Collaborative Management Strategy for the Gulf of Maine Distinct Population Segment of Atlantic Salmon

2020 REPORT OF 2019 ACTIVITIES

DPS Atlantic Salmon Collaborative Management Strategy
2020 Report of 2019 Activities

The Final Atlantic salmon recovery plan was released in 2019. The final plan incorporates the strategies and many of the associated actions that were developed through the Atlantic salmon framework process that was established in 2011. It also details recovery goals, objectives and criteria needed for recovery, with three Salmon Habitat Recovery Units (SHRUs) representing the spatial scale of recovery (Merrymeeting Bay, Penobscot Bay and Downeast Coastal SHRUs.) Each SHRU is expected to meet certain criteria before a down listing or delisting decision can be made.

In the fall of 2018 we initiated an internal review of the framework process aimed at aligning our governance structure with the Recovery Plan and addressing the challenges associated with communications and decision making. Ultimately, this review resulted in what is now called the Collaborative Management Strategy (CMS). In the fall of 2019, we began a one-year pilot of the CMS. The fundamental purpose of the CMS is to:

- Provide clarity on roles and responsibilities
- Provide clarity on where decisions are made
- Increase the speed of decision making
- Increase accountability and transparency
- Incorporate external partners

The CMS recognizes that the path to recovery in each of the SHRUs may be different based on land use patterns, habitat conditions, and the relative degree to which the specific threats identified in the recovery plan occur across the landscape. Therefore, the intent of the structure is to empower the different SHRU committees to coordinate recovery efforts in their geographic region. The SHRU teams are responsible for planning, coordinating and tracking recovery efforts in each SHRU; as well as developing and maintaining work plans that incorporate goals, priorities and actions, including stocking recommendations. Additionally, they are tasked with developing annual reports that describe progress towards meeting recovery goals. The 2019 annual reports are contained within this annual report.

While the SHRU teams coordinate the recovery strategy in their respective regions, the implementation team (IT), which includes the management board, their support staff, and the SHRU chairs, ensures vertical and horizontal communications across SHRUs, across agencies, with the Tribe, and among leadership. The IT provides a venue for collaboration and communication on substantive issues that affect the program as a whole, or affect another agencies' ability to carry out its programs.

The CMS envisions that committees (ad hoc or standing) will be established that will conduct specific tasks geared towards providing essential information necessary for the Implementation Team to make informed decisions in respect to the direction of the program. The management board authorizes and sets the charge for committees, and each committee is guided by a terms-

of-reference. In 2019, one standing committee was established to review studies associated with FERC projects in the GOM DPS. The annual report from this committee is included in this report (Appendix 1).

This report includes four sections. The first is a high-level summary of the status of the GOM DPS of Atlantic salmon in relation to the reclassification and delisting criteria laid out in the 2019 recovery plan. The remaining three sections provide additional information at the SHRU level, and are developed by the SHRU coordinating committees with significant input from stakeholders in their respective SHRUs.

GOM DPS Annual Summary

As detailed in the 2019 Final Recovery Plan, in order for the listing status of Atlantic salmon to change, each of the relevant biological criteria must be met in two (downlisting) or three (delisting) of the recovery units.

The biological criteria for reclassifying (downlisting) the GOM DPS of Atlantic salmon from endangered status to threatened status are:

1. ***Abundance:*** The DPS has total annual returns of at least 1,500 adults originating from wild origin, or hatchery stocked eggs, fry or parr spawning in the wild, with at least 2 of the 3 SHRUs having a minimum annual escapement of 500 naturally reared adults.

2. ***Productivity:*** Among the SHRUs that have met or exceeded the abundance criterion, the population has a positive mean growth rate greater than 1.0 in the 10-year (two-generation) period preceding reclassification.

3. ***Habitat:*** In each of the SHRUs where the abundance and productivity criterion have been met, there is a minimum of 7,500 units of accessible and suitable spawning and rearing habitats capable of supporting the offspring of 1,500 naturally reared adults.

The biological criteria for removing Atlantic salmon from the endangered species list are:

1. ***Abundance*****:** The DPS has a self-sustaining annual escapement of at least 2,000 wild origin adults in each SHRU, for a DPS-wide total of at least 6,000 wild adults.

2. ***Productivity:*** Each SHRU has a positive mean population growth rate of greater than 1.0 in the 10-year (two-generation) period preceding delisting. *In addition*, at the time of delisting, the DPS demonstrates self-sustaining persistence, whereby the total wild population in each SHRU has less than a 50-percent probability of falling below 500 adult wild spawners in the next 15 years based on population viability analysis (PVA) projections.

3. ***Habitat:*** Sufficient suitable spawning and rearing habitat for the offspring of the 6,000 wild adults is accessible and distributed throughout the designated Atlantic salmon critical habitat, with at least 30,000 accessible and suitable Habitat Units in each SHRU, located according to the known migratory patterns of returning wild.

In the below sections, we summarize the return data and habitat accessibility data from 2019 in reference to the reclassification and delisting criteria.

Abundance

In 2019, 1,528 prespawn salmon returned to the GOM DPS (Table 1). Of those, 15% returned to the Downeast Coastal SHRU; 79% returned to the Penobscot Bay SHRU; and 6% returned to the Merrymeeting Bay SHRU. The abundance of returning salmon was more than 20% higher than the 10-year average (Table 2), and the proportion of the run that was naturally reared (24%) was higher than what has been seen on average over the last decade (16%) (Figure 1). Regardless, the abundance of wild and naturally reared returns remain well below what is needed for either reclassification or delisting (Table 3).

Table 1. Summary of adult returns for the GOM DPS in 2019 by SHRU. These numbers represent trap counts when available and redd based estimates of returns to the remaining rivers. Determination of origin is based on proration of adults at traps, smolts from corresponding cohort or primary lifestage stocked.

SHRU	Total Returns (2019)	Hatchery (2019)	Wild/naturally reared (2019)
Downeast Coastal	236	113	123
Merrymeeting Bay	87	17	70
Penobscot Bay	1205	1028	177
Total	***1528***	***1162***	***366***

Table 2. Average number (10-year) of adult returns to the GOM DPS by SHRU.

SHRU	Total returns (10 yr avg.)	Hatchery returns (10 yr avg.)	Wild/naturally reared returns (10 yr avg.)
Downeast Coastal	120	54	66
Merrymeeting Bay	56	21	35
Penobscot Bay	1071	973	98
Total	***1247***	***1048***	***199***

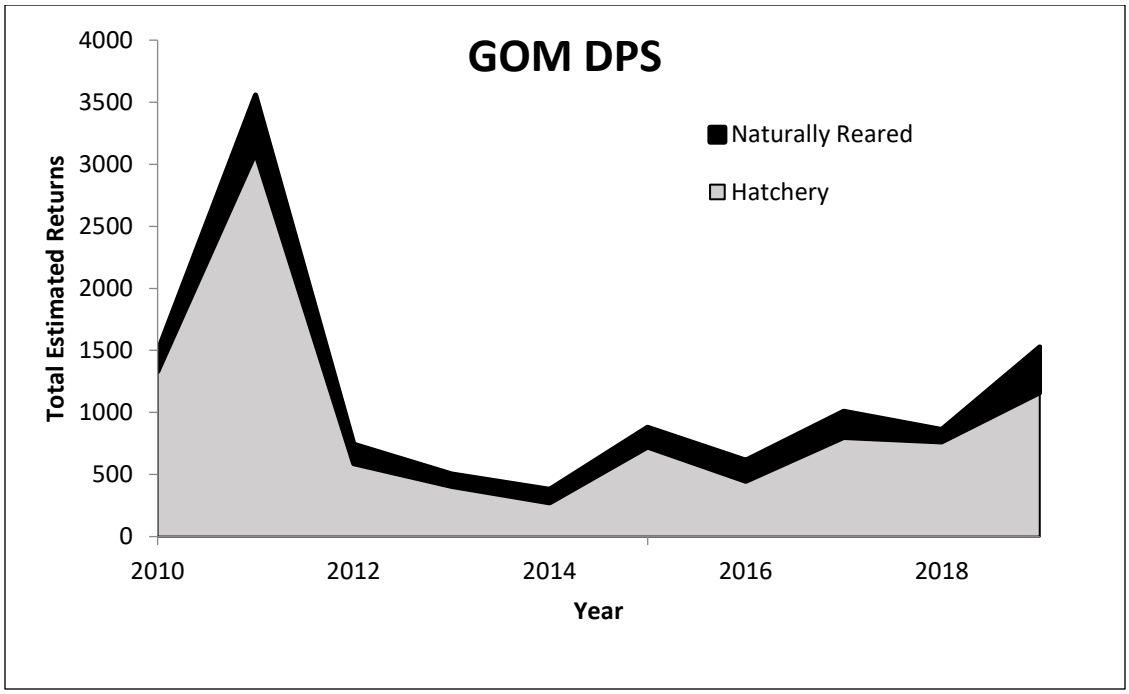

Figure 1. Adult returns of Atlantic salmon from 2009 to 2019. Black shaded area represents naturally reared origin salmon (redd, egg, or fry). Grey shaded area indicates hatchery origin salmon (fall parr, smolt, adult) (USASAC 2020).

Table 3. The average number of wild or naturally-reared returns to each SHRU in relation to the reclassification and delisting goals described in the 2019 recovery plan.

SHRU	Wild/natural reared returns (10 yr avg.)	% of Downlisting goal	% of Delisting goal
Downeast Coastal	66	13.20%	3.30%
Merrymeeting Bay	35	7.00%	1.75%
Penobscot	98	19.60%	4.90%

Productivity

The mean 10-year population growth rate for the GOM DPS as a whole in 2019 was 1.12, making it the eighth consecutive year where that threshold rate has exceeded 1.0 (Figure 2). However, the reclassification and delisting productivity criteria require that *each SHRU* sustain a population growth rate of more than 1.0, in addition to meeting the relevant abundance criteria. In 2019, the 1.0 threshold was exceeded at both the Merrymeeting Bay (1.84) and Penobscot Bay (1.08) SHRUs, but was not met at the Downeast Coastal SHRU (0.99). For more information, refer to the enclosed SHRU reports.

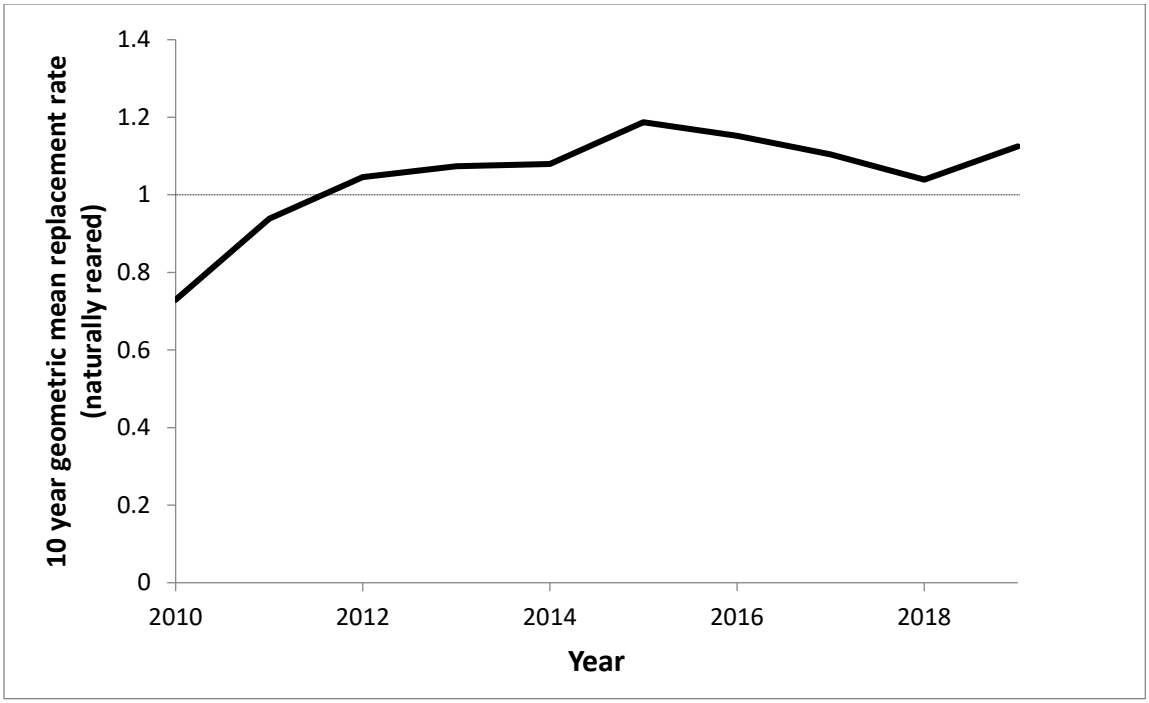

Figure 2. Replacement rate of naturally-reared salmon in the GOM DPS from 2009 to 2019 (USASAC 2020).

Habitat

In 2019, a minimum of 31connectivity projects were conducted that improved access to 108 stream miles (Table 4). These projects do not necessarily lead to gains that can be counted towards the habitat recovery criteria, as many of them are upstream of barriers that have not yet been deemed accessible themselves. However, the most notable project in 2019, the breaching of the Head Tide Dam on the Sheepscot River, restored access to 2,363 habitat units in the Merrymeeting Bay SHRU, which have been added to the total accessible habitat units under the recovery criteria. It should be noted that the number of projects reported in the 2019 SHRU reports are likely an underestimate of the number of projects actually conducted.

Table 4. The number of connectivity projects (culverts and dams) that have been reported in the SHRU annual reports for 2019, and the cumulative amount of stream habitat where access has been improved.

SHRU	Projects Reported	Stream miles
Penobscot	21	27
Merrymeeting	2	60
Downeast	8	21
GOM DPS	31	108

As of 2019, all three SHRUs have achieved the reclassification (downlisting) goal of at least 7,500 accessible habitat units (Table 5). However, none of the SHRUs have yet to achieve the delisting goal of 30,000 accessible habitat units. Figure 3 shows the HUC 12 watersheds in the GOM DPS that we considered accessible in terms of recovery in 2019, as well as those that are partially accessible, and those that are not currently accessible.

Table 5. The amount of habitat (1 habitat unit=100m^2) in critical habitat that is considered accessible in each of the SHRUs, and how that relates to the habitat recovery goals. These are likely over estimates as they are based on dam passage and do not consider habitat blocked by road stream crossings.

Habitat Criterion	**Suitable and Accessible Habitat**	**% of 7,500 units (Downlisting)**	**% of 30,000 units (delisting)**
Downeast	28,594	381%	95.31%
Merrymeeting Bay	12,423	166%	41.41%
Penobscot	18,583	248%	61.94%

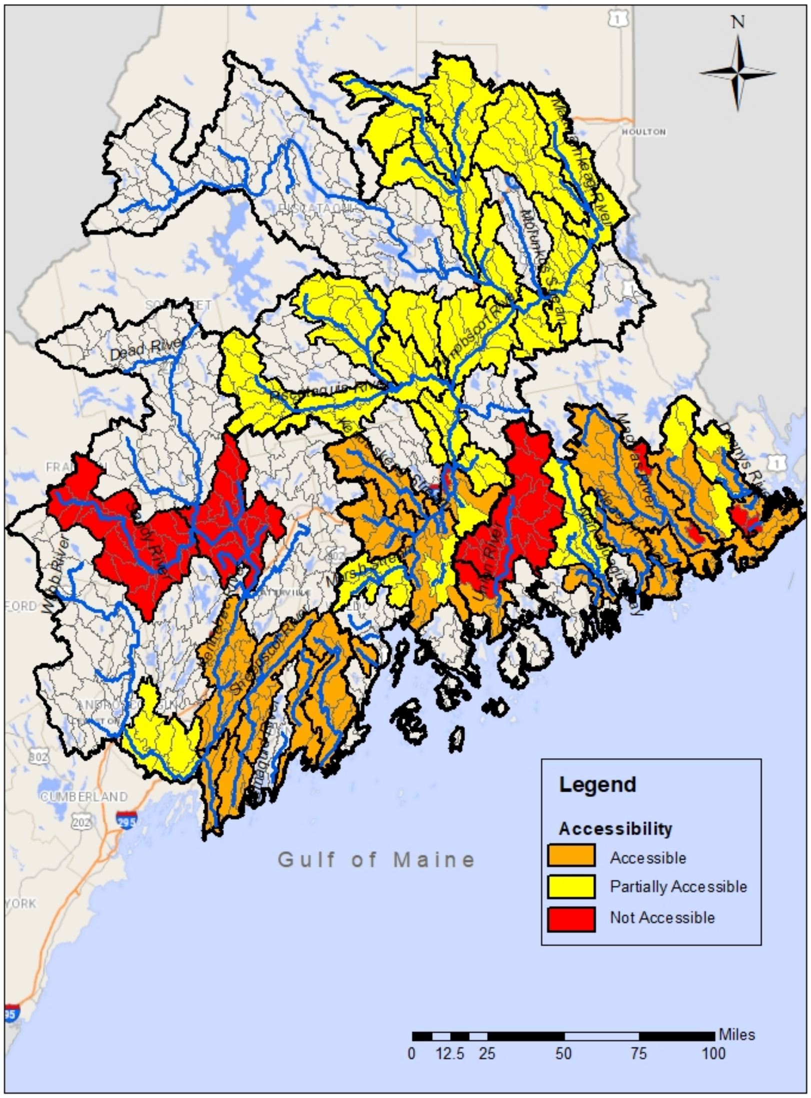

Figure 3. HUC 12 watersheds that have been determined to be accessible in 2019. *Accessible* watersheds have no mainstem dams, or else have dams that have fishways that have been evaluated and determined to be highly effective. The habitat in these watersheds meet our recovery criteria for accessibility. *Partially accessible* watersheds are above dams that have fishways that have yet to be evaluated. *Not accessible* watersheds are above dams that do not have swim through fishways. Watersheds above impassable dams where adult salmon are trucked are not considered accessible in terms of recovery. This map does not consider the effect of road stream crossings.

Emerging Issues

COVID-19 Outbreak

The outbreak of a novel strain of coronavirus in 2020 is currently having significant effects to the day-to-day operation of the salmon program. The implications of this will largely be discussed in the 2020 annual report; however, a few of the more significant consequences are discussed below for the awareness of all stakeholders.

North Atlantic Salmon Conservation Organization

As a result of the extraordinary circumstances in 2020 due to the Covid-19 pandemic, the annual meeting of NASCO was cancelled. Essential business of NASCO will be conducted over email correspondence and brief teleconferences. Furthermore, the group that reviews the Annual Reports of all NASCO Parties and jurisdictions was not able to meet in April as planned. As such, Annual Progress Reports (APRs) submitted in 2020 for activities that occurred in 2019 did not undergo critical review. The APRs hold NASCO Parties and jurisdictions accountable to their obligations in respect to NASCO's goals for its three theme areas: management of salmon fisheries; management of salmon habitat; aquaculture, introductions and transfers, and transgenics. Although the APRs will not be reviewed in 2020, the statistics reported within the APRs were submitted as required by the NASCO Convention. The schedule for reviewing APRs will resume in 2021.

Ad hoc committees

In March of 2020, the management board established two ad hoc committees to develop contingency plans to address the primary effects of the pandemic on the salmon program: 1) Fish passage and broodstock collection, and 2) stocking. The committees were made up of representatives of NOAA, USWFS, PIN, and MDMR, and were charged with developing alternatives for addressing potential modifications to operations associated with limited staff capacity attributed to social distancing requirements dictated by the state and federal governments, as well as by private industry. The final reports of these groups are attached to this annual report (Appendix 2 and Appendix 3), and will be made available on the Atlantic salmon recovery website (atlanticsalmonrestoration.org).

Annual Report for the Downeast Recovery Unit – Calendar year 2019 activities

This report summarizes progress toward achievement of recovery goals for Downeast Salmon Habitat Recovery Unit (Downeast SHRU).

Section 1 – Abundance and population trends

Adult returns of Atlantic salmon to the Downeast SHRU for 2019 were much higher (236) than 2018 (72; Figure 1.1). Adult to adult replacement rates in 2019 were also slightly higher than the previous eight years (Figure 1.2.) but the 10-year geometric mean of adult-to-adult survival is 0.99 (0.54 to 1.82 at 95%). The adult return information and replacement rate presented below is from the work of the U.S. Atlantic Salmon Assessment Committee (USASAC 2020); therefore, the definition of "naturally reared" salmon does not include adults resulting from parr and/or smolt stocking.

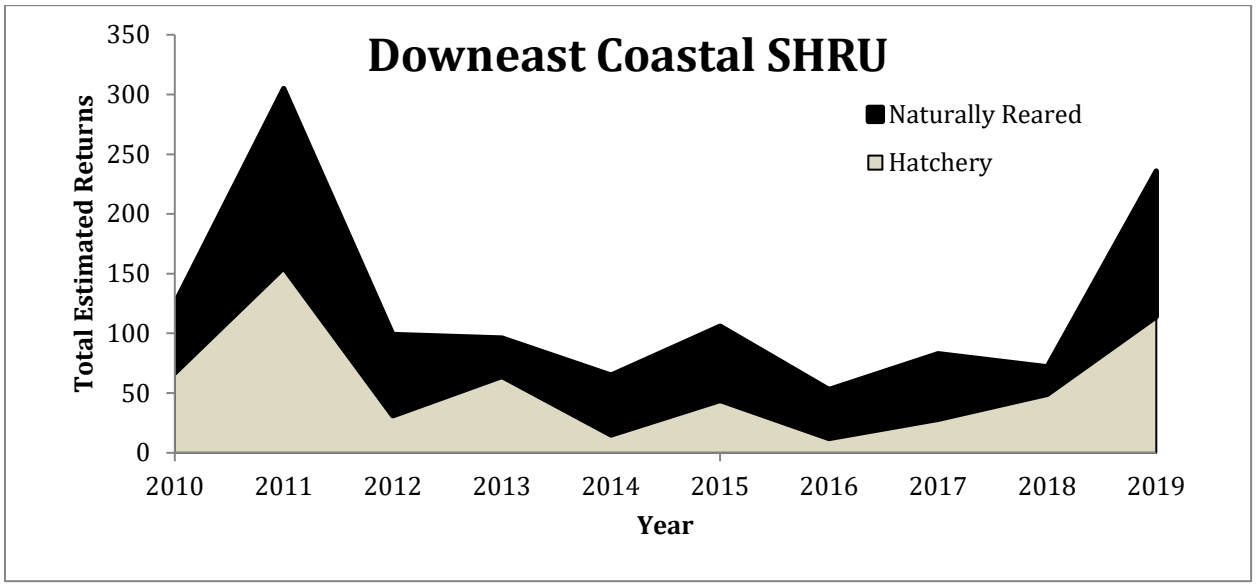

Figure 1.1. Adult returns of Atlantic salmon from 1999 to 2019. Black shaded area represents naturally reared origin salmon (redd, egg, or fry). Grey shaded area indicates hatchery origin salmon (fall parr, smolt, adult) (USASAC 2020).

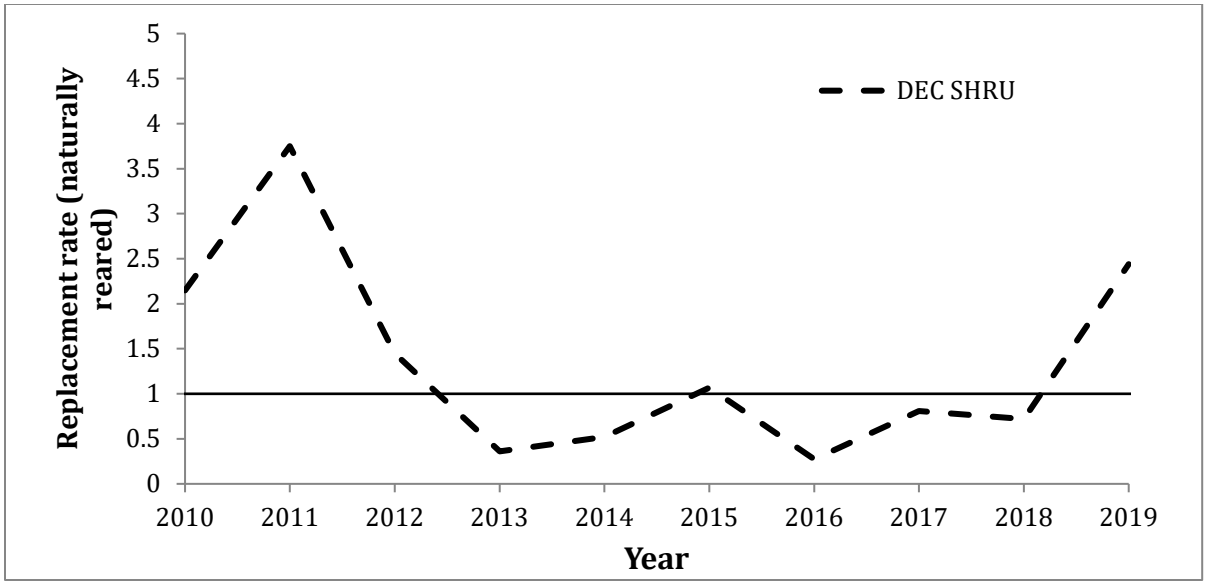

Figure 1.2. Replacement rate of naturally-reared salmon in the Downeast SHRU from 1999 to 2019. Solid horizontal reference line indicates a spawner to spawner replacement rate of 1 based on a 5-year lifecycle (USASAC 2020).

Table 1.1. Summary of adult returns for the Downeast SHRU in 2019. These numbers represent trap count from the Narraguagus and Union Rivers and redd based estimates of returns to the remaining rivers. Determination of origin is based on proration of adults at traps, smolts from corresponding cohort or primary lifestage stocked.

River	Adult returns	% naturally reared	% Hatchery Origin
Union	2	100%	0%
Narraguagus	123	37%	63%
Pleasant	26	100%	0%
East Machias	40	10%	90%
Machias	29	100%	0%
Dennys	16	100%	0%

Section 2 – Spatial Distribution

Given contemporary abundance levels that are well below spawning targets, spatial distribution of Atlantic salmon is closely correlated with stocking activities. The primary strategy used in the Downeast SHRU is unfed fry followed in numbers by fall parr in the East Machias River and eyed ova planting in the Machias and Pleasant Rivers (Table 2.2.). These salmon are stocked into accessible habitat across the DE SHRU (Figure 2.1.). As new reaches are accessed through

barrier removals, they are assessed for rearing suitability and included in fish distribution. Work done by Project SHARE reconnected 24.26 kilometers of rearing habitat in 2019 (Table 2.1).

Mean occupied habitat for the DE SHRU was 15% with a minimum of 0% and a maximum of 95% occupied. Since stocked drainages are limited to the Narraguagus, Pleasant, Machias, East Machias, and Dennys Rivers this leave a large portion of the SHRU presumed to be unoccupied or underutilized. Within these drainages, the proportion occupied ranged from 3% to 95% with a mean of 50% (Figure 2.2.). A total of 1,248,833 salmon were stocked into the DE SHRU in 2019. Of these, the majority were stocked as fry (669,000) or were stocked as fall parr (226,000). Additionally, 245,000 eyed eggs were planted in the Machias, Pleasant and Narraguagus and 100,000 hatchery reared smolt were stocked into the Narraguagus (Table 2.2).

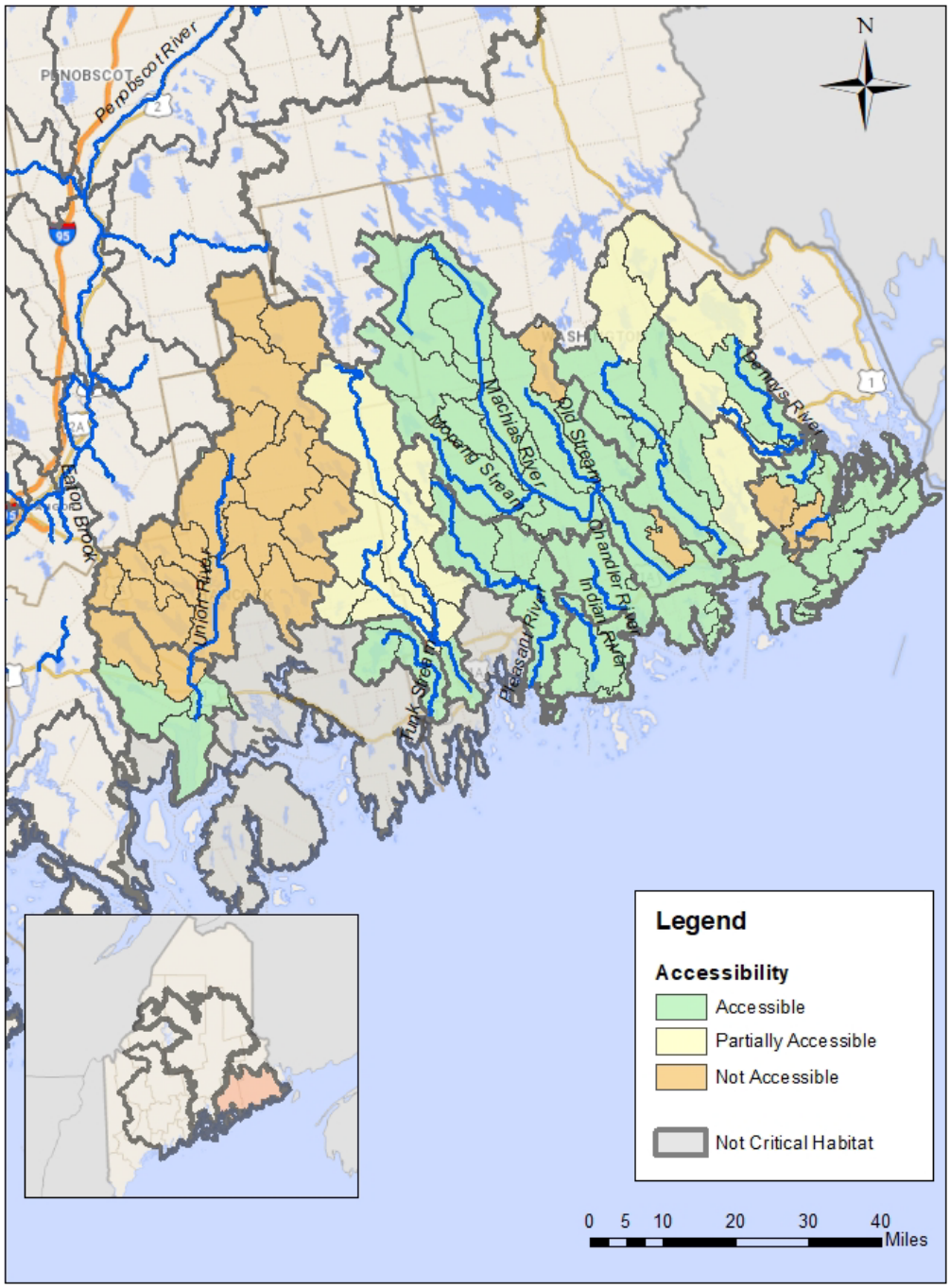

Figure 2.1. Map of currently accessible habitat at the Hydrologic Unit 12 level within the Downeast Salmon Habitat Recovery Unit. This does not account for road crossing barriers.

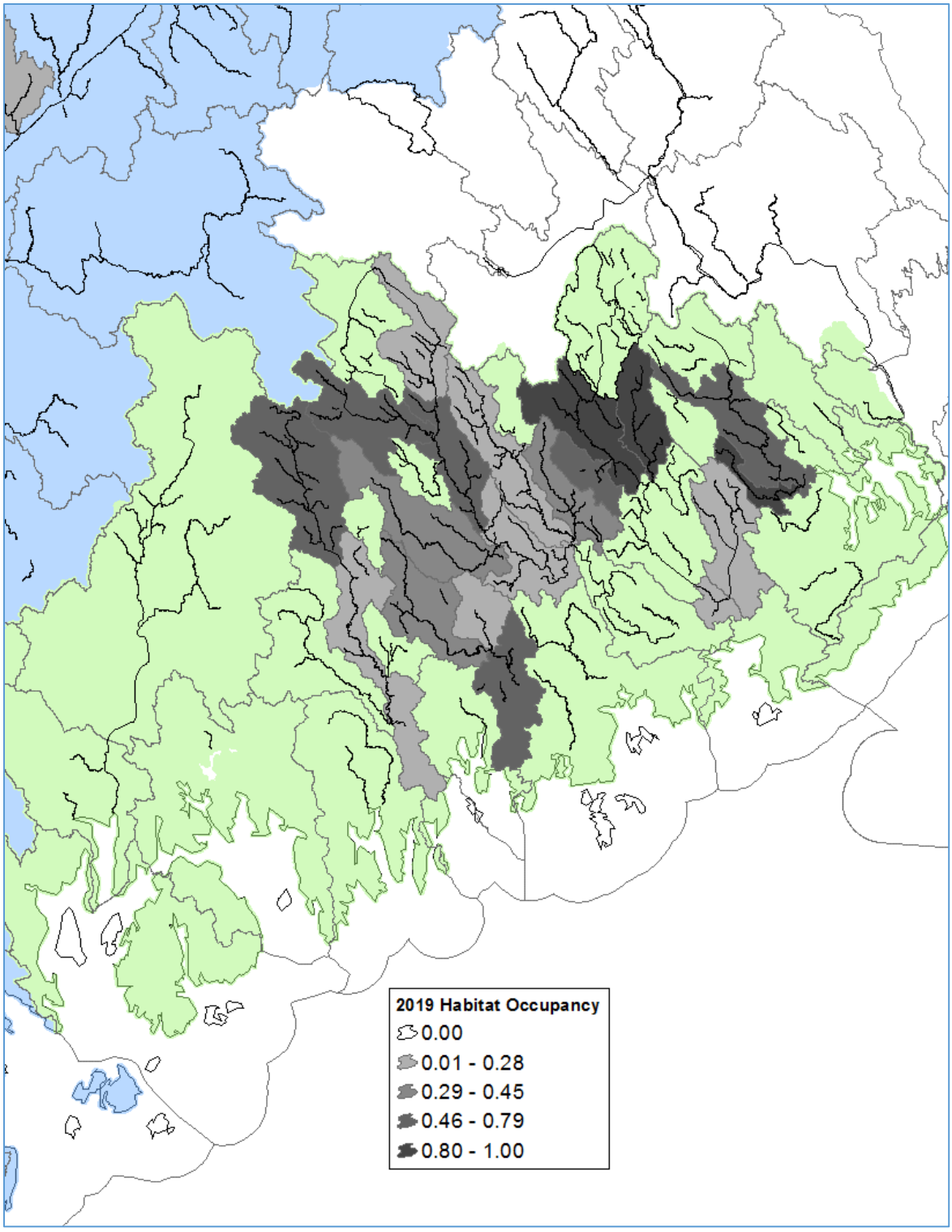

Figure 2.2 Proportion of rearing habitat occupied at the Hydrologic Unit level 12 (HUC 12) in the Downeast Salmon Habitat Recovery Unit. Occupancy is determined as the presence or absence of salmon in the HUC 12. These are based on known occupancy resulting from spawner surveys and stocking activities.

Table 2.1. Summary of recovery related projects completed in the Downeast SHRU (2019).

Recovery Action	Project Type	Lead Partner	Watershed	Stream/ Lake	Stream Miles	Stream Kilometers
C4.8	Open Bottom Culvert	Project SHARE	East Machias	Seavey Brook	5.5	8.85
C4.8	Open Bottom Culvert	Project SHARE	East Machias	Roaring Brook	2.5	4.02
C4.8	Embedded Round Culvert	Project SHARE	East Machias	Richardson Trib.	0.7	1.13
C4.8	Open Bottom Culvert	Project SHARE	East Machias	*unnamed*	0.2	0.32
C4.8	Open Bottom Culvert	Project SHARE	East Machias	*unnamed*	1.28	2.06
C4.8	Open Bottom Culvert	Project SHARE	Narraguagus	Baker Brook	2.5	4.02
C4.8	Open Bottom Culvert	Project SHARE	Narraguagus	Sinclair Brook	2.4	3.86
C2.3	Dam Removal	Downeast Salmon Federation	Union	Branch Lake Stream	6.0	9.65
F4.4	Restore Natural Watershed Boundary	Downeast Lakes Land Trust	Machias	Getchel/Wabasus	N/A	N/A
F3.5	Wood Griphoist	Project SHARE	East Machias	Northern Stream	0.2	0.46
F3.5	Wood PALS/Mobile	Project SHARE	Narraguagus	Above Beddington Lake	0.6	1.00
F3.2	Thermal Profile	USFWS	Machias	Old Stream (Rkm 26.9-30.2)	2.1	3.30
F3.2	Thermal Profile	USFWS	East Machias	Rkm 1.0-48.0)	29.2	47.00

* To be considered accessible, the habitat above connectivity projects must be consistent with delisting criteria in part 2F/2G of the final recovery plan and described in detail on p. 23.

PALS= Post Assisted Log Structures, Mobile Wood= Tree length wood placed at 1 location.

Table 2.2. Summary of salmon stocked by river in 2019. Note, all post-spawn adult salmon stocked in the Downeast SHRU are domestic or captive broodstock.

River	Life stage	Number
Union	fry	2,000
Narraguagus	egg	66,000
	fry	179,000
	1+ smolt	95,500
	2+ smolt	100
	Post-Spawn adult	253
Pleasant	egg	88,000
	fry	132,000
	post-spawn adult	171
East Machias	0+ parr	226,000
	post-spawn adult	194
Machias	egg	91,000
	fry	183,000
	2+ smolt	100
	post-spawn adult	251
Dennys	fry	175,000
	0+ parr	10,000
	post-spawn adult	264

Section 3 – Diversity

For each broodstock within the Downeast SHRU, a target of 200 parr to collect and retain for broodstock is being used starting with the 2017 collection year. Results below represent the mean number of alleles per locus (based on 18 microsatellite loci) for each population, measured within the most recent collection of parr for broodstock (in this case, the 2017 collection) (Figure 3.1.). For each parr collection, allelic diversity increased over the previous (2016 estimate). More detailed summaries of genetic diversity are found in the USASAC report.

Allelic diversity (Figure 3.1.) of the five broodstocks in the Downeast SHRU remain relatively stable over the time period measured. Continued monitoring of diversity levels is very important as the Downeast SHRU contains five of seven total river-specific stocks remaining in the entire United States. An apparent uptick in adult returns was noted in 2019; however, it is important to note the majority of the uptick in the Narraguagus River is dominated by 1SW males (grilse) resulting from age-1 smolt stocking.

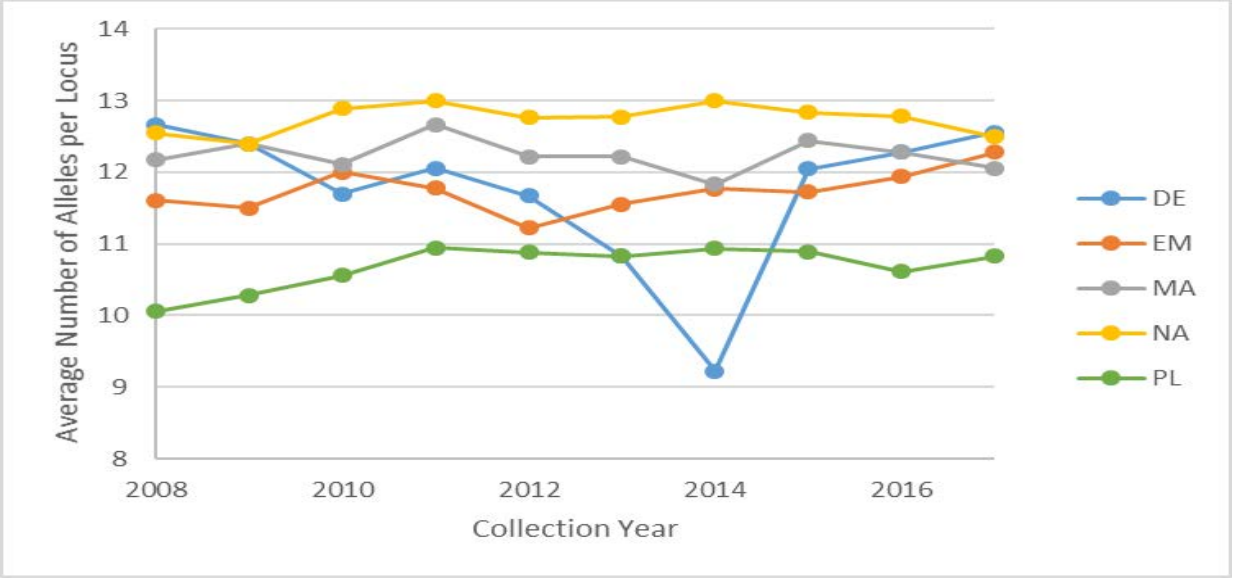

Figure 3.1. Allelic diversity for each broodstock in the Downeast SHRU.

Table 3.1. Life history attributes from adult returns to the Narraguagus River and Union Rivers in 2019 in terms of counts of sea-run, Atlantic salmon returns by gender and sea-age (One sea-winter, 1SW; two sea-winter, 2SW; three sea-winter, 3SW; multi sea-winter, MSW; and repeat spawner, RPT). Also included are counts of aquaculture (AQS) and captive reared freshwater (CRF) adults captures (USASAC 2020).

River	%1SW	%2SW	%3SW	%Repeat spawners	%Age 1 smolt	%Age 2 smolt	%Age 3+ smolt
Narraguagus	81	15	1	3	63	35	2
Union	0	100	0	0	NA	NA	NA

Section 4 – Emerging issues and priorities

- Freshwater production of smolts in the DE SHRU (as indexed in the Narraguagus River) is near historical lows.
- Utilizing vacant habitats to maximize freshwater production of smolts is limited by current hatchery program rearing capacity.
- The “Bay of Fundy Aquatic Connectivity” project was unveiled during the Atlantic Salmon Ecosystems Forum in Orono, on, Wednesday, Jan. 15, as an opportunity to restore habitat access in more than 300,000 square acres in eastern Maine. The project – sponsored by the Maine Department of Inland Fisheries and Wildlife, and the Maine Department of Marine Resources – will receive major funding from the USDA’s Natural Resources Conservation Service (NRCS) and is designed to improve stream connectivity in watersheds flowing into the Bay of Fundy and the Gulf of Maine.
- Recent evaluations reveal that the smolt to adult survival rates in the East Machias River are considerably higher than nearby rivers like the Narraguagus.

- There is a proposal by the Downeast Salmon Federation to raise other populations at the Peter Gray Hatchery. DSF is exploring partnership opportunities for expanded funding, including with state and federal agencies.
- Work to increase habitat complexity in the upper Narraguagus River offers promise of improving freshwater production; however, the project remains underfunded.
- Some adult stocking is planned by Maine DMR in the Machias River (2022 and 2023).
- The future of the Ellsworth Dam in the Union River remains uncertain as the Department of Environmental Protection recently denied the water quality certification for the Ellsworth Dam. Such certification is required in order for the Federal Energy Regulatory Commission to issue a new license.
- Restoration of fish passage is now underway at the Meddybemps powerhouse. With assistance from DMR, DSF, US Fish and Wildlife Service, and the Smith family, the site will be accessible to sea-run species, most notably sea-run alewives.
- Coordination for future fish passage improvement at the Rt. 9- Beaverdam Stream crossing has been initiated between Maine DOT and USFWS. In 2019, USFWS staff completed a detail topographic survey of the crossing, and a conceptual design will be presented to Maine DOT in 2020.
- Feasibility of fish passage is now underway at Lower Sabao Dam in the West Branch Machias drainage. In 2019 water level loggers recorded lake and tail water elevations, and a topographical survey is planned in 2020. USFWS fish passage engineers will create conceptual designs that will be reviewed by interested parties.
- Thermal profiles to locate cold water refugia and quantify cold water inputs have been completed in mainstem areas of the Narraguagus, East Machias and Dennys. If summer 2020 conditions are suitable for conducting thermal profile surveys, the Machias below Rt. 9 RKM 60.4) is high priority.

Section 5 – Stakeholder input

The following section is input solicited from some of the primary partners involved in Atlantic salmon recovery efforts in the Downeast SHRU. The input is provided directly from the Executive Directors of these organizations, unedited by the Downeast coordinating committee.

Project SHARE – Chris Federico

Project SHARE is a nonprofit organization that focuses on Atlantic salmon habitat restoration in the Downeast SHRU. SHARE works directly with state and federal biologists to complete projects in the highest priority sub-watersheds. SHARE's current focus is on the upper Narraguagus River. We have assembled a team of scientists to help prioritize, plan, and implement our habitat enhancement projects. Partners include DMR, NOAA, USFWS, NRCS, Maine Coast Heritage Trust, University of Maine, Connecticut College, and the landowners. The main project objective is to increase the smolt population leaving the watershed. To achieve this, we need to reconnect all existing habitat and increase the rearing suitability of the habitat. Since the formation of the Upper Narraguagus Watershed Restoration Project in 2014, SHARE

has reconnected 625.3 units of habitat (1 unit = 100 m^2) and added ~800 pieces of large wood into ~400 habitat units. To date 99.5% of the habitat in the upper Narraguagus is connected to Beddington Lake, the downstream-most point in the sub-watershed.

In our view, there are 3 major issues with the U.S. Atlantic salmon program, an overall lack of funding, a lack of communication between funders and resource managers, and a lack of fish. Funding habitat suitability/complexity projects has been extremely difficult often taking multiple rounds of grant writing to fund projects that state and federal salmon biologists tell us should be top priority projects. The only dedicated salmon money comes through NOAA's budget, but currently the only way to apply for it is through a national RFP process. Habitat suitability projects simply do not rank well nationally against large hydro dam removal, oyster bed restoration, and coral reef restoration. As a result, a habitat suitability implementation project in the Narraguagus River identified as the top priority restoration implementation project for the Downeast SHRU was not invited to apply and therefore not eligible to apply for the only Atlantic salmon recovery funds that exist. Note: there were 57 wild salmon redds observed in the proposed project area during the fall of 2019 and senior NOAA biologists from the Northwest and Northeast Science Centers are supportive of and advise that these process-based habitat suitability actions are needed.

As an example of the lack of fish, DMR fully stocks the habitat in the upper Narraguagus in support of our project; but in order to do that the rest of the watershed is either not supplemented or at an extremely reduced rate.

Section 6 – Work plan for the next calendar year

The coordinating committee looks forward to developing and updating the five-year plan in close coordination with partners.

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

Atkinson, E. and J. Zydlewski. 2020. Examining dispersal of point stocked Atlantic salmon fry relative to habitat qualities in streams in eastern Maine, USA. Presentation given at the 2020 Atlantic Ecosystems Forum January 21st to 23rd, 2020. Orono, Maine.

Dennys River Water Temperature/Habitat Evaluation. 2019 Atlantic Salmon Freshwater Action Team Report. April 25, 2019. Lead Author: USFWS MeFWCO. 53 p.

Upper Narraguagus River Water Temperature/Habitat Evaluation. A Report to the Upper Narraguagus River Watershed Working Group. June 13, 2019. Lead Author: USFWS MeFWCO. 31 p.

Annual Report of the US Atlantic Salmon Assessment Committee Report No. 32 – 2019 Activities. Portland, ME

Appendix 1. **Estimate of Juvenile Atlantic salmon productivity in the Narraguagus River**

In 2019, Downeast SHRU coordination team assembled a simple dataset to estimate summer juvenile Atlantic salmon productivity in the Narraguagus River based on USGS gage 01022500

and water temperature data collected at river kilometer (RKM) 48.2 (above Route 9). Overall 2019 summer conditions (based on low discharge and water temperature metrics) were similar to normal to ideal conditions that occurred in 2012-2015 (Figure 7.1). Poor summer conditions occurred during 2016-2018 and juvenile production and fitness was likely adversely effected.

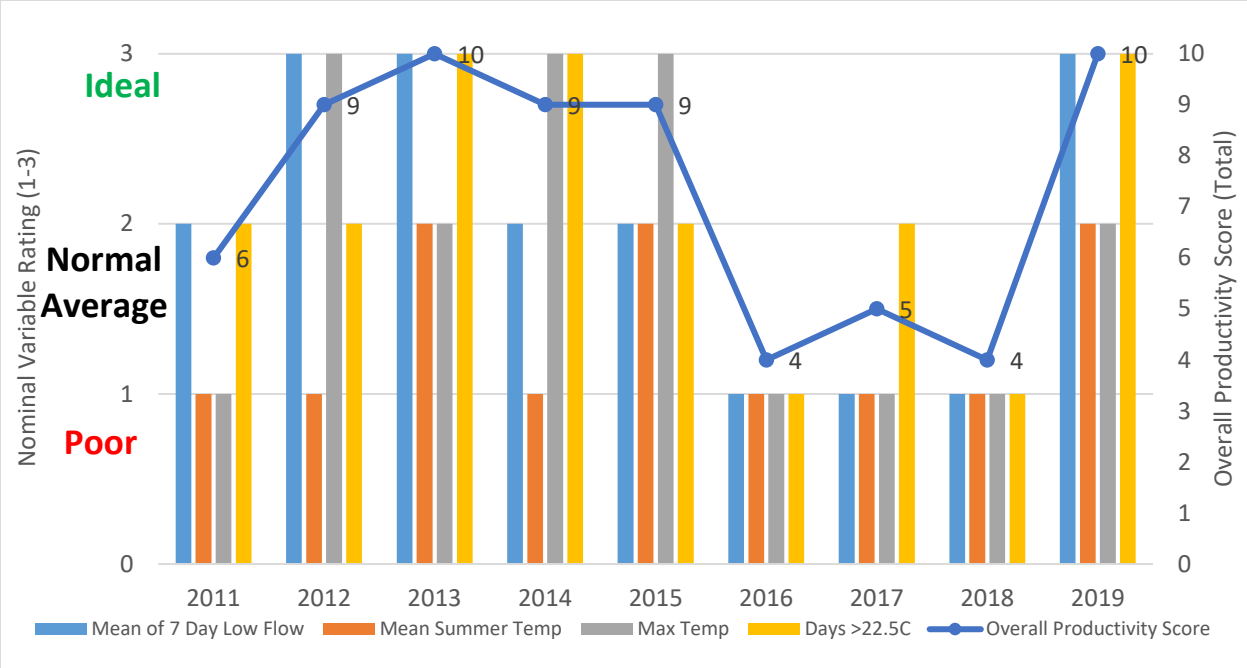

Figure 7.1 Atlantic salmon productivity estimates (2011-2019) in the Narraguagus River.

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

Recovery of the Gulf of Maine Distinct Population Segment (DPS) requires coordination of numerous conservation planning and management efforts across the entire DPS. An effective governance structure is key to charting a comprehensive long-term recovery program that facilitates interagency and intergovernmental cooperation along with the strategic involvement of a full range of partners and interested parties. The latest Atlantic salmon governance structure, the Collaborative Management Strategy, was initiated in the fall of 2019 after considerable input for stakeholders and agencies.

The Collaborative Management Strategy for the Gulf of Maine Atlantic Salmon Recovery Program, which is subject to change, includes Salmon Habitat Recovery Unit (SHRU) Teams for each major geographical area identified in the Recovery Plan for Atlantic Salmon in GOM. The SHRU Teams, in part, develop five-year work plans that include SHRU specific projects aimed at the goal of recovery of Atlantic salmon. This is a report of the 2019 activities of the Merrymeeting Bay (MMB) SHRU Team.

Section 1. Abundance and Population Trends

In the past ten years within the MMB SHRU, the adult population has increased, yet also been highly variable. In particular, adult returns have increased in the Kennebec River. This is likely a result of an increase in supplementation to the Sandy River that began in 2010 as well as improvements to marine survival, and improvements in downstream passage. The other shift that has occurred in the Kennebec River is the decreased proportion of adult returns that are of hatchery origin. Hatchery origin adults captured in the Kennebec River are likely strays from other programs that have smolt releases as part of their supplementation programs. Since 2014, the proportion of hatchery origin adults has decreased to two or less annually. The change in proportions is partially a result of the increase in wild and naturally reared adults; however, other factors such as stocking practices in other watersheds likely play a role. The Androscoggin River has not seen a positive population trend in the past 10 years. Likely due to the lack of supplementation program, the Androscoggin sees few returning adults. Like the Kennebec River, the number of hatchery fish documented on the Androscoggin has declined in the past five years. The reasons for this decline are not entirely clear but could be the result of changes to the stocking practices in other rivers. The Androscoggin River's proximity to the Kennebec River, in Merrymeeting Bay would make it a likely destination for straying Kennebec River salmon. In turn, as the population in the Kennebec River increases, an increase in adult returns to the

Androscoggin River is also expected. The Sheepscot River has not displayed any major changes in adult returns.

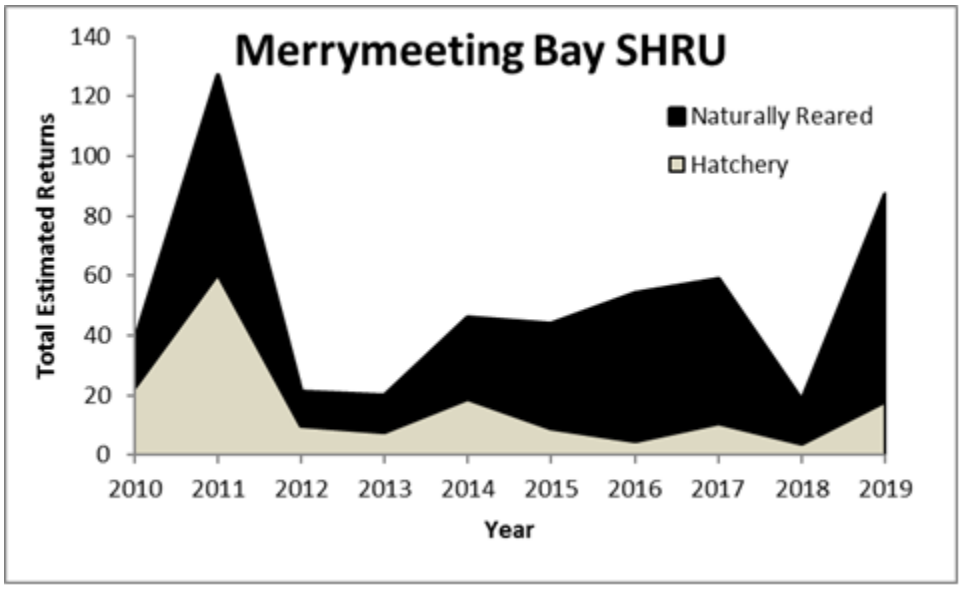

Figure 1a. Adult returns of Atlantic salmon in the Merrymeeting Bay SHRU for the last 10 years. The Kennebec returns are indicative of adult returns upstream of the confluence with the Sebasticook (i.e. at the Lockwood fishlift).

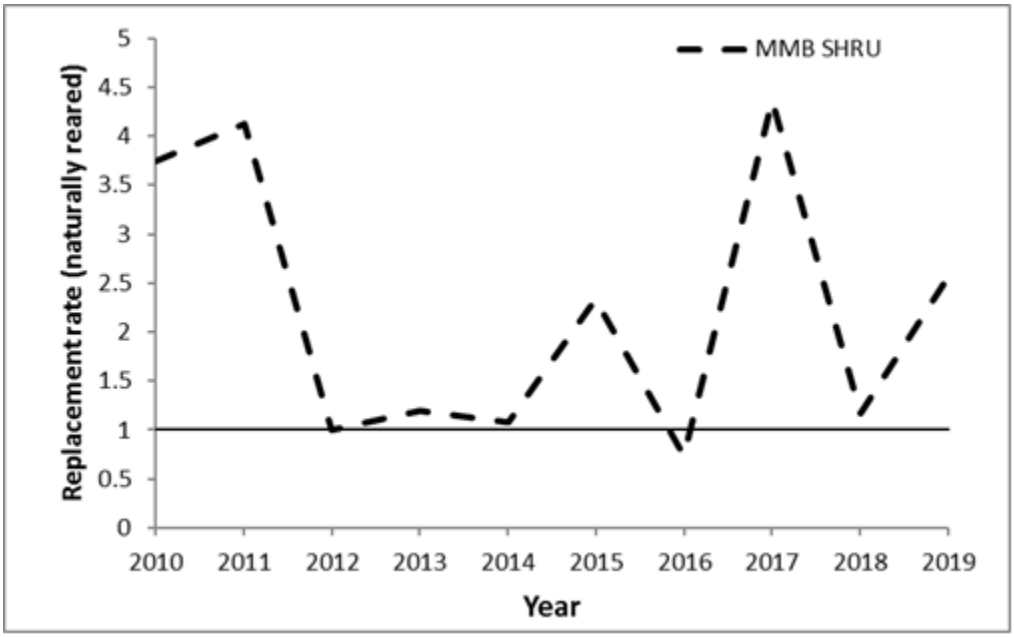

Figure 1b. The geometric mean replacement rate for DPS including the Merrymeeting Bay SHRU.

Adult Returns in 2019

Androscoggin River

In 2019, The Brunswick fishway trap was operated from May 7 to October 31 . Maine Department of Marine Resources (MDMR) operated the passage facility upon the May 7 opening until August 1st. On August 1st, Brookfield Renewable Energy Partners (Brookfield) staff took over passage operations. One adult Atlantic salmon was captured at the Brunswick fishway trap. On June 1, 2019, a Brookfield fishway observer documented a salmon in the fishway viewing window, however, this salmon was not passed upstream, as MDMR staff were not available at that time to operate the passage facility. Occasionally an adult Atlantic salmon will pass undetected through the fishway at Brunswick during maintenance/cleaning, so a minimal redd count effort was conducted. Two small sections of the Little River where redds have been documented in past years were surveyed for redd presence, totaling 0.04 river kilometers covered. No redds or test pits were found in these sections of river.

Kennebec River

In 2019, The Lockwood Dam fish lift was operated by BRP staff from May 7 to October 31. Fifty-six adult Atlantic salmon were captured at the lift. In addition, due to the dam configuration, adults are occasionally rescued from a set of ledges in the bypass canal. In July, four additional salmon were captured returning to the Kennebec River, bringing the total captures at Lockwood Dam to sixty. Biological data were collected from all returning Atlantic salmon in accordance with MDMR protocols, and the presence of marks and tags were recorded. Of the sixty returning Atlantic salmon, fifty-three (88.3%) were two sea-winter (2SW), 6 (10.0%) were grilse (one sea-winter) and one (1.7%) long absence repeat spawner. Two salmon were of hatchery origin and fifty-eight were naturally reared in origin. Thirty-nine of the returning salmon were transported to the Sandy River drainage, a large tributary to the Kennebec River, and released. The remaining twenty-one were radio tagged and released below the Lockwood Dam for research related to an assessment of energetic impacts resulting from passage delays conducted by the United States Geological Survey (USGS) and MDMR. Of these twenty-one salmon, nine were recaptured transported and released to the Sandy River. Between the thirty-nine non-study fish and nine study fish that were recaptured, a total of forty-eight adult salmon were translocated to the Sandy River. The fifty-seven adults trapped at Lockwood fish lift and rescued from the ledges are likely from the Sandy River as scale analysis revealed that all were naturally reared. The Sandy River is the only sub drainage in the Kennebec River currently under active naturally reared supplementation. One adult captured at the Lockwood fish lift had an adipose clip indicating it likely came from another program. Redd surveys were conducted in 18.73 percent of known spawning habitat primarily within the Sandy sub-drainage. Twenty-one redds were observed in the Sandy River and one in Bond Brook for a total of twenty-two redds in the Kennebec Drainage.

In 2019, the Sebasticook River, at Benton Falls fish lift facility, was operated by MDMR staff from May 1 to November 4. No Atlantic salmon were captured.

Sheepscot River

The Sheepscot River has no fish counting facility on it, so estimates of adult returns rely on redd counts. There were thirty redds observed in the Sheepscot River; twenty-seven were observed in the mainstem and three were observed in the West Branch. The thirty redds were likely from sea-run adults. A total of 89 percent (34.55km) of known spawning habitat was surveyed in the Sheepscot River drainage.

Table 1. Adult returns to rivers where traps are used in the Merrymeeting Bay SHRU in 2019.

River	Open Date	Median Catch Date	Close Date	Hatchery					Naturally Reared / Wild					Total Sea-run Returns
				1SW	2SW	3SW	RPT	Total	1SW	2SW	3SW	RPT	Total	
Lower Kennebec River	07 May	20 Jun	31 Oct	2	0	0	0	2	4	53	0	1	58	60
Sebasticook River	01 May	n/a	04 Nov	0	0	0	0	0	0	0	0	0	0	0
Lower Androscoggin R.	07 May	09 Jun	07 Nov	0	1	0	0	1	0	0	0	0	0	1

Section 2. Distribution within the Merrymeeting Bay SHRU

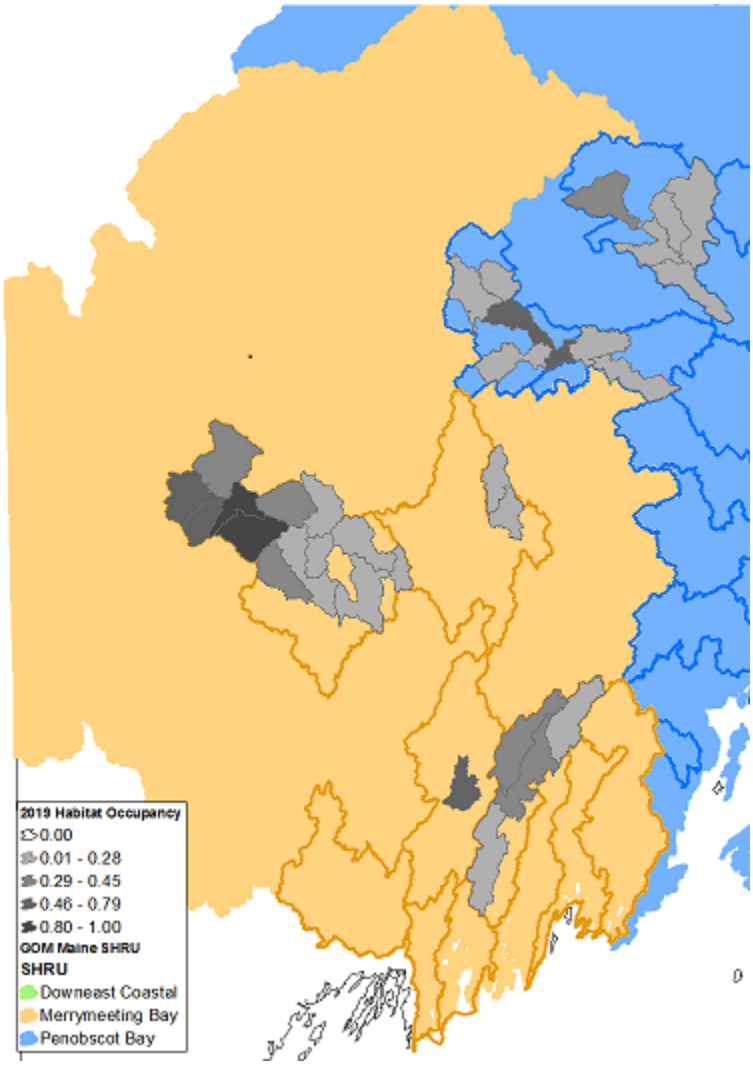

Figure 2a. Map highlighting the relative proportion of river habitat occupied for the MMB SHRU (see figure legend) by the 2019 cohort at a HUC-12 watershed summary level. Production is a synthesis of modeled distributions from spawning surveys of Atlantic salmon in 2018, winter 2019 egg planting, and 2019 fry and parr stocking.

The stocking effort in the MMB SHRU is focused in the Sandy River and the Sheepscot River with three age classes of juveniles (Figure 2b and Table 1). The primary supplementation strategy in the MMB SHRU is the planting of eyed eggs. In the Sandy River 917,613 eggs were planted between January and mid-March. In the Sheepscot River 209,582 were planting during the same timeframe. Eggs are generally divided between mainstem and tributaries according to the amount of juvenile rearing habitat in the vicinity of the planting site as well as estimate emergence rates. In the Sheepscot River a small number of fry are released annual in areas of the river where winter access may be preventative for egg planting. In 2019, 9,205 fry were

released in the upper West Branch and the mainstem Sheepscot River above Sheepscot Pond. In 2019, a small number of eggs were planted in Togus Stream a tributary to the Kennebec River in Randolph Maine. These eggs were of Sheepscot River origin and were planted to assess the potential of reintroducing Atlantic salmon to this historic habitat. This effort is currently ongoing. Lastly, the lower Sheepscot River is annually stocked with 16,845 0+ parr reared at Unites States Fish and Wild Life Service (USFWS) Craig Brook National Fish Hatchery. Parr and smolt production estimates from this effort have indicated that it produces a large portion of the natural reared juveniles in the drainage and likely contributes to the adult returns.

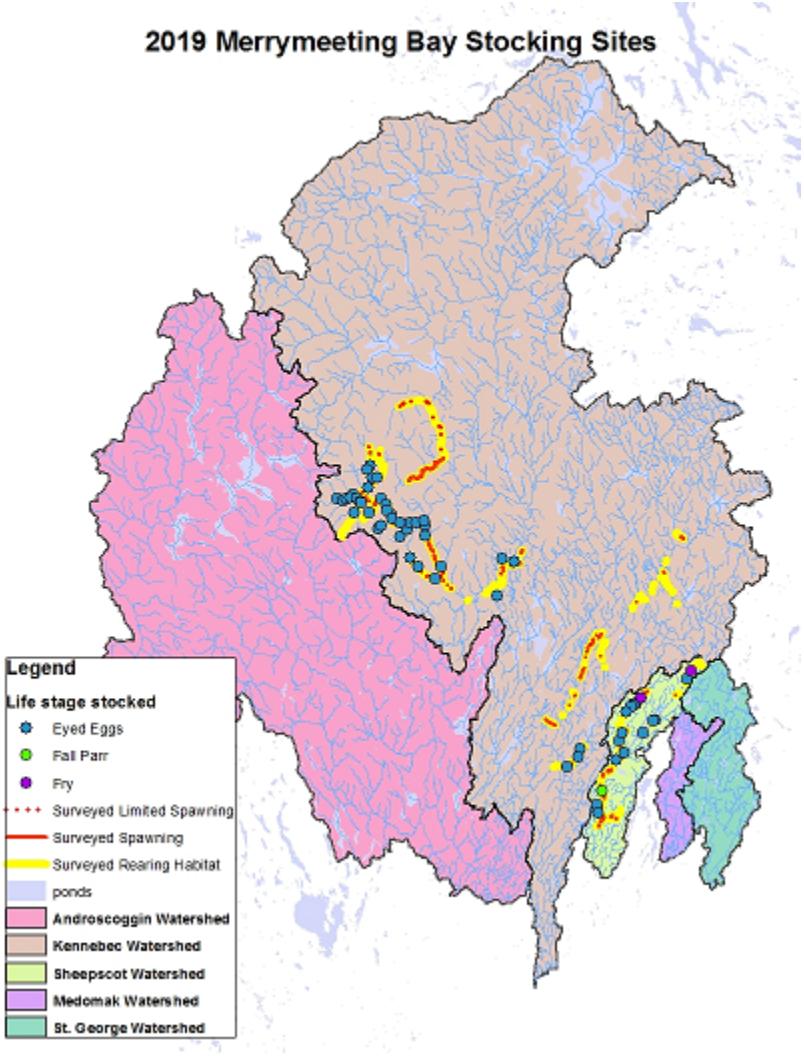

Figure 2b. Map of stocking locations in the Merrymeeting Bay SHRU.

Table 1. Atlantic salmon released in the Merrymeeting Bay SHRU.

2019 Merrymeeting Bay Atlantic Salmon Released						
Drainage	**Watershed**	**Eggs**	**Fry**	**Fall Parr**	**Smolts**	**Captive Reared Adults**
Kennebec	Sandy River	917613	0	0	0	0
	Togus Stream	5128	0	0	0	0
Sheepscot	All	209582	9205	16845	0	0

Table 2. Fish passage projects completed in 2019 in the Merrymeeting Bay SHRU.

River	Project Name	Passage Improvement Type	Access (Stream Miles)	Lake/Pond Make Accessible (Acres)
Kennebec	Togus Stream Fishway	Accessible	N/A	790
Sheepscot	Headtide Dam Improvements	Accessible	60	N/A

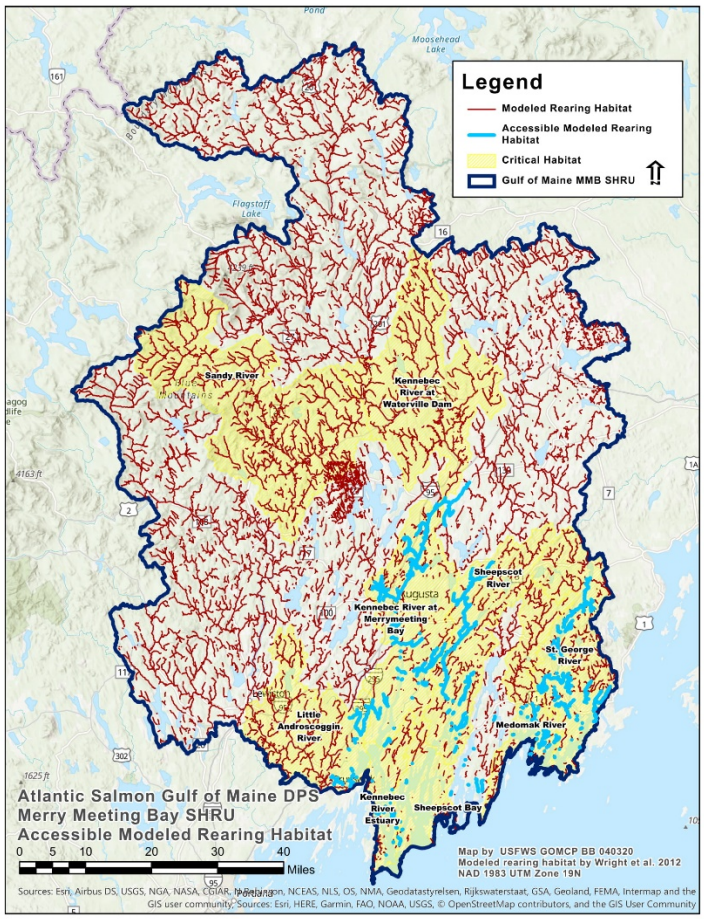

Figure 2c. Map of the MMB SHRU showing river and stream reaches accessible for anadromous fish.

Section 3. Diversity

For each broodstock within SHRUs, a target of 200 parr to collect and retain for broodstock is being used starting with the 2017 collection year. Results below represent the mean number of alleles per locus (based on 18 microsatellite loci) for the Sheepscot River broodstock, measured within the most recent collection of parr for broodstock (in this case, the 2017 collection). For the 2017 parr collection, allelic diversity decreased over the previous (2016 estimate) and is slightly less than the 10-year average (of mean number of alleles = 11.51). More detailed summaries of genetic diversity are found in the United States Atlantic Salmon Committee (USASAC) report.

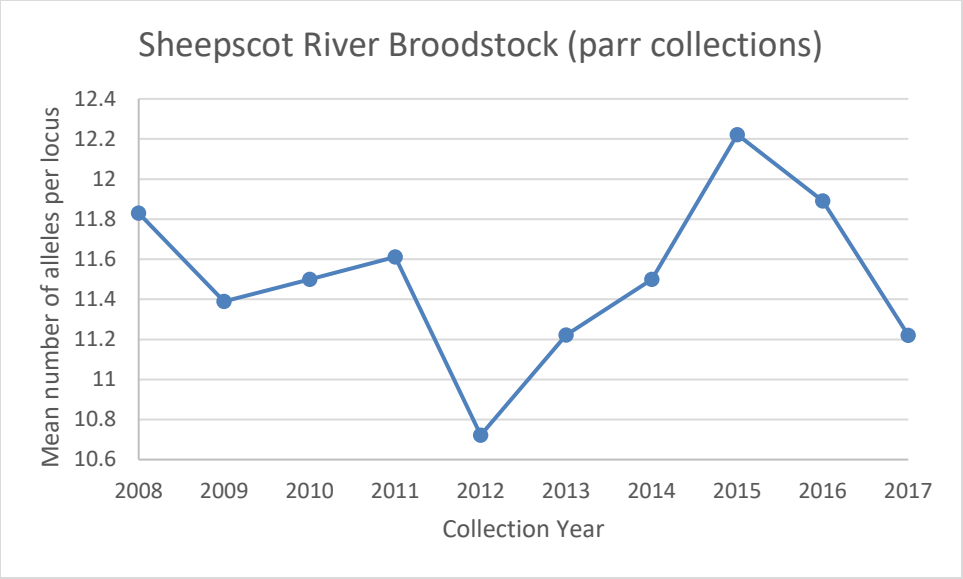

Figure 3. Figure of allelic diversity in the Sheepscot River.

The genetic diversity in the Kennebec River is unknown, but given the supplementation program, stock origin is a large portion of the domestically reared broodstock (F^2) Penobscot River program, it is likely comprised of a similar genetic diversity to the Penobscot River stock. The Penobscot River origin stock currently has the largest effective population size in Maine, which makes it a good choice as a donor stock. In addition to the supplementations from the F2 program, in 2018 approximately 287,00 eggs were planted in the Sandy River from the Denny's River specific origin stock. If these eggs were to produce adult returns the 2021 and 2022 adult cohorts will add to the Kennebec River's diversity. In addition, it is also likely that one of the adults that was captured in 2019 and transported to the Sandy River was from the Sheepscot River program. The adult had an observed adipose clip and an analysis of a scale sample indicates it had spent at least two years in fresh water. The closest physical river where juveniles are marked and many of which are expected to remain in freshwater for at least two years is the Sheepscot River. If this adult were to successfully spawn it would add to the Kennebec Rivers genetic diversity.

Table 3. Age and origin of adult returns to the Kennebec River 2019.

Adult Returns to the Kennebec River										
Total Adult Returns to the Kennebec	**Hatchery**					**Naturally Reared / Wild**				
	1SW	**2SW**	**3SW**	**RPT**	***Total***	**1SW**	**2SW**	**3SW**	**RPT**	***Total***
60	2	0	0	0	*2*	4	53	0	1	*58*
	3.33%	0.00%	0.00%	0.00%	*3.33%*	6.67%	88.33%	0.00%	1.67%	*96.67%*

Section 4. Emerging Issues and Priorities

Strengthening public engagement and outreach associated with recovery efforts is a priority for the upcoming year. The new governance structure provides fresh new opportunities to build partnerships and strengthen existing ones. A focus for the year will be increased engagement with land trusts to preserve river and stream corridors associated with the Sandy and Sheepscot. In addition, exploring ways in which to reach new audiences to discuss the benefits and importance of recovery and to mobilize local action will also be a priority.

Efforts to conduct habitat restoration activities within the watershed and improve fish passage at dams is another priority for the Merrymeeting Bay SHRU. Temple Stream habitat connectivity work, which includes removal of Walton's Mills Dam and the replacement of two culverts, is a prime example. There are sixty-five Federal Energy Regulatory Commission licensed dams within the SHRU. Ensuring safe, timely, and effective passage at these dams is paramount. While implementing specific projects will support recovery, continued efforts by SHRU team members to identify and strategically prioritize climate resilient watersheds is will help to advance recovery.

An emerging issue that will need to be addressed is the loss of the Sheepscot River parr program. Discontinued in winter of 2019, the program constituted 55 percent of the salmon production for the river.

While not an emerging issue, the impacts of climate change within the SHRU, both ecologically and socially, remains an issue within the SHRU.

Section 5. Stakeholder Input

On February 4, 2020, the MMB Coordinating Committee met with representatives from the Atlantic Salmon Federation and the Midcoast Conservancy to review and update SHRU-based work plans associated with the Final Recovery Plan for Atlantic salmon. Non-Governmental Organizations (NGO) attendees were invited in light of the Committee's knowledge of those entities currently active in projects relevant to the existing work plans. In addition to the review of the existing work plans, the Committee and the participants identified any projects that were not present on the work plans and that could begin or be completed within the next calendar year. The Committee used information from this stakeholder input to inform proposed actions for 2020 (Table 6a) and to identify new activities to add to the MMB SHRU work plans (Table 6b) included in this report.

Additionally, the Committee held a public SHRU team meeting on March 13, 2020. The meeting was well-attended by representatives from seven different NGOs, five different state and federal agencies, and Maine Sea Grant. The purpose of the public meeting was to introduce attendees to the new Collaborative Management Strategy and to elicit preliminary input regarding the goals, objectives, and structure of the MMB SHRU Team moving forward. The

Committee also obtained information from the meeting regarding proposed actions for 2020 (Table 6a) and to identify new activities to add to the MMB SHRU work plans (Table 6b) included in this report. The Committee expects that information from this engagement and future SHRU meetings will help inform the five-year plan, currently in development. The Committee anticipates holding additional public meetings in 2020 to continue developing a collaborative and cohesive MMB SHRU Team.

Section 6. Work Plan 2020

Table 6a. Proposed actions for 2020.

Project	Action	Watershed	Partners
Broodstock Stocking	Stock Sheepscot broodstock in vacant habitat to conserve genetic diversity.	MMB SHRU	
Sheepscot Broodstock Evaluation	Evaluate Sheepscot Broodstock as a donor stock compared to Penobscot donor stock in vacant habitat through a common garden evaluation	MMB SHRU	
Sheepscot Lake Dam	Evaluate opening of fishway for herring	Sheepscot	
Branch Pond Dam	Explore opportunities for dam removal/fish passage improvements for herring	Sheepscot	
Togus Pond Fishway	Fish passage/ Dam removal	Kennebec	DMR, USFWS, Lake Association, NOAA
Benton Falls	Develop SPP for salmon	Kennebec	Dam owner, NOAA, MDMR, USFWS
Lockwood Dam	Finalize SPP for salmon	Kennebec	
Hydro Kennebec Dam	Finalize SPP for salmon	Kennebec	Dam owner, NOAA, MDMR, USFWS
Shawmut Dam	Finalize SPP for salmon	Kennebec	Dam owner, NOAA, MDMR, USFWS
Weston Dam	Finalize SPP for salmon	Kennebec	Dam owner, NOAA, MDMR, USFWS
Temple Stream	Continue progress on dam removal	Kennebec	NGOs, Dam owner, MDMR, USFWS, NOAA
Carrabassett River	Conduct habitat surveys	Kennebec	MDMR
Sabattus River	Explore opportunities for dam removal/fish passage improvements	Androscoggin	Dam owners, NGOs, MDMR, NOAA

Table 6b. New activities added to the Merrymeeting Bay SHRU work plans.

Project	Action	Watershed	Partners
Taylor Rd. Bridge	Remove bridge remnants	Sheepscot	
Sheepscot Habitat Enhancement	LWD additions	Sheepscot	MDMR, USFWS
Trout Brook	Replace culvert	Sheepscot	
Dyer Habitat Enhancement	Enhance habitat	Sheepscot	NRCS
Land Protection	Easement purchases	Sheepscot	
0+ Parr Releases	Alternatives planning	Sheepscot	USFWS, DMR
Adult Studies	Timing, routes, survival predation, spawning success, etc.	Kennebec	MDMR,USFWS,NOAA, Academia
Smolt Studies	Timing, routes, survival predation, spawning success, etc.	Kennebec	MDMR,USFWS,NOAA, Academia
Smolt Socking/Adult Success	Evaluation of smolt stocking to maximize survival and returns	Kennebec	MDMR,USFWS,NOAA, Academia
Wild Reproduction	Evaluation of egg planting in comparison to wild redd production.	Kennebec	MDMR,USFWS,NOAA, Academia
Kelt Studies	Downstream studies at mainstem dams to evaluate survival and improve safe, timely, and effective kelt passage.	Kennebec	Dam owners, MDMR, USFWS, NOAA, Academia
Habitat Restoration	Enhance habitat by additions of large wood and other structures and monitor effectiveness.	Kennebec	MDMR, USFWS NOAA, NGOs
Mainstem Kennebec Dams	Explore opportunities for dam removal/fish passage improvement alternatives	Kennebec	NGOs, Dam owner, MDMR, NOAA, USFWS
Shawmut Relicensing	Participate in FERC relicensing process	Kennebec	All Stakeholders
Carrabassett River	Explore opportunities for dam removal/fish passage	Kennebec	Dam owner, NGOs, MDMR, NOAA, USFWS
Sandy River Stocking	Collaborate with IFW to explore opportunities to minimize the negative effects of stocking	Kennebec	IFW,MDMR, NOAA, NGOs
Invasive Species	Collaborate with IFW to explore opportunities to minimize or eliminate non-native species	Kennebec	FW,MDMR, NOAA, NGOs

Temple Stream: Barrier ID 15270 Culvert Enhancements	Enhance two undersized culverts	Kennebec	ASF, USFWS, Town of Farmington
Temple Stream: Cummings Hill Rd.	Enhance three undersized and failing culverts	Kennebec	ASF, USFWS, Town of Farmington
Cottle Brook: Davenport Flat Rd.	Enhance insufficient culvert	Kennebec	Town of Phillips, USFWS
Bond Brook: East Sandy Rd.	Enhance insufficient culvert	Kennebec	Town of Starks, USFWS
Swan Island: Tributary at Libby Hill Rd.	Enhance insufficient culvert	Kennebec	Town of Pittston, USFWS
Orbeton	Replace barrier (bridge)	Kennebec	U.S. Navy, USFWS
Orbeton	Enhance insufficient culverts	Kennebec	U.S. Navy, USFWS
Orbeton	Enhance insufficient culvert	Kennebec	U.S. Navy, USFWS
Nequasset	Back River Creek Restoration Project	Kennebec	USFWS, KELT, ME-DOT, MNAP
Kelt Studies	Downstream studies at mainstem dams to evaluate survival and improve safe, timely, and effective kelt passage.	Androscoggin	Dam owners, MDMR, USFWS, NOAA, Academia
Brunswick Dam	Finalize SPP for salmon	Androscoggin	Dam owner, NOAA, MDMR, USFWS
Pejepscot	Finalize SPP for salmon	Androscoggin	Dam owner, NOAA, MDMR, USFWS
Pejepscot Relicensing	Participate in FERC relicensing process	Androscoggin	All Stakeholders
Lewiston Falls	Finalize SPP for salmon	Androscoggin	Dam owner, NOAA, MDMR, USFWS
Habitat Restoration	Enhance habitat by additions of large wood and other structures and monitor effectiveness.	Androscoggin	MDMR, USFWS NOAA, NGOs
Patty's Pond Bridge	Replacement for herring access	Kennebec	DOT
Madrid Bridge Replacements	Rt. 4 crossing replacements	Kennebec	DOT
Temple Bridge Removal	Temple on Russell Mills Rd.	Kennebec	DOT
Outreach Tool	Desktop tool for decision support on stocking and restoration projects.	MMB SHRU	Sea Grant
Little Androscoggin Relicensing's	Participate in FERC relicensing's at Upper Barker and Hackett Mills	Androscoggin	All Stakeholders

Water Quality Standards Review	Statewide review of water quality standards for salmon habitat areas	MMB SHRU	MDEP
Cobbosseecontee Stream	River herring reintroduction	Kennebec	NGOs

Section 7. Reports and Publications from the Merrymeeting Bay SHRU

None to report for 2019

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

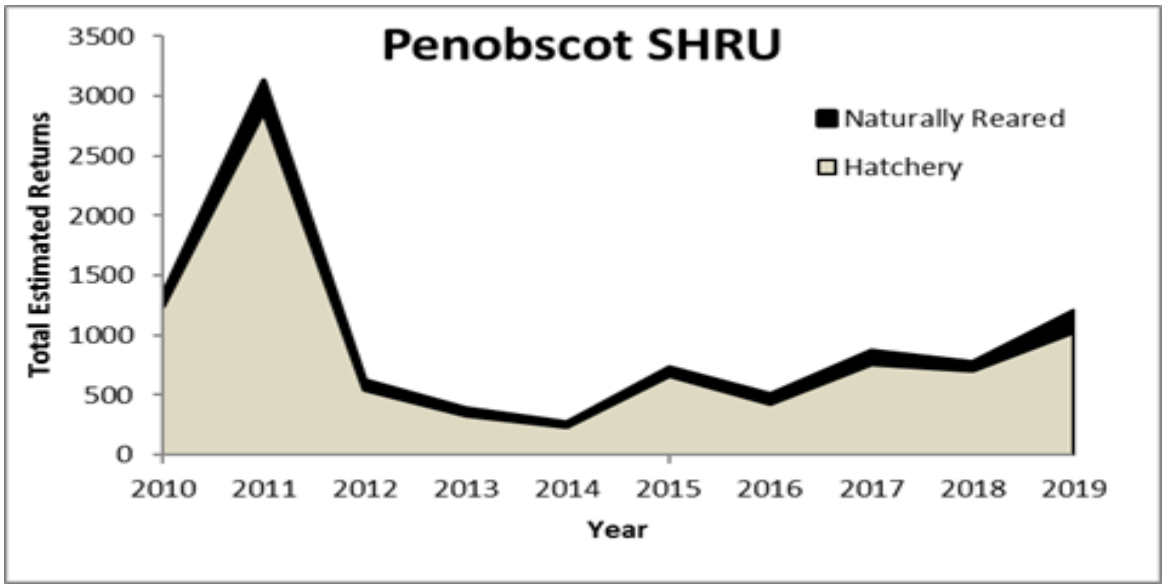

Figure 1a. Adult returns of Atlantic salmon from 1999 to 2019. Black shaded area represents naturally reared origin salmon (redd, egg, or fry). Grey shaded area indicates hatchery origin salmon (fall parr, smolt, adult). (USASAC 2020).

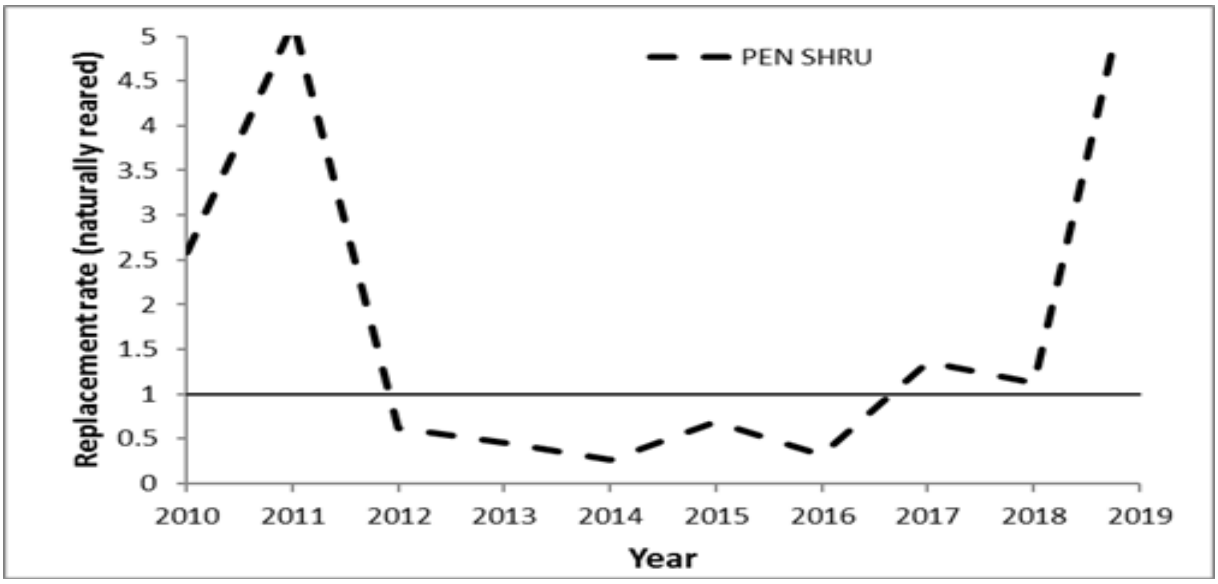

Figure 1b. Replacement rate of naturally-reared salmon in the Penobscot SHRU from 1999 to 2019. Solid horizontal reference line indicates a spawner to spawner replacement rate of 1 based on a 5-year lifecycle. (USASAC 2020)

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).

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

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

*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.

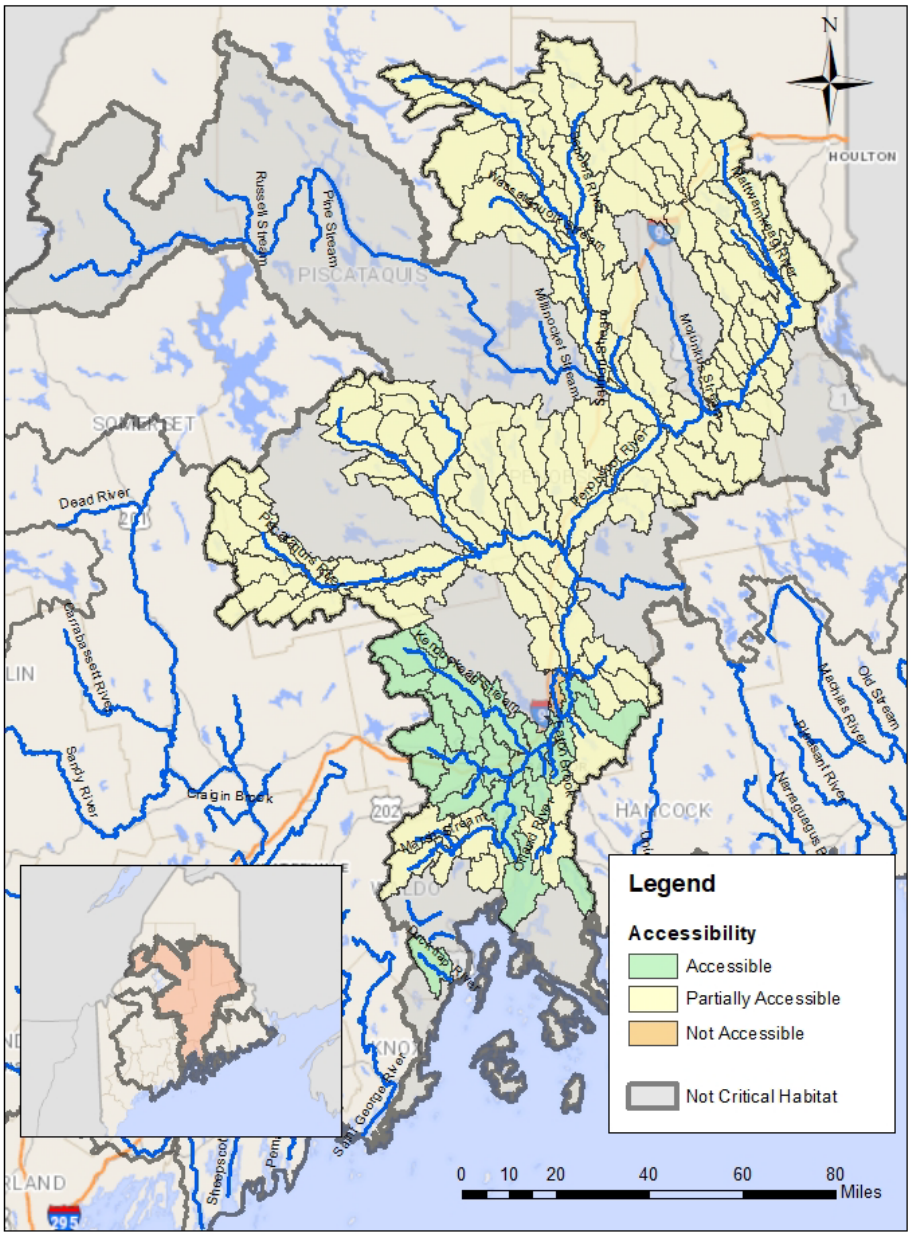

Figure 2a. Map of currently accessible habitat. This does map does not account for road crossing barriers. To meet the standard of accessible habitat 1) habitat is accessible above a dam with upstream and downstream passage that does not preclude recovery, or 2) accessible above road stream crossings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

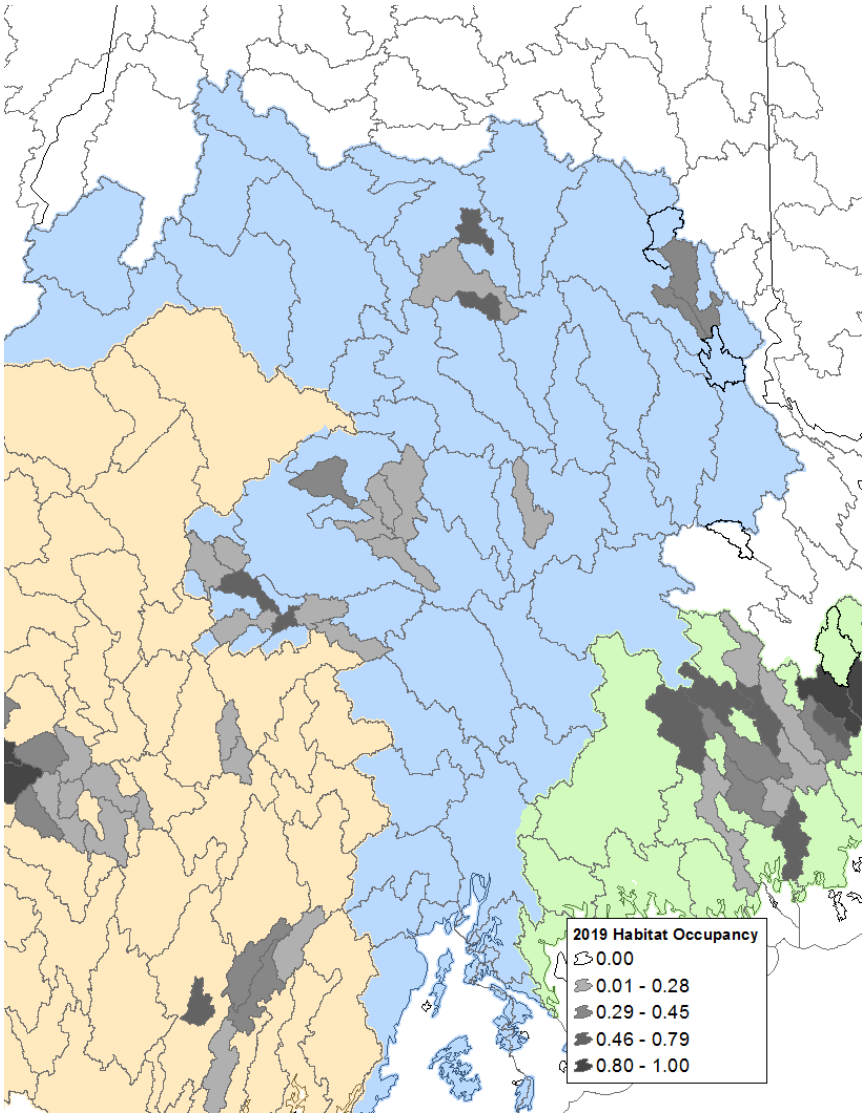

Figure 2b. Proportion of rearing habitat occupied at the Hydrologic Unit level 12 (HUC 12) in the Penobscot Salmon Habitat Recovery Unit. Occupancy is determined as the presence or absence of salmon in the HUC 12. These are based on known occupancy resulting from spawner surveys and stocking activities.

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

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

*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.

Watershed	Stream	Project Type	Passage improvement type (fully accessible vs accessible vs partially accessible*	Stream miles made accessible (according to RP criteria)	Lake/pond acres made accessible
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	
Penobscot	Unnamed Trib, Stockton Springs, Rte 1	Culvert replacement		1	

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

Section 3 – Diversity

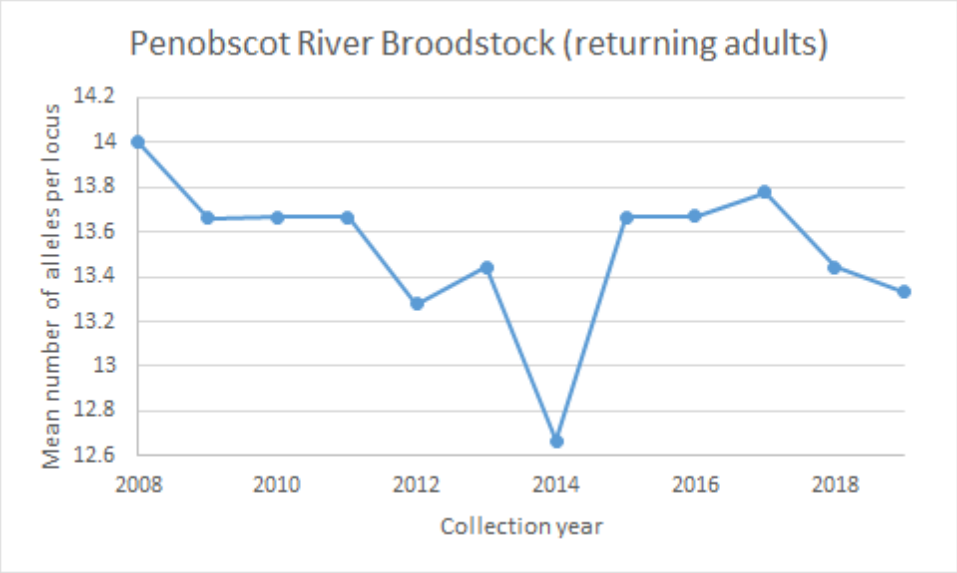

Figure 3. Graph of the mean number of alleles per locus for the Penobscot River broodstock, based on the adults sampled at Milford Dam for transport to Craig Brook National Fish Hatchery. Results represent the mean number of alleles per locus (based on 18 microsatellite loci) for the sea-run broodstock 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 spawners	%Age 1 smolt	%Age 2 smolt	%Age 3+ 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.

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

Watershed	Threat	Activity	Partners	Recovery Action	Summary of planned work for next year
Penobscot	Parker Pond Dam blocks passage of alewives	Restore fish passage	USFWS	C5.3	USFWS has funded a nature like fishway with construction anticipated in 2020
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/Frost Pond culvert impedes passage of sea run fish	Complete tier 1 road stream crossing according to the Maine DOT's Programmatic consultation for transpor	NOAA, TNC	C4.3	Final design and engineering is expected to be completed in 2020, with construction in 2021

		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/Baskahegan 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 Penobscot River		Identify and coordinate actions associated with Salmon for Maine's Rivers project and other passage, habitat, and stocking activities within the East Branch	FWS, NOAA, MDMR, PIN, TNC, USGS, U of Maine,	C1.3. Identify and prioritize fish passage barriers in the Penobscot SHRU necessary for the survival and recovery of Atlantic salmon. 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.
Piscataquis River		Identify and coordinate actions associated fish passage and maximizing natural reproduction of hatchery products	FWS, NOAA, MDMR, PIN, DOT, TNC, USGS, U of Maine, ASF, NRCS	C1.3. Identify and prioritize fish passage barriers in the Penobscot SHRU necessary for the survival and recovery of Atlantic salmon. 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)