)

*Kenduskeag = 1 grilse, and 5 2SW

*Souabadscook = 1 grilse and 2 2SW

Narrative– The purpose of this section is to describe the most recent return year highlighting any interesting events or unanticipated findings.

There were 1,205 adult Atlantic salmon returns to the Penobscot SHRU in 2019, which included returns to the Penobscot River, Kenduskeag Stream, and Soudabadscook Stream. The returns to the Kenduskeag and Soudabascook included 1 grilse and additional multi-sea winter fish. Of the returns to the Penobscot River, 85.9% were from smolt origin, and 14.1% were from naturally reared Atlantic salmon. Naturally reared origin includes fish from natural reproduction, or hatchery origin through stocking eggs or fry.

Section 2 – Spatial Distribution

As described in the Final Recovery Plan (2018), the life history of the Atlantic salmon requires a high degree of access between freshwater, estuarine, and marine environments, and sufficiently suitable natural habitats must be available to support wild populations. Habitat access is categorized as: (1) Habitat with No Access, (2) Habitat with Impeded Access, (3) Habitat that is Accessible, and (4) Habitat that is Fully Accessible.

To ensure the long-term sustainability of wild populations, there must be sufficient access to suitable habitat to support spawning and juvenile rearing. Ultimately, returning adults will dictate the actual amount of habitat needed. But the minimum amount of suitable habitat that

must be accessible to returning adults for achieve delisting criteria is 30,000 Habitat Units per SHRU. Currently, the total estimated habitat units that are suitable and accessible in the Penobscot SHRU is 18,600 units.



Figure 2a. Map of currently accessible habitat. This does map does not account for road crossing barriers. To meet the standard of accessible habitat 1) habitat is accessible above a dam with upstream and downstream passage that does not preclude recovery, or 2) accessible above road stream crossings set at the correct elevation using the Stream Simulation methodology.



Figure 2b. Proportion of rearing habitat occupied at the Hydrologic Unit level 12 (HUC 12) in the Penobscot Salmon Habitat Recovery Unit. Occupancy is determined as the presence or absence of salmon in the HUC 12. These are based on known occupancy resulting from spawner surveys and stocking activities.

River	Life stage	Number
Penobscot	Smolts	555,000
Penobscot	Fry	631,000
Penobscot	Parr	93,000
Penobscot	Eggs	495,000
Penobscot	Adults (pre-spawn)	97*
Penobscot	Adults (Post-spawn)	1437

Table 1. Summary of salmon stocked by river last calendar year (Appendix 01)

*The number of pre-spawn adults released includes 17 adults that were stocked pre-spawn following detection of non-pathogenic ISA, and 80 adults that were stocked into the East Branch Penobscot River (USASAC 2020).

Narrative

In comparison to previous years, changes were observed in both smolt and adult stocking. As with previous years, smolts were stocked at Sandy Point, but in 2019 smolts were also stocked at the Costigan Boat Ramp, upstream of Milford Dam and at the Gilford Boat Ramp into the upper Piscataquis River. Pre-spawn adults were also stocked into the East Branch of the Penobscot River, to increase the potential for natural reproduction by stocked adults to generate additional outmigrating smolts that could be used as a potential source for fish to be stocked into net pens for marine rearing (the Salmon for Maine's Rivers project).

Table 2. Summary of fish passage projects completed in the previous year. Project types include aquatic organism passage (AOP Crossing), decommissioned dams, culvert replacements, and culvert extensions. The total stream miles made accessible according to Recovery Plan criteria in 2019 was 27.09 miles.

			Passage	Stream miles	
			improvement type	made	Lake/pond
Watershed	Stream	Project Type	(fully accessible vs	accessible	acres made
			accessible vs	(according to	accessible
			partially accessible*	RP criteria)	
Lower Penobscot	Boyd Stream	AOP Crossing		0.75	
Lower Penobscot	Trib to Hoyt Brook	AOP Crossing		0.51	
Piscataquis	Baker Brook	AOP Crossing		1.68	
Piscataquis	Mountain Brook	AOP Crossing		0.34	
Piscataquis	South/Rock Slide Brook (local name)	Decommission		2.54	
Piscataquis	Unnamed Brook	Decommission		0.63	
Piscataquis	Unnamed Brook	Decommission		0.64	
Lower Penobscot	Unnamed trib to Dead Stream	Decommission		0.26	
Piscataquis	unnamed trib to Carlton Stream	AOP Crossing		1.00	
Piscataquis	unnamed trib to Carlton Stream	AOP Crossing		0.86	
Piscataquis	Unnamed trib to Cook Brook	AOP Crossing		0.60	
Piscataquis	Cook Brook	AOP Crossing		0.56	
Mattawamkeag	Unnamed trib to Fish Stream	AOP Crossing		0.14	
East Branch Penobscot	Unnamed trib to Matagamon Lake	AOP Crossing		0.35	
East Branch Penobscot	Unnamed trib to Matagamon Lake	AOP Crossing		1.25	
Penobscot	Unnamed trib to Blackmon Stream	AOP Crossing		1.44	
		Culvert			
Penobscot	Unnamed Trib, Stockton Springs, Rte 1	replacement		1	

		Culvert		
Mattawamkeag	Webb Brook, Patten Route 11	replacement	4.74	
	Unnamed Trib, Howland to	Culvert		
Penobscot	Mattamiscontis I-95	extension	1	
	Unnamed Trib, Medway to Herseytown I-	Culvert		
Mattawamkeag	95	extension	1	
	Unnamed Trib, Black Stream, Dover	Culvert		
Piscataquis	Foxcroft Route 7	replacement	0.2	
	Total		27.09	

Section 3 – Diversity



Figure 3. Graph of the mean number of alleles per locus for the Penobscot River broodstock, based on the adults sampled at Milford Dam for transport to Craig Brook National Fish Hatchery. Results represent the mean number of alleles per locus (based on 18 microsatellite loci) for the sea-run broodstock collected annually.

Table 3. Life history attributes from adult returns from the previous year for rivers with available information. Within the Penobscot SHRU, the only rivers with this information available in 2019 include the Penobscot, Kennebec, and Narraguagus.

River	%1SW	%2SW	%3SW	%Repeat	%Age 1	%Age 2	%Age 3+
				spawners	smolt	smolt	smolt
Penobscot	24%	75%	1%	0	86%	13%	1%
Kenduskeag	17%	83%	0	0		100%*	
Souadabscook	33%	66%	0	0		100%*	

* Based on the assumption that all wild smolts are typically age 2

Narrative

For the Penobscot adult 2019 broodstock collected at the Milford fish lift, allelic diversity decreased over the previous (2016 estimate), and is slightly less than the 12 year average (of mean number of alleles = 13.52). A more detailed summary of the genetic diversity of Maine Atlantic salmon can be found in the USASAC report (USASAC 2020).

Returning adults to the Penobscot and tributaries was predominantly composed of 2 sea winter

(2SW) adults, with 3 SW adults only seen in the Penobscot. No repeat spawning adults were identified in 2019. All returning adults to the Kenduskeag and Soudabascook streams were age 2 smolts (natural origin, which could include egg or fry stocked hatchery origin individuals), whereas returning adults to the Penobscot (trapped at Milford) included predominantly age 1 smolts (hatchery origin) individuals.

Section 4 – Emerging issues and priorities

There are a variety of emerging issues that will soon impact the Penobscot SHRU. The most significant change is likely to be the Salmon for Maine's Rivers project, which will utilize hatchery and natural origin smolts, reared in net pens in Penobscot Bay starting in 2020, and transported upstream to the East Branch of the Penobscot River for spawning in 2021 and 2022. This project is expected to continue for 10 years, involve multiple partners, and require coordination of many aspects for project implementation, monitoring, and outreach.

Continued opportunities to evaluate fish passage and conduct habitat restoration activities within the watershed, including ongoing and future FERC relicensing is also a priority within the Penobscot SHRU. Multiple partners and landowners are actively engaged in passage issues ranging from culvert replacement, bridge projects, implementation of fish passage, and other habitat improvement issues.

Another emerging issue within the Penobscot SHRU is the concern about ongoing support for the PIT tag arrays used to monitor fish movement through various hydropower facilities within the Penobscot River. These PIT tag arrays provide information about survival and entrainment at the various facilities, and with upcoming projects such as the Salmon for Maine's Rivers project, monitoring of PIT tagged fish will be important for assessment.

Section 5 – Stakeholder input

Over thirty stakeholders participated in the Penobscot SHRU team meeting on March 12, 2020. The group consisted of representatives from Federal, state, NGO, Tribal entities, sportsmen, and private landowners. There was an opportunity for brainstorming ideas for current and future recovery ideas in the SHRU. A few items that came to light during the discussion included: evaluating the impacts from delays at multiple dams to conduct a comprehensive study of impacts, set a goal for spawning in the Upper Piscataquis as well as ensuring safe passage in the Piscataquis, evaluation of the 2-year old smolt program, and maximizing current hatchery operations. As we continue to build support and momentum around this new SHRU structure, we anticipate more input from stakeholders.

Section 6 – Work plan for the next calendar year

Following the first public meeting of the Penobscot SHRU, the group decided initially to host meetings to focus on three topic areas reflecting areas within the Penobscot River. These

discussions will assist with identification of items that could be included into the 5-year work plan for the Penobscot SHRU. The 5-year work plan will also incorporate other activities not captured by these topic areas, for other parts of the Penobscot SHRU geography. These activities will also include communication with partners to develop a stocking plan as part of the 5-year work plan, and other activities as needed that span the entire Penobscot SHRU.

Specifically, ongoing monitoring of adult movement through dams and actions that are part of the Salmon for Maine's Rivers projects will continue. For example, smolt trapping in the East Branch will commence in 2020 to capture outmigrating smolts from the drainage as part of the Salmon for Maine's Rivers project. Continued tagging of adults to evaluate upstream movement through fish passage facilities as well as stocking smolts into the Piscataquis River to evaluate downstream movement are also planned for 2020.

	Threat	Activity	Partner	Recovery	Summary of planned work for
Watershed			S	Action	next year
Penobscot	Parker Pond Dam blocks	Restore fish passage	USFWS		USFWS has funded a nature like fishway with construction anticipated in 2020
	passage of alewives			C5.3	
Penobscot	The dam at Walker Pond impedes passage of alewives	Improve fish passage	NOAA, TNC	C5.3	A nature like fishway is anticipated for construction in 2020
Penobscot	The Snows Brook/Fros t Pond culvert impedes passage of sea run fish	Complet e tier 1 road stream crossing accordin g to the Maine DOT's Program matic consultat ion for transpor	NOAA, TNC	C4.3	Final design and engineering is expected to be completed in 2020, with construction in 2021

Table 6a. Table of proposed actions for next calendar year (including a worked example from the Penobscot SHRU).

		tation project		
Penobscot	Eskatasis fishway		C5.3	Anticipated engineering and design in 2020; construction 2021
	Gristmill Pond nature-like fishway		C5.3	Anticipated engineering and design in 2020; construction 2021
	Crooked Brook/Bask ahegan Lake Pool and weir		C5.3	Anticipated construction 2021

Table 6b. Table of any new activities added to the SHRU-specific work plan by the SHRU team coordinating committee.

Watershed	Threat	Activity	Partners	Recovery Action
East Branch		Identify and	FWS, NOAA,	C1.3. Identify
Penobscot River		coordinate	MDMR, PIN,	and prioritize
		actions	TNC, USGS, U of	fish passage
		associated with	Maine,	barriers in the
		Salmon for		Penobscot SHRU
		Maine's Rivers		necessary for
		project and		the survival and
		other passage,		recovery of
		habitat, and		Atlantic salmon.
		stocking		F1.0. Evaluate
		activities within		distribution and
		the East Branch		abundance of
				naturally-reared
				Atlantic salmon
				and hatchery
				products.
				F3.0. Identify,
				maintain, and
				restore priority
				freshwater
				habitats for
				Atlantic salmon.
Piscataquis River		Identify and	FWS, NOAA,	C1.3. Identify
		coordinate	MDMR, PIN,	and prioritize
		actions	DOT, TNC,	fish passage
		associated fish	USGS, U of	barriers in the
		passage and	Maine, ASF,	Penobscot SHRU
		maximizing	NRCS	necessary for
		natural		the survival and
		reproduction of		recovery of
		hatchery		Atlantic salmon.
		products		F1.0. Evaluate
				distribution and
				abundance of
				naturally-reared
				Atlantic salmon
				and hatchery
				products.
				F3.0. Identify,
				maintain, and

			restore priority freshwater habitats for Atlantic salmon.
West Branch	Identify and coordinate actions associated fish passage for future habitat accessibility and passage	FWS, NOAA, MDMR, PIN, DOT, TNC, USGS, U of Maine, IFW, TU	C1.3. Identify and prioritize fish passage barriers in the Penobscot SHRU necessary for the survival and recovery of Atlantic salmon.

Section 7 - List of Reports and Publications resulting from Projects within SHRU

Follow the form of a reference list. Include the abstract for the paper or report.

Zimmerman, Emily. Water Quality in Seboeis River, February 2020.

Despite the restoration efforts of numerous groups since the 1970s, the population size of Atlantic salmon (*Salmo salar*) has remained low (USASAC 2018). On the Penobscot River, access has been improved by removing two major dams and constructing a bypass around a third (PRRT 2018), but three main stem dams remain between Seboeis River, a major tributary to the East Branch Penobscot River, and the ocean. The Maine Department of Marine Resources (MDMR) stopped stocking juvenile salmon in Seboeis River in 2014 due to low parr production. This stream has spawning and rearing habitat of good quality, however the watershed is likely oligotrophic, as are many nearby waters. This study investigated the hypothesis that water quality in Seboeis River exceeds stress thresholds or contains levels of nutrients too low for salmon growth.

(https://www.maine.gov/dep/water/monitoring/rivers and streams/salmon/index.html)