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

2023 REPORT OF 2022 ACTIVITIES

Contents

Chapter 1 Introduction

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). 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 2022 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 2020, the management board determined that they would not stand up any

additional standing committees until after the pilot year review. Therefore, only one standing committee has been established to review studies associated with FERC projects in the GOM DPS. The annual report from this committee is included in this report (Attachment 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.

Chapter 2 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 following sections, we summarize the return data and habitat accessibility data from 2019 in reference to the reclassification and delisting criteria.

Abundance

In 2022, an estimated 1,520 pre-spawn salmon returned to the GOM DPS, of which 218 were wild or naturally reared (Table 2-1). Of the total, approximately 5% returned to the Downeast Coastal SHRU; 88% returned to the Penobscot Bay SHRU; and 7% returned to the Merrymeeting Bay SHRU. Of the 218 wild or naturally reared adults returning to the GOM, 53% returned to the Penobscot, 26% returned to the Downeast, and 21% returned to the Merrymeeting Bay. The proportion of the total run that was naturally reared (14%) was considerably lower than what has been seen on average over the last decade (21%), the total abundance of returning salmon was below the 10-year average (Table 2-2; Figure 2-1). Regardless, the abundance of wild and naturally reared returns remain well below what is needed for either reclassification or delisting (Table 2-3).

Table 2-1. Summary of adult returns for the GOM DPS in 2022 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	HATCHERY	WILD/NATURALLY REARED
DOWNEAST COASTAL	73	17	56
MERRYMEETING BAY	113	68	45
PENOBSCOT BAY	1,334	1,217	117
TOTAL	***1,520***	***1,302***	***218***

Table 2-2. The 10-year average number (2013-2022) of adult returns to the GOM DPS by SHRU

SHRU	TOTAL RETURNS	HATCHERY	WILD/NATURALLY REARED
DOWNEAST COASTAL	105	50	56
MERRYMEETING BAY	55	17	39
PENOBSCOT BAY	807	706	102
TOTAL	968	772	196

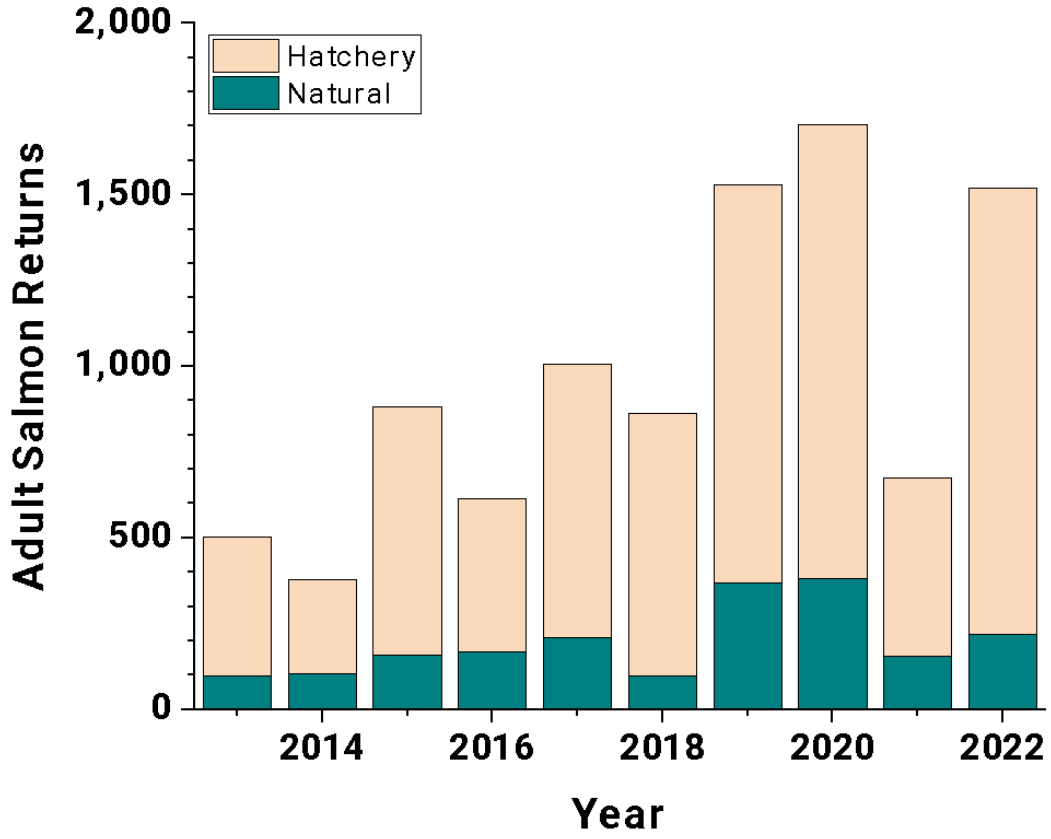

Figure 2-1. Adult returns of Atlantic salmon from 2013 to 2022. Blue shaded area represents naturally reared origin salmon (wild, egg stocked or fry stocked). Pink shaded areas indicate hatchery origin salmon (fall parr, smolt, adult).

Table 2-3. The average number (2013-2022) 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 (AVERAGE)	% OF DOWNLISTING GOAL	% OF DELISTING GOAL
DOWNEAST COASTAL	56	11.2%	2.8%
MERRYMEETING BAY	39	7.8%	1.9%
PENOBSCOT BAY	102	20.4%	5.1%

Productivity

The GOM DPS rate for 2022 returns was 0.97 (95% CL 0.58-1.63); because error bounds around this rate overlap 1.0, this indicates relative stability. This rate does not reflect the true wild population growth rates because naturally reared salmon returns include not only individuals that are the product of wild reproduction but also products of the U.S. hatchery system (e.g., stocked fry and planted eggs). As such, the inclusion of hatchery products in the 10-year geometric mean replacement rate overestimates wild population growth rate. (Figure 2-2). The reclassification and delisting productivity criteria require that *each SHRU* sustain a geometric mean replacement rate of more than 1.0, in addition to meeting the relevant abundance criteria. As indicated above, no SHRU meets the abundance criteria. In 2022, (as in 2021) the population growth rate was met in the Merrymeeting Bay SHRU, but not in either of the other two SHRUs. For more information, refer to the enclosed SHRU reports.

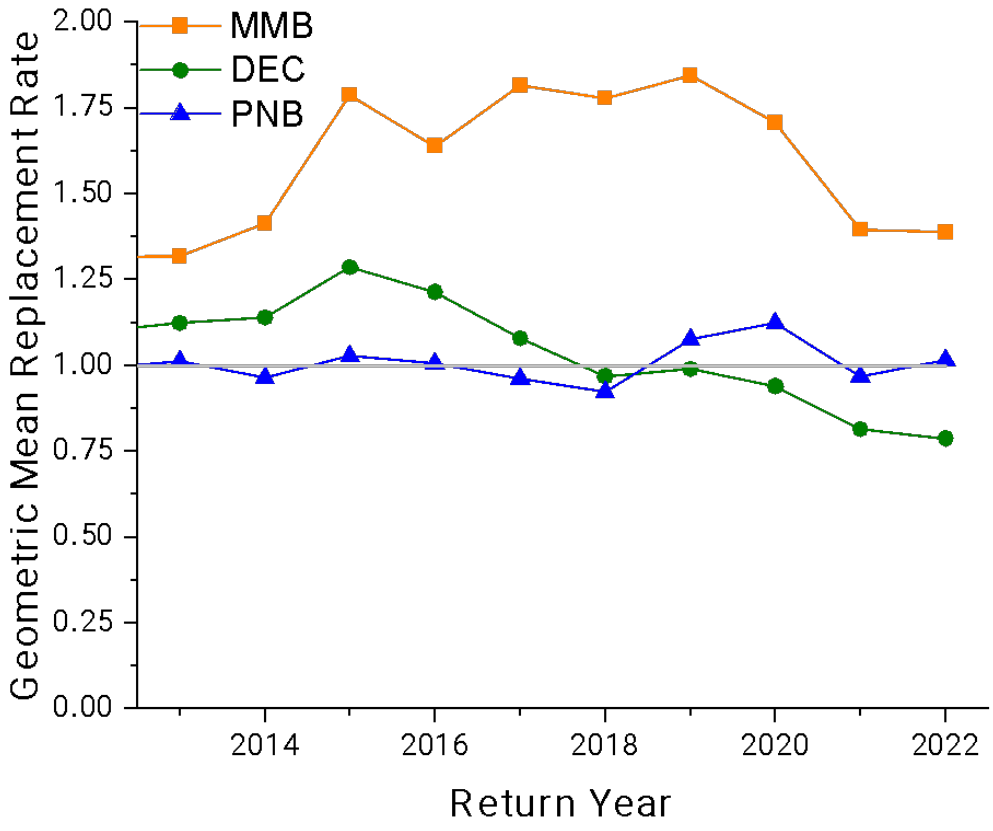

Figure 2-2. Annually calculated ten-year geometric mean replacement rates for the GOM DPS of Atlantic salmon for Merrymeeting Bay (orange), Penobscot Bay (blue), and Downeast Coastal (green) for each SHRU individually from 2013 to 2022.

Habitat

In 2022, a minimum of 27 connectivity projects were conducted that improved access to 110.1 stream miles (Table 2-4). Not all of these improvements occurred in watersheds that are currently accessible to Atlantic salmon due to other passage obstructions downstream. For instance, a project located on a tributary that is upstream of an impassable dam will not make the habitat accessible to salmon in the context of our recovery criteria until the downstream barriers have been addressed. However, these types of projects will be critical for achieving the criteria once the downstream barriers have been made accessible.

Table 2-4. The number of connectivity projects (culverts and dams) that have been reported in the SHRU annual reports for 2022, and the cumulative amount of stream habitat miles where access has been improved.

SHRU	PROJECTS REPORTED	STREAM MILES
MERRYMEETING BAY	19	100.9
PENOBSCOT BAY	7	8.77
DOWNEAST COASTAL	1	0.1
GOM DPS	28	109.77

In years past, we have reported on the estimated total number of suitable and accessible habitat units. However, it has become apparent that our estimates of accessibility and suitability require considerable refinement. As we reported "accessibility" in previous reports, we did not fully factor in the effects of road-stream crossings, which are a considerable barrier to fish passage in many instances. Thus, the estimates we made were overly optimistic. Additional spatial analyses are needed before we can make a reliable estimate of the number of accessible habitat units in the three SHRUs.

In addition, considerable uncertainty remains on what constitutes "suitable" habitat. The way we have done this in the past relies on simply estimating the number of habitat units from the existing habitat model produced by Wright et al. (2008). Greater attention toward defining what constitutes "suitable" habitat is needed before we can make a reliable estimate of the number of suitable habitat units. A working group initiated in 2022 is identifying the metrics needed to report on the recovery criteria of "suitable and accessible habitat."

As described in the Final Recovery Plan (2019), 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, however, the minimum amount of suitable habitat

that must be accessible to returning adults to achieve delisting criteria is 30,000 Habitat Units per SHRU. Figure 2-3 shows areas within designated critical habitat that are unimpeded by dams as of the 2022. There was no change to the areas unimpeded by dams during 2022. Currently, none of the FERC-licensed dams meet the minimum passage criteria necessary for upstream habitats to be considered "accessible" according to the definitions in the Final Recovery Plan.

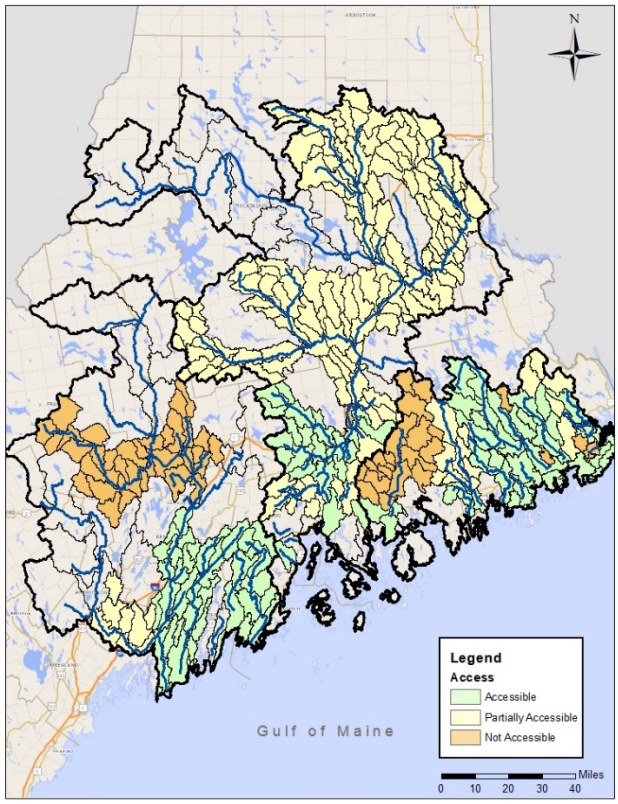

Figure 2-3. Watersheds that have been determined to be accessible in 2022. No changes have been made since last report in 2021. Accessible watersheds have no mainstem dams, or else have dams that have fishways that have been evaluated and determined to be highly effective. The habitat in these watersheds 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.

Chapter 3 Annual Report for the Downeast Recovery Unit – Calendar year 2022 activities

This report summarizes progress toward achievement of recovery goals for the Downeast Salmon Habitat Recovery Unit (Downeast SHRU) in 2022.

Abundance and population trends

Adult returns of Atlantic salmon to the Downeast SHRU for 2022 (73) were like those in 2021 (74; Figure 3-1). The 10-year geometric mean of the growth rate for the naturally-reared salmon for the period 2013 to 2022 is 0.79 with a 95% confidence limit ranging from 0.50 to 1.24. The adult return information and replacement rate presented below is from the work of the U.S. Atlantic Salmon Assessment Committee (USASAC 2023); therefore, the definition of "naturally reared" salmon refers to salmon that originated from natural spawning (redds) or hatchery origin lifestages (egg and fry) but not parr, smolt or gravid adults.

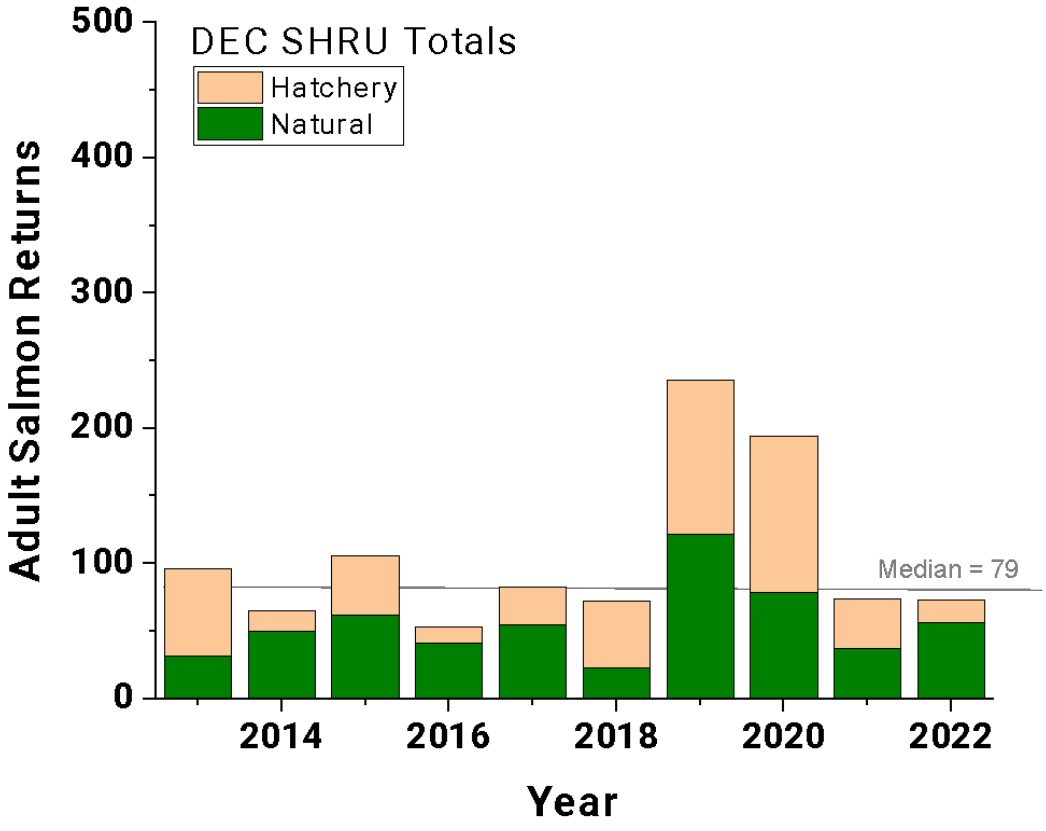

Figure 3-1. Adult returns of Atlantic salmon from 2013 to 2022. Green shaded area represents naturally reared origin salmon (redd, egg, or fry). Tan shaded area indicates hatchery-origin salmon (fall parr, smolt, adult; USASAC 2023). The term "DEC SHRU" refers to the Downeast SHRU.

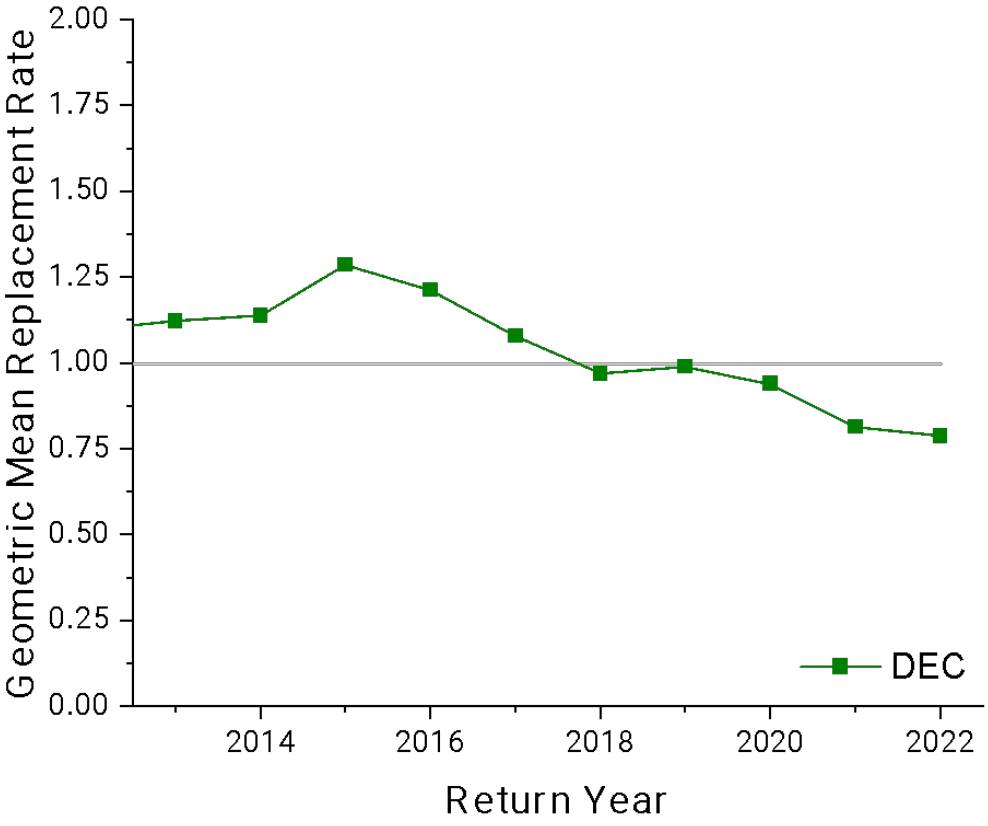

Figure 3-2. Replacement rate of naturally reared salmon in the Downeast SHRU from 2013 to 2022. Solid horizontal reference line indicates a spawner-to-spawner replacement rate of 1 based on a 5-year lifecycle (USASAC 2023). The term "DEC" refers to the Downeast SHRU

Table 3-1. Summary of adult returns for the Downeast SHRU in 2022. 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	0	NA	NA
NARRAGUAGUS	19	95%	5%
PLEASANT	21	100%	0%
MACHIAS	10	100%	0%
EAST MACHIAS	17	6%	94%
DENNYS	6	100%	0%
TOTALS	73		

Spatial Distribution

In previous years, the coordinating committee for the Downeast SHRU has reported the number of suitable and accessible habitat units. However, it has become apparent that estimates of accessibility and suitability require considerable refinement. As "accessibility" was described in previous reports the effects of road-stream crossings, which are a considerable barrier to fish passage in many instances, were not factored in. Thus, the accessibility estimates made were overly optimistic. Additional spatial analyses are needed before a reliable estimate of the number of accessible habitat units in the Downeast SHRU can be made.

In addition, considerable uncertainty remains on what constitutes "suitable" habitat. Previous calculations of suitability relied on simple estimates of the number of habitat units from the existing habitat model produced by Wright et al. (2009). Greater attention toward defining what is truly "suitable" habitat is needed before a reliable estimate of the number of suitable habitat units exist in the Downeast SHRU can be made.

Contemporary spatial distribution of Atlantic salmon in the Downeast SHRU is closely correlated with stocking activities since abundance levels are so low. A total of 1,173,763 salmon were stocked into the Downeast SHRU in 2022 (Table 3-2). Of these, the majority were stocked as fry. The Peter Gray Hatchery has increased their production capacity and can now provide age 0+ parr for the Narraguagus River in addition to the East Machias.

Table 3-2. Summary of salmon stocked in the Downeast SHRU by river in 2022

River	Life stage	Number
Union	Fry	1,000
Narraguagus	Fry	72,000
	Parr	90,000
Pleasant	Fry	326,000
Machias	Fry	221,000
	Parr	16,000
	Smolt	938
	Adult	40
East Machias	Fry	19,000
	Parr	165,000
Dennys	Fry	262,000
	Total	1,172,978

Captive spent (post-spawn) adult broodstock (941) were also released from Craig Brook NFH in the Downeast SHRU in 2022: Dennys, 213; East Machias, 177; Machias, 196; Narraguagus, 171; Pleasant, 184. However, as these fish are unlikely to contribute to future generations they are not included in estimates of occupancy. In addition, 40 pre-spawn adults originating from the Salmon for Maine Rivers program were released in the Machias River.

One way to visually represent spatial distribution is with occupancy maps. Figure 3-3 describes the estimated proportion of rearing habitat within a HUC 12 occupied by Atlantic Salmon. The estimate is derived from known presence of salmon based on spawner surveys identifying wild production areas (WPA) or stocking events aimed at releasing egg, fry, or 0+ parr lifestages. An estimate of upstream and downstream dispersal is used to select occupied habitat and occupancy is the ratio of occupied rearing habitat to total rearing habitat in a HUC12. While still at only modest occupancy, the Downeast SHRU has a generally broad distribution of juveniles in the Dennys, East Machias, Machias, Narraguagus, and Pleasant Rivers (Figures 3-3, 3-4, 3-5, and 3-6).

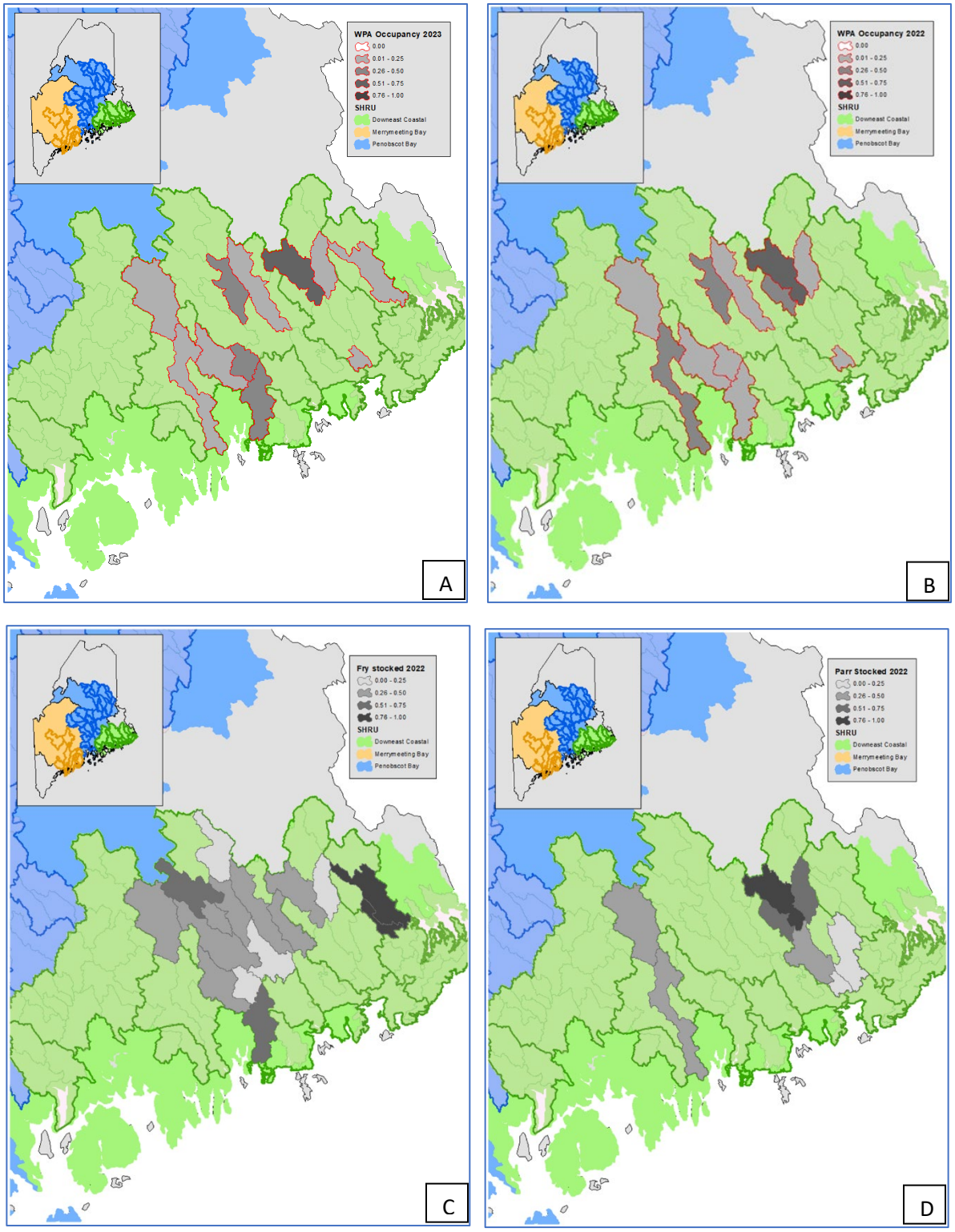

Figure 3-3. Spatial occupancy by lifestage across the Downeast Salmon Habitat Recovery Unit. Panel A describes the probable 2023 wild cohort (WPA) HUC 12 proportion occupancy based on 2022 spawner surveys. Panels B through D describe the HUC12 proportion occupied for the 2022 cohort originating from: B, WPA from 2022 spawner surveys; C, fry stocking; and D, 0+ parr stocking.

Barriers to fish passage continue to limit the spatial distribution of Atlantic salmon in the Downeast SHRU to some extent. For example, the Cherryfield Dam in the Narraguagus River and the remnants of the fishway at Saco Falls in the Pleasant River limit fish passage. Thus, reconnecting 30,000 units of suitable habitat remains a top priority in the Downeast SHRU. However, fish passage barriers are much less common in the Downeast SHRU in comparison to other SHRUs. In particular, many improvements at road-stream crossings have been completed throughout much of the Downeast SHRU largely through collaboration and partnerships involving Project SHARE, DSF, The Nature Conservancy in Maine, many municipalities, and the Maine Department of Transportation. In 2022, there was just one project that was completed that improved connectivity in the Downeast SHRU (Table 3-3).

Table 3-3. Summary of fish passage projects completed in the Downeast SHRU in 2022

RIVER	PROJECT NAME	PASSAGE IMPROVEMENT TYPE **(FULLY ACCESSIBLE VS ACCESSIBLE VS PARTIALLY ACCESSIBLE*)**	STREAM MILES MADE ACCESSIBLE **(ACCORDING TO RP CRITERIA)**	LAKE/POND ACRES MADE ACCESSIBLE
DENNYS	Meddybemps Powerhouse removal	Accessible	0.1 miles of upstream habitat with improved access	Improved access to 6765 acres (Meddybemps Lake)

** To be considered fully accessible, the habitat above the project must be consistent with the criteria in part 2f of the final recovery plan.*

Diversity

Meredith Bartron, USFWS

For each broodstock within the Downeast SHRU, a target of 200 parr to collect and retain for broodstock use was implemented 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 2020 collection) (Figure 3-7). Allelic diversity (Figure 3.7) of the five broodstocks in the Downeast SHRU remain relatively stable over the time period measured. Estimates of allelic diversity are slightly above average (Dennys and Pleasant broodstocks), and slightly below average (East Machias, Machias, and Narraguagus) but within the range of previous variation. However, the decline in allelic diversity for the Machis River is of note. Continued monitoring of estimates of genetic diversity is very important as the Downeast SHRU contains five of seven river-specific Atlantic salmon broodstocks remaining in the United States. More detailed summaries of genetic estimates of diversity are found in the USASAC report.

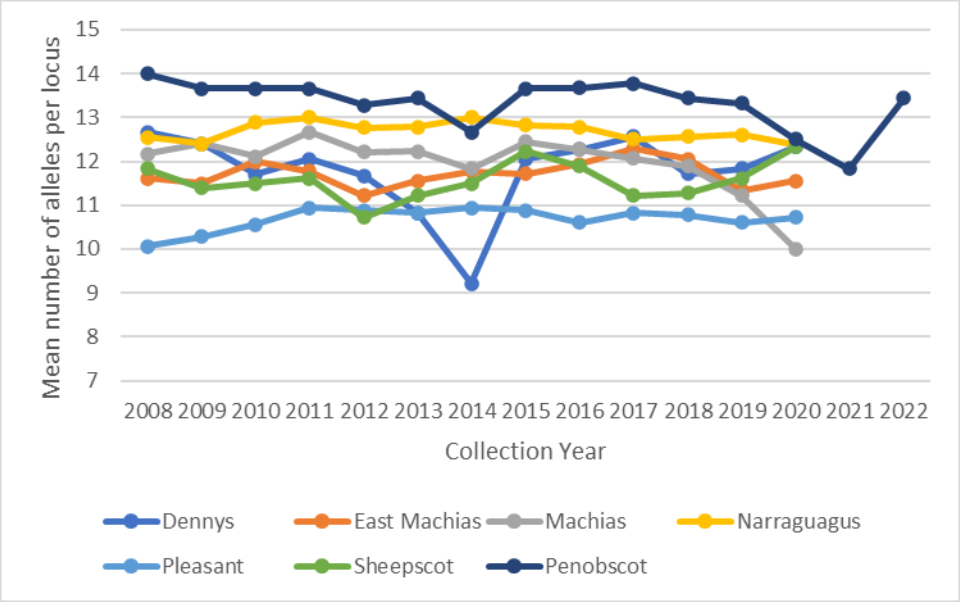

Figure 3-7. Graph of the mean number of alleles per locus for the five Downeast SHRU broodstocks, based on parr collected annually for broodstock collection surveys from 2008 to 2022. Also included are allelic diversity estimates for the other captively-spawned Atlantic salmon broodstocks for reference from the Merrymeeting Bay (Sheepscot River broodstock) and Penobscot (Penobscot sea-run broodstock) SHRUs. Because the sea-run Penobscot broodstock is obtained from returning adults, there is a two- year difference in collection time due to the life stage being collected (adults versus parr). For all broodstocks, results represent the mean number of alleles per locus (based on 18 microsatellite loci) for the parr broodstock collected annually.

Emerging issues and priorities

Collaboration on restoring connectivity and ecological conditions in the Narraguagus River will remain a top priority in 2023. The work being done in the Narraguagus is an encouraging example of collaboration among diverse groups hoping to advance salmon recovery. In the lower Narraguagus progress on the feasibility of improving fish passage at the Cherryfield Dam (i.e., Stillwater Dam) occurred in 2022; much of this work was facilitated by the Downeast Salmon Federation. This work is critical because the Cherryfield Dam is the only remaining mainstem dam on the Narraguagus River and the only mainstem dam on any river containing river-specific salmon in the Downeast SHRU. Once improvements are made at that site, Atlantic salmon and the full suite of diadromous fish, will hopefully have full access to the entire Narraguagus River. Further upstream, Project SHARE has developed a habitat restoration program that has already restored connectivity in the upper Narraguagus and is now enhancing suitability of rearing habitat and restoring natural stream processes in the focus areas by adding instream complexity using wood and boulders. DMR, under cooperative agreement with NOAA Fisheries, continues to monitor all lifestages via the Narraguagus Life Cycle Monitoring Station (LCMS) to evaluate the effectiveness of these combined recovery efforts.

Other ongoing priorities for our efforts to recover Atlantic salmon and the ecosystem upon which they depend include:

- The DSF will continue to raise Narraguagus-origin salmon 0+ parr at the Peter Gray Hatchery with funding and support from the U.S. Fish and Wildlife Service.

- The future of the Ellsworth Dam in the Union River remains uncertain as the Department of Environmental Protection denied the water quality certification for the facility. Such certification is required for the Federal Energy Regulatory Commission to issue a new license.
- DMR and Project SHARE are working on feasibility and design of improved passage at Saco Falls on the Pleasant River.

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 each organization.

Project SHARE

Project SHARE is a non-profit organization based in Downeast Maine that focuses on the restoration of riverine habitat in the Downeast Coastal SHRU. Nearly all of SHARE's field work involves the restoration of natural stream processes and can be broadly broken down into two types: restoration of habitat connectivity and enhancement of existing stream habitat. Habitat connectivity projects are projects that open previously inaccessible habitat (or have limited accessibility). Our habitat enhancement work involves adding complexity elements into stream channels, typically large wood but boulders as well. SHARE specifically focuses on native salmonid (Atlantic salmon and Eastern brook trout) habitat, but our projects can benefit most aquatic organisms. SHARE's primary focus is the Upper Narraguagus subwatershed where SHARE and the landowners have already reconnected 99.9% of the mapped salmon habitat.

In 2022, SHARE continued to focus on enhancing the habitat in the Upper Narraguagus. Five habitat enhancements were undertaken during the ten-week field season. Four of those used a "soft" approach where stream-side trees are manually pulled over into the river. The roots of the tree are left partially intact so that the tree is anchored not only by its mass but also its root system. Eighteen large pine and hemlock trees were added this way, which added much needed complexity elements to ~38 habitat units (3,800 m^2). To date over 1,000 trees have been added to various reaches throughout the subwatershed.

The fifth treatment was our Route 9 Narraguagus Project. This project involved diverting the mainstem Narraguagus around the project area to allow heavy equipment to work in the channel. The river was diverted for almost three weeks during which time three engineered log jams, two boulder clusters, four other log jams, and a new floodplain was created. Additionally, an overflow channel was excavated so that it activates regularly. More than 300 trees, 1,250 yd^3 of stone/gravel fill, and 100s of boulders were brought in to complete the project. This project transformed a 165 m long reach that was heavily armored and embedded riffle/run habitat into a much more dynamic stretch of river. A diversity of habitat are now located in the project area including adult holding pools, multiple riffle/run/pool sequences, and backwater/eddy areas for sandbar/island formation. The project was finalized in September with a riparian planting workshop. Over 50 volunteers showed up from a variety of groups, including University of Maine, University of Maine Machias, NOAA, USFWS, NRCS and Maine Audubon, to help plant native herbaceous and woody species along the new floodplain and atop the engineered

log jams. Partners for the entire project included SHARE, USFWS-GOMCP, USFWS-MeFWCO, USFWS-Moosehorn NWR, USFWS-Green Lake NFH, Maine DMR, USFS, Mark Jordan P.E., and local landowners.

Figure 3-8. View of Narraguagus River treatment site and un-treated site at Route 9. Showing comparison between habitat rehabilitation and un-altered reaches.

Calendar Year 2023 Work Plan

- Cherryfield Dam
    - Work will continue improving fish passage at the Cherryfield Dam that partially obstructs the Narraguagus River. Work includes a study into the feasibility of alternate structures that will satisfy the U.S. Army Corps of Engineers' need to manage ice damage at the same time improving upstream and downstream passage for all diadromous species.
- Habitat complexity Project at Route 9
    - Project SHARE will be conducting an intensive stream rehabilitation project, located just downstream of the Route 9 crossing of the Narraguagus River above Beddington Lake, involving mechanized equipment. This project aims to add sinuosity and structure to a 200-meter reach of river.
- 0+ parr stocking in the Narraguagus River
    - The Downeast SHRU committee supported a proposal that river-specific parr (age 0+) raised at the Peter Gray Parr Hatchery be stocked in the Narraguagus River. The DSF has

acquired permits and funding that will allow them to continue to raise parr for the Narraguagus. DMR is evaluating the effectiveness of this stock enhancement program via the Narraguagus LCMS.

- Improve fish passage at Saco Falls in the Pleasant River
    - The planning process is under way to restore full fish passage at Saco Falls. At certain flows passage is possible through the falls, but due to human caused changes access is limited. The goal is to evaluate passage alternatives which may include rebuilding the existing fishway. It is hoped designs and planning will be done in 2023.

List of Reports and Publications resulting from Projects within SHRU

- None to report for 2022

Chapter 4 Annual Report for the Penobscot Recovery Unit – Calendar year 2022 activities

This report summarizes progress toward achievement of recovery goals for the Penobscot Salmon Habitat Recovery Unit (Penobscot SHRU) in 2022.

Summary of adult returns and redd counts for the previous year (abundance and population trends)

The number of returns to the Penobscot SHRU in 2022 was 1,334 (106 naturally reared and 1,228 hatchery origin); the second highest return rate in the ten-year time series (Table 4-1). Of the returns, 1,324 were documented at the Milford trap, and based on red counts, an estimated five adults returned to each the Kenduskeag and Ducktrap. Neither the 2022 naturally reared returns nor the 10 year average of naturally reared returns met the minimum abundance criterion of 500 needed for downlisting from endangered to threatened (USFWS and NMFS 2018). However, over the last 10 years the trend in both hatchery and naturally reared returns continues to increase slightly. The proportional contribution of hatchery fish to the returning adults in the Penobscot SHRU remains high (92%).

The 10 year geometric mean replacement rate for the Penobscot SHRU is averaging around 1, with a slight increase in 2022 (Figure 4-2). A minimum 10-year geometric mean replacement rate of greater than 1 is needed for downlisting from endangered to threatened. As part of the reclassification criteria, additional parameters specific to habitat accessibility are also required.

In total, 557 broodstock were collected. CBNFH capped the number of broodstock collected per day at 40 individuals because one of the goals it to collect brood throughout the run and to facilitate disease sample processing, although the highest number of fish captured in a single day did not exceed 36. In addition, no collections were made on weekends or holidays. Broodstock collections were initiated on May 11th, and concluded on July 7th with a total of 63 trips being made. Of the 557 adults collected one died prior to tagging, eight were removed [released to the river] prior to acceptance into the broodstock population following ISAv (Infectious Salmonid Anemia Monitoring**)**, three were culled for genetic reasons prior to spawning, 13 died of natural causes prior to spawning, and two died of natural causes post spawning.

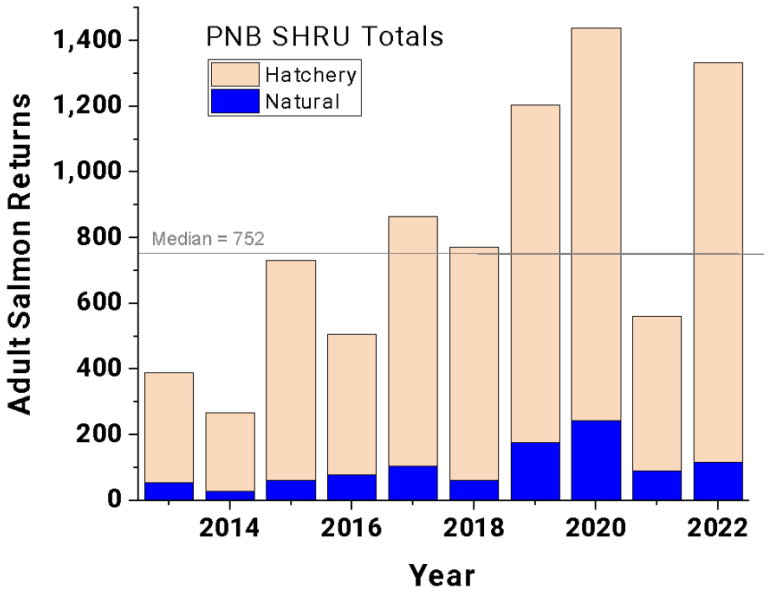

Figure 4-1. Graph of adult returns for the last 10 years (from 2013 to 2022).

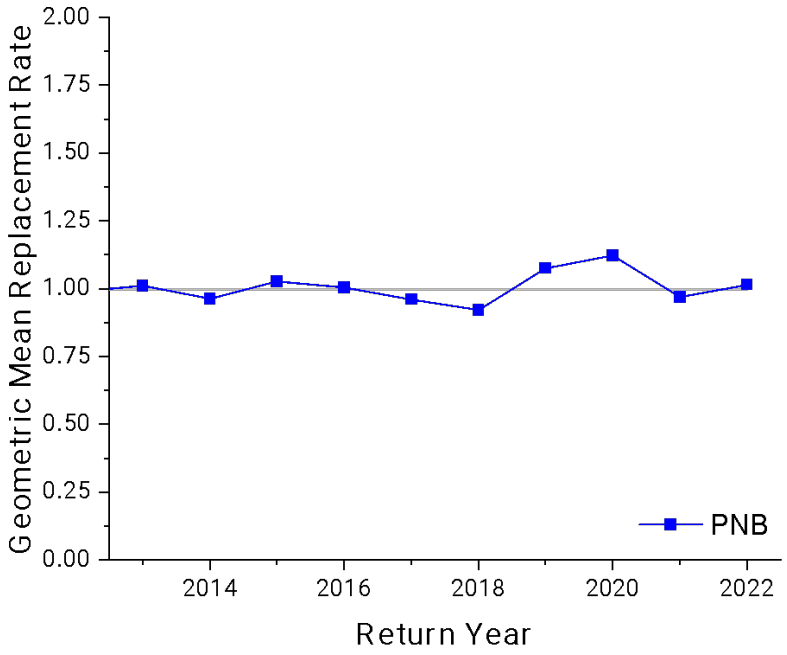

Figure 4-2. The 10 year geometric mean replacement rate for the Penobscot SHRU from 2013 to 2022. The replacement rate for the Penobscot SHRU has averaged around 1 over the last 10 years. The replacement rate reflects only naturally reared Atlantic salmon, and the average replacement rate for naturally reared fish in the Penobscot SHRU

Table 4-1. The number of returns to the Penobscot SHRU and their origin (hatchery or naturally reared) between 2013 and 2022.

Return Year	Number hatchery reared	Number of naturally reared
2013	334	54
2014	239	29
2015	670	61
2016	429	78
2017	761	105
2018	711	61
2019	1028	177
2020	1196	243
2021	470	91
2022	1,228	106

Table 4-2. Summary of adult returns for the Penobscot SHRU. (Table 5.1.1 from USASAC 2023)

RIVER	ADULT RETURNS	# NATURALLY REARED	# SMOLT STOCKED
COVE BROOK	0		
DUCKTRAP	5	5	
PENOBSCOT (ABOVE MILFORD)	1,324	96	1,228
KENDUSKEAG	5	5	
SOUADABSCOOK	0		

Spatial Distribution

Spatial distribution of Atlantic salmon in the Penobscot SHRU is relative to habitat connectivity and natural spawning, as well as areas that are stocked. Occupancy of unstocked habitats are determined through redd count surveys and electro-fishing. Given the size of the Penobscot SHRU, not all areas are surveyed so the information below only provides an estimate of occupancy based on the best available information.

Connectivity

In years past, we have reported on the estimated total number of suitable and accessible habitat units. However, additional spatial analyses are needed before we can make a reliable estimate of the number of accessible habitat units in the Penobscot SHRU. In addition, considerable uncertainty remains on what constitutes “suitable” habitat. The way we have done this in the past relies on simply estimating the number of habitat units from the existing habitat model produced by Wright et al. (2008). Greater attention toward defining what is truly “suitable” habitat is needed before we can make a reliable estimate of the number of suitable habitat units exist in the Penobscot SHRU.

As described in the Final Recovery Plan (2019), 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, the quantity of accessible habitat needed is the amount that will allow for the return of 2000 natural-origin adults; however, the minimum amount of suitable habitat that must be accessible to returning adults to achieve delisting criteria is 30,000 Habitat Units per SHRU. Figure 4-1 shows areas within designated critical habitat that are unimpeded by dams. Currently, none of the FERC license dams meets the minimum passage criteria necessary for upstream habitats to be considered “accessible” according to the definitions in the Final Recovery Plan.

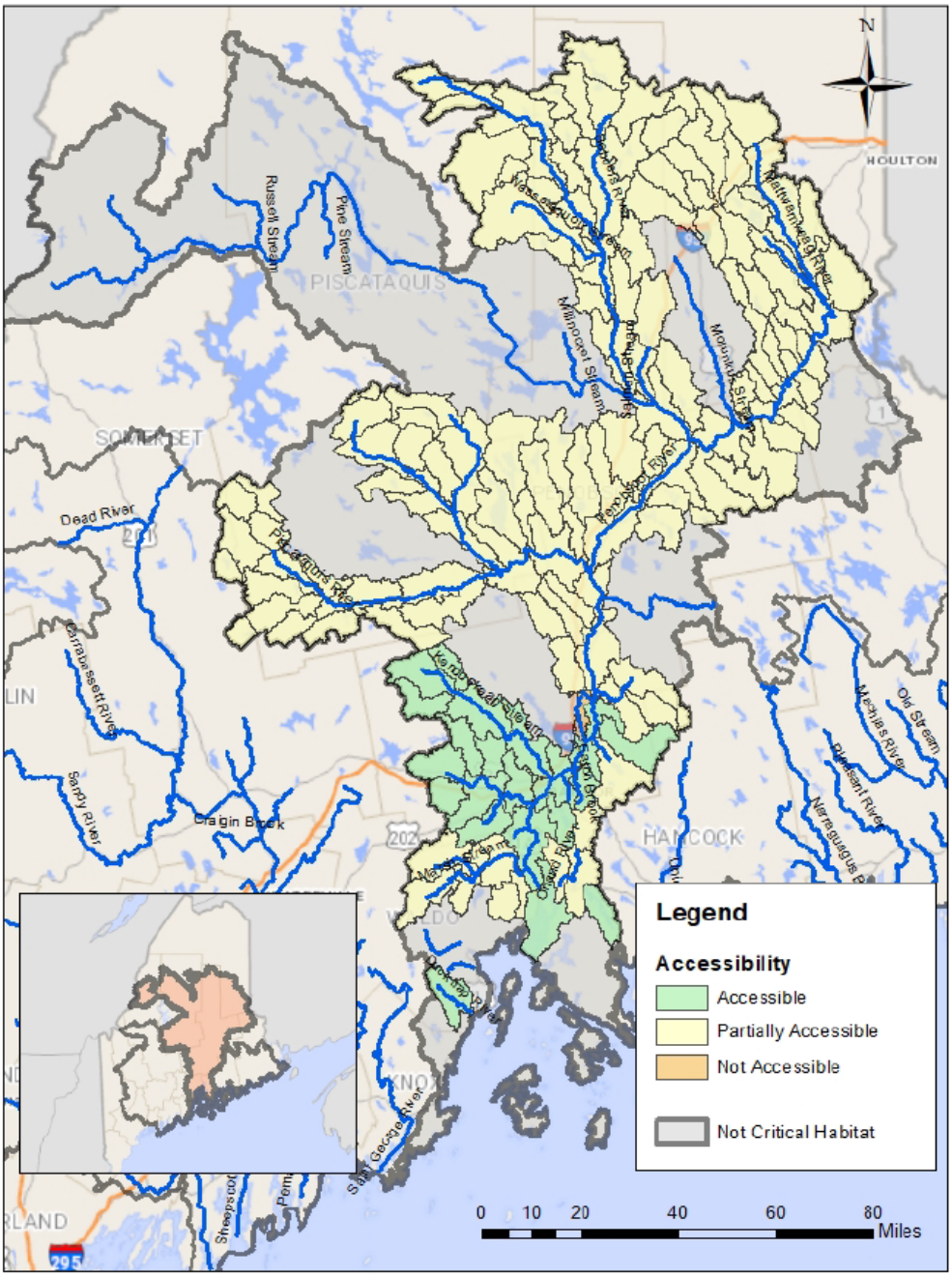

Figure 4-3. Map of habitat within designated Critical Habitat that is unimpeded by Dams. This does not fully account for habitats blocked or impeded by culverts.

The Final Recovery Plan (2019) provides definitions for habitat accessibility:
Habitat with Impeded Access (partially accessible): *Habitat above a barrier that temporarily blocks or impairs a salmon's natural ability to pass (e.g., a culvert or dam with a fishway with limited function).*

Habitat that is Accessible: *At a minimum, the habitat must allow for movement of parr that seek out suitable habitats for feeding and sheltering, downstream movements of smolts during the spring migration, and upstream and downstream movement of adults that seek out habitats for spawning and resting. To meet this standard, habitat must be either: (1) 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.*

Habitat that is Fully Accessible: *Habitat where there is no artificial barrier between it and the ocean*

2022 Connectivity Projects

In 2022, one dam was replaced with a nature-like fishway and six road crossings were improved. Although there was improved access to 8.77 stream miles, downstream barrier or partial barriers prevent these habitats from counting towards the habitat criterion as defined in the Final Recovery Plan (Table 4-3).

Table 4-3. Summary of fish passage projects completed in 2022. Eight connectivity projects were completed that improved access to an estimated 11 stream miles and 43.8 units of habitat. The total Atlantic salmon habitat units made accessible according to Recovery Plan criteria was 0 units.

HUC 10 NAME	STREAM NAME	CRITICAL HABITAT (Y/N)	PROJECT TYPE	BARRIER CLASS BEFORE	BARRIER CLASS /NEW STRUCTURE AFTER	MOST LIMITING BARRIER DOWNSTREAM (IF KNOWN)	STREAM MILES OPENED	SALMON HABITAT UNITS UPSTREAM TO NEXT BARRIER
BLUE HILL-MOUNT DESERT	Seal Cove Pond Outlet	N	Dam to nature like fishway	Impeded	Accessible	Accessible	7.3	0
PENOBSCOT BAY	No Name	Y	Road Crossing	Impeded	Accessible	Accessible	N/A	0
PENOBSCOT BAY	Meadow Brook	Y	Road Crossing	Impeded	Accessible	Impeded	N/A	0
SEBEC	Prescott Stream	N	Road Crossing	Impeded	Accessible	Inaccessible	0.37	0
MATTAMASCONTIS	No Name	Y	Road Crossing	Impeded	Accessible	Impeded	0.4	0
MATTAMASCONTIS	No Name	Y	Road Crossing	Impeded	Accessible	Impeded	0.7	0
PENOBSCOT RIVER (4) AT VEAZIE DAM	Unnamed stream	Y	Road Crossing	Impeded	Accessible	Accessible	N/A	0
						Total	**8.77**	**0**

Estimates of Occupancy

The U.S. Atlantic Salmon Assessment Committee (USASAC) estimated December 2022 mean proportion occupancy attributed to stocking of juveniles and documented natural reproduction for each of the 3 SHRUs at a HUC-12 resolution (*see* USASAC 2022, Figure 2.4.1.2). For this analysis we considered occupancy to be the proportion of habitat occupied within each HUC 12 watershed, as estimated using known stocking and redd locations, as well as electrofishing. While the three SHRUs vary in size and number of HUC-12 watersheds, the amount of occupied juvenile rearing area is typically around 8,800 to 13,600 units of habitat in each SHRU. The Penobscot SHRU with 148 HUC-12 watersheds had cohort

occupancy of between 10,300 and 18,400 units for the 3 cohorts in 22 areas (15% of the HUC 12 watersheds in the SHRU) where these 3 cohorts had a proportion occupancy above 0.01 (Figure 4-4).

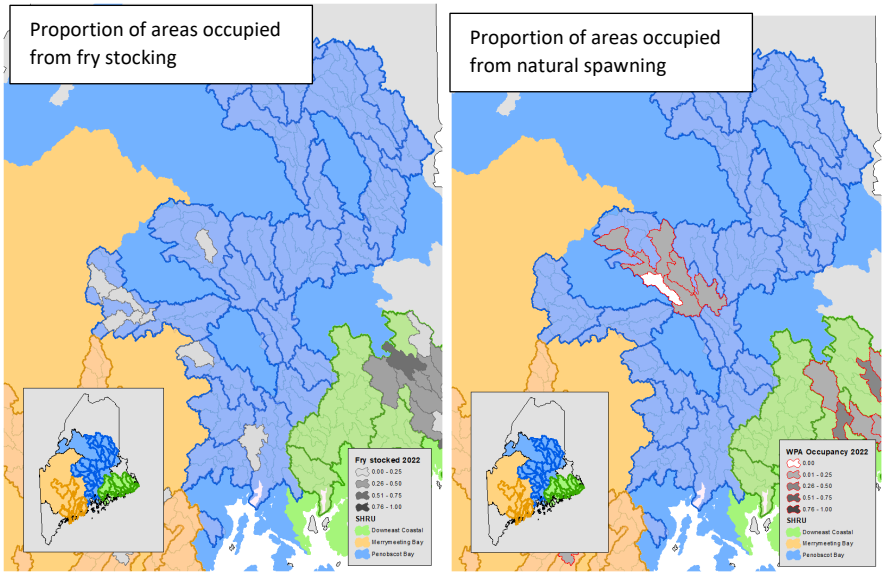

Figure 4-4. Map for mean 2022 cohort occupancy across the 2019 to 2022 cohorts as of December 2022. This does not include the 2023 cohort from last fall's wild spawning. The proportion is the total amount of habitat that has at least one salmon, divided by the total available rearing habitat based on the Wright et al. (2008) Salmon habitat model.

Stocking

In 2022, approximately 870,500 Atlantic salmon of various lifestages (fry, parr and smolts) were stocked into the Penobscot SHRU (Table 4-4).

Eggs: No eggs were stocked in 2022 into the Penobscot drainage. Approximately 219,400 Penobscot origin domestic eyed eggs (i.e. F2) were transferred from Green Lake NFH to Craig Brook NFH to support the fry program. In addition, 438,000 F2 eyed eggs were transferred to the Merrymeeting Bay SHRU, approximately 522,000 F2 eyed eggs were retained at Green Lake NFH for smolt production, and 13,000 F2 eyed eggs were provide to the Fish Friend outreach program.

Fry: 213,000 fry were stocked in the Penobscot SHRU in 2022. Approximately 195,000 of the fry were stocked into the Piscataquis watershed including the mainstem Piscataquis, West Branch Piscataquis, Kingsbury Stream and the Middle Branch Pleasant River. The remaining fry were stocked into Kenduskeag Stream and Cove Brook in the lower Penobscot. Based on the average return rate of naturally reared fish over the last 15 years, 211,000 stocked fry will contribute in the range of 16 naturally reared adults in 2025.

Parr: Green Lake NFH stocked 13,000 Penobscot River origin age 0 parr into the West Branch Pleasant River in 2022. Green Lake NFH also transferred 100,000 Penobscot River origin age 0 parr to Nashua NFH as part of a smolt program for the Merrymeeting Bay SHRU.

Smolts: Green Lake NFH stocked approximately 584,000 Penobscot River origin age 1 smolts into the Penobscot River downstream of the Milford Dam and French Island from Sandy Point Road. Another 64,000 smolts were stocked in the Piscataquis River in Abbot above the Guilford Dam in an effort to increase escapement of adults into the Piscataquis River. Smolt stocking began on April 14, 2022 and

ended on April 29, 2022. Green Lake NFH provided 600 Penobscot River origin age 1 smolts to the Maine Cooperative Fish and Wildlife Research Unit at the University of Maine, Orono for a predation research project.

Table 4-4. Summary of salmon stocked by river in 2022 in the Penobscot SHRU.

RIVER	EGGS	FRY	PARR	SMOLT
MAINSTEM PENOBSCOT				583,900
MIDDLE BRANCH PLEASANT RIVER		49,500		
WEST BRANCH PLEASANT RIVER			11,500	
WEST BRANCH PISCATAQUIS RIVER		31,600		
MAINSTEM PISCATAQUIS RIVER		90,800		63,900
KINGSBURY STREAM		22,700		
KENDUSKEAG STREAM		6,900		
COVE BROOK		9,700		
MARSH STREAM				
EAST BRANCH MATTAWAMKEAG				
TOTAL		**211,200**	**11,500**	**647,800**

Diversity

Meredith Bartron, USFWS

Of the seven river-specific broodstocks maintained for the DPS Atlantic salmon populations, the Penobscot River broodstock represents the largest number of individuals spawned and estimates of genetic diversity are higher than any of the other six broodstocks. In 2022, estimates of allelic diversity in the sea-run broodstock increased in comparison to previous years; the number of alleles per locus in the 2022 Penobscot broodstock was 13.4 (Figure 4-5). This increase was likely due to the slightly

increased number of broodstock collected in 2022, and the increased potential to recapture additional allelic diversity present in the population. In 2022, 556 adults were captured for use as broodstock at Craig Brook National Fish Hatchery, compared to 147 Atlantic salmon that were collected in 2021 and 221 Atlantic salmon that were collected in 2020. Other metrics of genetic diversity such as estimates of effective population size were decreased from previous years (N_e=346.7) and was below the 13-year average observed between 2008 and 2022 (average N_e=408.7). Continued monitoring of estimates of genetic diversity is very important as the Penobscot SHRU contains the largest number of returning adults in any of the Maine populations, and it represents the largest river-specific Atlantic salmon broodstock remaining in the United States. More detailed summaries of genetic estimates diversity are found in the USASAC report.

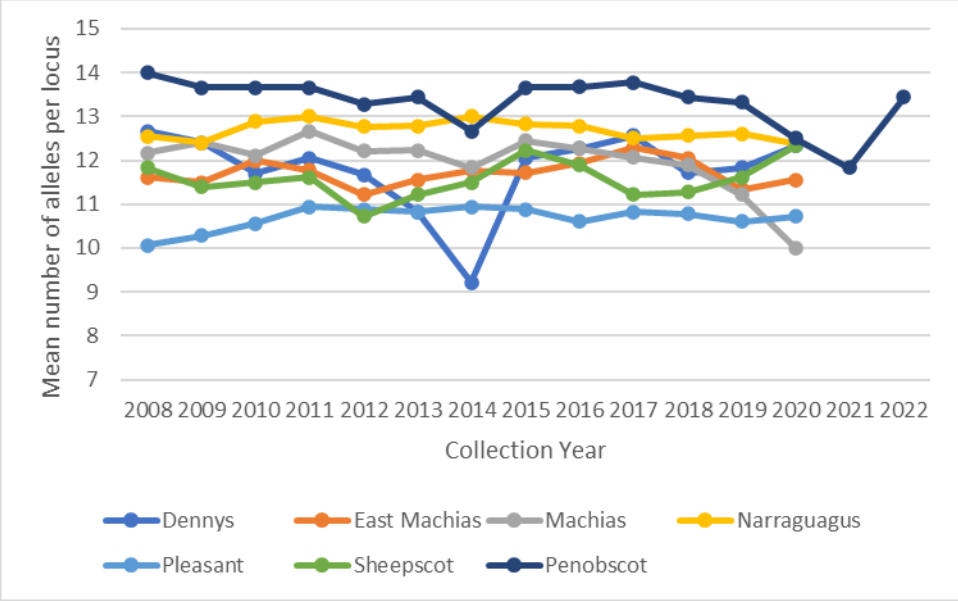

Figure 4-5. Graph of the mean number of alleles per locus for the sea-run Penobscot River broodstock based on the adults sampled at Milford Dam for transport to Craig Brook National Fish Hatchery from 2008 to 2022. Also included are allelic diversity estimates for the other captively-spawned Atlantic salmon broodstocks for reference from the Merrymeeting Bay (Sheepscot River broodstock) and Downeast (Dennys, East Machias, Machias, Narraguagus, and Pleasant broodstocks) SHRUs. Because the sea-run Penobscot broodstock is obtained from returning adults, there is a two- year difference in collection time due to the life stage being collected for broodstock (adults versus parr). For all broodstocks, results represent the mean number of alleles per locus (based on 18 microsatellite loci) for the sea-run broodstock collected annually.

Table 4-5 shows the proportion of returns to the Penobscot relative to sea-age as well as naturally reared returns. Mixing across year classes is an important element of diversity for Atlantic salmon.

Table 4-5. Life history attributes from adult returns in the Penobscot in 2022 including age class distribution and percent naturally reared.

RIVER	%1SW	%2SW	%3SW	%REPEAT SPAWNERS	% NATURALLY REARED
PENOBSCOT	23.3%	76%	.6%	0.3%	7.6%

Emerging issues and priorities

In 2020, the Management Board requested each SHRU provide "must-do" projects that were of priority for the upcoming year. In developing the Penobscot SHRU work plan, six Keystone Issues were identified among the multiple actions within the work plan that were of highest priority for the Penobscot SHRU team. In 2022, though we have retained the original six keystone actions we have modified our list of keystone actions to account for all ongoing and upcoming FERC relicensings and ESA consultations. The current keystone actions are as follows:

1. **Comprehensive Marking Program:** The Penobscot SHRU Team is continuing to explore the feasibility of implementing a basin-wide marking program such that hatchery origin fish and project specific fish (e.g. Salmon for Maine's Rivers fish) can be easily distinguished from naturally reared returns. Marking of fish is a priority to account for the returns and escapement of naturally reared and wild origin spawners that contribute towards downlisting and delisting criteria.
2. **Piscataquis River:** The Penobscot SHRU Team continues to prioritize recovery efforts in the Piscataquis River sub-basin aimed at increasing escapement and natural reproduction in the Piscataquis River. Increasing access into the Piscataquis was a focus of the Penobscot River Restoration Project and remains a priority for the Penobscot SHRU team given the abundance of high quality habitat in the basin. Our stocking plan focusses efforts in the Piscataquis basin, particularly the Pleasant River watershed, with the goal of reaching 150 naturally reared spawners within the next five years. In addition to focused stocking efforts, there will be an increased focus on addressing fish passage at the Brownsmills, Moosehead, and Guilford dams on the Piscataquis.
3. **Salmon for Maine's Rivers:** Although the Salmon for Maine's Rivers project in the East Branch Penobscot River has encountered some setbacks, the project remains a priority for the SHRU Team to encourage the commitment of resources needed to support assessment and monitoring necessary to gauge project effects and its utility towards supporting recovery efforts.
4. **Stocking Plan:** The Penobscot SHRU Team stocking plan is near completion. The draft plan is currently being used to inform spring fry stocking, and 2023 broodstock collections. We anticipate that the stocking plan will be completed in the spring of 2023. The plan aims to align stocking efforts with the goals and priorities set forth by the Penobscot SHRU Team.

5. **Lower River Tributaries:** The Penobscot SHRU Team acknowledges the importance of the coastal streams and lower Penobscot River tributaries recognizing that these areas are not impacted by hydro-electric dams and they may provide our best opportunity to further recovery until passage issues at mainstem dams are resolved.
6. **FERC Actions:** All ongoing or upcoming (anticipated to commence in 2023) hydro-relicensing's and ESA Consultations on dams in the Penobscot SHRU are a priority for the Penobscot SHRU. We prioritize this work to emphasize connectivity as a priority and to highlight the importance that all project operations aim to avoid any ecosystem impacts (which includes ensuring passage for all native species), and any impacts that may hamper or preclude Atlantic salmon recovery efforts. Below is a list of ongoing or upcoming FERC related actions:

   FERC relicensings (Federal Power Act):

   - West Enfield (Mainstem)
   - Pumpkin Hill (Passadumkeag River)
   - Ripogenus and Penobscot Mills Dams (West Branch Penobscot)

   ESA consultations/re-initiations

   - Milford (Mainstem) (re-initiation for failing to achieve performance standards related to delay)
   - Browns Mills (Piscataquis)
   - Matagamon (Pending future developments)

   ESA Compliance Monitoring

   - Stillwater (Stillwater Branch)
   - Orono (Stillwater Branch)
   - Milford
   - West Enfield

Stakeholder input (contributions provided by AMC, TU, ASF)

Pending

Work plan for the next calendar year

Pending

List of Reports and Publications resulting from Projects within SHRU

Leach, L., Simpson, M., Stevens, J. R., & Cammen, K. (2022). Examining the impacts of pinnipeds on Atlantic salmon: The effects of river restoration on predator–prey interactions. *Aquatic Conservation: Marine and Freshwater Ecosystems*, *32*(4), 645-657.

Frechette, D.M, Hawkes, J.P., and Kocik, J.F. 2023. Managing for Atlantic Salmon Smolt Run Timing Variability in a Changing Climate. *North American Journal of Fisheries Management. DOI: 10.1002/nafm.108681*

Ramberg-Pihl, N. C., Klemmer, A. J., Zydlewski, J., Coghlan Jr, S. M., & Greig, H. S. (2023). Smallmouth bass (Micropterus dolomieu) suppress Atlantic salmon (Salmo salar) feeding activity and increase aggressive behaviours at warmer temperatures. *Ecology of Freshwater Fish*.

U.S. Atlantic Salmon Assessment Committee. 2023. Annual report of the U.S. Atlantic Salmon Assessment Committee [online]. US Atlantic Salmon Assessment Committee, Report no. 35 – 2022 Activities, Portland, Maine.

Literature Cited

U.S. Atlantic Salmon Assessment Committee. 2021. Annual report of the U.S. Atlantic Salmon Assessment Committee [online]. US Atlantic Salmon Assessment Committee, Report no. 33 – 2020 Activates, Portland, Maine.

U.S. Fish and Wildlife Service and National Marine Fisheries Service. 2018. Recovery Plan for the Gulf of Maine Distinct Population Segment of Atlantic Salmon (*Salmo salar*): Final Plan for the 2009 ESA Listing.

Wright, J., J. Sweka, A. Abbott, T. Trinko. 2008. GIS-based Atlantic salmon habitat model. https://www.researchgate.net/profile/Jed-Wright/publication/238053462_GIS-Based_Atlantic_Salmon_Habitat_Model/links/544a4e660cf2f6388084ffbb/GIS-Based-Atlantic-Salmon-Habitat-Model.pdf Appendix C

Chapter 5 Annual Report for the Merrymeeting Recovery Unit – Calendar year 2022 activities

Effective coordination of planning and implementation efforts throughout the Gulf of Maine Distinct Population Segment (DPS) is required for the successful restoration of Atlantic salmon. 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 Collaborative Management Strategy is the current Atlantic salmon governance structure. Implemented in the fall of 2019, it is the result of significant stakeholder and agency input and collaboration.

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 2022 activities of the Merrymeeting Bay (MMB) SHRU Team.

Abundance and Adult Population Trends

In the past ten years within the MMB SHRU, the adult population has increased. The increase in adult returns to the MMB SHRU is likely due to increases in stocking in the Kennebec River drainage. In 2010 the Sandy River a large tributary to the Kennebec River began receiving relatively large numbers of eyed eggs as part of an experimental reintroduction program. In addition, more recent increases can be contributed to a smolt stocking program that began in 2020. The Androscoggin River, however, has not seen a positive population trend in the past 10 years. The number of hatchery fish documented on the Androscoggin has declined in the past five years except for the most recent year. The increase in 2022 is likely due to strays from the smolt stocking program on the Kennebec River. Also due to proximity to the Kennebec River, the Sebasticook River did see adult returns in 2022 for the first time in many years. The Sheepscot River has not displayed any major changes in adult returns.

MMB SHRU Total Salmon Returns

Adult returns of Atlantic salmon from 2013 to 2022

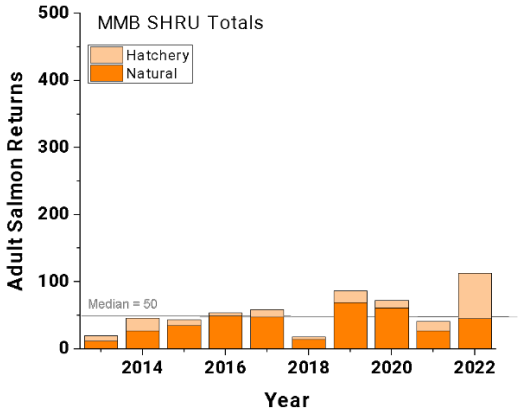

Figure 5-1. Adult returns of Atlantic salmon in the Merrymeeting Bay SHRU for the last 10 years.

GOM DPS – MMB SHRU 10-Year Series

Geometric Mean Replacement Rate

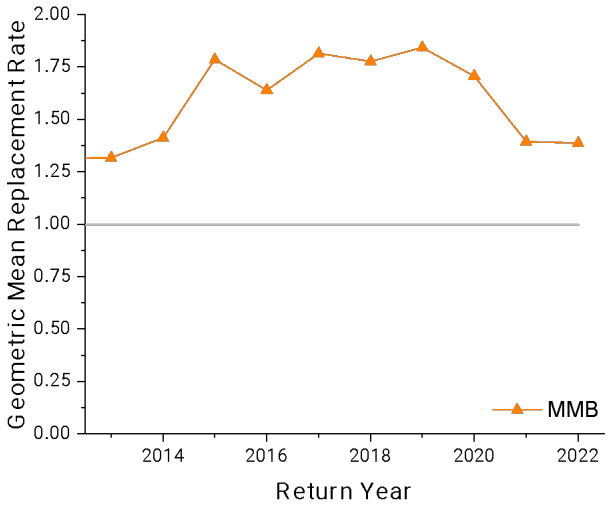

Figure 5-2. The geometric mean replacement rate for the Merrymeeting Bay SHRU.

Adult Returns in 2022

Androscoggin River

The Brunswick fishway trap was operated from 29 April to 15 November 2022 by a combination of MDMR and Brookfield Renewable Partners (BRP) staff. Seventeen adult Atlantic salmon were passed at the Brunswick fishway trap. These consisted of 8 (47.0%) hatchery reared grilse and 9 (53.0%) hatchery reared 2SW adults. One hatchery grilse was recaptured. Due primary to the proximity of the Androscoggin River to several other trapped rivers, adults that are handled at this facility are marked differently from other rivers with an upper caudal punch in order to identify strays from recaptured salmon. Biological data were collected from 13 trap-captured returning Atlantic salmon in accordance with Maine Marine Resources (MDMR) protocols, and the presence of marks and tags were recorded.

Occasionally an adult Atlantic salmon will pass undetected through the fishway at Brunswick during maintenance/cleaning, so a minimal redd count effort was conducted. One small sections of the Little River where redds have been documented in past years were surveyed for redd presence, totaling 0.23 river kilometers covered.

Kennebec River

The Lockwood Dam fish lift was operated by BRP staff from 1 May to 31 October 2022. Eighty-two adult Atlantic salmon were captured at the lift. Biological data were collected from all 82 lift-captured returning Atlantic salmon in accordance with Maine Marine Resources (MDMR) protocols, and the presence of marks and tags were recorded. Of the 82 returning Atlantic salmon 2SW, 39 (47.56%) were naturally reared 2SW, 7 (8.54%) were hatchery reared 2SW, 2 (2.44%) were naturally reared grilse 1SW, 34 were hatchery reared grilse (1SW). The grilse were recaptured. No adults were recaptured that had been previously handled at the Brunswick fishway.

Spawning surveys were limited to the Sandy River, Togus Stream and Bond Brook. Forty redds were observed in the Sandy River and none in Bond Brook or Togus Stream. A total of 89.3 river kilometers were surveyed which contained 20.2% of the surveyed spawning habitat in the Kennebec River drainage. Sandy River surveys covered 66.1 river kilometers and 59.7% of the spawning habitat. Togus Stream surveys covered 8.95% of the spawning habitat and the Bond Brook surveyed covered 86.3% of the spawning habitat.

Sebasticook River at Benton Falls fish lift facility was operated by MDMR staff from 01 May to 01 November 2022. Five Atlantic salmon were captured; all were pro-rated as hatchery reared 2 SW as they are not handled at this facility.

Sheepscot River

There were 5 redds observed in the Sheepscot River; four were observed in the mainstem and one was observed in the West Branch. The 5 redds were likely from sea-run adults. A total of 51.63 river kilometers were surveyed which contained 76.59% of the spawning habitat in the drainage. The Redds Based Returns model estimate was 9 (3 – 24).

Table 5-1. Adult returns to rivers where traps are used in the Merrymeeting Bay SHRU in 2022. Most adult salmon are caught at the Lockwood fishlift on the lower Kennebec River, Benton Falls fishlift on the Sebasticook River and Brunswick fishlift on the lower Androscoggin River.

River	Hatchery				Naturally Reared / Wild				Total Sea-run Returns
	1SW	2SW	3SW	RPT	1SW	2SW	3SW	RPT	
Lower Kennebec River	34	7	0	0	2	39	0	0	82
Sebasticook River	0	5	0	0	0	0	0	0	5
Lower Androscoggin R.	8	9	0	0	0	0	0	0	17

Distribution within the Merrymeeting Bay SHRU

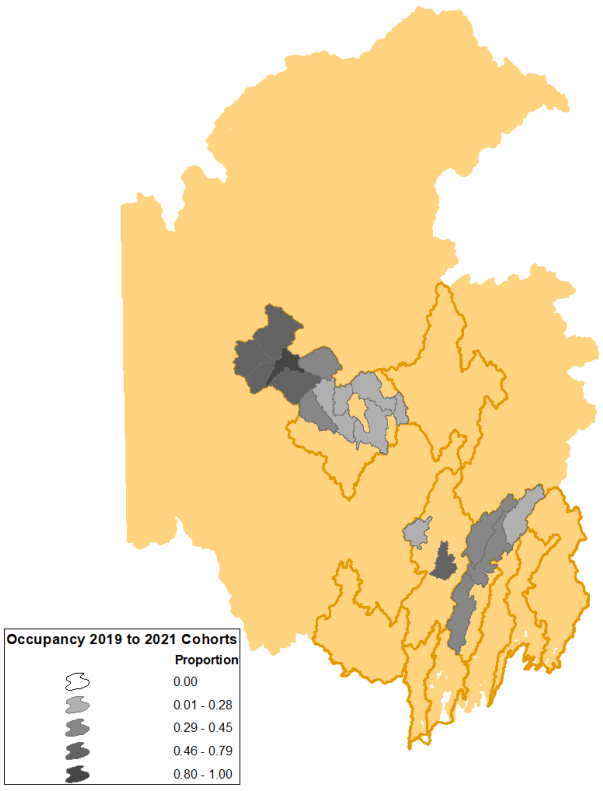

Figure 5-3. Map of designated Critical Habitat highlighting the relative proportion of river habitat occupied for the MMB SHRU (see figure legend) by the 2019-2021 cohorts at a HUC-12 watershed summary level. Production is a synthesis of modeled distributions from spawning surveys of Atlantic salmon in 2020, winter 2021 egg planting and spring 2021 fry stocking.

The stocking effort in the MMB SHRU is focused in the Sandy River and the Sheepscot River with four age classes of juveniles (Figure 5-4 and Table 5-2). The primary supplementation strategy in the MMB SHRU is the planting of eyed eggs. In the Sandy River 438,093 eggs were planted between February and March. In addition to eggs the Kennebec River received 97,539 smolts in the spring of 2022. The smolts are part of an effort to boost wild reproduction and releases are expected to continue annually for the

next several years. In the Sheepscot River 264,662 eggs were planted 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 estimated emergence rates. In the Sheepscot River a small number of fry are released annually in areas of the river where winter access may be preventative for egg planting. In 2022, 17,348 fry were released in the upper West Branch and the mainstem Sheepscot River above Sheepscot Pond. In addition, 0+parr were released at Kings Mills in Whitefield. In September 15,050 0+parr were released.

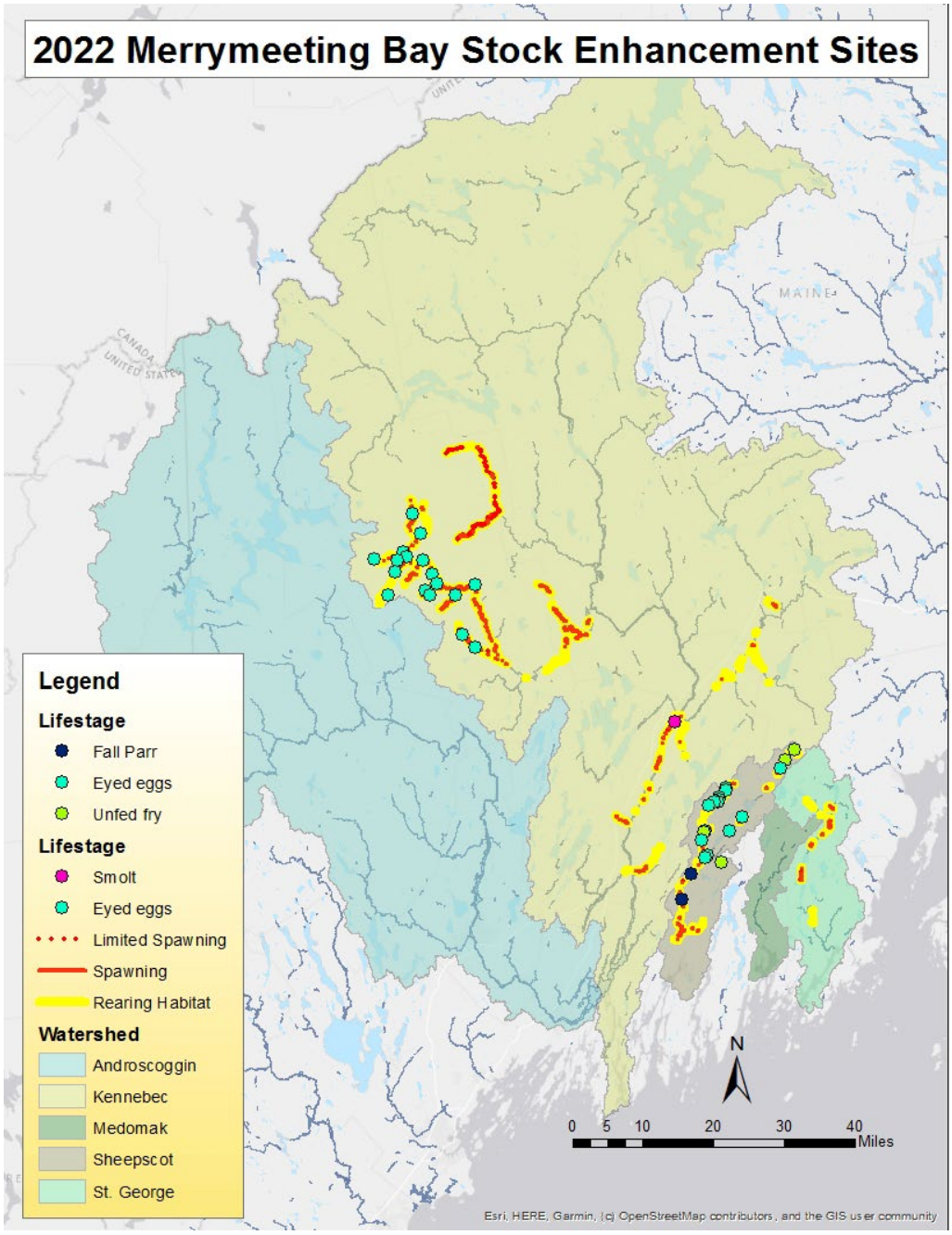

Figure 5-4. Map of stocking locations in the Merrymeeting Bay SHRU.

Table 5-2. Atlantic salmon released in the Merrymeeting Bay SHRU.

Drainage	Watershed	Eyed Eggs	Fry	Fall Parr	Smolts
Kennebec	Sandy River	438,093	0	0	0
	Mainstem	0	0	0	97,539
Sheepscot	All	264,662	17,348	15,050	0

Connectivity

Access for anadromous fish is described as one of the criteria used to monitor salmon recovery. In 2022, 19 connectivity projects improved access to 100.9 stream miles (Table 5-3). Unfortunately, while access is currently available to most of the lower watersheds in the MMB SHRU, the upper portions of the Kennebec River remain inaccessible due to large dams (Figure 5-4).

Table 5-3. Summary of fish passage projects completed in 2022. Eight connectivity projects were completed that improved access to an estimated 11 stream miles and 43.8 units of habitat. The total Atlantic salmon habitat units made accessible according to Recovery Plan criteria was 0 units.

HUC 10 NAME	STREAM NAME	PROJECT TYPE	MOST LIMITING BARRIER DOWNSTREAM (IF KNOWN)	STREAM MILES OPENED	LAKE AREA OPENED (ACRES)	SALMON HABITAT UNITS UPSTREAM TO NEXT BARRIER
MIDDLE SANDY RIVER	Temple Stream	Impassable Dam	Inaccessible	40	0	1,856
CATHANCE RIVER - ANDROSCOGGIN	Sabattus River	Impassable Dam	Inaccessible	7.8	0	91.6
CATHANCE RIVER - ANDROSCOGGIN	Mallon Brook	(1) 96'S, (1) 84"S, (1) 24"S x~33'L	Accessible	N/A	0	36.4
UPPER SEBASTICOOK	Meadow Brook	12'Sx6.2'Hx26'L		9.25	0	
WESSERUNSETT STREAM	Mill Stream	Road Crossing	Inaccessible	2.23	0	43.8
WEBB RIVER	Thomas Brook	(2)2'Sx40'L		0.67	0	
CATHANCE RIVER - ANDROSCOGGIN	No Name	3'Sx39'L		0.79	0	0
CATHANCE RIVER - ANDROSCOGGIN	No Name	(2)2'Sx40'L		0.24	0	0

HUC 10 NAME	STREAM NAME	PROJECT TYPE	MOST LIMITING BARRIER DOWNSTREAM (IF KNOWN)	STREAM MILES OPENED	LAKE AREA OPENED (ACRES)	SALMON HABITAT UNITS UPSTREAM TO NEXT BARRIER
LITTLE ANDROSCOGGIN	Black Brook	14'Sx110'L		3.1	0	
LOWER SANDY RIVER	Duley Brook	3'Dx60'L HDPE	Inaccessible	5.86	0	0
KENNEBEC RIVER ESTUARY	Abagadasset River	(2) 4.5'Dx80'L CMP	Inaccessible	8.4	0	0
KENNEBEC RIVER ESTUARY	Abagadasset River	6'Dx68'L CMP	Inaccessible	1.05	0	0.95
SWIFT RIVER	No Name	4'Dx42'L Concrete pipe		0.2	0	
KENNEBEC RIVER AT WATERVILLE DAM	Gilman Broook			NA	0	
KENNEBEC RIVER AT MERRYMEETING BAY	Unnamed trib to Eastern River	Culvert Replacement		0.95	0	0
KENNEBEC RIVER AT WATERVILLE DAM	Carrabassett Stream	Bridge Replacement	Inaccessible	200 feet	0	10
KENNEBEC RIVER AT WATERVILLE DAM	Black Stream	Bridge Replacement	dam 3.8 miles downstream		0	NA
MEDOMAK RIVER	Unnamed trib to Webber Pond	Culvert Replacement		20.38	0	0
CATHANCE RIVER-ANDROSCOGGIN RIVER	Dearing Brook	Bridge Replacement	inaccessible		0	49.32

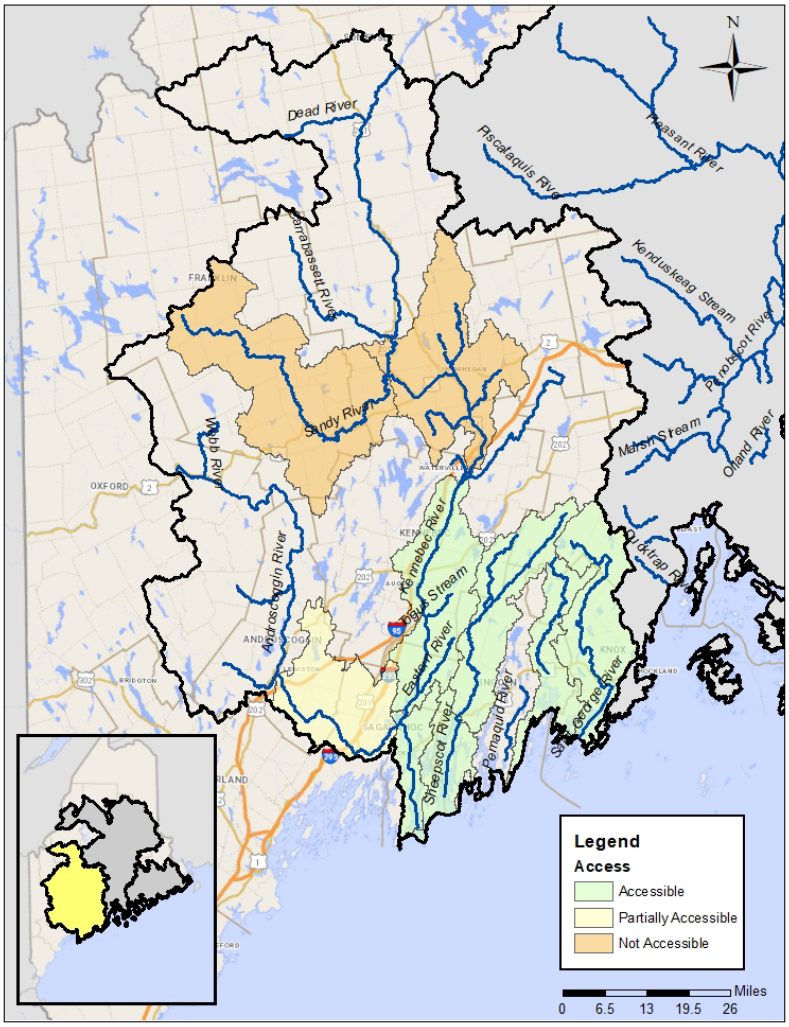

Figure 5-5. Map of the MMB SHRU showing river and stream reach accessibility for Atlantic salmon. Accessible watersheds have no mainstem dams, or else have dams that have fishways that have been evaluated and determined to be highly effective. The habitat in these watersheds meet our recovery criteria 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.

In addition, the Midcoast Conservancy was able to secure three parcels of land to help protect the Sheepscot River from urbanization (Table 5-5).

Table 5-5. Land Protection Accomplishments in 2022.

Acres	Shoreline (Feet)	Stream (Feet)
742	3,892	16,118

Diversity

Meredith Bartron, USFWS

For each broodstock within the Merrymeeting Bay SHRU, a target of 200 parr to collect and retain for broodstock use was implemented starting with the 2017 collection year. Results below represent the mean number of alleles per locus (based on 18 microsatellite loci) for the 2020 collection of Sheepscot River broodstock (Figure 5-6), which is the only broodstock maintained specifically within the Merrymeeting Bay SHRU. For the 2020 parr broodstock collection from the Sheepscot River, allelic diversity slightly increased over the previous collection year estimate (2019 collection year) and is slightly higher than the 13-year average (mean number of alleles = 11.56). Continued monitoring of estimates of genetic diversity is important as the Merrymeeting SHRU contains only one of the seven river-specific Atlantic salmon broodstocks remaining in the United States. More detailed summaries of genetic estimates of diversity are found in the USASAC report.

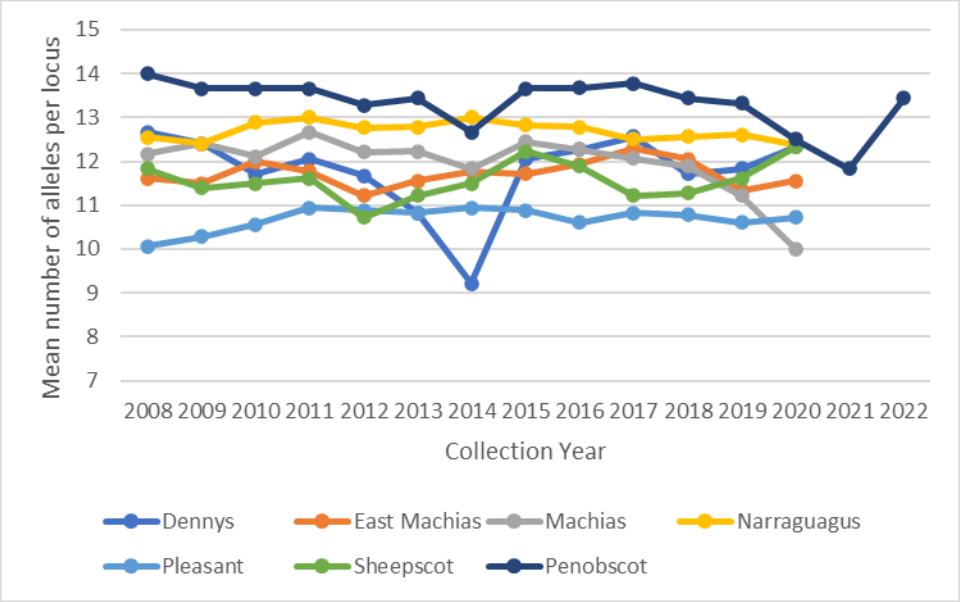

Figure 5-6. Graph of the mean number of alleles per locus for the Sheepscot broodstock, based on parr collected annually for broodstock collection surveys from 2008 to 2020. Also included are allelic diversity estimates for the other captively-spawned Atlantic salmon broodstocks for reference from the Downeast (Dennys, East Machias, Machias, Narraguagus, and Pleasant broodstocks) and Penobscot (Penobscot sea-run broodstock) SHRUs. Because the sea-run Penobscot broodstock is obtained from returning adults, there is a two- year difference in collection time due to the life stage being collected (adults versus parr). For all broodstocks, results represent the mean number of alleles per locus (based on 18 microsatellite loci) for the parr broodstock collected annually.

Table 5-4. Age and origin of adults returns in the Merrymeeting Bay to rivers that are trapped. Most adult salmon are caught at the Lockwood fishlift on the lower Kennebec River and Brunswick fishlift on the lower Androscoggin River

Total Adult Returns to the Kennebec	Hatchery					Naturally Reared / Wild				
	1SW	2SW	3SW	RPT	*Total*	1SW	2SW	3SW	RPT	*Total*
82	34	7	0	0	*41*	2	39	0	0	*41*
	41.46%	8.54%	0.00%	0.00%	*50.00%*	2.44%	47.56%	0.00%	0.00%	*50.00%*
Total Adult Returns to the Sebasticook	**Hatchery**					**Naturally Reared / Wild**				
	1SW	**2SW**	**3SW**	**RPT**	***Total***	**1SW**	**2SW**	**3SW**	**RPT**	***Total***
5	0	7	0	0	*7*	0	0	0	0	*0*
	0.00%	100.00%	0.00%	0.00%	*100.00%*	0.00%	0.00%	0.00%	0.00%	*0.00%*
Total Adult Returns to the Androscoggin	**Hatchery**					**Naturally Reared / Wild**				
	1SW	**2SW**	**3SW**	**RPT**	***Total***	**1SW**	**2SW**	**3SW**	**RPT**	***Total***
17	8	9	0	0	*17*	0	0	0	0	*0*
	47.06%	52.94%	0.00%	0.00%	*100.00%*	0.00%	0.00%	0.00%	0.00%	*0.00%*

Emerging Issues and Priorities

Coordination among the recovery and conservation community will continue to be a top priority in 2023. Multiple federal and state funding sources are available for conservation and restoration work that will advance Atlantic salmon recovery and improve aquatic connectivity. Partners are encouraged to apply to the multiple funding sources and collaborate with agencies early in the process.

Advancing the rapid geomorphic assessment for the Sheepscot is a key priority along with aligning land protection efforts within the SHRU. Significant progress has been made to date, and a continued emphasis on these two workplan priorities will continue in 2023.

Partners identified connectivity issues on the Kennebec, challenges at Sheepscot Lake, beaver dams on the West Branch of the Sheepscot, and continued stakeholder and landowner outreach as issues that will be addressed in 2023 in addition to those that are presented in the workplan.

Stakeholder Input

Stakeholders were invited to share their perspective on emerging issues, priorities, or any other considerations related to the Merrymeeting Bay SHRU Team. We did not receive any contributions to include in this report.

Work Plan 2023

Table 5-5. Proposed actions for 2023.

Sheepscot Focus Area

Project	Action	Partners
Branch Pond Dam	Install fish passage at the Branch Pond outlet dam to allow for unimpeded passage of river herring	Dam owner, Atlantic Salmon Federation,

Project	Action	Partners
		NRCS, MDMR, USFWS, NOAA, NGOs
Taylor Road Bridge	Remove bridge remnants	Property owner, MDMR, USFWS, NOAA, NGOs
Inadequate culvert (Trout Brook)	Replace culvert	Road Owner, NRCS, NGOs
Culverts	Identify and perform outreach.	Road owners, MEDMR, USFWS, NOAA, NGO's
Land Protection	Sheepscot River watershed is one of the most subdivided salmon watersheds. This may help to protect valuable habitat from future anthropogenic effects.	Midcoast Conservancy
Inventory of anthropogenic structures in river	The Sheepscot River has many anthropogenic effects via log drives, agriculture, remnant stream crossings that impact the flow of the river that need to be inventoried and surveyed.	MDMR, Midcoast Conservancy, USFWS, DEP, MCHT, ASF
Hatchery Supplementation	Consider alternative to replace eliminated 0+ parr stocking program	USFWS, DMR
Qualitative Habitat	Qualitative habitat surveys to guide stocking and habitat restoration	
Habitat Structure Additions	Improve habitat by additions of large wood and other structures	MDMR, USFWS

Kennebec Focus Area

Project	Action	Partners
Lockwood Dam	Restore up- and downstream accessibility (accessible or fully accessible) via dam removal or by implementing safe, timely, and effective upstream and downstream passage.	Dam owner, FERC, NOAA, MEDMR, USFWS, NGOs, MEDEP, MEIFW
Hydro Kennebec Dam	Restore up- and downstream accessibility (accessible or fully accessible) via dam removal or by implementing safe, timely, and effective upstream and downstream passage.	Dam owner, FERC, NOAA, MEDMR, USFWS, NGOs, MEDEP, MEIFW
Shawmut Dam	Restore up- and downstream accessibility (accessible or fully accessible) via dam	Dam owner, FERC, NOAA, MEDMR,

Project	Action	Partners
	removal or by implementing safe, timely, and effective upstream and downstream passage.	USFWS, NGOs, MEDEP, MEIFW
Weston Dam	Restore up- and downstream accessibility (accessible or fully accessible) via dam removal or by implementing safe, timely, and effective upstream and downstream passage.	Dam owner, FERC, NOAA, MEDMR, USFWS, NGOs, MEDEP, MEIFW
Henry Mitchell Brook (Temple Stream)	Collaborate with stakeholders to design replacement road crossings to accommodate 100-year flow and provide better passage to Atlantic salmon critical habitat.	Road owner, MEDMR, USFWS, NOAA, NGO's, Atlantic Salmon Federation, Maine Audubon
Sandy River Culverts	Work with towns of Temple, Phillips, Avon, and Madrid to complete existing conditions site surveys at priority culverts. Assess and design feasible options for road crossing replacements.	Road owners, MEDMR, USFWS, NOAA, NGO's
Chesterville Dam	Complete feasibility study to assess options to restore upstream and downstream fish passage	Maine IFW, MEDMR, USFWS, NOAA, NGOs, Atlantic Salmon Federation
Cobboseecontee Connectivity	Work with owners of the remaining mainstem dams to explore opportunities for dam removal or installation of fish passage for river herring,	MDMR, NOAA, USFWS, Maine Rivers
Comprehensive Plans	Develop or finalize comprehensive/management plans.	MDMR,USFWS,NOAA, MDIFW, MEDEP
Smolt Trap	Operate smolt trap and collect biological and population data as detailed in the Atlantic Salmon Freshwater Assessments and Research	MDMR, NOAA
Smolt Stocking	Conduct smolt stocking (100,000 smolts) to maximize survival and increase adult returns	MDMR, USFWS, NOAA, Universities
Land Protection	Establish conservation easements, purchase or acquire property rights, etc.	USFWS, NGOs including TNC, HPA, etc.
Temple Stream	Water quality monitoring	DEP
Black Brook	Two town-owned crossings (15063 and 15061), two privately owned crossings (15186 and 15188), and a DOT owned crossing (15058) persist as barriers to passage upstream and downstream. Collaborate with stakeholders to replace road crossings to accommodate 100-year flow and provide better passage to Atlantic salmon critical	ASF, NOAA, USFWS, MDMR, DOT

Project	Action	Partners
	habitat. Crossings #15063, 15186 and 15188 expected to be replaced in 2023	
DOT Crossings	Collaborate with DOT and stakeholders to replace road crossings to accommodate 100-year flow and provide better passage to Atlantic salmon critical habitat.	DOT and stakeholders

Androscoggin Focus Area

Project	Action	Partners
Sabattus River Connectivity	Work with dam owners to explore dam removal or fish passage improvements that maximize the production potential of river herring in Sabattus Pond, and allow for the survival and recovery of Atlantic salmon	Dam Owners, NGOs, MDMR, NOAA
Pejepscot	Participate in FERC relicensing; request studies, provide comments, recommendations, terms and conditions, section 18 prescriptions, WQC conditions.	Dam owner, FERC, NOAA; Partners: MDMR, USFWS, MIFW, MEDEP, NGOs
Worumbo	Participate in FERC relicensing; request studies, provide comments, recommendations, terms and conditions, section 18 prescriptions, WQC conditions.	Dam owner, FERC, NOAA; Partners: MDMR, USFWS, MIFW, MDEP, NGOs
Oxford (Little Androscoggin)	Grade control structure	

MMB SHRU Team Actions

Project	Action
Annual Report	Submit Annual Report in accordance with CMS guidelines
Annual Meeting	Conduct Annual SHRU Team meeting in accordance with CMS guidelines.
FERC Sub-Committee	Convene FERC sub-committee to: 1) track and maintain information regarding the status of FERC processes; 2) encourage coordination, planning, and participation in FERC relicensing processes; and 3) to encourage coordination, planning, and participation in the post-license compliance monitoring and adaptive management of FERC projects in an effort to achieve the best possible passage outcomes.

Project	Action
Mapping/GIS	1) Compile or develop maps that depict mapped/predicted salmon habitat, barriers, and critical landscape elements and integrate this effort with similar initiatives (e. g. NOAA USGS); 2) Provide tools through the Maine Stream Habitat View or other interface to make the information available for use within the SHRU Team.

Table 5-6. New Activities added to the Merrymeeting Bay SHRU work plan.

CMS Team Actions

Activity	Description	Partner
Smolt stocking plan for the evaluation of safe, timely, and effective upstream passage in the lower Kennebec River	Finalize plan to conduct smolt stocking upstream of the Weston Dam to ensure 200+ returning adults in the Kennebec River, necessary to complete the "Adult Studies" workplan task.	USFWS, Brookfield, DMR, NOAA

Sheepscot River

Activity	Description	Partner
Inadequate culvert	Finalize designs for Ben Brook culvert replacement	Midcoast Conservancy, NOAA
Water Quality Monitoring	Address gaps in early-season water quality data in tributaries to the Sheepscot	DEP
Watershed Restoration Plan (W. Branch)	Prepare watershed restoration plan for the West Branch Sheepscot	USFWS

Kennebec River

Activity	Description	Partner
Carrabassett River Habitat Survey	Perform a survey of habitat in the lower mainstem Carrabassett River	MDMR
Broodstock Plan	Develop or finalize broodstock management plan to support supplementation-related workplan elements.	MDMR, NOAA, USFWS

Reports and Publications from the Merrymeeting Bay SHRU

Craig, Scott D. 2020. MEFWCO Final Branch Pond Report for 2020 activities.

Craig, Scott D. 2020. Quantabacook MEFWCO Annual Report 2020.

Eisenhauer, Z. J., P. M. Christman, J.-M. Matte, W. R. Ardren, D. J. Fraser, and J. W. A. Grant. 2020. Revisiting the restricted movement paradigm: the dispersal of Atlantic salmon fry from artificial redds. Canadian Journal of Fisheries and Aquatic Sciences 11(November):1–11.

Rubenstein, S. R. 2021. Energetic Impacts of Passage Delays in Migrating Adult Atlantic Salmon. University of Maine, Orono.

Chapter 6 Update on Marine Survival – Calendar year 2022

The following update on adult return rates and marine survival is an excerpt from the USASAC Annual Report for 2022.

The USASAC updated adult return rate metrics for Penobscot River hatchery origin smolts based on 2022 returns. For naturally reared smolts produced in the Narraguagus, Sheepscot, and East Machias Rivers, no returns were updated because no smolt estimates were conducted in 2020 due to the pandemic. Typically, for these three populations, estimated smolt emigration and subsequent adult returns by sea age are used to generate a smolt-to-adult return rate (SAR). When combined with redd-based adult population estimates or trap counts by age, these provide additional indices of return rates for these Maine populations. For the Penobscot River, we used the methods of Stevens et al. (2019) to decouple losses of smolts in-river and in the estuary to provide an estimate of postsmolts entering the Gulf of Maine. This method accounts for both stocking location and flow-specific mortality to generate a postsmolt estimate that was then applied to subsequent adult returns to calculate a postsmolt to adult survival rate (PSAR) for the Penobscot.

Naturally reared smolt abundance was the result of wild spawning, egg planting, fry stocking and stocking of fall parr (ambient-temperature reared parr). These parr were reared at Craig Brook National Fish Hatchery (Orland, Maine) for the Sheepscot and Narraguagus and the Peter Gray Parr Hatchery (East Machias, Maine) for the East Machias. The longest time series is for naturally reared populations is the Narraguagus River starting with the 1997 smolt cohort. Most of the adult return data for this population comes from trap counts of adults at the Cherryfield Dam. In years of high flow (more fish bypass the trap), redd counts are used as they more accurately reflect total returns. All these age-based adult estimates are in USASAC databases. Sheepscot River smolts were monitoring started from 2009 to 2019 and East Machias monitoring was conducted from 2013-2019. When adult returns are estimated from redd counts, ages are pro-rated by standard methods used by USASAC.

The 1 SW PSAR for the Penobscot 2022 returns was 0.06% and the Narraguagus estimate was 0.05%. However, tends in the last decade (smolt cohorts 2010-2019) indicate Penobscot Hatchery 1SW population PSAR averaged 0.07% with a higher average the SAR values in the Narraguagus River (0.42%) despite several years without grilse returns. For the entire time series of the Sheepscot River 11 years, the average was 0.16% and East Machias 7-year average was 0.53%. Grilse in Maine are typically a smaller component of returns and most commonly males.

Because salmon predominantly return at 2SW, return rates are higher for these fish. In 2022, the 2020 smolt cohort PSAR for the Penobscot was 0.17%, more than doubling 2021 2SW return rates (Figure 6-1). These are similar to returns of 2SW salmon in the last decade where the Penobscot PSAR averaged 0.14% (Figure 6-1). This PSAR is substantially lower than the decadal average SAR for 2SW returns in the Narraguagus (1.16%) and Sheepscot Rivers (0.58%) or the East Machias 7-year time series of 1.84%. While the interannual variability is larger in

these smaller populations, these data suggest better marine performance for naturally reared smolts. Despite the average 7, 4, and 13 fold higher rates for the Narraguagus, Sheepscot, and East Machias, overall low smolt freshwater production results in lower number of adult returns in these 3 populations. Marine survival remains a primary threat to the recovery of all Gulf of Maine Atlantic salmon stocks. Reviews of marine survival indicate the best management strategy to address current ocean conditions is to maximize the production of wild or naturally reared smolts. Given the amount of vacant habitat across the DPS, there is significant unused habitat capacity. Additional hatchery capacity would be expected to boost returns by utilizing more habitat and further evaluating habitat quality. For hatchery smolts, research and adaptive management changes could help close the marine performance gap and yield more spawners. Ongoing efforts to ensure safe downstream passage for both naturally reared and hatchery smolts remains essential.

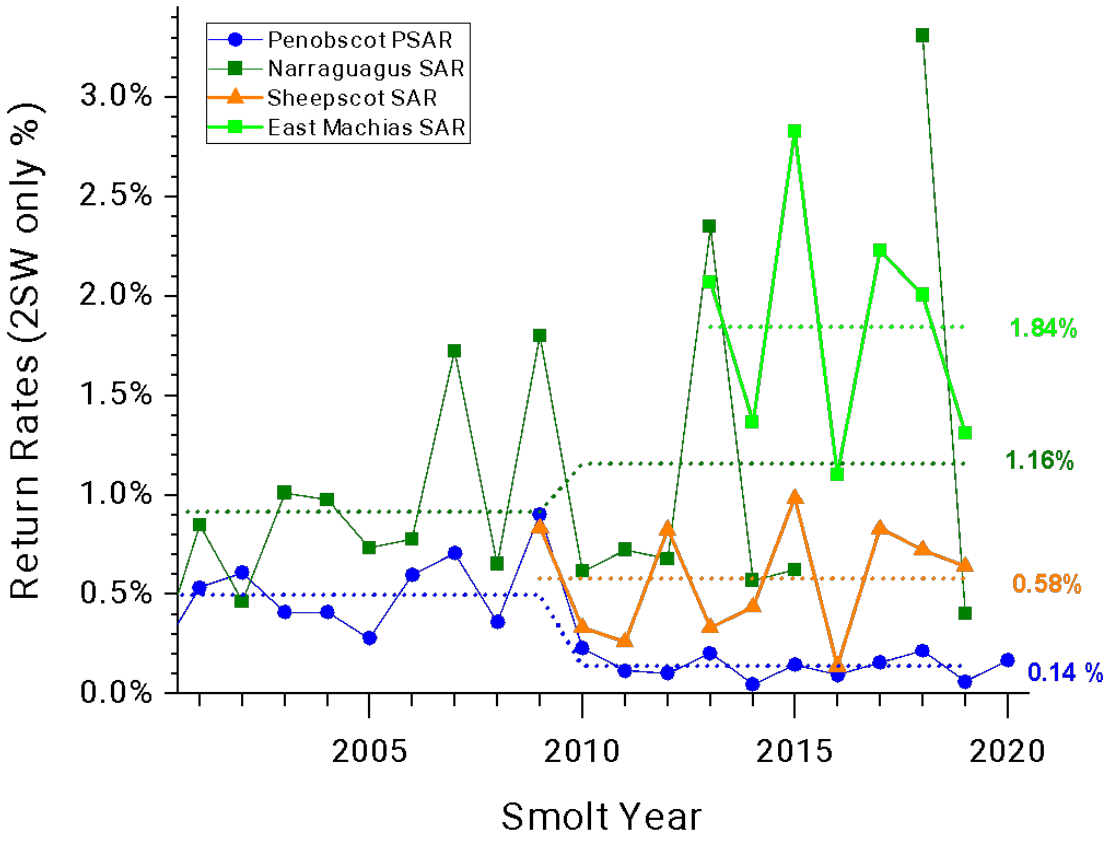

Figure 6-1. Marine survival of Two Sea Winter (2SW) Atlantic salmon returns since the 2001 smolt cohorts for the Penobscot, Narraguagus, Sheepscot, and East Machias Rivers as indexed by Smolt to Adult Returns (SAR) for all rivers and the Post Smolt to Adult Returns that removed freshwater and estuary mortality for the Penobscot (Stevens et al. 2019). Lines indicate average by decade or available time series in case of East Machias.

Attachment 1

FERC STANDING COMMITTEE
2022 Activities

Role of Committee

- Review research and monitoring studies at FERC hydro projects.
- Make recommendations to improve Atlantic salmon survival, abundance, and distribution at FERC hydro projects.
- We also discuss other diadromous fish species including herring, shad, and American eels.

Responsibilities

- Provide input and coordination concerning priorities for the use of hatchery origin and wild Atlantic salmon for research and monitoring purposes at FERC hydro projects.
- Review and provide technical input concerning the methods, results, data analysis, and conclusions of newly issued research and monitoring study reports concerning FERC hydro projects in the GOM DPS.
- To help guide the development of opportunities to improve the survival, abundance, and distribution of Atlantic salmon at various FERC hydro projects based upon the results of research and monitoring.

Ways of Working

- The Group typically meets once a month as necessary to review draft study reports.
- Chair distributes newly issued research and monitoring study reports prior to meetings for review and discussion
- After meeting, the Chair distributes notes for review and comment as necessary.
- Consists of members from State and Federal Resource Agencies, PIN, and University Researchers

In 2022 the group held ~six meetings. Activities included:

- Reviewed the following draft fish passage study reports:
    - Evaluation of upstream adult river herring passage at the Orono and Milford Projects
    - Milford sensor fish survival and injury assessment of juvenile alosines
    - Milford upstream shad passage study
    - Upstream eel passage study at Orono and Milford.
    - West Enfield alewife upstream passage effectiveness study
    - West Enfield condition assessment of alewives using the upstream fishway

- UMO Presented:
    - Updates on Penobscot River Predation Studies

- Other
    - Multiple updates on FERC relicenings in Penobscot, Kennebec and Union Rivers
    - Multiple updates on fish passage studies in these watersheds
    - Penobscot American Shad Model (Dan Stich)