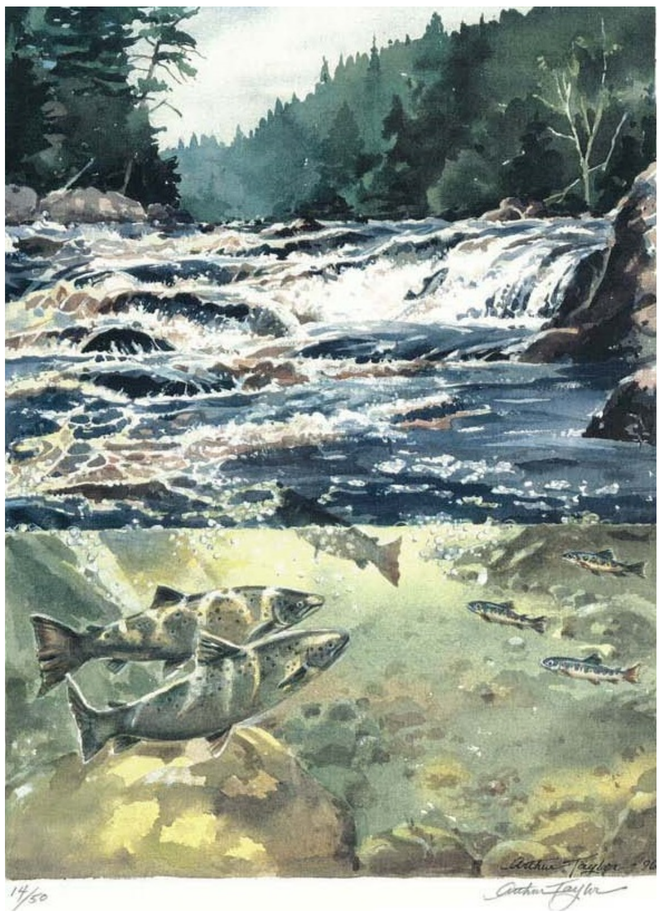
Recovery Plan for the Gulf of Maine Distinct Population Segment of Atlantic Salmon (*Salmo salar*)

FINAL PLAN FOR THE 2009 ESA LISTING



U.S. Department of Commerce
National Oceanic and Atmospheric Administration
National Marine Fisheries Service

U.S. Department of Interior
Fish and Wildlife Service
Ecological Services and Fisheries

Recovery Plan for the Gulf of Maine Distinct Population Segment of Atlantic Salmon (*Salmo salar*)

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PREFACE

This recovery plan has been developed pursuant to the Endangered Species Act of 1973, as amended (16 U.S.C. 1531 et seq.) (ESA). The recovery plan is accompanied by a Website that contains supplemental scientific assessments and supporting information (www.Atlanticsalmonrestoration.org). Recovery plans are subject to public review; comments received during the review period were considered during preparation of the final plan. The supplemental information was accessible for informational purposes but was not provided for formal public review.

The ESA establishes policies and procedures for identifying, listing, and protecting species of fish, wildlife, and plants that are endangered or threatened with extinction. The purposes of the ESA are "to provide a means whereby the ecosystems upon which endangered species and threatened species depend may be conserved, [and] to provide a program for the conservation of such endangered species and threatened species." The ESA definition of "species" includes any subspecies of fish or wildlife or plants, and any distinct population segment of any species of vertebrate fish or wildlife that interbreeds when mature. Defined in the ESA, an endangered species is any species that is in danger of extinction throughout all or a significant portion of its range whereas a threatened species is any species that is likely to become an endangered species within the foreseeable future throughout all or a significant portion of its range.

The Gulf of Maine (GOM) distinct population segment (DPS) of Atlantic salmon was originally listed as endangered in December 2000 (65 FR 69459, November 17, 2000) by NOAA's National Marine Fisheries Service (NMFS) and the U.S. Fish and Wildlife Service (USFWS) and encompassed salmon populations in small river systems along the Maine coast. Subsequently, new data led to expansion of the GOM DPS to include, in addition to the coastal rivers, populations in larger river systems covering a more extensive geographic area. Jointly, NMFS and the USFWS published the final rule for the expanded DPS in June 2009 (74 FR 29344, June 19, 2009).

The Secretaries of the Department of the Interior and the Department of Commerce are responsible for administering ESA provisions as they apply to GOM DPS of Atlantic salmon. Management authority for endangered and threatened species under the Departments' jurisdictions has been delegated to the USFWS and NMFS. These agencies, collectively referred to as the Services, share Federal jurisdiction for GOM Atlantic salmon, with USFWS having lead responsibility primarily for activities in freshwater and NMFS having lead responsibility for activities in the estuary and marine environments and for dams.

To help identify and guide recovery needs for listed species, section 4(f) of the ESA directs the Secretaries to develop and implement recovery plans for listed species. A recovery plan must include to the maximum extent practicable: (1) a description of site-specific management actions necessary to conserve the species; (2) objective, measurable criteria that, when met, will allow the species to be removed from the endangered and threatened species list; and (3) estimates of the time and funding required to achieve the plan's goals.

This recovery plan specifically addresses the planning requirements of the ESA for the GOM DPS of Atlantic salmon listed in 2009. It presents a recovery strategy based on the biological and ecological needs of the species as well as current threats and conservation accomplishments that affect its long-term viability. This recovery document wholly supersedes the recovery plan approved in 2005 for the DPS listed in 2000 (NMFS and USFWS, 2005). Because it addresses the 2009 expanded DPS, this plan is the initial recovery plan for the currently listed entity.

DISCLAIMER

Recovery plans delineate such reasonable actions believed to be necessary, based upon the best scientific, commercial data available, for the conservation and survival of listed species. The USFWS in cooperation with, and with major contributions from, NMFS prepared this recovery plan for the GOM DPS of Atlantic salmon (*Salmo salar*).

Recovery plans do not necessarily represent the views or the official position or approval of any individuals or agencies other than the USFWS and NMFS. Recovery plans are neither regulatory nor decision documents; rather, they are technical advisory documents that provide recommendations to achieve stated recovery objectives. Objectives will be attained and funds expended contingent on appropriations, priorities, and other budgetary constraints. Nothing in this plan should be construed as a requirement that any Federal agency obligate or pay funds in contravention of the Anti-Deficiency Act, 31 U.S.C. 1341, or any other law or regulation. Approved recovery plans are subject to modification as dictated by new findings, changes in species status, and completion of recovery actions.

Literature citations should read as follows:

U.S. Fish and Wildlife Service and NMFS. 2018. Recovery plan for the Gulf of Maine Distinct Population Segment of Atlantic salmon (*Salmo salar*). 74 pp.

Review copies of this recovery plan can be downloaded via the Internet at:

http://www.fws.gov/northeast/EcologicalServices/recovery.html

or

https://www.greateratlantic.fisheries.noaa.gov/protected/atlsalmon/

Copies will also be provided upon request to the U.S. Fish and Wildlife Service, Maine Fish and Wildlife Service Complex, 306 Hatchery Road, East Orland Maine 04431; telephone 207-902-1567.

GUIDE TO THE PLAN

This document represents a departure from the 2005 recovery plan for the GOM DPS of Atlantic salmon as it does not include detailed supplementary information. Rather, the plan focuses on the statutory requirements of the ESA, which are to identify, to the maximum extent practicable, recovery criteria, recovery actions, and time and cost estimates. More in-depth scientific information and analyses, as well as activities that address the site-specific recovery actions, are contained in other documents made available on the Atlantic Salmon Restoration Website (see box 1 below). Although the material on the Website is not part of the recovery plan itself, hyperlinks to specific Web pages are included throughout this document. Note also that technical and management terms are defined in the glossary to the Atlantic salmon recovery plan companion document.

The major sections of the plan include:

Part I. **Introduction**, which describes the listed entity and governance structure for recovery and summarizes the threats and conservation measures that affect the current status of the DPS

Part II. **Recovery Strategy**, which lays out the long-term guiding principles for the criteria and actions that comprise the GOM DPS recovery program

Part III. **Recovery Goals, Objectives, and Criteria**

Part IV. **Recovery Actions**, describing the long-term actions needed to meet recovery criteria and general implementation responsibilities

Part V. **Time and Cost Estimates** for achieving the ESA delisting goal

CHANGES FROM THE 2005 RECOVERY PLAN

- This recovery plan addresses the expanded range of the GOM DPS of Atlantic salmon described in the 2009 listing rule (74 FR 29344, June 19, 2009).
- This plan reflects a new recovery planning approach (termed the Recovery Planning and Implementation, or RPI) being adopted by the USFWS. RPI plans focus on the statutory elements of recovery criteria, recovery actions, and time and cost estimates.
- Details about biology and threats, and other supporting documentation can be accessed at the Atlantic Salmon Recovery Plan Companion Document.
- A long-term implementation strategy and site-specific recovery actions at a Salmon Habitat Recovery Unit (SHRU) scale are identified in this plan, while management activities that implement recovery actions in the short term can be found in SHRU-level workplans posted on the Atlantic Salmon Restoration Website.

Box 1.

ACKNOWLEDGMENTS

The primary intent of this recovery plan is to provide recovery goals and objectives toward which all stakeholders can cooperatively work. This plan builds on the significant body of published work and expert knowledge regarding Atlantic salmon and other diadromous species.

Many individuals have contributed to the development of this plan. Writing team members Dan Kircheis, Peter Lamothe, and Mary Parkin, have worked from a draft authored by Antonio Bentivoglio. In addition, the following individuals have made substantial contributions to the plan: Alex Abbott, Bill Archambault, William Ardren, Ernie Atkinson, Mike Bailey, Meredith Bartron, Dave Bean, Colby Bruchs, Steve Coghlan, Mary Colligan, Scott Craig, Paul Christman, Oliver Cox, Julie Crocker, Kim Damon-Randall, Serena Doose, Rob Dudley, Kayla Easler, Stewart Fefer, Jaime Geiger, Anna Harris, Clayton Hawkes, Chris Holbrook, Bob Houston, Ted Koch, John Kocik, Steve Koenig, Ben Letcher, Trent Liebech, Greg Mackey, Wende Mahaney, Mark McCollough, Steve McCormick, Mike Millard, Martin Miller, Slade Moore, Katrina Mueller, Lori Nordstrom, Paul Phifer, Peter Ruksznis, Paul Santavy, Rory Saunders, Fred Seavey, Tim Sheehan, Steve Shepard, Randy Spencer, John Sweka, Joan Trial, Tara Trinko Lake, Jed Wright, Laury Zicari and Joe Zydlewski.

Special thanks go to Ruth Taylor and Ed Baum for providing the copyrights for the use of Arthur Taylor's "Coming Home" painting as the cover art for this recovery plan.

This plan is dedicated to the treasured memory of Jed Wright, Melissa Laser, Clem Fay, Joris Naiman, and Barbara Arter and their outstanding contributions to Atlantic salmon recovery in Maine. The accomplishments of Melissa and Clem have been noted in previous documents and are an inspiration for current and future conservation efforts needed to recover this endangered species. Here, we would like to elaborate on those more recently lost, Joris, Barbara and Jed.

Joris Naiman was the Department of Interior Solicitor who spent countless hours reviewing both the original Atlantic salmon recovery plan and, for as long as he could sustain his energy, this plan. He cared greatly that we, as Federal servants, adhere to both the letter and the spirit of the ESA. Although his intellect was his defining feature, he had a sense of adventure that included flying helicopters. Joris never hesitated to point out flaws in logic or to delve deeply into the meaning of how we proposed to recover salmon in the GOM DPS. He was a major force in ensuring the integrity of recovery plans, a legacy that we hope we have carried forward in this plan.

Barbara Arter was a conservationist and avid fly fisher who worked tirelessly as a volunteer, teacher, and consultant to advocate and promote the conservation of natural resources in Maine. She was never afraid to ask the tough questions, and always with a smile. As a conservation planner, she was diligent and thorough in her investigations. She made significant contributions to the Atlantic salmon program in writing watershed management plans; facilitating project oriented workshops and meetings, and, more recently, serving as the Science Information Coordinator for the Diadromous Species Research and Restoration Network. Barbara's determination, insights, abilities, personality, and laughter will be greatly missed by all those fortunate enough to have worked with her.

Jed Wright was the Project Leader for the USFWS Gulf of Maine Coastal Program Office in Falmouth, Maine. Jed began his career with the USFWS mapping Atlantic salmon habitat in the rivers of Downeast Maine. Jed evolved to become a leader in improving aquatic connectivity throughout the state and New England. Jed's passion for conservation and his patience and quiet leadership were a motivating force for all who knew and worked closely with him. Jed worked closely with a multitude of partners including the Nature Conservancy, the Audubon Society, many land trust and conservation groups as well as state and federal government agencies. Jed will be greatly missed by all who had the honor and pleasure to have worked with him.

EXECUTIVE SUMMARY

After originally listing the Gulf of Maine (GOM) distinct population segment (DPS) of Atlantic salmon as endangered in December 2000 and publishing a recovery plan in November 2005, the USFWS and NMFS conducted a second status review and listed an expanded GOM DPS on June 19, 2009. The expanded DPS encompasses all anadromous Atlantic salmon in a freshwater range covering the watersheds from the Androscoggin River northward along the Maine coast to the Dennys River and includes all associated conservation hatchery populations used to supplement these natural populations. Concurrent with the new listing, NMFS identified and designated critical habitat within the range of the expanded GOM DPS. This recovery plan pertains to the expanded DPS and accounts for new information.

RECOVERY PLANNING APPROACH: The plan adopts a planning approach recently endorsed by the USFWS and, for this plan, NMFS. The new approach, termed Recovery Planning and Implementation (RPI), focuses on the three statutory requirements in the ESA, including site-specific recovery actions; objective, measurable criteria for delisting; and time and cost estimates to achieve recovery and intermediate steps. It also provides relevant background information for understanding the proposed recovery program, including a summary of the governance structure, threats, conservation measures, and recovery strategy for the DPS. Other relevant data and analyses are available on the Atlantic Salmon Recovery Plan Companion Document. Links to specific web pages are included throughout this plan.

RECOVERY UNITS: The critical habitat rule (74 FR 29300, June 19, 2009) delineates recovery units for the expanded DPS. These units, designated as Salmon Habitat Recovery Units (SHRUs)[1], respond to life history needs and the environmental variation associated with freshwater habitats. The SHRUs encompass the full range of the DPS, including:

- Merrymeeting Bay, which covers the Androscoggin and Kennebec, and extends east to include the Sheepscot, Pemaquid, Medomak, and St. George watersheds;

- Penobscot Bay, which covers the entire Penobscot basin and extends west to and includes the Ducktrap watershed; and,

- Downeast, including all coastal watersheds from the Union River east to the Dennys River.

THREATS TO THE DPS: This plan is based in large part upon an updated threats analysis for the expanded GOM DPS. The 2009 listing rule called particular attention to three major threats to Atlantic salmon: dams, inadequacy of regulatory mechanisms related to dams, and low marine survival. The rule also identified a number of secondary stressors, including activities or actions that pertain to habitat quality and accessibility, commercial and recreational fisheries, disease and predation, inadequacy of regulatory mechanisms related to water withdrawal and water quality,

[1] Recovery units also assist with the implementation of Section 7 consultations under the ESA. However, each Section 7 consultation must assess the effects of an action to the recovery unit and the entire listed entity.

aquaculture, artificial propagation, climate change, competition, and depleted diadromous fish communities. Collectively, these stressors constitute a fourth major threat. Since the 2009 listing, our understanding of threats to the DPS has continued to grow. New and emerging threats, all of which constitute significant impediments to recovery, include road stream crossings that impede fish passage, international intercept fisheries, and new information about the effects of climate change. It is important to note that, as recovery proceeds, information and the level of concern about various threats will continue to evolve.

RECOVERY STRATEGY: This recovery plan is based on two premises: first, that recovery actions must focus on rivers and estuaries located in the GOM DPS until we better understand threats in the marine environment, and second, that survival of Atlantic salmon in the DPS will be dependent on conservation hatcheries through much of the recovery process. In addition, the scientific foundation for this plan includes conservation biology principles regarding population viability, our understanding of freshwater habitat viability, and threats abatement needs. These principles are summarized within the viability framework of resiliency, representation, and redundancy.

The recovery strategy also incorporates adaptive management, phasing of recovery actions, a geographic framework based upon the three SHRUs, and a collaborative approach that focuses on full inclusion of partners in implementing recovery actions. This recovery plan includes a table that generally identifies the priority, timing, and involved parties for the various actions, but it is important to recognize that decisions made about recovery activities will be formulated in SHRU-level work plans.

RECOVERY GOAL: The overall goal of this recovery plan is to remove the GOM DPS of Atlantic salmon from the Federal List of Endangered and Threatened Wildlife. The interim goal is to reclassify the DPS from endangered to threatened status.

RECOVERY OBJECTIVES AND CRITERIA: The objectives and criteria in this plan address biological recovery needs and abatement of threats, as summarized below.[2]

> **Reclassification Objectives –** Maintain sustainable, naturally reared populations with access to sufficient suitable habitat in at least two of the three SHRUs, and ensure that management options for marine survival are better understood. In addition, reduce or eliminate those threats that, either individually or in combination, pose a risk of imminent extinction to the DPS.
>
> **Delisting Objectives –** Maintain self-sustaining, wild populations with access to sufficient suitable habitat in each SHRU, and ensure that necessary management options for marine survival are in place. In addition, reduce or eliminate all threats that, either individually or in combination, pose a risk of endangerment to the DPS.

Biological Criteria for Reclassification – Reclassification of the GOM DPS from endangered to threatened will be considered when all of the following biological criteria are met:

[2] The biological recovery criteria for the GOM DPS of Atlantic salmon were established in the 2009 critical habitat final rule (NOAA 2009).

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.

Biological Criteria for Delisting - Delisting of the GOM DPS will be considered when all of the following criteria are met:

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 adult salmon. This will require both habitat protection and restoration at significant levels.

Threats Abatement Criteria: Threats to GOM DPS identified both in the 2009 listing rule and since then, must be diminished prior to reclassification and, to a greater extent, delisting. Therefore, this plan includes criteria specific to reducing threats to the survival and recovery of the species. In this Plan we identify a number of primary threats as well as a number of secondary stressors, that in their combination constitute a primary threat. In order to delist the GOM DPS of Atlantic salmon, each individual primary threat must be sufficiently abated according to stated criteria in section III. The Services also recognize that primary threats may change over time. The Services will develop an implementation strategy to address the secondary stressors in a manner that allows for a sufficient reduction in extinction risk as the recovery process advances. To facilitate this strategy, the adaptive management and collaborative aspects of the Recovery Strategy will come into play. Monitoring and relevant research will be critical in determining to what extent secondary stressors must be resolved in association with abatement of the threats.

Numerous criteria for abating the threats and the stressors are detailed in the body of the recovery plan.

RECOVERY ACTIONS: This recovery plan focuses on the site-specific actions necessary to recover the GOM DPS of Atlantic salmon. These actions address both survival and recovery needs and are site-specific to the extent practicable as required by section 4(f)(1)(B)(i) of the ESA. In this plan, the SHRU often represents the site in which the actions are scaled to. In some circumstances, recovery actions encompass the entire DPS or are not geographically based (e.g. genetic studies and other research). Scaling site-specific actions to the SHRU takes into account both the multi-faceted, interdisciplinary nature of recovery actions and long timeframe needed to reach reclassification and delisting objectives; thus, the SHRU constitutes the geographic scale in which the Services will measure recovery progress and carry out adaptive management. Using a finer scale than the SHRU to identify site-specific actions is not practicable because there are a number of different pathways and scenarios that could allow for salmon recovery to happen. Every dam removal or every restoration project will affect the population differently based on its position within the watershed, the level of impact that the activity is actually having on the population to begin with, and its relationship to other threats within the watershed. Therefore, being more prescriptive by using a finer scale than the SHRU-level regarding what projects need to happen would be too inflexible and mask viable options given the wide range of possible pathways and different combinations of restoration actions that could allow for recovery to occur. SHRU-level workplans provide the basis for determining activities within the SHRU that should be implemented in order to complete the plan's SHRU specific recovery actions. Although these workplans link back to this recovery plan, they are not considered part of the plan itself. The eight categories of recovery actions include:

- **Habitat Connectivity**, intended to enhance connectivity between the ocean and freshwater habitats important for salmon recovery;
- **Freshwater Conservation**, intended to increase adult spawners through the freshwater production of smolts;
- **Marine and Estuary**, intended to increase survival in these habitats by increasing understanding of these salmon ecosystems and identifying the location and timing of constraints to the marine productivity of salmon in support of management actions to improve survival;
- **Outreach, Education, and Engagement**, intended to collaborate with partners and engage interested parties in recovery efforts for the GOM DPS;
- **Federal/Tribal Coordination**, intended to ensure federal agencies and associated programs continue to recognize and uphold federal Tribal Trust responsibilities;
- **Conservation Hatchery**, intended to provide demographic support and maintain genetic diversity appropriate for the purpose of recovering Atlantic salmon in the Gulf of Maine DPS;
- **Genetic Diversity**, intended to maintain the genetic diversity and promote increased fitness of Atlantic salmon populations over time;
- **Funding Program Actions,** intended to identify funding programs that support State, local and NGO conservation efforts that benefit Atlantic salmon recovery

ESTIMATED TIME TO RECOVERY: The Services project a 75-year timeframe to achieve delisting of the GOM DPS of Atlantic salmon. This accounts for approximately 15 generations of salmon and assumes an estimated upper limit for resource investment into implementation of recovery actions. It is difficult to estimate a time and cost for reclassification because of uncertainties associated with the current significant threats to the species, especially marine survival, and impacts of climate change. The earliest possible time scenario would be 10 years based on the current reclassification criteria.

ESTIMATED COST OF RECOVERY: The implementation plan includes actions that are funded or partially funded under the Services baseline budget (based on fiscal year 2017 budget allocations), and actions that are necessary for Atlantic salmon recovery but are currently not funded under our current budget. The baseline budget of the USFWS and NMFS is approximately $8.6 million per year. This largely includes funding to support the State of Maine's management of Atlantic salmon through Maine Department of Marine Resources, population assessments, genetic analysis, and implementation of the ESA including Section 7 and Section 10, and hatchery operations. The estimated cost of implementing recovery actions not covered by the Services baseline budget is estimated at approximately $24 million per year. These costs include actions such as fishway installations, dam removals, replacing undersized culverts, among other activities. The cost of implementing recovery actions will change over time as recovery actions are completed, new actions are identified, and as new technologies and management approaches are adopted. As such estimating the final cost of recovery over 75 years is highly speculative although we present one possible scenario in Part V of the recovery plan.

ASSESSMENT OF RECOVERY PRIORITY: The USFWS and NMFS have adopted separate Recovery Priority systems to prioritize recovery planning and implementation. The recovery priority for each agency is reassessed at least biannually, as part of the agency's biennial reports to congress on recovering threatened and endangered species under the ESA. The USFWS and NMFS will revisit these priority determinations on a biannual basis and will work to ensure that these determinations are based on a consideration of the best available information and are coordinated to the maximum extent practicable, with any differences identified and explained.

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BOXES, FIGURES, AND TABLES

PART I. INTRODUCTION

A. Listed Entity and Recovery Units

1. Gulf of Maine Distinct Population Segment of Atlantic Salmon

Atlantic salmon populations in the United States have been grouped into the Long Island Sound, Central New England, and Gulf of Maine (GOM) population segments (figure 1) (Fay, et al., 2006). Under the Endangered Species Act (ESA), a distinct population segment of a vertebrate species is treated as a species for listing and recovery purposes if it meets the qualifying criteria defined by the joint Distinct Population Segment (DPS) policy of 1996 (61 FR 4722, February 7, 1996). This policy lays out three criteria, all of which must be met before a population segment can be listed as a DPS. These criteria include the discreteness of the population segment in relation to the remainder of the species to which it belongs, the significance of the population segment to the species to which it belongs, and the population segment's conservation status in relation to the ESA's standards for listing as endangered or threatened.

Figure 1. **Freshwater range of Atlantic salmon in the United States represented by three distinct population segments. Only the Gulf of Maine Distinct Population Segment currently support wild populations**

All native Atlantic salmon populations in the Long Island Sound and Central New England population segments have been extirpated. As of 2014, non-native Atlantic salmon were still present in the Central New England and Long Island Sound population segments as an artifact of a reintroduction program that existed in the Connecticut and Merrimack Rivers from 1967 to 2012. In 2013, the USFWS discontinued the federally supported programs to rebuild these stocks. However, Atlantic salmon persist in some rivers in the Long Island Sound and Central New England DPS as a result of state supported efforts to maintain Atlantic salmon presence in some rivers. These include the State of Connecticut's Atlantic Salmon Legacy program that supports a small stocking program in the Connecticut River, and the Saco River Salmon Club's hatchery program supported by the State of Maine's Department of Marine Resources (DMR) that continues to maintain a small stocking program in the Saco River. The Atlantic salmon used to support these programs are not part of the listed entity and therefore, are not protected under the ESA. Only the GOM population segment supports native wild salmon populations, all of which are at extremely low population size, leading to the designation of this population segment as a DPS.

The GOM DPS of Atlantic salmon was first listed by the U.S. Fish and Wildlife Service (USFWS) and the National Oceanic and Atmospheric Administration's National Marine Fisheries Service

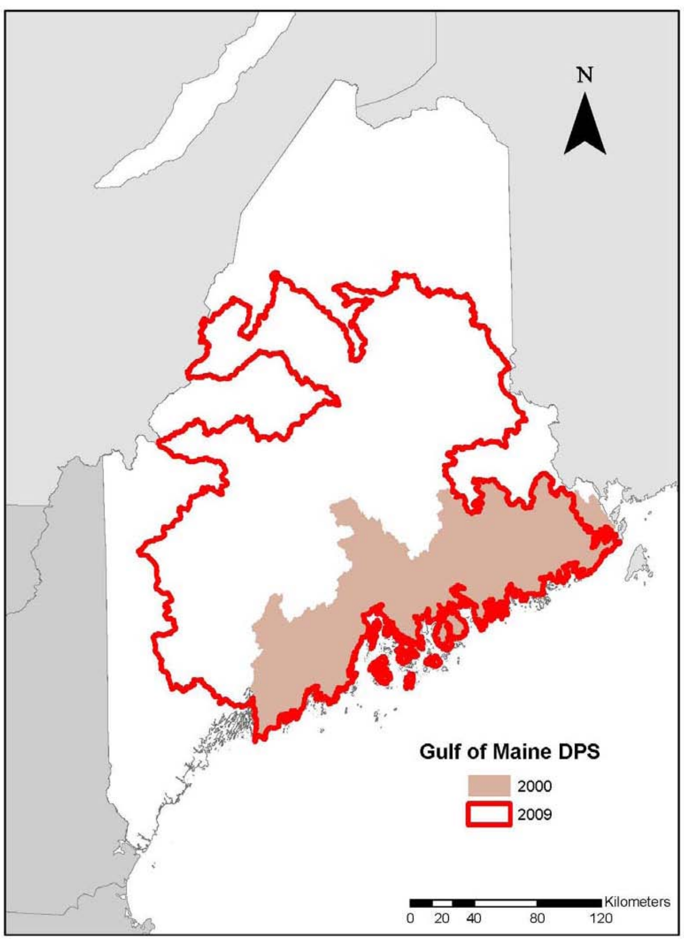

Figure 2. Geographic range of the GOM DPS as defined in the 2000 and 2009 listing rules.

(NMFS) (collectively referred to as the Services) as endangered in 2000 (65 FR 69459, November 17, 2000). The 2000 GOM DPS included all naturally reproducing remnant populations of Atlantic salmon from the Kennebec River downstream of the former Edwards Dam site, northward to the mouth of the St. Croix River. At the time of the 2000 listing, however, there were uncertainties associated with biological and genetic relationships of Atlantic salmon inhabiting the Androscoggin River, Kennebec River, and Penobscot River to wild Atlantic salmon populations (Figure 2).

A subsequent status review (Fay et al., 2006) recommended that the GOM DPS be expanded to incorporate all naturally reproducing anadromous Atlantic salmon having a freshwater range in the watersheds from the Androscoggin River northward along the Maine coast to the Dennys River, including all associated conservation hatchery populations used to supplement these natural populations. The marine range, which remained unchanged, extends from the GOM throughout the Northwest Atlantic Ocean to the coast of Greenland. The Services jointly listed this expanded GOM DPS as endangered on June 19, 2009 (74 FR 29300, June 19, 2009).

2. Atlantic Salmon Recovery Units

In considering recovery needs for the GOM DPS at the time of the 2009 listing, we identified the geographic and population-level factors that would buffer the DPS from adverse demographic and environmental events. This included the fundamental need to ensure that Atlantic salmon are well distributed across their GOM range to accommodate metapopulation dynamics. To address life history characteristics as well as demographic and environmental variation, a geographic framework represented by three SHRUs within the DPS was established (Figure 3; also see NMFS 2009, Appendix A).

Figure 3. Salmon Habitat Recovery Units (SHRU's) within the GOM DPS

The three SHRUs delineated for the GOM Atlantic salmon DPS are the:

- Merrymeeting Bay SHRU – Incorporates two large basins, the Androscoggin and Kennebec, and extends east to include the Sheepscot, Pemaquid, Medomak, and St. George watersheds;

- Penobscot Bay SHRU – Includes the entire Penobscot basin and extends west to include the Ducktrap watershed; and,

- Downeast Coastal SHRU – Includes all coastal watersheds from the Union River east to the Dennys River.

The Services will use the recovery units to organize geographically based recovery actions, as well as to assist with the appropriate implementation of Section 7 consultations under the ESA. In doing the latter, the Services will assess the effects of an action on the recovery unit and the entire range of the listed entity.

B. Overview of Recovery Governance and Coordination

1. Recovery Governance Structure

Recovery of the GOM 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 National Research Council (2004) also undertook a review of Atlantic salmon in Maine and recommended that recovery planning for the species adopt a systematic, structured approach to making management decisions, focused on understanding critical uncertainties and on developing strategies that address key sources of ecological risk. In 2004 and 2005, the agencies collaborated to develop joint priorities with the goal of providing an internal and external focus to agency efforts on behalf of Atlantic salmon. The three focus areas were as follows: (1) investigate possible causes and magnitude of early marine survival; (2) operate and evaluate conservation hatchery programs for the DPS and Penobscot River; and (3) Habitat.

The USFWS, NMFS, Maine DMR, and the Penobscot Indian Nation (PIN) share a stewardship interest and governmental responsibility for recovering Atlantic salmon. Collectively the agencies developed a governance structure to facilitate coordination and decision making among these entities and address the recommendations made by the National Research Council.

The current governance structure, which is subject to change, includes an Action Team for each major recovery program element, an Atlantic Salmon Policy Board, and an Atlantic Salmon Management Board. The Action Teams develop implementation plans, review and recommend changes in or approval of project proposals, identify and resolve areas of policy or scientific disagreement, and coordinate to implement and monitor recovery actions. The Policy Board guides broad policy direction, annually reaffirms program priorities, and commits resources for recovery implementation. The Management Board provides updates on potential and real changes to resource commitments and resolves differences of priorities among Action Teams.

The GOM DPS of Atlantic salmon cannot be recovered without broader participation. The governance structure is intended not only to guide recovery efforts among the government entities but to engage other partners in the salmon recovery program, including governmental agencies, nongovernmental organizations (NGOs), commercial and recreational interests, and the general public. Types of recovery actions that NGOs and other partners have implemented to date include dam removals, passage inventories and improvements at road stream crossings, hatchery production of fry, fry stocking, parr stocking, and land conservation and protection. Collaboration, local initiatives, public involvement and support, monitoring, and adaptive management will continue to be essential to this recovery effort.

The recovery governance structure has several stated purposes, including:

- Ensuring that recovery of the GOM DPS is achieved in a manner that is transparent and easily understood in terms of roles and responsibilities of the government entities;
- Ensuring that the best available science is being integrated into recovery;
- Ensuring that resources are made available to implement recommended actions in any given funding cycle;
- Resolving disputes and ensure continuity of operations throughout the operational year;
- Ensuring effective communication among the agencies and the various organizational levels within the agencies;
- Ensuring effective communication among the agencies and their partners in recovery, including NGOs, commercial and recreational interests and the general public;
- Ensuring that the trust responsibilities of the Federal agencies to federally recognized Tribes are appropriately exercised; and,
- Ensuring that those proposals requesting agency resources are vetted and determined to be consistent with agency policies and available resources.

Atlantic salmon recovery is also guided by multi-agency, issue-specific documents, interagency agreements, and international cooperative efforts. The value of these guidance documents is in no way diminished by completion of a recovery plan, and they will continue to provide important technical guidance for recovery actions.

Given our Federal trust responsibilities with regard to Tribal consultation, we provide more detail below on coordination with Maine tribes relative to Atlantic salmon recovery.

2. Tribal Coordination and Collaboration

In Maine, the Wabanaki people represent four tribes: the Passamaquoddy Tribe in Washington County, the Penobscot Indian Nation based at Indian Island on the Penobscot River, the Houlton Band of Maliseets in Northern Maine, and the Aroostook Band of Micmacs, also in Northern Maine. Atlantic salmon and the suite of diadromous fish indigenous to Maine's rivers, streams, lakes, and ponds are of great cultural importance to these Tribes for religious/cultural ceremonies, subsistence, and commerce, all of which have been negatively affected by the decline of Atlantic salmon. Up through 1988[3], the Penobscot Indian Nation harvested Atlantic salmon for sustenance. Since then, however, the Tribe has voluntarily abstained from harvesting Atlantic salmon out of concern for the health of the species. The Passamaquoddy Tribe and Penobscot Indian Nation also hold lands containing habitat that is critical to the survival and recovery of Atlantic salmon. As a result, the working relationship between the Services, the State of Maine, and the Tribes is crucial to the recovery of Atlantic salmon.

The Penobscot Indian Nation, along with the Services and Maine DMR, are co-participants in the management of Atlantic salmon. The Penobscot Indian Nation has member participation on Atlantic salmon Action Teams, the Atlantic salmon Policy Board, and the Atlantic salmon Management Board. Beyond the Management Board, the Services are committed to working with all Tribes in Maine in managing Atlantic salmon while finding ways to best achieve the fisheries needs of the Tribes.

Both Federal agencies have policies and guidance that establishes meaningful procedures for the collaboration and coordination with tribal officials. Detailed information on these procedures can be found at: Department of Commerce Policies and U.S. Fish and Wildlife Service Policies .

[3] Two salmon were harvested for ceremonial purposes in 1988 by Tribal members; see 50 CFR 29344.

C. Threats to Species Viability

1. Threats Identified at Time of Listing

This section summarizes the primary and secondary stressors—described according to the ESA's five listing factors in the box below—upon which the 2009 rule for the Atlantic salmon GOM DPS was based (74 FR 29344, June 19, 2009), and which continue to affect its survival and recovery.

FIVE LISTING FACTORS UNDER THE ESA (§4(a)(1))

A species is listed when it is determined to be endangered or threatened because of any of the following factors:

(A) The present or threatened destruction, modification, or curtailment of its habitat or range;
(B) Overutilization for commercial, recreational, scientific, or educational purposes;
(C) Disease or predation;
(D) The inadequacy of existing regulatory mechanisms; and
(E) Other natural or manmade factors affecting its survival.

These factors must also be evaluated when reclassifying or delisting any listed species.

Box 2.

The 2009 listing rule highlighted three threats as the most significant factors in the decline of Atlantic salmon in Maine as well as a number of secondary stressors that collectively constitute a significant threat to the continued existence of the GOM DPS of Atlantic salmon. The threats and stressors as they relate to each of the five listing factors are summarized below. See Chapter 6 of The Companion Document for a more detailed description of the threats.

Significant threats associated with listing factor A (habitat loss or degradation)

Dams

The direct, indirect, and delayed mortality associated with dams and the ecological effects of dams are a significant threat to the recovery of the GOM DPS of Atlantic salmon. Dams significantly impede migration pathways and can result in direct, indirect or delayed mortality of Atlantic salmon adults, smolts and kelts. Mortality can occur in electricity-generating dams if salmon travel over the spillway, through a downstream fish passage facility or through power-generating turbines. Indirect or delayed mortality can occur when fish are injured or disoriented by the dams and become more vulnerable to predators. Lack of flow cues at dam reservoirs can also increase predation because of the increased time salmon spend in the impoundment.

Dams have a number of additional negative ecological effects on Atlantic salmon. Dams create impoundments that inundate the natural stream and river habitat and cause sediment deposition that can cover important rearing and spawning habitat. Impoundments create large pools of water in which water temperatures can increase above preferred Atlantic salmon temperature levels. These impoundments and associated habitat changes can become preferred habitat for warm water exotic species that prey on juvenile Atlantic salmon. Impoundments can cause migratory delays, which, in turn, can reduce a salmon's tolerance to salinity, thereby increasing estuarine mortality (McCormick et al., 1998). For additional information, see Fay et al. (2006), and Appendix 8 in Fay et al. (2006), and the 2009 GOM DPS Atlantic salmon listing rule (74 FR 29344, June 19, 2009).

Secondary stressors associated with factor A

Habitat Complexity

Some forest, agricultural, and other land use practices have reduced habitat complexity within the range of the GOM DPS of Atlantic salmon. Reduced habitat complexity acts as a stressor on the GOM DPS by reducing spaces for hiding from predators and increasing water temperature. Large wood and boulders are currently lacking from many rivers because of historical timber harvest practices. When present, large wood and boulders create and maintain a diverse variety of habitat types. Large trees were harvested from riparian areas; this reduced the supply of large wood to channels. In addition, any large wood and boulders that were in river channels were often removed in order to facilitate log drives. Historical forestry and agricultural practices were likely the cause of currently altered channel characteristics, such as width-to-depth ratios (i.e., channels are wider and shallower today than they were historically). Channels with large width-to-depth ratios tend to experience more rapid water temperature fluctuations, which are stressful for salmon, particularly in the summer when temperatures are warmer.

Water Quantity

Direct water withdrawals and groundwater withdrawals for crop irrigation and commercial and public use can directly impact Atlantic salmon habitat by depleting stream flow. Reduced stream flow can reduce the quantity of habitat, increase water temperature, and reduce dissolved oxygen. The cumulative effects of individual water withdrawal impacts on Maine rivers is poorly understood; however, it is known that adequate water supply and quality is essential to all life stages and life history behaviors of Atlantic salmon, including adult migration, spawning, fry emergence, and smolt emigration.

Water Quality

Maine's water quality classification system provides for different water quality standards for different classes of water. These standards were not developed specifically for Atlantic salmon, and the lower quality standard classes may not provide high enough water quality to protect all life stages of Atlantic salmon. See Chapter 6 of The Companion Document for a more detailed description of the threats associated with factor A.

Significant threats associated with listing factor B (Overutilization)

No significant threats were identified at the time of listing that are associated with factor B.

Secondary stressors associated with factor B

Fish Harvest

Intercept fisheries, by-catch in recreational fisheries, and poaching result in direct mortality or cause stress, thus reducing reproductive success and survival of Atlantic salmon. Although international commercial harvest has been highly restricted since 2002, this issue has reemerged as a growing concern (see New and Emerging Threats below). Recreational angling of many freshwater species occurs throughout the range of the GOM DPS, and the potential exists for the incidental capture and misidentification of both juvenile and adult Atlantic salmon. Direct or indirect mortality may result even in fish that are caught and released as a result of injury or stress.

Significant threats associated with listing factor C (disease or predation)

No significant threats were identified at the time of listing that are associated with factor C.

Secondary stressors associated with factor C

Disease Outbreaks

Disease outbreaks, whether occurring in the natural or hatchery environment, have the potential to cause negative population-wide effects. Atlantic salmon are susceptible to numerous bacterial, viral, and fungal diseases. Parasites can also affect salmon. Federally managed conservation hatcheries adhere to rigorous disease prevention protocols and management regulations designed to: prevent the introduction of pathogens into the natural and hatchery environments; prevent and control, as necessary, disease outbreaks in hatchery populations; and, prevent the inadvertent spread of pathogens between facilities and river systems.

Predation

The impact of predation on the GOM DPS is important because of the imbalance between the low numbers of adults returning to spawn and the increase in population sizes of both native and nonnative predators. Increased numbers of predators combined with decreased abundance of alternative prey have likely increased predation mortality on juvenile Atlantic salmon, especially at the smolt life stage.

Significant threats associated with listing factor D (Inadequacy of regulatory mechanisms)

Inadequate regulatory mechanisms related to dams

Atlantic salmon require access to suitable habitat to complete their life history. As described under Factor A, dams within the range of the GOM DPS impede access to much of the suitable habitat that was historically available.

Hydroelectric dams in the GOM DPS are licensed by FERC under the Federal Power Act (FPA). As of 2018, there are 36 FERC dams in the Merrymeeting Bay SHRU. Eleven of these are in designated critical habitat, and two of those have FERC exemptions. Of the 11 dams in designated critical habitat, four of the dams have swim through fishways and one of the dams has a trap-and-truck facility. There are 25 FERC dams in the Penobscot SHRU. Eight FERC dams are located in designated critical habitat, of which three have FERC exemptions. Of the eight dams in designated critical habitat, five of the dams have swim through fishways, and one has a trap-and-truck facility. In the Downeast Coastal SHRU there are three FERC dams. All three dams are in designated critical habitat. Of the three dams, there are no swim through fishways and one trap-and-truck facility.

FERC exemptions are intended for projects that should have minimal environmental impacts. Exemption orders are subject to mandatory fish and wildlife conditions by fish and wildlife agencies under section 30 of the FPA. However, exemptions have no statutory maximum term, and include no mechanism to require reevaluation of the exempted project's environmental impacts should environmental conditions or circumstances change.

Current FERC licenses for many dams contain a reservation provision under FPA section 18 (16 U.S.C. 797) that could allow fishways to be prescribed by the Services (16 U.S.C. 811) outside of the relicensing process. Exercise of this authority requires administrative proceedings before the FERC that requires initiation by either NMFS or USFWS. The FERC maintains that, for the remainder of the projects whose licenses do not contain reserve authority, reopening these licenses may be dependent upon the success of a petition to the FERC to exercise its own reserve authority. The Services' section 18 authorities under the FPA are limited to prescribing a facility for fish passage (such as a fish ladder), operation and maintenance of the facility, and any other conditions necessary to ensure effective passage. Habitat degradation and ecological impacts caused by these dams cannot be addressed by the Services' prescriptive authority under section 18 of the FPA, but may be under FPA section 10(j) (16 U.S.C. 803) recommendations.

NMFS has completed consultation pursuant to section 7 of the ESA on a number of the hydroelectric dams; typically, consultation has been triggered as a result of a relicensing proceeding or by the licensee's request for a license amendment to incorporate measures to minimize or monitor effects on Atlantic salmon (referred to as a Species Protection Plan). Section 7(a)(2) of the ESA requires every Federal agency to insure that any action it authorizes, funds, or carries out is not likely to jeopardize the continued existence of any listed species or results in the destruction or adverse modification of critical habitat. Section 9 of the ESA prohibits take of listed species. If take is occurring at a facility, FERC and/or the applicant needs to initiate the process under section 7 or 10 of the ESA to obtain an exemption from the section 9 prohibitions, which would be conditioned on implementation of measures to minimize, monitor and report incidental take. NMFS is currently engaging these Licensees to develop Species Protection Plans for these dams.

The majority of dams within the GOM DPS do not generate electricity, and therefore do not require either a FERC license or a Maine Department of Environmental Protection (MDEP) water quality certification. These dams are typically small and historically were used for a variety of purposes, including flood control, log drives, mill working, storage, recreation, and processing water. Most of these facilities do not have fish passage, and many of them are not in use. Before salmon were listed, lack of fish passage and other impacts to salmon could be addressed only through State law, as noted previously. Overall, the inadequacy of existing regulatory mechanisms relating to dams is a significant threat to the GOM DPS.

Secondary stressors associated with factor D

No secondary stressors were identified at the time of listing that are associated with factor D.

Significant threats associated with listing factor E (other factors)

Marine survival

Despite significant reductions in commercial intercept fisheries, rates of marine survival of GOM DPS Atlantic salmon are very low. Factors other than fisheries that effect marine survival include factors like climate variability, shifting foodweb dynamics, and climate change. Marine survival is indexed by smolt return rates; a smolt return rate is the ratio of the number of adult returns produced by a smolt cohort to the number of outmigrating smolts (number of naturally reared smolts and/or the number of stocked hatchery smolts). It should be noted that by using this method marine survival incorporates a significant amount of mortality that may originate in the freshwater or estuarine system from dam-associated direct, indirect, or delayed mortality (see Factor A). Regardless of the metric, far fewer adult Atlantic salmon return to Maine rivers than is sustainable. See "Threats Associated with Factor E" in Chapter 6 of the Companion Document for more on the impact of low marine survival on the DPS.

Secondary stressors associated with factor E

Depleted Diadromous Communities

Damming rivers, thus preventing migration to spawning grounds, was a major factor in the decline of Atlantic salmon and much of the co-evolved suite of diadromous fish (e.g., alewife and blueback herring). Many co-evolved diadromous species have experienced dramatic declines throughout their ranges and current abundance indices are fractions of historical levels. The dramatic decline in diadromous species has negative impacts on Atlantic salmon populations, including through depletion of an alternative food source for predators of salmon, reductions in food available for juvenile and adult salmon, nutrient cycling, and habitat conditioning. These impacts may be contributing to decreased survival in lower river and estuarine areas.

Artificial Propagation

The conservation hatchery programs at Craig Brook and Green Lake National Fish Hatcheries (CBNFH and GLNFH) are vital to preserving and stabilizing individual and composite genetic stocks until freshwater and marine conditions improve. Without hatchery production, the likelihood of imminent extinction would be very high, and it is also important to know that hatchery salmon are protected as part of the GOM DPS. Nonetheless, inherent risks associated with the broodstock and stocking program for the DPS include domestication and loss of genetic variability, along with the potential for catastrophic loss due to the limited number of hatcheries maintaining GOM DPS Atlantic salmon. To mitigate these risks, a broodstock management plan has been implemented with the goal of maintaining genetic diversity throughout the hatchery management process, including estimating genetic diversity for each captive broodstock (Bartron, et al., 2006).

Aquaculture

Concerns about the effects of Atlantic salmon aquaculture on wild Atlantic salmon stocks, including the GOM DPS, continue, including the risk of exposing native salmon to serious salmon pathogens and genetic and ecological risks. Although recent advances in containment and marking of aquaculture fish offer more control over the potential for negative impacts, they do not eliminate the risk that aquaculture fish pose to wild Atlantic salmon. More information on conservation measures that have been taken to address the threat of aquaculture can be found on in chapter 6 under Threats Associated with Factor E of the Companion Document.

Competition

Prior to 1800, the resident riverine fish communities in Maine were made up of native species. Today, Atlantic salmon coexist with a diverse array of nonnative resident fishes, including brown trout, largemouth bass, smallmouth bass, and northern pike. The range expansion of these nonnative species is of particular concern, because they often require similar resources and can exclude salmon from preferred habitats, reduce food availability, and increase predation.

2. New and Emerging Significant Threats to the Species

In addition to the threats identified at the time of listing, new information on road stream crossings, the West Greenland intercept fishery in the North Atlantic, and climate change is causing growing concern about their effects on Atlantic salmon in the GOM DPS. Therefore, this recovery plan has identified these as significant threats affecting the GOM DPS. For more information on New and Emerging Threats see Chapter 7 of the Companion Document.

Road stream crossings (Factor A)

Together with dams, lack of access to suitable freshwater habitat due to road stream crossings has become a major concern with regard to recovery of the GOM DPS of Atlantic salmon. The amount of accessible freshwater habitat is a fraction of historical levels; this was initially caused by building dams and later by road stream crossings that created barriers to upstream migration. Fish passage barriers continue to prevent fish from reaching essential spawning and rearing habitat. Undersized culverts create hydraulic barriers that sever habitat connectivity within the range of the GOM DPS. Improperly placed and undersized culverts create fish passage barriers through perched outlets, increased water velocities, or insufficient water flow and depth within the culvert. Poorly placed or designed road stream crossings reduce access to habitat necessary for Atlantic salmon spawning and rearing and alter stream processes including transport of sediment and materials. These barriers also impair ecological complexity and increase the salmon's vulnerability to higher rates of extinction from demographic, environmental, and genetic stochasticity. More information on the threat of road/stream crossings can be found in Chapter 7 of the Companion Document.

Intercept fisheries in the North Atlantic (Factor B)

Commercial fisheries for Atlantic salmon within the United States have been closed since 1947; however, small but significant fisheries continue within the species' migratory corridor off the coast of Canada and Greenland. To effectively engage in issues requiring international collaboration, the United States is a party to the North Atlantic Salmon Conservation Organization (NASCO) and International Conference for the Exploration of the Seas (ICES). The United States is a signatory to the "Convention for the Conservation of Salmon in the North Atlantic Ocean" which entered into force in October 1983, creating NASCO to ensure that the burden of Atlantic salmon conservation was shared by both States of Origin and Distant Water Countries. Intercept fisheries (adult fish captured in nets while in transit to or from their feeding grounds in the North Atlantic or on their feeding grounds in the North Atlantic) have posed a significant challenge to recovery of the GOM DPS. Among distance water fisheries, the West Greenland fishery intercepts the greatest number of U.S. origin fish. Other fisheries where U.S. origin fish are harvested include the St. Pierre and Miquelon fishery located off the coast of Newfoundland, and a subsistence fishery that occurs in Labrador, Canada. More information on the threat of the Intercept Fisheries in the North Atlantic can be found in Chapter 7 of the Companion Document.

Climate change (Factor E)

At the time of listing in 2009, there was reasonable certainty that climate change was affecting Atlantic salmon in the GOM DPS (e.g., National Research Council, 2004; Fay et al. 2006), but there was uncertainty about how and to what extent. Since listing, new and emerging science has led to a better understanding of climate change effects and its impact on salmon. Recent information indicates that climate change is having significant impacts on the habitats that Atlantic salmon depend on and, in turn, is affecting the overall survival and recovery of Atlantic salmon (Mills et al. 2013, Renkawitz, 2015).

Briefly, climate change can affect all aspects of the salmon's life history by altering habitat features through increases in sea surface temperatures. Global averaged temperature combined with land and ocean surface temperatures show a warming trend. Although these temperature changes seem subtle, they are associated with changes in the seasonal cycles of phytoplankton, zooplankton, and fish populations in the marine environment (Greene and Pershing 2007). Subtle increases in global temperature are also associated with changes in freshwater hydrologic regimes; and alterations in the timing and frequency of river ice flows (Dudley & Hodgkins 2002)**.** All of these factors influence environmental cues that stimulate Atlantic salmon migration, spawning, and feeding activities. As this is now considered to be an emerging threat to the viability of the DPS, new information and analyses will be made available in Chapter 7 of the Companion Document as it becomes available.

D. Historical and Contemporary Conservation Measures

Atlantic salmon conservation and restoration efforts have been underway for more than 150 years. The earliest efforts to restore and improve anadromous fish runs in New England rivers were driven by depletion of stocks through non-sustainable commercial fisheries, coupled with habitat loss due to impassable dams. Pollution was also considered a factor in fish population declines.

Starting in the late 1800s artificial propagation and fish culture programs were established first at CBNFH and later at GLNFH. These programs have allowed Atlantic salmon to survive during times that many of Maine's rivers were not suitable for salmon survival; they also allowed for maintenance of an economically important commercial fishery into the early 1900s and a recreational fishery through the early 1990s. The hatchery programs are now essential in preserving the genetic integrity of the last remaining Atlantic salmon populations in the United States.

Efforts to restore river habitats in order to support Atlantic salmon started with the recognition that dams without fish passage were a major threat to the species. A number of Federal laws were then enacted that contributed to Atlantic salmon conservation, including the Water Pollution Control Act of 1948, which subsequently became the Clean Water Act of 1972 (CWA), and the Anadromous Fish Conservation Act of 1965. The Clean Water Act significantly curtailed pollution that had once caused rivers and streams in Maine to be toxic to both humans and fish, while the Anadromous Fish Conservation Act provided resources to install fishways on most of the mainstem dams in the Penobscot River and remove or breach defunct dams in the Narraguagus, Machias, and Sheepscot Rivers. By all indications, these efforts were working to restore salmon, as Atlantic salmon returns began increasing starting in the early 1970s. Through the mid-1980s, between 2,000 and 3,000 adult returns were consistently being documented annually on the Penobscot River.

In 1983, the State of Maine adopted its first prioritized, biologically based, statewide restoration and management plan for Atlantic salmon (Baum 1997). This plan was directed at building and maintaining a viable run of Atlantic salmon and a fishery in the seven remaining rivers that contained wild Atlantic salmon. Unfortunately, shortly thereafter Atlantic salmon marine survival rates crashed, leading to precipitous declines in GOM salmon populations.

In the 1990s, the salmon program shifted away from a recreational fishery program to a stock preservation program that including genetics studies, habitat surveys and biological monitoring to further understand why populations were declining. During this time, federal hatcheries transitioned to a program aimed at preserving remaining river-specific natural genetic diversity. Other management and science efforts also shifted towards more active conservation, including closing a commercial export fishery in Greenland that was believed to be central to the decline, and assessing freshwater habitats.

Following the 2000 federal listing of Atlantic salmon as endangered and the development of the first Atlantic salmon recovery plan (2005), emphasis was placed on making major improvements to the conservation hatchery and stocking programs, and expanding habitat conservation efforts. Conservation efforts were directed toward concerns with aquaculture, protecting accessible freshwater habitats by reducing threats from water and land use practices, and identifying impacts associated with water quality.

Although efforts to improve water quality and access to freshwater habitats have been underway for many decades (e.g., Edwards dam removal (1999), Clean Water Act enacted in 1972), there was an emphasis shift in the mid-2000s that focused restoration efforts on restoring habitat connectivity. This included improving connectivity by locating and removing culvert barriers, removing dams when possible, and installing fishways when dam removal was not feasible. These efforts were exemplified by the removal of two mainstem hydroelectric projects and construction of a bypass at a third project on the Penobscot River. In addition, the Services and hydro developers in the GOM DPS have worked together to craft plans for fish passage at many of the remaining hydro facilities. Downstream and upstream fish passage improvement projects and fish passage studies are now underway at many hydro projects within the designated critical habitat area for Atlantic salmon.

The conservation efforts of the past century, largely driven by regulatory measures, have afforded important conservation benefits to the GOM DPS and the entire suite of diadromous fish that coexist alongside Atlantic salmon. Without these efforts, salmon, along with many other diadromous species, would likely have been extirpated from Maine's rivers and streams decades ago. Examples of conservation successes since Atlantic salmon were first listed in 2000 include:

1. **Conservation successes addressing the threat of Dams**

Numerous dams have been removed and many new fishways have been constructed since Atlantic salmon were first listed as an endangered species in 2000. The most comprehensive efforts to improve fish passage encompassed the work of the Penobscot River Restoration Project, the State of Maine's 2009 Operation Plan for the Restoration of the Penobscot River (MDMR and MDIFW, 2009), and designation of the Penobscot Habitat Focus Area by NMFS. Part of these efforts included a negotiation process involving the Penobscot Indian Nation, industry representatives, the State of Maine, NGOs and federal partners that resulted in a Settlement Agreement. These efforts lead to the removal of Veazie (2013) and Greatworks Dam (2012), the two lowermost mainstem dams on the Penobscot river; and the removal of, or improvement of fish passage at numerous other small dams in the Penobscot watershed. In addition, a state of the art fishway was constructed at the Milford Dam (2012) which is now the lower most dam in the Penobscot. Most of these projects were supported by funds made available through programs that target the conservation of threatened and endangered species, such as money allocated to States through Section 6 of the ESA. Furthermore, Section 7 consultation was carried out to assess the effects of the dam removals and project modifications. Monitoring requirements were implemented and are authorized under Section 7 and Section 10 of the ESA. We continue to use these tools to monitor and ensure the effectiveness of these projects in achieving their conservation goals of reconnecting Maine's rivers and restoring sea-run fish communities.

Although Atlantic salmon have been slow to respond to in-river improvements, largely because of continued threats they face while at sea, the other sea-run species have responded significantly. River herring that were once constrained to the lower 30 miles of the Penobscot River have now been observed more than 130 miles upstream from sea. Before the dams were removed, annual returns of river herring numbered near or below 2,000. Since the dams were removed, and with the support of stocking efforts, the numbers of river herring and American shad passing upstream of the Milford Dam has increased significantly. The dam removals also allowed for the expansion of the range of American shad and ESA listed shortnose sturgeon. Both were once constrained to below the lowermost dam on the Penobscot River. In 2016, shortnose sturgeon were observed using their historic habitat upstream of the Veazie and Greatworks dams for the first time in over

100 years. Furthermore, more than 7,000 American shad were observed passing through the fishway at the Milford dam and some were seen in the river up to 70 miles upstream from the sea. Given the observance of shad in the Penobscot, anglers are once again seeking out American shad as a viable sport fish in the Penobscot River.

There has also been significant conservation successes in the Kennebec River watershed. The Kennebec River Diadromous Fish Restoration Project was initiated in 1986 when the Maine Department of Marine Resources (MDMR) signed a settlement agreement with the Kennebec Hydro-Developers Group (KHDG). A second settlement agreement signed in 1998 by state and federal fisheries resource agencies, non-governmental organizations, and the KHDG resulted in the removal of Edwards Dam in Augusta to provide fish passage for all diadromous fish species, instituted schedules or triggers for fish passage at the seven KHDG dams, and provided additional funding for the stocking program. From 1837 to 1999 the Edwards Dam in Augusta prevented any upstream fish passage. Removal of Edwards dam restored full access to historical spawning habitat for species like Atlantic sturgeon, shortnose sturgeon, and rainbow smelt, but not for species including alewife, American shad and Atlantic salmon that migrated much further up the river (MDMR, 2007). With the removal of Edwards Dam, the first dam on the Mainstem is now the Lockwood Dam in Waterville. In 2006, a fish lift was constructed with the ability to trap and truck Atlantic upstream of three dams that continued to block access to the Sandy River. The Sandy River contains high quality, abundant Atlantic salmon spawning and nursery habitat.

The Sebasticook River, a tributary to the Kennebec, enters the mainstem on the east bank at Waterville just below the Lockwood dam. Historically the Sebasticook supported large runs of diadromous fish. Particularly, American shad, blueback herring and alewives (MDMR 2007). Until the year 2000, the Fort Halifax, Benton, and Burnham dams blocked passage of diadromous fish into most of the Sebasticook River (MDMR 2007). Though the removal of the Edwards dam in Augusta allowed fish passage as far up as far as Lockwood on the Kennebec River, the Fort Halifax dam on the Sebasticook River prevented passage of all diadromous fish into the Sebasticook. In 2000, a fish pump was installed capable of pumping alewives (though not effective at passing other diadromous fish) over the dam (Gail Wippelhauser, e-mail communications, January 2008). By 2006, fish passage was enhanced at the Benton and Burnham dams allowing free passage of alewives once above Fort Halifax throughout the mainstem of the Sebasticook River as far up as Sebasticook Lake. In 2008, the Fort Halifax dam was completely removed such that the first dam on the Sebasticook River is now at Benton Falls.

Because of efforts like this, Maine is one of only a few states along the east coast where populations of river herring are actually growing. Although Atlantic salmon continue to be a critically endangered species, the actions and protections afforded to salmon through the ESA and the perseverance and motivation of the NGO community, has afforded considerable conservation benefit to some of Maine's most economically and ecologically important fisheries resources. Restoration of the searun fish, such as alewife and American shad, help restore the ecosystems upon which Atlantic salmon depend by restoring the flow of marine nutrients into freshwater ecosystems (Guyette 2012, Guyette, Loftin et al. 2014), and likely provides a predation buffer to emigrating smolts (Saunders et al. 2006). Furthermore, with these efforts, Maine's sea run fisheries continue to represent a long standing and essential part of Maine's culture and economy.

For more information on conservation efforts see Chapter 8 of the Companion Document.

2. Conservation successes addressing the threat of Aquaculture

The overall threat that aquaculture poses to GOM DPS Atlantic salmon has decreased substantially over the past decade; impacts associated with aquaculture to the GOM DPS are less than they were historically. This decrease in potential aquaculture impacts is demonstrated by:

a. There are fewer aquaculture salmon along the Maine coast. Current aquaculture stocking levels are 1,984,000 farmed salmon down from 4,511,000 farmed salmon in 2000.

b. As a result of gear type and pen material improvements, Containment Management System plans, and other requirements, the number of escaped farmed salmon documented in GOM DPS rivers has dropped significantly.

c. All Maine aquaculture salmon are currently from North American stocks. This reduces the impacts of gene introgression on the GOM DPS.

d. As a result of mandatory permit requirements and voluntary programs, Maine salmon aquaculture facilities have improved disease and parasite prevention and control measures to the point that we do not anticipate a major threat from the transfer of disease or parasites to GOM DPS salmon.

PART II. RECOVERY STRATEGY

The following recovery strategy recognizes that the continued survival of the GOM DPS of Atlantic salmon currently relies on the conservation hatchery programs. Reliance on the hatchery programs is expected to continue until freshwater ecosystem function has been improved, connectivity has been adequately restored, and marine survival rates improve to the point where wild salmon are returning to spawn at sustainable levels. Therefore, the primary drivers of ongoing and future recovery efforts are the need to reduce uncertainty and the ability to address those factors most likely to allow increased numbers of wild salmon to return to their spawning habitat each year. Each element of this strategy is discussed below.

A. Foundation

1. Conservation Frameworks

The central aim of recovery of the GOM DPS is for the population to have a low risk of extinction in the foreseeable future due to threats from environmental variation, demographic variation, or changes in genetic diversity. The foundational principles for achieving this aim are based on Shaffer and Stein's (2000) "3-Rs" principles and McElhaney et al.'s (2000) principles regarding viable salmon populations (VSPs). The "3-Rs" framework identifies resilience (population health), redundancy (distribution), and representation (genetic and niche diversity) as the basic indicators of species viability. In general, the more resilient, redundant, and representative a species is, the more likely it is to persist over time, even under changing environmental conditions. The VSP framework, originally used to determine the conservation status of Pacific salmonids, is now recognized as a tool that can be applied to evaluating the viability of additional salmonid and non-salmonid species.

2. Conservation Assessments

In addition to these conservation frameworks, recovery of the GOM DPS is predicated on the assessment results for three fundamental aspects of Atlantic salmon conservation: population viability, habitat availability, and abatement of threats to the species. Although each of these aspects pertains to the range-wide status of the species, the near- to mid-term recovery focus is on assessing and managing for viability in the freshwater environment, as we know what is needed to restore freshwater habitats. Although survival of emigrating Atlantic smolts and adults while at sea is the biggest drivers of Atlantic salmon population trends in the GOM DPS, the maximum potential abundance of the salmon is directly proportional to the quantity and quality of freshwater habitats that are available for spawning and juvenile rearing. Further, barriers that block or impede salmon passage and threats that reduce the quality and quantity of habitat decrease the potential abundance of salmon–an abundance that is needed to support a sufficiently large, geographically distributed population that is resilient to environmental perturbations such as poor marine conditions, drought, and extreme temperatures.

Population Viability

Preventing extinction will require substantial increases in the abundance, productivity, and distribution of naturally reared Atlantic salmon in GOM DPS rivers as addressed by both the 3-Rs and VSP frameworks. Increased abundance and productivity will improve the resilience of each population in the DPS, while maintaining a wide distribution of Atlantic salmon across the range of the DPS. Increased abundance and productivity will ensure that the metapopulation (A collection of spatially divided subpopulations that experience a certain degree of gene flow among them) characteristics of Atlantic salmon are retained and provide redundancy and representation of populations across the range. Atlantic salmon have strong homing characteristics that allow local breeding populations to become well-adapted to a particular environment. At the same time, limited straying (i.e., spawning in their non-natal river) does occur among salmon populations; this helps maintain population diversity through exchange of some genes between populations and allows for population expansion and recolonization of extirpated populations. Accommodating these life history characteristics and distributional needs should provide protection from demographic and environmental variation.

Assessment of both population-level and rangewide extinction risks provides the foundation for setting recovery thresholds with respect to abundance, productivity, and distribution. This assessment requires analysis of the various factors that influence viability. Overall analysis results indicate that a minimum of 2,000 adult wild salmon must return to spawn in each SHRU to achieve rangewide population viability (NMFS 2009 (Appendix A)).

The USFWS hatchery program is critical to maintaining genetic diversity and effective population size while populations are low (see Phased Approach below). It is also important, however, to recognize that hatchery management is subject to funding availability. Hatchery funding contingencies could lead to changes in the recovery strategy for the DPS in the future. For more information on population viability, see Chapter 10 of the Companion Document.

Freshwater Habitat Availability

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. These categories are fully defined in section F, below.

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 is considered to be 30,000 Habitat Units per SHRU to delist the DPS (NMFS 2009 (Appendix C)).

This estimate is tied to the 2,000 adult wild spawners in each SHRU needed to ensure the long-term viability of the GOM DPS. Suitable freshwater habitat is assessed at the hydrological unit code (HUC) level 10 and is based on observations of physical and biological features that salmon most often select (*https://water.usgs.gov/GIS/huc.html*). Although the habitat quality assessment provides reasonable predictability of where the best habitats are for the spawning and rearing of Atlantic salmon, they do not represent verifiable evidence of the productivity of a HUC 10 watershed. Not until areas that are currently impeded or inaccessible allow for uninterrupted migration will we be able to fully assess the productive potential of a particular habitat area for Atlantic salmon. Likewise, the optimal composition and spatial distribution of this habitat throughout each SHRU is uncertain as tools to identify and characterize habitat productivity at fine resolution across entire watersheds are currently limited. These limitations will be addressed through adaptive management approaches.

Threats Abatement

Recovery criteria correspond to the five factors upon which determinations to list, reclassify, and delist a species are based. Although not every identified threat needs to be completely eliminated to remove a species from the federal endangered species list, current and foreseeable threats must be abated to the point where a recovered species is unlikely to become in danger of extinction again within the foreseeable future.

Because of the high level of uncertainty regarding threats and management options in the marine environment, this recovery strategy places a primary focus on abating threats in the freshwater environment and increasing our understanding of threats to marine survival. As we learn more about opportunities to improve marine survival, the recovery strategy, and recovery criteria based on the strategy, will expand accordingly to address those threats.

B. Adaptive Strategy

Recovery strategies are predicated on maximizing the likelihood of recovery success. To accomplish this, the strategy must address many sources of uncertainty. Assumptions must be made about future conditions, including environmental conditions, threats, funding availability, partner interest, and the species' response to management actions. To maintain the maximum likelihood of recovery success over time, the recovery strategy may need to be revised should any of these assumptions prove to be incorrect. Adaptive management, that is, adjusting management as management results and other events become better understood, provides a systematic means of addressing uncertainties and is an important approach for any recovery strategy. In addition to being a guiding principle for the overall recovery strategy, recovery actions that can benefit from a formal adaptive management process are specified in Part IV of this plan.

C. Phased Approach

Given the unavoidable complexity and uncertainties associated with recovery of the GOM DPS, as well as inevitable funding constraints, this recovery strategy adopts a stepwise approach that outlines a pathway towards recovery through four phases. The recovery actions outlined in Part

IV of this plan will be linked to each phase to demonstrate their role in the overall recovery effort. Since the 2000 listing of Atlantic salmon populations, a number of recovery actions have already been addressed; consequently, the actions in phase 1 are largely complete, and the overall recovery effort has generally entered phase 2.

Phases of recovery:

> ***Phase 1:*** Includes identifying the threats to the species and characterizing the habitat needs of the species necessary for their recovery.
>
> ***Phase 2:*** Focuses on ensuring the persistence of the GOM DPS through the use of the conservation hatcheries while abating imminent threats to the continued existence of the DPS. By the end of this phase, reclassification from endangered to threatened should be possible (see Part III).
>
> Recovery actions associated with Phase 2 are geared toward creating the necessary foundation for establishment and protection of sufficiently resilient wild populations to withstand foreseeable long-term stresses, and toward providing Atlantic salmon with access to suitable habitat throughout their life cycle. Given our current level of understanding, Phase 2 focuses on freshwater habitat used by Atlantic salmon for spawning, rearing, and upstream and downstream migration; it also emphasizes research on threats within the marine environment.
>
> ***Phase 3:*** Focuses on increasing the abundance, distribution, and productivity of naturally reared Atlantic salmon. This phase involves transitioning from dependence on the conservation hatcheries to wild smolt production and ensuring that mechanisms are in place to address continuing threats to the species in both the freshwater and ocean environments. We recognize that this is a long-term endeavor that will also need to address the information gaps associated with marine survival and, with this information in hand, identify appropriate management actions. At the end of Phase 3, delisting should be possible (see Part III).
>
> ***Phase 4:*** Focuses on ensuring the Gulf of Maine Distinct Population of Atlantic salmon is comprised of a self-sustaining wild population geographically distributed across connected habitats throughout the range, with minimal dependence on human intervention to complete its natural life cycle. This will require that mechanisms are in place that prevent or abate the foreseeable threats to the long-term survival of the species and will involve post delisting monitoring to show that recovery is being sustained.

D. Geographic Framework

Recovery of the GOM DPS is contingent on a wide range of research and management actions over an extended period of time. In this recovery plan the three SHRU's (*see* NMFS, 2009 (Appendix A)) represent the geographic framework to organize recovery actions and ensure that they are implemented as effectively as possible. These SHRUs (Downeast, Penobscot, and Merrymeeting Bay) provide a framework for articulating spatial distribution objectives and ensuring that viable populations are established across the major geographic regions within the DPS, and that threats are addressed effectively across the DPS.

E. Coordination and Collaboration

Federal agencies, state agencies, tribes, industries, conservation organizations, private citizens, and other groups have been working toward restoring Atlantic salmon populations in Maine for over 100 years; many of these groups continue to provide support to salmon recovery throughout the DPS. In addition to NMFS and USFWS, Maine DMR, and the PIN, key recovery collaborators, as of early 2018, include: American Rivers; Appalachian Mountain Club; Atlantic Salmon Federation; Downeast Lakes Land Trust; Downeast Salmon Federation; Ducks Unlimited; Environmental Protection Agency; Fisheries Improvement Network; Forest Products Council; Forest Society of Maine; Keeping Maine's Forests; Maine Audubon; Maine Coast Heritage Trust; Maine Department of Environmental Protection; Maine Department of Inland Fisheries and Wildlife; Maine Department of Transportation; Maine Forest Service; Maine Rivers; Maine Tree Foundation; Natural Resources Conservation Service; Natural Resources Council of Maine; Penobscot River Restoration Trust; Project SHARE; The Nature Conservancy; Trout Unlimited; University of Maine Cooperative Extension Service; USGS; University of Maine; and the ACOE, among many others.

To promote continued, strategic coordination among the wide array of partners to salmon recovery in Maine, the following approach to recovery implementation has been devised.

1. DPS-wide Recovery Implementation Strategy

This plan lays out site-specific recovery actions, at various scales, that should lead to the achievement of rangewide recovery objectives as measured by the recovery criteria. Often times research projects are not geographically based, but the results may apply to specific geographic areas or rangewide. The geographic scale at that site-specific actions are described is the SHRU. Using this scale is appropriate to monitor recovery progress and apply adaptive management strategies. Using a finer scale than the SHRU to identify site-specific actions is not practicable because there are a number of different pathways and scenarios that could allow for salmon recovery to happen. Every dam removal or every restoration project will affect the population differently based on its position within the watershed, the level of impact that the activity is actually having on the population to begin with, and its relationship to other threats within the watershed. Subsequently, being more prescriptive than the SHRU on what projects need to happen would be too inflexible and mask viable options given the wide range of possible pathways and different combinations of restoration actions that could allow for recovery to occur. SHRU-level workplans, described in the next section, provide the basis for determining activities that should be implemented in the short term for each of the plan's recovery actions.

2. SHRU-level Workplans

The SHRU-level workplans for each SHRU provides guidance on activities that upon their implementation will help address recovery actions in the recovery plan. Although these workplans link back to this recovery plan, they are not considered part of the plan itself. The workplans identify activities that, within each SHRU and ultimately on a DPS-wide basis, will contribute to a coordinated recovery effort aimed at meeting the recovery criteria laid out in Part III. Some activities may be unique to a particular SHRU, while others may apply to all three SHRUs but at differing priorities or levels of effort.

We anticipate that the SHRU-level workplans will change over time as a function of adaptive management and identification of newly identified opportunities or threats. Regular discussions about the workplans, involving partners and the interested public, will be held to ensure that recommended activities are responsive to ongoing and emerging needs and opportunities. The SHRU-level workplans can be found on the Atlantic Salmon Recovery Plan Website (Click here).

F. Definitions Pertaining to Recovery Criteria and Actions

For ease of reference, we are providing the following definitions for concepts and terms contained in Part III, Recovery Criteria, and Part IV, Recovery Actions. Further discussion of these concepts is presented in the 2009 critical habitat rule.

1. Habitat Accessibility Categories

Habitat with No Access: Habitat above a barrier (dam or road stream crossing) that has no fish passage.

Habitat with Impeded Access: 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.[4]

[4] The Services may categorize some bridges with natural stream channels and bottomless culverts as fully accessible if the area beneath the bridge has a gradient, stream width, floodplain, and configuration similar to the existing natural channel upstream or downstream of the crossing.

2. Critical Habitat Features

Certain recovery criteria reference critical habitat features. Section 3 of the ESA defines critical habitat, in part, as specific areas within the geographical area occupied by the species supporting those physical and biological features that are essential for the conservation of the species and that may require special management considerations or protection. Federal agencies are required to consult with the Services on actions they carry out, fund, or authorize to ensure that their actions will not destroy or adversely modify critical habitat. ESA Section 7 consultation is required for any Federal action that may affect designated critical habitat. The necessary physical and biological features constituting critical habitat are described in detail in the final critical habitat designation (74 FR 29300, June 19, 2009). These include seven habitat features essential to spawning and rearing and six habitat features essential to migration, as defined below:

Spawning and rearing

1. Deep, oxygenated pools and cover (e.g., boulders, woody debris, vegetation) near freshwater spawning sites necessary to support adult migrants during the summer while they await spawning in the fall.

2. Freshwater spawning sites that contain clean, permeable gravel and cobble substrate with oxygenated water and cool water temperatures to support spawning activity, egg incubation, and larval development.

3. Freshwater spawning and rearing sites with clean, permeable gravel and cobble substrate with oxygenated water and cool water temperatures to support emergence, territorial development, and feeding activities of Atlantic salmon fry.

4. Freshwater rearing sites with space to accommodate growth and survival of Atlantic salmon parr.

5. Freshwater rearing sites with a combination of river, stream, and lake habitats that accommodate Atlantic salmon parrs' ability to occupy many niches and maximize parr production.

6. Freshwater rearing sites with cool, oxygenated water to support growth and survival of Atlantic salmon parr.

7. Freshwater rearing sites with diverse food resources to support growth and survival of Atlantic salmon parr.

Migration

1. Freshwater and estuary migratory sites free of physical and biological barriers that delay or prevent access for adult salmon seeking spawning grounds needed to support recovered populations.

2. Freshwater and estuary migration sites with pool, lake, and instream habitat that provide cool, oxygenated water, and cover items (e.g., boulders, woody debris, vegetation) to serve as temporary holding and resting areas during upstream migration of adult salmon.

3. Freshwater and estuary migration sites with abundant, diverse native fish communities to serve as a protective buffer against predation.

4. Freshwater and estuary migration sites free of physical and biological barriers that delay or prevent emigration of smolts to the marine environment.

5. Freshwater and estuary migration sites with sufficiently cool water temperatures and water flows that coincide with diurnal cues to stimulate smolt migration.

6. Freshwater migration sites with water chemistry needed to support seawater adaptation of smolts.

PART III. RECOVERY GOALS, OBJECTIVES, AND CRITERIA

The following goals, objectives, and criteria set standards for ascertaining when recovery progress has been made under the ESA. These standards refer to the definitions of endangered and threatened under section 3 of the ESA: endangered means that a species is *in danger of extinction throughout all or a significant portion of its range*, whereas a threatened species is *likely to become an endangered species within the foreseeable future throughout all or a significant portion of its range*.

Recovery goals, objectives, and criteria guide the recovery program toward accomplishments that bring the species closer to the definition of threatened and, ultimately, to the point where neither definition applies and listing is no longer warranted. The criteria in recovery plans can be changed based on new information and insights. The five-factor analysis under ESA section 4(a)(1) is the statutory process for making reclassification and delisting determinations. Any changes to this document could require a plan revision which is subject to the public review and comment period provisions under ESA section 4(f)(4).

G. Recovery Goals

The ultimate goal of this recovery program is to improve the long-term population viability of the GOM DPS of Atlantic salmon to the point where it no longer requires the protections of the ESA and can be removed from the Federal List of Endangered and Threatened Wildlife. The intermediate goal is to reclassify the DPS from endangered to threatened by improving conditions to the point where it is no longer in danger of extinction but, in the absence of continued ESA protections, would likely revert to an endangered species in the foreseeable future.

H. Recovery Objectives

1. Reclassification Objectives

- Maintain a sustainable, naturally reared population in at least two of the three SHRUs and ensure access to sufficient suitable habitat in these SHRUs for these populations.

- Ensure that management options, if any, for marine survival are better understood.

- Reduce or eliminate those threats that either, individually or in combination endanger the DPS.

2. Delisting Objectives

- Maintain self-sustaining, wild populations in each SHRU, and ensure access to sufficient suitable habitat in each SHRU for these populations.
- Ensure that necessary and available management options for marine survival are in place.
- Reduce or eliminate those threats that either, individually or in combination threaten the DPS.

I. Recovery Criteria

In accordance with section 4(f) of the ESA, this section presents criteria for identifying when the reclassification and delisting objectives for the GOM DPS have been achieved. The starting point for these criteria is the preliminary delisting criteria that were described in detail in the 2009 critical habitat rule (74 FR 29300, June 19, 2009). Both biological and threats-abatement criteria are provided to address recovery objectives. Atlantic salmon abundance and productivity criteria cannot be met without addressing low marine survival and mortality from dams.

These criteria reflect the achievement of recovery through the strategy described in the Part II, Recovery Strategy, of this plan. In particular, the biological criteria address fulfillment of the resiliency, redundancy, and representation components of DPS viability as indicated below. The threats-abatement criteria are included to ensure that viability is achieved through the recovery process and maintained after the DPS is delisted. The recovery criteria may be subject to revision if there are changes in the conditions that salmon live or if new information becomes available. Any revision to the criteria would trigger a public notice and an opportunity for public comment. Please note that, for ease of reference, terms regarding habitat access or critical habitat features in the following criteria are defined in Part II, section F, above.

1. Biological Criteria[5]

Reclassification Criteria:

Reclassification of the GOM DPS from endangered to threatened will be considered when all of the following biological criteria are met:

1a. Abundance (Resilience): 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.

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[5] The criteria for both reclassification and delisting address *only* the conditions needed to achieve a probability of long-term viability such that ESA protections are no longer warranted. The abundance criteria for DPS salmon do not take into account additional numbers of fish to support either recreational or sustenance fishing. Establishment of harvestable levels of salmon would necessarily be above and beyond these recovery criteria.

1b. ***Productivity (resilience):*** Among the SHRU's that have met or exceeded the abundance criterion, the population has a positive mean growth rate greater than 1 in the 10-year (two-generation) period preceding reclassification.

1c. ***Habitat (redundancy and representation):*** 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.

Delisting Criteria:

Delisting of the GOM DPS will be considered when all of the following criteria are met:

1d. ***Abundance (Resilience)*****:** 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.

1e. ***Productivity (Resilience):*** Each SHRU has a positive mean growth rate of greater than 1.0 in the 10-year (two-generation) period preceding delisting. *And* 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.

1f. ***Habitat (Redundancy and Representation):*** 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 adult salmon. This will require both habitat protection and restoration at significant levels.

2. Threats-abatement Criteria

The criteria in this section describe how the five listing factors (see box 2, page 6) will be addressed to determine whether a species warrants the protections of the ESA. The criteria focus first on primary threats to the DPS (including ongoing threats identified in the 2009 listing rule, as well as emerging threats). These criteria are followed by criteria for threats considered to be secondary on an individual basis but which, in combination, constitute a major threat.

Reclassification Criteria:

The following threats-abatement criteria must be met to the extent necessary to support a GOM DPS of Atlantic salmon that is no longer in danger of extinction. Completion of the recovery actions needed to meet these criteria will signal the end of phase two of the recovery process for the DPS as described in the Recovery Strategy section of this plan.

2a. ***Dams and road stream crossings (factor A):*** A combination of dam removals, passage improvements at dams, passable road crossing structures, and removal or redesign of any other instream barriers to fish passage provides salmon access to sufficient habitat needed to achieve the habitat criterion for reclassification (see Biological Criterion 1d, above).

2b. ***Regulatory mechanisms for dams (factor D):*** FERC licenses for hydroelectric dams in designated Atlantic salmon critical habitat have been amended, or otherwise include, requirements to protect upstream and downstream migrating Atlantic salmon and minimize effects to habitat.

2c. ***Climate change (factor E):*** A water quality monitoring program is established to track climate change trends and effects on: (a) freshwater, estuarine, and marine habitats, and (b) salmon health. This program includes adaptive management strategies to mitigate or protect salmon from any harmful effects associated with climate change. In addition, freshwater areas that have greater resilience to climate change are identified, quantified, and incorporated into recovery goals and actions.

2d. ***Low marine survival (factor E):*** In combination with the climate change monitoring program, a program for identifying and quantifying additional anthropogenic threats in the marine environment is designed and implemented, and adaptive management strategies for mitigating the harmful effects of these threats, when possible, are developed. These factors include, but are not necessarily limited to, intercept fisheries and aquaculture management.

2e. ***Loss of genetic diversity (factor E):*** Extant DPS family groups and genetic diversity are maintained at levels needed to support Biological Criteria 1a, 1b, and 1c, above, through adaptive hatchery practices and stock management strategies.

Delisting Criteria

The following threats-based criteria must be met to the extent necessary to support a recovered GOM DPS of Atlantic salmon. Completion of the recovery actions needed to meet these criteria will signal the end of phase 3 of the recovery process for the DPS as described in the Recovery Strategy section of this plan.

Delisting criteria addressing primary threats:

2f. ***Dams (factor A):*** Upstream and downstream passage at dams deemed essential to the conservation of Atlantic salmon are improved by dam removal and/or through operational or structural changes. Dam removals and structural changes must provide access to spawning and nursery habitats (freshwater habitat that is categorized as accessible or fully accessible habitat (See section "F" of this recovery plan) will be counted toward meeting this recovery criterion), reduce direct and indirect mortality of upstream and downstream migrating salmon, and provide for properly functioning critical habitat features.

2g. Road stream crossings (factor A): Upstream and downstream passage at culverts deemed essential to the conservation of Atlantic salmon are improved through culvert removal or through culvert installation or replacement. Culvert removals or improvements must provide access to spawning and nursery habitats (freshwater habitat that is categorized as accessible or fully accessible habitat will be counted toward meeting this recovery criterion), reduces degradation of surrounding habitat features, and provides for properly functioning critical habitat features.

2h. Regulatory mechanisms for dams (factor D): Regulatory mechanisms for hydroelectric and non-hydroelectric dams are in place and effectively enforced to maintain accessible and fully accessible upstream and downstream passage, water quality conditions that support a recovered population, and properly functioning critical habitat features.

2i. Marine survival (factor E): Marine survival is at a level that supports a recovered population, factors that influence marine survival (including intercept fisheries) are identified and quantified, management measures that maintain marine survival are implemented, and an adaptive management strategy that incorporates marine survival models into Atlantic salmon management plans and regulatory mechanisms is implemented.

2j. Climate change (factor E): Recognizing a high degree of uncertainty, climate-induced threats to Atlantic salmon in both their freshwater and marine environments are addressed to meet the following conditions:

- Sufficient data, data collection tools, and predictive models are in place to allow for accurate forecasting of climate conditions as they relate to Atlantic salmon survival in freshwater and marine environments; and
- Robust predictive models and appropriate actions are incorporated into Atlantic salmon management and regulatory mechanisms.
- Climate resilient habitats are identified and incorporated into management measures

Delisting criteria addressing secondary threats:

This category of threats includes multiple stressors that, *in combination*, rise to the level of a significant extinction risk to DPS salmon. Within this category, tradeoffs can be made in terms of how different stressors are addressed; in other words, not every criterion for secondary threats has to be met to consider delisting. As progress is achieved in addressing these threats, and as a better understanding is gained of how addressing these threats contributes to achievement of the biological criteria, the extent to which these threats must be addressed to support a recovered GOM DPS of Atlantic salmon can be better described.

2k. ***Instream flow conditions (factor A):*** Instream flow in designated critical habitat is managed according to conditions that are well suited for Atlantic salmon spawning, incubation, rearing, and migration.

2l. ***Water quality (factor A):*** Water quality, including water temperature, in designated critical habitat is managed according to conditions that are best suited to support Atlantic salmon spawning, incubation, rearing, and migration.

2m. ***Habitat complexity (factor A):*** Riparian areas are managed to promote diverse and complex habitat features suitable for Atlantic salmon habitat through appropriate forest and land management practices, including managing riparian zones that promote large wood.

2n. ***Overutilization (factor B):*** Utilization of GOM DPS Atlantic salmon for commercial, recreational, scientific, and educational purposes, and utilization related to bycatch and poaching, are managed by meeting the following conditions:

- Monitoring programs and management plans are in place and implemented; and
- NASCO participation ensures adequate management of intercept fisheries that impact United States-origin GOM DPS Atlantic salmon.

2o. ***Disease (factor C):*** Bacterial, viral, and fungal disease risks are managed by all hatcheries and other facilities by implementing rigorous disease prevention and management measures and protocols that incorporate the most up-to-date science and information by all hatcheries and other facilities.

2p. ***Predation (factor C):*** Plans for the management of species that prey on Atlantic salmon support a recovered GOM DPS of Atlantic salmon and are implemented.

2q. ***Regulatory mechanisms related to water withdrawals (factor D):*** Regulatory mechanisms that ensure maintenance of natural variations in flows and water levels are enforced.

2r. ***Regulatory mechanisms related to water quality (factor D):*** Regulatory mechanisms that protect water quality necessary to support Atlantic salmon spawning, rearing, and migration needs are enforced.

2s. ***Regulatory mechanisms related to illegal utilization (factor D):*** Regulatory mechanisms that control illegal utilization of GOM DPS Atlantic salmon are enforced.

2t. ***Regulatory mechanisms related to predation and competition (factor D):*** Regulatory mechanisms that prohibit the illegal stocking and introduction of any species that prey on, or compete with, Atlantic salmon are enforced.

2u. ***Artificial propagation (factor E):*** Atlantic salmon hatchery, broodstock, and stocking management plans are implemented to reduce the risks of domestication and loss of genetic diversity of the GOM DPS of Atlantic salmon.

2v. ***Aquaculture (factor E):*** Programs and management plans are implemented to ensure that aquaculture practices adequately reduce interactions of aquaculture fish with wild populations of Atlantic salmon.

2w. ***Depleted diadromous fish communities (factor E):*** Co-evolved diadromous species are restored to the extent necessary to provide the resources and ecosystem functions needed for a recovered GOM DPS of Atlantic salmon.

2x. ***Competition by nonnative species (factor E):*** Develop and implement plans for the stocking, introduction, and management of nonindigenous species that compete with Atlantic salmon to ensure they support a recovered GOM DPS of Atlantic salmon

D. Evaluating Recovery Progress

The USFWS and our partners monitor progress towards recovery through the Environmental Conservation Online System (ECOS), a gateway Website that provides access to data systems in the USFWS and other government data sources (see: *http://ecos.fws.gov/ecp/*). This central point of access assists USFWS and NMFS personnel in managing data and information, and it provides public access to information from numerous USFWS databases. NMFS and partners monitor recovery progress through the Recovery Action Mapping Tool (RAMT), a Website database that tracks recovery action status and related projects (https://www.webapps.nwfsc.noaa.gov/wcr/). The Services review, at least once every five years, all listed species to determine if the species should be reclassified or removed from the ESA list. This review involves evaluation of the Factors (A-E) and, where a recovery plan exist, progress in achieving the recovery criteria.

PART IV. RECOVERY ACTIONS

As explained in Part II, this recovery plan focuses on the statutory requirements of the ESA, including site-specific recovery actions. The geographic scale at which most actions are described is the SHRU. Some actions encompass all SHRU's, whereas a number of actions are specific to the marine environment and cannot be described at the SHRU scale. The SHRUs were developed to describe the appropriate spatial scale necessary to support a recovered population and thus we believe this is the appropriate scale at which to monitor recovery progress and apply adaptive management strategies. Geographically based activities that can be implemented in the short term will be determined through SHRU-level workplans that will be updated as new implementation ideas, new opportunities, and additional information become available. Although these workplans will link back to the following recovery actions, they are not considered part of the recovery plan itself.

A. Recovery Actions

Connectivity Actions (C): The Goal of connectivity actions are to enhance connectivity between the ocean and freshwater habitats important for salmon recovery.

C1.0 Identify and Prioritize Barriers to Atlantic Salmon.
This action should ensure that the most productive areas are well connected to each other and to the GOM, and that restoration projects are prioritized based on their biological merits. The prioritization must provide a clear and transparent way of assessing the relative biological value of individual restoration opportunities. Ways that this action will be completed are:

> **C1.1** Identify and prioritize fish passage barriers in the Merrymeeting Bay SHRU necessary for the survival and recovery of Atlantic salmon.
>
> **C1.2** Identify and prioritize fish passage barriers in the Downeast Coastal SHRU necessary for the survival and recovery of Atlantic salmon.
>
> **C1.3** Identify and prioritize fish passage barriers in the Penobscot SHRU necessary for the survival and recovery of Atlantic salmon.

C2.0 Remove Dams to Ensure Access to Habitats Necessary for Atlantic Salmon Recovery.
One of the most significant threats to Atlantic salmon are dams. Dams block or significantly impede a salmon's ability to access freshwater habitats essential for spawning and juvenile rearing. Dams, especially dams with turbines, can delay, injure or kill a significant number of downstream migrating smolts as they are heading to the ocean. Dams can kill (directly or indirectly) post-spawned adults (kelts) as they attempt to return to the ocean, preventing their ability to spawn again. Dam removal offers the highest likelihood of addressing these threats. Dam removals will need to be accomplished through partnerships and collaboration among all stakeholders. Ways that this action will be completed are:

C2.1 Remove non-regulated dams in the Merrymeeting Bay SHRU as appropriate, and according to the barrier prioritizations.

C2.2 Remove non-regulated dams in the Penobscot Bay SHRU as appropriate, and according to the barrier prioritizations.

C2.3 Remove non-regulated dams in the Downeast Coastal SHRU as appropriate, and according to the barrier prioritizations.

C2.4 When feasible, remove hydro-electric dams that afford significant conservation benefit to Atlantic salmon and the ecosystems that they depend on.

C3.0 Improve Fish Passage at Dams to Ensure Access to Habitats Necessary for Atlantic Salmon Recovery. In some instances, removal of fish passage barriers (particularly dams) is not possible. However, traditional engineered fishways and nature-like fishways (rock ramps, nature-like bypasses, etc.) may be installed to partially ameliorate the effects of a given barrier. If properly designed, these fishways can provide sufficient protection to Atlantic salmon and their ecosystems. Ways that this action will be completed are:

C3.1 Install fishways at non-FERC licensed dams in the Merrymeeting Bay SHRU as appropriate, and according to the prioritizations.

C3.2 Install fishways at non-FERC licensed dams in the Penobscot Bay SHRU as appropriate, and according to the prioritizations.

C3.3 Install fishways at non-FERC licensed dams in the Downeast Coastal SHRU as appropriate, and according to the prioritizations.

C3.4 Install fishways at FERC licensed dams in the Merrymeeting Bay SHRU as appropriate, and according to the prioritizations.

C3.5 Install fishways at FERC licensed dams in the Penobscot Bay SHRU as appropriate, and according to the prioritizations.

C3.6 Install fishways at FERC licensed dams in the Downeast Coastal SHRU as appropriate, and according to the prioritizations.

C4.0 Improve Fish Passage at Road Crossings. Culverts and other road crossings can block the migration of salmon and other migratory fish, particularly in headwater areas where culverts are ubiquitous across the landscape. Headwater habitats can serve as spawning and nursery habitats and are often important areas for temporary or long-term feeding and thermal refuge by Atlantic salmon parr. The effects of known passage barriers can be ameliorated by culvert removal (often through road de-commissioning), culvert replacement (i.e., resizing to 1.2 bank-full width or greater), or bridge construction. Ways that this action will be completed include:

C4.1 Complete tier 1 road stream crossings according to the Maine DOT's Programmatic consultation for transportation projects (USFWS 2017) in the Merrymeeting Bay SHRU.

C4.2 Complete tier 1 road stream crossings according to the Maine DOT's Programmatic consultation for transportation projects (USFWS 2017) in the Penobscot Bay SHRU.

C4.3 Complete tier 1 road stream crossings according to the Maine DOT's Programmatic consultation for transportation projects (USFWS 2017) in the Downeast Coastal SHRU.

C4.4 Complete tier 2 road stream crossings according to the Programmatic consultation for transportation projects (USFWS 2017) in the Merrymeeting Bay SRHU.

C4.5 Complete tier 2 road stream crossings according to the Programmatic consultation for transportation projects (USFWS 2017) in the Penobscot Bay SHRU.

C4.6 Complete tier 2 road stream crossings according to the Programmatic consultation for transportation projects (USFWS 2017) in the Downeast Coastal SHRU.

C4.7 Install culverts and bridges that allow for unimpeded passage of all life stages of Atlantic salmon along municipally owned roads.

C4.8 Install culverts and bridges that allow for unimpeded passage of all life stages of Atlantic salmon along privately owned roads.

C5.0 Implement Connectivity Projects that Ensure Access to the Co-Evolved Suite of Diadromous Fish that are Part of the Ecosystem that Atlantic Salmon Depend On. Atlantic salmon evolved in the presence of eleven other native sea-run species of fish including alewives, blueback herring, and sea lamprey. The life histories of these species share many similarities likely to take advantage of the ecological services that the other species provide. These services likely include buffering from predation, serving as sources of food and nutrients, and habitat conditioning such as what lamprey do when they excavate redds for spawning. Therefore, removing barriers that block the passage of the co-evolved suite of sea-run species is necessary to restore the ecosystems upon which salmon depend on. Ways that this action will be completed include:

C5.1 Identify and prioritize fish passage barriers across all SHRU's that maximize opportunities for the co-evolved suite of diadromous fish that are part of the ecosystem that salmon depend on.

C5.2 Remove dams across all SHRU's according to the prioritization that maximize opportunities for the co-evolved suite of diadromous fish that are part of the ecosystem that salmon depend on.

C5.3 Install fishways at dams across all SHRU's according to the prioritization that maximize opportunities for the co-evolved suite of diadromous fish that are part of the ecosystem that salmon depend on.

C6.0 Employ Science, Assessment and Monitoring of Barriers to Fish Passage. Conducting feasibility analysis, engineering studies, pre-and post-passage effectiveness and survival studies, and post restoration monitoring is essential in implementing and completing successful connectivity projects. Many of these studies are necessary components to inform the prioritization actions in C1.0. The level of assessments and monitoring is site specific and can vary considerably from project to project. Ways that this action will be completed include:

> **C6.1** Use the best available methods, including fish tagging and marking, to perform fish passage barrier assessments throughout the GOM DPS as necessary.
>
> **C6.2** Determine the feasibility of connectivity projects that afford direct benefits to Atlantic salmon.
>
> **C6.3** Conduct engineering studies for potential fish passage improvement projects that provide direct benefits to Atlantic salmon.
>
> **C6.4** Determine the feasibility of connectivity projects that primarily benefit the co-evolved suite of sea-run fish that Atlantic salmon depend on.
>
> **C6.5** Conduct engineering studies for potential fish passage improvement projects that primarily benefits the suite of sea-run fish that Atlantic salmon depend on.
>
> **C6.6** As needed conduct pre- and post- barrier removal and fish passage improvement monitoring using up-to-date methods.
>
> **C6.7** Establish Atlantic salmon passage efficiency targets that support the survival and recovery of the GOM DPS.
>
> **C6.8** Establish downstream and upstream Atlantic salmon passage design criteria for road stream crossings.

C7.0 Permit, Monitor and Enforce Regulations Related to Barriers to Fish Passage. A variety of local, state, and federal regulations must be complied with during restoration project implementation. This requires application to a variety of regulatory agencies for permits to conduct the project as well as post construction compliance monitoring. Ways that this action will be completed include:

> **C7.1** Complete ESA section 7 programmatic consultations with action agencies on road stream crossing improvement projects that effect Atlantic salmon.
>
> **C7.2** Prioritize regulatory mechanisms that maintain and promote connectivity within designated critical habitat.
>
> **C7.3** Conduct compliance monitoring of fish passage efficiency target and carry out enforcement actions when necessary.

C7.4 Carry out consultation pursuant to section 7 of the ESA on authorizations, funding or permits for potential fish passage improvement projects.

Freshwater Actions (F): The goal of freshwater actions is to increase adult spawners by increasing the numbers of smolts in freshwater.

F1.0 Evaluate Distribution and Abundance of Naturally-Reared Atlantic Salmon and Hatchery Products. Methodical and scientifically defensible population monitoring implemented to determine trends in abundance of all life-stages of Atlantic salmon and to evaluate the effects of recovery actions is necessary. Ways that this action will be completed include:

F1.1 Enumerate smolt populations to assess freshwater productivity and hatchery product survival in all SHRUs.

F1.2 Monitor and assess instream young-of-year and parr to evaluate freshwater productivity, early lifestage survival from egg to smolt, and hatchery product fitness and survival in all SHRUs.

F1.3 Conduct redd counts to estimate adult Atlantic salmon escapement and assess natural re-colonization within the range of the GOM DPS.

F1.4 Enumerate returns of adult Atlantic salmon captured at fish trapping facilities within the range of the GOM DPS.

F2.0 Implement Stocking Programs For Vacant Habitat Targeted at Preventing Extinction of Locally Adapted Stocks and Increasing Their Abundance and Distribution. This action will implement stock enhancement strategies focused on maximizing fitness and maintaining genetic diversity of the GOM DPS of Atlantic salmon. Ways that this action will be completed include:

F2.1 Prevent extinction of locally adapted stocks in all SHRUs by using diverse stocking strategies that protect and promote increased fitness and genetic diversity.

F2.2 Increase resiliency of all locally adapted stocks across the DPS by identifying and utilizing vacant habitats, including climate resilient habitats where they exist to create redundant populations.

F2.3 Develop and implement a stock reintroduction plans for vacant suitable habitats in all SHRUs.

F3.0 Identify, Maintain, Protect and Restore Priority Freshwater Habitats for Atlantic salmon. These efforts aim to conserve and restore properly functioning freshwater ecosystems that support biological requirements of all lifestages of Atlantic salmon. Ways that this action will be completed include:

F3.1 Establish and implement a water temperature monitoring protocol in all SHRUs to support efforts to identify climate vulnerable and climate resilient habitats.

F3.2 Inventory and prioritize freshwater habitats that provide the best opportunity for salmon recovery, including climate resilient habitats, in all SHRUs.

F3.3 Protect and maintain freshwater and riparian habitats according to prioritization in all SHRUs.

F3.4. Develop watershed restoration action plans for all SHRUs that identifies appropriate site specific actions necessary to restore ecological processes that promote and sustain properly functioning stream channels.

F3.5 Restore freshwater and riparian habitats according to the restoration action plans described in action F3.4.

F3.6 Conduct a detailed climate change risk analysis for all locally adapted salmon populations in the DPS to help prioritize actions and develop new ones that are necessary to support climate resilient populations.

F3.7 Review and if needed, revisit critical habitat designation to ensure that there is sufficient climate resilient habitats into the foreseeable future necessary to allow for Atlantic salmon survival and recovery.

F4.0 Implement Methods to Minimize Predation Pressures and Angling Pressure on Atlantic Salmon. Maximize survival of Atlantic salmon by reducing predatory and/or competitive interactions of other avian, mammalian, and/or piscine species and finding ways to minimize capture of Atlantic salmon by anglers. Ways that this action will be completed include:

F4.1 Identify, and when possible, remove derelict manmade structures that increase foraging opportunities for avian and mammalian predators on Atlantic salmon in all SHRUs.

F4.2 Identify and implement measures to minimize localized avian predation on hatchery-origin Atlantic salmon smolts in all SHRUs.

F4.3 Evaluate effects of mammalian predation on adult Atlantic salmon in all SHRUs, and if needed, implement measures to minimize predation.

F4.4 Identify and implement measures to avoid or minimize the spread of non-native species that prey on, or compete with Atlantic salmon in all SHRUs.

F4.5 Identify and implement measures to minimize competition with or predation on Atlantic salmon by non-native species in all SHRUs.

F4.6 Identify and reduce incidental catch of Atlantic salmon by regulatory area closure and/or angler education.

F5.0 Minimize Escapes and the Effects of Escaped Aquaculture Atlantic salmon on Local Populations. Protect locally adapted Atlantic salmon stocks from negative breeding and/or competitive interaction with commercially-reared salmon. Ways that this action will be completed include:

F5.1 Where capture facilities exist, monitor for and collect genetic samples of adult returns suspect of being from aquaculture origin.

F5.2 Develop and implement a contingency plan for capturing and culling escaped aquaculture origin Atlantic salmon within rivers without capture facilities.

F5.3 Ensure Federal and State permit include requirements for containment management plans to minimize escapes and the risks from escapes, and for such plans to be monitored for effectiveness.

F5.4 Ensure, when necessary, that Federal and State permits include requirements for the use of North American strain Atlantic salmon at aquaculture sites where escapes have the potential to interact with wild fish.

F5.6 Ensure, when necessary, Federal and State permit include requirements for reporting escapes of farmed Atlantic salmon.

F5.7 Continue international efforts to coordinate escape reporting and permit requirements to minimize interactions of farmed salmon with wild salmon.

F6.0 Avoid and Minimize the Effects of Pollution, Water Use and Other Activities on Atlantic salmon and Their Habitats. Reduce the impact of agriculture, aquaculture, residential or commercial use on water levels and/or water quality. Ways that this action will be completed include:

F6.1 Review and update the State of Maine water quality standards to ensure they are protective of all lifestages of Atlantic salmon.

F6.2 Monitor waste-water and storm water discharge and associated pollutants to ensure that effects to Atlantic salmon and their habitat are minimized.

F6.3 Install streamflow gauges or use other appropriate methods to monitor the effects of water withdrawal and implement measures to avoid and minimize effects of water withdrawals to all life stages of Atlantic salmon.

<u>Marine and Estuary Actions (M):</u> The goal of marine and estuary actions is to increase Atlantic salmon survival through increased ecosystem understanding and identification of spatial and temporal constraints to salmon marine productivity to inform and support management actions that improve survival.

M1.0 Continue Ongoing International Negotiations and Partnerships to Ensure U.S. Interests in Atlantic Salmon Conservation are Understood and Considered: Given the majority of U.S. salmon time at sea is in Canadian, Greenland, or international waters, partnerships and research networks are key to research and cost-savings. This includes fulfilling the U.S. role in international science-based management. Ways that this action will be completed include:

> **M1.1** Maintain an active U.S. management role at the North Atlantic Salmon Conservation Organization (NASCO) to improve at-sea distant water survival of Atlantic salmon through reduction of fishing mortality and evaluation of drivers of natural mortality at sea.
>
> **M1.2** Pursue opportunities outside NASCO to minimize the impact of intercept fisheries in Canada, St. Pierre et Miquelon, and Greenland on U.S. Atlantic salmon.
>
> **M1.3** Continue to participate in collaborative research initiatives through the International Atlantic Salmon Research Board, Canada Atlantic Salmon Research Joint Venture, Ocean Tracking Network, and U.S. Animal Tracking Network to strengthen knowledge and expertise while leveraging resources to study salmon seascapes and ecosystems (research).

M2.0 Continue Ongoing Research and Monitoring to Further Understand the Ecological Conditions that Allow Atlantic Salmon to Succeed in the Estuary and Marine Environment and the Factors that Impede Their Survival: Continued research and monitoring of Atlantic salmon in the estuary and marine environment is essential in understanding the conditions that salmon need to survive. This includes understanding salmon's interactions with other species, and changing foodweb dynamics that could have cascading effects that affect many commercially, and ecologically important species beyond salmon. Ways that this action will be completed include:

> **M2.1** Study marine prey base shifts to understand prey production dynamics, energy budgets, and distribution to inform management of forage to minimize impacts of climate change.
>
> **M2.2** Expand upon pilot studies (2012-2018) of the ecological role of co-evolved diadromous species.
>
> **M2.3** Seek opportunities to enhance resiliency of Atlantic salmon to changing conditions in the estuary and marine environment. Managing for resilience includes: (a) examining interactions of salmon with predators and parasites; (b) conducting smolt, post-smolt, and adult tracking studies to further investigate migration ecology; and (c) continue evaluation of existing marine related data for correlations at U.S., North American, and North Atlantic scales to better characterize the impact of oceanographic changes.

M3.0 Reduce Effects of Human Activities on Migratory Smolts/Post-Smolts in Estuary, Coastal, and Northeast Shelf Domestic Waters: The purpose of this action is to fulfill responsibilities under the ESA and the Atlantic salmon Fisheries Management Plan issued under the Magnuson-Stevens Fisheries Conservation and Management Act. The way that this action will be completed is:

> **M3.1** In response to project proposals, evaluate the effects of human activities on Atlantic salmon and their habitats in the estuary and marine environment using Section 7 and Section 10 of the ESA and propose measures, as appropriate, to minimize such effects.

Outreach and Education Actions (O): The goal of the outreach and education actions are to collaborate with partners and engage interested parties in recovery efforts for the GOM DPS.

O1.0 Inform Stakeholders and the Public of Sea-Run Fish Resources in Maine and the Importance of Protecting and Restoring the Ecosystems Upon Which They Depend. Help the target audience understand the role they play in salmon recovery and make more informed decisions about how their actions may affect the ecosystems that salmon depend on. Ways that this action will be completed include:

> **O1.1** Collaborate on preparation of outreach materials.
>
> **O1.2** Develop and maintain a website where information about all sea run fish, including their biology, ecology, and conservation, can be accessed.
>
> **O1.3** Participate in key outreach events with representatives from the full range of sea run fish restoration partners.
>
> **O1.4** Continue existing outreach programs in coordination with partners.

O2.0 Fulfill the Conservation Goals of the ESA by Engaging with Stakeholders and the Public to Guide the Implementation of Actions Necessary for the Recovery of Atlantic salmon. The purpose of this action is to promote conservation efforts that benefit Atlantic salmon and the ecosystems they depend on. Ways that this action will be completed include:

> **O2.1** Conduct Atlantic salmon framework meetings as a means for the agencies, stakeholders and the public to engage in dialogue on Atlantic salmon recovery efforts.
>
> **O2.2** Continue with the Atlantic salmon ecosystem forum as a means to learn of new science and management efforts that pertain to the restoration of Atlantic salmon and the ecosystems that they depend on.
>
> **O2.3** Work with federal agencies to find opportunities where they can use their authorities to further the conservation of Atlantic salmon as directed under Section 7(a)(1) of the ESA.
>
> **O2.4** Involve interested parties in the development and updating of SHRU-level workplans.

O3.0 Provide Training and Opportunities for Stakeholders to Increase Capacity in Implementing Recovery Efforts. The purpose of this action is to educate and ensure that the Endangered Species Act and its regulatory measures are clearly understood, articulated, and carried out by entities that directly affect recovery of Atlantic salmon and their ecosystems. Ways that this action will be completed include:

> **O3.1** Provide training on approaches to habitat restoration including road crossing and Section 6 funding resources.
>
> **O3.2** Conduct workshops and trainings on ESA requirements.
>
> **O3.3** Increase the number of received proposals to federal funding opportunities that support salmon recovery efforts by increased communication and outreach to stakeholders.

Federal/Tribal Coordination (T): The goal of Federal/Tribal Coordination is to ensure that federal agencies and associated programs continue to recognize and uphold Tribal Trust Responsibilities.

T1.0 Continue Federal/Tribal Engagement and Coordination: The federal trust responsibility, which originates from the unique, historical relationship between the United States and Indian tribes, consists of the highest moral and legal obligations that the federal government must meet to ensure the protection of tribal and individual Indian lands, assets and resources as well as treaty and similarly recognized rights. Through government-to-government consultation, defined as Consultation, the Federal government recognizes and distinguishes the views and policies of Federally-recognized American Indian and Alaska Native tribal governments from those of the general public and considers those views in the context of the responsibilities of Federally-recognized tribes to their people and tribal members (NOAA 13175 Policy). Agencies will carry out their obligations by committing to and completing these actions.

> **T1.1** Strengthen the government-to-government relationship with tribal nations and fulfill federal trust obligations.
>
> **T1.2** Ensure continued tribal representation in the co-management of Atlantic salmon.

Conservation Hatchery Actions (H): The goal of hatchery actions is to implement hatchery practices that maintain fitness and genetic diversity of the GOM DPS of Atlantic salmon.

H1.0 Implement Methods Necessary to Maintain and Promote Genetic Diversity of Salmon Populations in the Hatcheries: The purpose of this action is to implement hatchery practices that are necessary to protect and preserve the remaining genetic diversity that constitutes the GOM DPS of Atlantic salmon; ensure the continued existence of the species so that recovery in the wild can occur; and increase distribution and abundance as recovery efforts improve access and productivity of freshwater habitats. Ways in which this action will be completed include:

H1.1 Conduct annual fish health, disease, and biosecurity activities related to conservation hatcheries annual activities.

H1.2 Capture, collect and maintain captive, domestic, and sea run broodstock as necessary to preserve and maximize the genetic diversity of the GOM DPS and enhance, to the extent possible, the effective population size of the GOM DPS.

H1.3 Produce Atlantic salmon to be stocked as eggs and fry to increase freshwater selection and representation of locally adapted stocks, and minimize the loss of family groups during parr broodstock collections.

H1.4 Produce Atlantic salmon to be stocked as parr and smolts to increase marine selection and representation of locally adapted stocks, and minimize the loss of family groups during sea run adult broodstock collections.

H1.5 Investigate and implement alternative hatchery practices that increase survival of hatchery product in the wild and promote resilience to climate variability.

H1.6 Identify and implement hatchery practices that minimize the effects of domestication on remaining wild stocks of Atlantic salmon (examples might include selective breeding and marking programs).

H1.7 As necessary and appropriate for salmon recovery, develop broodstock programs in watersheds that currently do not have locally adapted breeding populations within the GOM DPS (e.g. Kennebec and Androscoggin rivers).

H2.0 Provide Hatchery Product Necessary to Support Science, Research and Assessments that are Needed to Evaluate Recovery Efforts and Assess Threats to the Continued Survival of the Species. Science and assessment is needed to further understand the threats that impede Atlantic salmon recovery as well as to evaluate the effectiveness of recovery efforts. In many circumstances, the use of Atlantic salmon is necessary to effectively carry out these actions. Ways in which this action will be implemented include:

H2.1 Identify by life stage, the numbers of GOM DPS origin Atlantic salmon that can be allocated to support survival studies at FERC dams, and other research and assessment efforts without compromising the hatcheries efforts to prevent extinction of the species and support recovery efforts.

H2.2 As appropriate and within the scope of H2.1, provide eggs to support research, threat assessments and recovery efforts for Atlantic salmon. This could include programs at private hatcheries, industry partners or academic institutions.

H2.3 As appropriate and within the scope of H2.1, produce Atlantic salmon to support upstream and downstream fish passage studies at hydroelectric and other fish passage structures/barriers within the GOM DPS.

<u>Genetics Actions (G):</u> The Goal of the Genetics actions are to maintain the genetic diversity and promote fitness of Atlantic salmon populations over time.

G1.0 Annually Characterize all Atlantic salmon Collected for use as Broodstock for Origin Determination and Genetic Variation. Genetic monitoring and analyses is a necessary component of managing Atlantic salmon in the conservation hatcheries. Genetic analyses allow for tracking of survival of Atlantic salmon eggs and fry stocked into rivers of origin, preventing the mating of siblings during spawning of hatchery salmon and maximizing overall diversity of hatchery brood stock. The ways that this action will be completed include:

> **G1.1** As needed, genetically screen Atlantic salmon that are suspected to originate from aquaculture escapes.
>
> **G1.2** Prioritize and implement ongoing genetic data analysis needs with respect to management goals and with the potential of considering new techniques and approaches.
>
> **G1.3** Manage data resulting from production, stocking, and genetic evaluation to facilitate program assessment and monitoring.
>
> **G1.5** Use genetic analyses to inform and improve best hatchery management practices.

G2.0 Use Genetic Data to Evaluate and Inform Recovery. Genetic information can be used to evaluate the health of wild populations and guide management to optimize diversity, fitness and resiliency of the GOM DPS. The ways this action will be completed include:

> **G2.1** Genetically analyze and evaluate management practices relating to DPS recovery.
>
> **G2.2** Use genetic analyses to guide efforts to increase distribution and abundance of locally adapted stocks among vacant habitats in the DPS.

<u>Funding Programs (FP):</u> The goal of these actions is to identify funding programs that support State, local and NGO conservation efforts that benefit Atlantic salmon recovery.

FP1.0: Provide Funds through Federal Grant Programs that Support Recovery Efforts for Atlantic Salmon: Various funding programs, some of which have been appropriated through Congress, support conservation and restoration efforts that benefit Atlantic salmon, and are not covered under the agencies' baseline budget. Ways that this action can be completed include:

> **FP1.1** Funding through NMFS and U.S. Fish and Wildlife ESA Section 6 programs that supports State and Tribal sponsored programs that benefit threatened and endangered species.
>
> **FP1.2** Funding through NMFS's Habitat Restoration Centers' Coastal and Marine Habitat Restoration Grants for projects that promote productive and sustainable fisheries, improve

the recovery and conservation of protected resources, and promote healthy ecosystems and resilient communities through the restoration of coastal habitats.

FP1.3 Funding through NMFS's Habitat Blue Print in support of restoration efforts on the Penobscot River.

FP1.4 Funding to support actions identified in SHRU-specific restoration work plans.

FP1.5 Provide funding, as available, for efforts that promote salmon conservation by minimizing interactions between Atlantic salmon and non-native fish.

B. Action Implementation

The following DPS-wide implementation table provides: the listing factor(s) that the action addresses (see Box 2 in section D, Threats to Species Viability), the action priority (see Box 3), the recovery phase(s) (see Part II), cost basis, estimated cost/year, estimated 5-year costs, cost rationale and responsible parties.

Actions where the costs are described as "baseline" are actions that can be completed under the existing baseline budget for NMFS, Maine DMR and the USFWS. The majority of these costs cover hatchery operations, fulfilling our obligations in implementing the ESA including Section 7 and Section 10, and active monitoring and assessment of population status and trends. Implementation of recovery actions covered under the baseline budget are based on Fiscal Year 2017 expenditures and inflation-based increases to cover increases in labor and operational costs including building leases and utilities. The FY 2017 budget dedicated to Atlantic salmon restoration among NMFS, Maine DMR Cooperative Agreement for Atlantic salmon programs, and the USFWS includes:

Greater Atlantic Regional Fisheries Office and NMFS Headquarters Offices……..$2,800,000.00
Northeast Fisheries Science Center: .. ………………………………………….. $2,257,000.00
Maine DMR Cooperative Agreement:...……………………………………………$877,000.00
U.S. Fish and Wildlife Service Hatchery Program:………………..………………$2,000,000.00
U.S. Fish and Wildlife Service Ecological Services:………………...………………..$700,000.00
Total Atlantic salmon program budget (FY-2017):…………………..…..……...$8,634,000.00

Actions where the costs are described as "Calculated" or "Professional Judgement" represent recovery actions that are not currently funded under the baseline budget, and subsequently will require additional resources to implement. Actions where the costs are described as "N/A" represent actions where the estimated cost for implementation is currently unknown as more information is needed to make a reasonable estimate of cost.

Action priority numbers and recovery phases are closely aligned. Recovery phases are, however, based additionally on operational considerations such as feasibility and the need to complete one action in order to begin implementing another. For instance, despite the need to maintain adequate marine survival rates to prevent extinction, research on marine survival needs to be well underway or completed before effective management actions can commence; in this case, some Priority 1 actions may not be included in Recovery phase 1.

RECOVERY ACTION PRIORITY NUMBERS

Priority 1: An action that must be taken to prevent extinction or to prevent the species from declining irreversibly.

Priority 2: An action that must be taken to prevent a significant decline in species population/habitat quality, or some other negative impact short of extinction,

Priority 3: All other actions necessary to provide for the full recovery of the species.

Box 3.

Note that the timeframes and costs take the entire recovery period into account and thus provide the information needed for Part IV of this plan. It should also be noted that each recovery action either addresses one or more of the five listing factors *or* is directly related to arresting and reversing declining population trends in order to meet the biological recovery criteria in Part III of the plan.

For those recovery actions that are geographically based, the actions in this table will tier down to SHRU-level workplans that describe activities with a 5-year horizon. Regularly scheduled SHRU-level meetings will be held to identify potential projects and report on past accomplishments.

Table 1. GOM DPS of Atlantic salmon DPS-wide recovery implementation table

Action #	Action	Listing Factor	Priority	Phase	Cost Basis (Baseline, Calculated, Expert Opinion, N/A)	Estimated cost/year	Estimated cost between FY 19 and FY 23	Cost Rationale	Partners
	CONNECTIVITY ACTIONS								
C1.0	**Identify and Prioritize Barriers to Atlantic salmon**								
C1.1	Identify and prioritize fish passage barriers in the Merrymeeting Bay SHRU necessary for the survival and recovery of Atlantic salmon	A	1	2	Baseline + expert opinion	$20,000.00	$100,000.00		NMFS, USFWS, Maine DMR, NGO's
C1.2	Identify and prioritize fish passage barriers in the Downeast Coastal SHRU necessary for the survival and recovery of Atlantic salmon	A	1	2	Baseline + expert opinion	$20,000.00	$100,000.00		NMFS, USFWS, Maine DMR, NGO's
C1.3	Identify and prioritize fish passage barriers in the Penobscot SHRU necessary for the survival and recovery of Atlantic salmon	A	1	2	Baseline	_	_	Prioritization is near completion for the Penobscot SHRU	NMFS, USFWS, Maine DMR, NGO's
C2.0	**Remove dams to ensure access to habitats necessary for Atlantic salmon Recovery**								
C2.1	Remove non-regulated dams in the Merrymeeting Bay SHRU as appropriate, and according to the barrier prioritizations	A	1	2	Calculated	$100,000.00	$500,000.00	Assumes an estimated $250,000/dam removal and an average of 2 removals every 5 years	Dam owners, NGO's, USFWS, NMFS

C2.2	Remove non-regulated dams in the Penobscot Bay SHRU as appropriate, and according to the barrier prioritizations	A	1	2	Calculated	$100,000.00	$500,000.00	Assumes an estimated $250,000/dam removal and an average of 2 removals every 5 years	Dam owners, NGO's, USFWS, NMFS, Tribes
C2.3	Remove non-regulated dams in the Downeast Coastal SHRU as appropriate, and according to the barrier prioritizations	A	1	2	Calculated	$50,000.00	$250,000.00	Assumes an estimated $250,000/dam removal and an average of 1 removal every 5 years	Dam owners, NGO's, USFWS, NMFS
C2.4	When feasible, remove hydro-electric dams that afford significant conservation benefit to Atlantic salmon and the ecosystems that they depend on.	A	1	2	N/A	_	_	Any removal would likely be done outside of the regulatory authority of the ESA through a negotiation process with the hydro industry and conservation partners. Subsequently the number of removals and the associated cost would likely vary considerably depending on the terms of an agreement.	Dam owners, NGO's, USFWS, NMFS
C3.0	**Improve Fish Passage at Dams to ensure access to habitats necessary for Atlantic salmon recovery**								
C3.1	Install fishways at non-FERC licensed dams in the Merrymeeting Bay SHRU as appropriate, and according to the prioritizations	A	2	2	Calculated	$100,000.00	$500,000.00	Assumes an estimated $250,000/fishway and an Average of 2 fishways every 5 years	Dam owners, NGO's, USFWS, NMFS
C3.2	Install fishways at non-FERC licensed dams in the Penobscot Bay SHRU as appropriate, and according to the prioritizations	A	2	2	Calculated	$100,000.00	$500,000.00	Assumes an estimated $250,000/fishway and an Average of 2 fishways every 5 years	Dam owners, NGO's, USFWS, NMFS, Tribes
C3.3	Install fishways at non-FERC licensed dams in the Downeast Coastal SHRU as appropriate, and according to the prioritizations	A	2	2	Calculated	$50,000.00	$250,000.00	Assumes an estimated $250,000/fishway and an Average of 1 fishways every 5 years	Dam owners, NGO's, USFWS, NMFS

C3.4	Install fishways at FERC licensed dams in the Merrymeeting Bay SHRU as appropriate, and according to the prioritizations	A	2	2	Calculated	$13,000,000.00	$65,000,000.00	Assumes 5 fish passage facilities at an estimated $13 million each at FERC licensed dams constructed before 2023.	Dam owners, USFWS, NMFS
C3.5	Install fishways at FERC licensed dams in the Penobscot Bay SHRU as appropriate, and according to the prioritizations	A	2	2	Calculated	N/A	N/A	Assumes no new fish passage facilities at FERC licensed dams constructed before 2023.	Dam owners, USFWS, NMFS
C3.6	Install fishways at FERC licensed dams in the Downeast Coastal SHRU as appropriate, and according to the prioritizations	A	2	2	Calculated	N/A	N/A	Assumes no new fish passage facilities at FERC licensed dams constructed before 2023.	Dam owners, USFWS, NMFS
C4.0	**Improve Fish Passage at Road Crossings**								
C4.1	Complete tier 1 road stream crossings according to the Maine DOT's Programmatic consultation for transportation projects (USFWS 2017) in the Merrymeeting Bay SRHU	A	2	2	Calculated	$80,262.00	$401,310.00	Assumes an average cost of $11,466/project over and above existing installation standards to ensure protections to Atlantic salmon	MEDOT, Federal Highways
C4.2	Complete tier 1 road stream crossings according to the Maine DOT's Programmatic consultation for transportation projects (USFWS 2017) in the Penobscot Bay SHRU	A	2	2	Calculated	$80,262.00	$401,310.00	Assumes an average cost of $11,466/project over and above existing installation standards to ensure protections to Atlantic salmon	MEDOT, Federal Highways
C4.3	Complete tier 1 road stream crossings according to the Maine DOT's Programmatic consultation for transportation projects (USFWS 2017) in the Downeast Coastal SHRU	A	2	2	Calculated	$68,796.00	$343,980.00	Assumes an average cost of $11,466/project over and above existing installation standards to ensure protections to Atlantic salmon	MEDOT, Federal Highways

C4.4	Complete tier 2 road stream crossings according to the Programmatic consultation for transportation projects (USFWS 2017) in the Merrymeeting Bay SRHU	A	2	3	Calculated	$57,330.00	$286,650.00	Assumes an average cost of $11,466/project over and above existing installation standards to ensure protections to Atlantic salmon	MEDOT, Federal Highways
C4.5	Complete tier 2 road stream crossings according to the Programmatic consultation for transportation projects (USFWS 2017) in the Penobscot Bay SHRU	A	2	3	Calculated	$57,330.00	$286,650.00	Assumes an average cost of $11,466/project over and above existing installation standards to ensure protections to Atlantic salmon	MEDOT, Federal Highways
C4.6	Complete tier 2 road stream crossings according to the Programmatic consultation for transportation projects (USFWS 2017) in the Downeast Coastal SHRU	A	2	3	Calculated	$57,330.00	$286,650.00	Assumes an average cost of $11,466/project over and above existing installation standards to ensure protections to Atlantic salmon	MEDOT, Federal Highways
C4.7	Install culverts and bridges that allow for unimpeded passage of all life stages of Atlantic salmon along municipally owned roads	A	2	2, 3	Calculated	$171,990.00	$859,950.00	Assumes 15 municipally owned culverts/year at an estimated cost of $11,466/project over and above existing installation standards to ensure protections to Atlantic salmon	Municipalities, Tribal Governments, FEMA, USDA-NRCS, NGO's
C4.8	Install culverts and bridges that allow for unimpeded passage of all life stages of Atlantic salmon along privately owned roads	A	2	2, 3	Calculated	$171,990.00	$859,950.00	Assumes 15 municipally owned culverts/year at an estimated cost of $11,466/project over and above existing installation standards to ensure protections to Atlantic salmon	USDA-NRCS, Private Landowners, NGO's
C5.0	**Implement connectivity projects that ensure access to the co-evolved suite of diadromous fish that are part of the ecosystem that Atlantic salmon depend on**								

C5.1	Identify and prioritize fish passage barriers that maximize opportunities for the co-evolved suite of diadromous fish that are part of the ecosystem that salmon depend on	A	2	2, 3	Baseline	—	—	—	NMFS, USFWS, Maine DMR, NGO's, Tribes
C5.2	Remove dams according to the prioritization that maximize opportunities for the co-evolved suite of diadromous fish that are part of the ecosystem that salmon depend on	A	2	2, 3	Calculated	$100,000.00	$500,000.00	Assumes an estimated $250,000/dam removal; Avg of 2 removals every 5 years	Dam owners, NGO's, Maine DMR, USFWS, NMFS, Tribes
C5.3	Install fishways at dams according to the prioritization that maximize opportunities for the co-evolved suite of diadromous fish that are part of the ecosystem that salmon depend on	A	2	2, 3	Calculated	$150,000.00	$750,000.00	Assumes an estimated $250,000/fishway; Avg of 3 fishways every 5 years	Dam owners, NGO's, Maine DMR, USFWS, NMFS, Tribes
C6.0	**Science, Assessment and monitoring of barriers to fish passage**								
C6.1	Use the best available methods, including fish tagging and marking, to perform fish passage barrier assessments throughout the GOM DPS as necessary.	A	2	2	Calculated	$500,000.00	$2,500,000.00	Estimate assumes $125,000 per study averaging 4 studies per year.	Dam owners, Academia, USFWS, NMFS
C6.2	Determine the feasibility of connectivity projects that afford direct benefits to Atlantic salmon.	A	2	2	Calculated	$30,000.00	$150,000.00	assumes 3 feasibility studies every 5 years on dams that afford direct benefits to Atlantic salmon	Dam owners, NGO's, USFWS, NMFS

C6.3	Conduct engineering design and permitting for potential fish passage improvement projects that provide direct benefits to Atlantic salmon	A	2	2	Calculated	$30,000.00	$150,000.00	assumes 3 engineering and designs every 5 years on dams that afford direct benefits to Atlantic salmon	Dam owners, NGO's, USFWS, NMFS
C6.4	Determine the feasibility of connectivity projects that primarily benefit the co-evolved suite of sea-run fish the Atlantic salmon depend on	A	2	2	Calculated	$30,000.00	$150,000.00	assumes 3 feasibility studies every 5 years on dams that primarily benefit the co-evolved suite of searun fish that Atlantic salmon depend on	Dam owners, NGO's, USFWS, NMFS
C6.5	Conduct engineering design and permitting for potential fish passage improvement projects that primarily benefits the suite of searun fish that Atlantic salmon depend on	A	2	2	Calculated	$30,000.00	$150,000.00	assumes 3 engineering designs and permitting every 5 years on dams that primarily benefit the co-evolved suite of searun fish that Atlantic salmon depend on	Dam owners, NGO's, USFWS, NMFS
C6.6	As needed conduct pre- and post- barrier removal and fish passage improvement monitoring using up-to-date methods.	A	2	2	Baseline+ $200,000 calculated	$40,000.00	$200,000.00	—	Dam owners, NGO's, Academia, Maine DMR, USFWS, NMFS
C6.7	Establish Atlantic salmon passage efficiency targets that do not "jeopardize the continued existence" of the GOM DPS.	A, D	1	1	Baseline	$150,000.00	$750,000.00	—	NMFS
C6.8	Establish downstream and upstream Atlantic salmon passage design criteria for road stream crossings.	A	1	1	Baseline	—	—	—	USFWS
C7.0	**Permit, monitor and Enforce regulations related to barriers to fish passage**								

C7.1	Complete ESA section 7 programmatic consultations with action agencies on road stream crossing improvement projects that effect Atlantic salmon	A	1	1	Baseline	_	_	_	MEDOT, ACOE, FEMA, USFWS, NMFS
C7.2	Prioritize regulatory mechanisms that maintain and promote connectivity within designated critical habitat.	A, D	1	1	Baseline	_	_	_	NMFS, USFWS
C7.3	Conduct compliance monitoring of fish passage efficiency targets and carry out enforcement actions when necessary.	A, D	1	2, 3	Baseline	_	_	_	NMFS, USFWS
C7.4	Carry out consultation pursuant to Section 7 of the ESA on authorizations, funding or permits for potential fish passage improvement projects	A	1	2, 3	Baseline	_	_	_	NMFS, USFWS

				FRESHWATER ACTIONS					
F1.0	**Evaluate distribution and abundance of naturally-reared Atlantic salmon and hatchery products**								
F1.1	Enumerate smolt populations to assess freshwater productivity, hatchery product survival.	A	1	ALL	Baseline	_	_	_	Maine DMR

F1.2	Monitor and assess instream young-of-year and parr to evaluate freshwater productivity, early lifestage survival from egg to smolt, and hatchery product fitness and survival in all SHRUs	A	1	ALL	Baseline	_	_	_	Maine DMR
F1.3	Conduct redd counts to estimate adult Atlantic salmon escapement and assess natural re-colonization within the range of the GOM DPS	A	1	ALL	Baseline	_	_	_	Maine DMR
F1.4	Enumerate returns of adult Atlantic salmon captured at fish trapping facilities within the range of the GOM DPS	A	1	ALL	Baseline	_	_	_	Maine DMR
F2.0	**Implement stocking programs for vacant habitat targeted at preventing extinction of locally adapted stocks and increasing their abundance and distribution**								
F2.1	Prevent extinction of locally adapted stocks in all SHRUs by using diverse stocking strategies that protect and promote increased fitness and genetic diversity	A, E	1	2	Baseline	_	_	_	Maine DMR, USFWS
F2.2	Increase resiliency of all locally adapted stocks across the DPS by identifying and utilizing vacant habitats, including climate resilient habitats where they exist to create redundant populations	A, E	1	2	Baseline	_	_	_	Maine DMR, USFWS
F2.3	Develop and implement a stock reintroduction plans for vacant habitats in all SHRUs	A, E	2	2	Baseline	_	_	_	Maine DMR, USFWS

F3.0	**Identify, maintain, protect and restore priority freshwater habitats for Atlantic salmon**								
F3.1	Establish and implement a water temperature monitoring protocol in all SHRUs to support efforts to identify climate vulnerable and climate resilient habitats	A	1	1	Baseline	_	_	_	USFWS, Maine DMR, NMFS, NGO's
F3.2	Inventory and prioritize freshwater habitats that provide the best opportunity for salmon recovery, including climate resilient habitats, in all SHRUs	A	1	1	Baseline	_	_	_	Maine DMR, USFWS
F3.3	Protect and maintain freshwater and riparian habitats according to prioritization in all SHRUs	A	1	2	Calculated	$5,000,000.00	$25,000,000.00	Estimate's assumes $5 million annual investment of roughly 45,000 acres/year that would provide some conservation benefit to salmon. This figure is estimated based on land acquisition efforts for the purpose of conservation made by the Lands for Maine's future program. This figure does not directly factor in restoration of freshwater habitats but it assumes that some fraction of the $5 million dollar investment would be used for these purposes if it were deemed appropriate.	Lands For Maine's Future, Maine DMR, USFWS, NMFS, NGOs,
F3.4	Develop watershed restoration action plans for all SHRUs that identifies appropriate site specific actions necessary to restore ecological processes that promote and sustain properly functioning stream channels	A	2	2	Baseline	_	_	_	Maine DMR, USFWS, NMFS, Tribes, NGO's

F3.5	Restore freshwater and riparian habitats according to the restoration action plans described in action F3.5	A	2	2	Expert Opinion	$50,000	$250,000.00	_	Maine DMR, USFWS, NMFS, Tribes, NGO's
F3.6	Conduct a detailed climate change risk analysis for all locally adapted salmon populations in the DPS to help prioritize actions and develop new ones that are necessary to support climate resilient populations	A, E	1	1	Expert Opinion	$150,000.00	_	_	Maine DMR, USFWS, NMFS, Tribes, NGO's, Acadamia
F3.7	Review and if needed, revisit critical habitat designation to ensure that there is sufficient climate resilient habitats into the foreseeable future necessary to allow for survival and recovery	A, E	2	1	Baseline	_	_	_	NMFS, USFWS
F4.0	**Implement methods to minimize predation pressures and angling pressures on Atlantic salmon**								
F4.1	Identify, and when possible, remove derelict manmade structures that increase foraging opportunities for avian and mammalian predators on Atlantic salmon in all SHRUs	C	3	2	expert opinion	$10,000.00	$50,000	_	Maine DMR, NGO's
F4.2	Identify and implement measures to minimize localized avian predation on hatchery-origin Atlantic salmon smolts in all SHRUs	C	3	2	expert opinion	$10,000.00	$50,000.00	_	USFWS, NMFS, Maine DMR, NGOs

F4.3	Evaluate impact of mammalian predation on adult Atlantic salmon in all SHRUs, and implement, if needed measures to minimize predation	C	3	3	N/A	_	_	_	USFWS, NMFS, Maine DMR, Acadamia
F4.4	Identify and implement measures to avoid or minimize the spread of non-native species that prey on, or compete with Atlantic salmon in all SHRUs	C	1	2	Expert opinion	$20,000.00	$100,000.00	_	Maine DMR, Maine DIFW, Acadamia
F4.5	Identify and implement measures to minimize competition with or predation on Atlantic salmon by non-native species in all SHRUs	C	2	2	Expert opinion	$10,000.00	$50,000.00	_	Maine DMR, Maine DIFW, Acadamia
F4.6	Identify and reduce incidental bycatch of Atlantic salmon by regulatory area closure and/or angler education	B, C	2	1	Expert opinion	$30,000.00	$150,000.00	_	Maine DMR, Maine DIFW, NGO's
F5.0	**Minimize escapes and the effects of escaped aquaculture Atlantic salmon on local populations**								
F5.1	Where capture facilities exist, monitor for and collect genetic samples of adult returns suspect of being from aquaculture origin	C	1	ALL	Expert Opinion	$50,000.00	$250,000.00	Cost estimates based on resource needs from previous escapes	Maine DMR, USFWS, NMFS
F5.2	Develop and implement a contingency plan for capturing and culling escaped aquaculture origin Atlantic salmon within rivers without capture facilities	C	1	ALL	expert opinion	$50,000.00	$250,000.00	Cost estimates based on resource needs from previous escapes	Maine DMR, USFWS, NMFS, Commercial Aquaculture

F5.3	Ensure when necessary, that Federal and State permit include requirements for containment management plans to minimize escapes and the risks from escapes, and for such plans to be monitored for effectiveness	C	1	ALL	Baseline	_	_	_		Maine DMR, Commercial Aquaculture, NMFS
F5.4	Ensure when necessary, that Federal and State permits include requirements for the use of North American strain Atlantic salmon at aquaculture sites where the potential for escapes have the potential tomay interact with wild fish.	C	1	ALL	Baseline	_	_	_		Maine DMR, Commercial Aquaculture, NMFS
F5.6	Ensure when necessary, that Federal and State permit include requirements for reporting escapes of farmed Atlantic salmon	C	1	ALL	Baseline	_	_	_		Maine DMR, Commercial Aquaculture, NMFS
F5.7	Continue international efforts to coordinate escape reporting and permit requirements to minimize interactions of farmed salmon with wild salmon	C	1	ALL	Baseline	_	_	_		NMFS, Dept. of Fisheries and Oceans - Canada.
F6.0	**Avoid and minimize the effects of pollution, water use and other activities on Atlantic salmon and their habitats**									
F6.1	Review and update the State of Maine water quality standards to ensure they are protective of all lifestages of Atlantic salmon	A	2	ALL	Baseline	_	_	_		Maine DEP, Maine DMR
F6.2	Monitor waste-water and storm water discharge and associated pollutants to ensure that effects to Atlantic salmon and their habitats are minimized	A	2	ALL	Baseline	_	_	_		Maine DEP, Maine DMR

F6.3	Install streamflow gauges or use other appropriate methods to monitor the effects of water withdrawal and implement measures to avoid and minimize effects of water withdrawals on all life stages of Atlantic salmon	A, E	2	ALL	Expert Opinion	$234,000.00	$450,000.00	Install 3 gauges/SHRU at $20,000/gauge and annual maintenance of $6,000	Maine DMR, USGS

MARINE AND ESTUARY ACTIONS									
M1.0	**Continue ongoing international negotiations and partnerships to ensure U.S. interests in Atlantic salmon conservation are understood and considered**								
M1.1	Maintain an active U.S. role at NASCO to improve at-sea distant water survival of Atlantic salmon through reduction of fishing mortality and evaluation of drivers of natural mortality at sea.	B, E	1	2	Baseline	—	—	ongoing with 3% annual increase in cost	State Department, NASCO, NMFS, Atlantic Salmon Federation
M1.2	Pursue opportunities outside NASCO to minimize the impact of intercept fisheries in Canada, St. Pierre et Miquelon, and Greenland on U.S. Atlantic salmon.	B	2	1	Baseline	—	—	ongoing with 3% annual increase in cost	Atlantic Salmon Federation, Department of Fisheries and Oceans Canada, State Department, NMFS

M1.3	Continue to participate in collaborative research initiatives through the International Atlantic Salmon Research Board, Canada Atlantic Salmon Research Joint Venture, Ocean Tracking Network, and U.S. Animal Tracking Network to strengthen knowledge and expertise while leveraging resources to study salmon seascapes and ecosystems (research).	B, E	1	1	Baseline	_	$475,000.00	Ongoing with 5% annual increase in cost. Due to increased costs, additional resources ($95 K annually) would be needed for this element in FY2021, or reduction is scope.	Atlantic Salmon Federation, Department of Fisheries and Oceans Canada, BOEM, Navy, NMFS
M2.0	**Continue ongoing research and monitoring to further understand the ecological conditions that allow Atlantic salmon to succeed in the estuary and marine environment and the factors that impede their survival**								
M2.1	Study marine prey base shifts to understand prey production dynamics, energy budgets, and distribution to inform management of forage to minimize impacts of climate change.	E	1	1	Baseline	_	_	ongoing with 5% annual increase in cost	Department of Fisheries and Oceans Canada and Greenland Institute of Natural Resources, Academia, NMFS
M2.2	Expand upon pilot studies (2012-2018) of the ecological role of co-evolved diadromous species.	C, E	3	1	Calculated	$145,000.00	$802,000.00	contractor with boat, seasonal technician, and supplies & equipment, 5% annual increase in cost	NGO's, Academia, NMFS

M2.3	Seek opportunities to enhance resiliency of Atlantic salmon to changing conditions in the estuary and marine environment. Managing for resilience includes: (a) examining interactions of salmon with predators and parasites; (b) conducting smolt. Post-smolt, and adult tracking studies to further investigate migration ecology; and (c) continue evaluation of existing marine related data for correlations at U.S., North American, and North Atlantic scales to better characterize the impact of oceanographic changes.	C, E	1	1	Calculated	$160,000.00	$884,000.00	2-3 year post-docs with research and analysis budgets with 5% annual increase in cost	Department of Fisheries and Oceans Canada, BOEM, Navy, Academia, NMFS
M3.0	**Reduce effects of human activities on migratory smolts/posts-molts in estuary, coastal, and Northeast Shelf domestic waters**								
M3.1	Evaluate the effects of human activities that affect Atlantic salmon and their habitats in the estuary and marine environment using Section 7 and Section 10 of the ESA and propose measures, as appropriate, to minimize such effects.	D	2	1	Baseline	—	—	ongoing with 5% annual increase in cost	Maine DMR, Atlantic Salmon Federation, Department of Fisheries and Oceans Canada, BOEM, Navy, NMFS

Outreach and Education Actions									
O1.0	**Inform stakeholders and the public of sea-run fish resources in Maine and the importance of protecting and restoring the ecosystems upon which they depend.**								
O1.1	Collaborate on preparation of outreach materials.	A	2	2	Baseline	_	_	_	USFWS, Sea Grant, NGO's, NMFS, Maine DMR, Tribal Partners
O1.2	Develop and maintain a website where basic information about all sea run fish, including their biology, ecology, and conservation, can be accessed.	A	2	2	Baseline	_	_	_	NMFS
O1.3	Participate in key outreach events with representatives from the full range of sea run fish restoration partners.	A	2	2	Baseline	_	_	_	USFWS, Sea Grant, NGO's, NMFS, Maine DMR, Tribal Partners
O1.4	Continue existing outreach programs in coordination with partners.	A	2	2	Baseline	_	_	_	USFWS, Sea Grant, NGO's, NMFS, Maine DMR, Tribal Partners
O2.0	**Fulfill the conservation goals of the ESA by engaging with stakeholders and the public to guide the implementation of actions necessary for the recovery of Atlantic salmon**								
O2.1	Conduct Atlantic salmon framework meetings as a means for the agencies, stakeholders and the public to engage in dialogue on Atlantic salmon recovery efforts	A	2	2	Baseline	_	_	_	USFWS, NMFS, Maine DMR, Tribal Partners

O2.2	Continue with the Atlantic salmon ecosystem forum as a means to learn of new science and management efforts that pertain to the restoration of Atlantic salmon and the ecosystems that they depend on	A	2	2	Baseline	_	_	_	NMFS
O2.3	Work with federal agencies to find opportunities where they can use their authorities to further the conservation of Atlantic salmon as directed under Section 7(a)(1) of the ESA.	A	2	2	Baseline	_	_	_	USFWS, NMFS, ACOE, FERC, USDA/NRCS, Federal Highways
O2.4	Involve interested parties in the development and updating of SHRU-level workplans	A	2	2	Baseline	_	_	_	USFWS, NMFS, Maine DMR, NGO's, Tribal Partners
O3.0	**Provide training and opportunities for stakeholders to increase capacity in implementing recovery efforts**								
O3.1	Provide training on approaches to habitat restoration including road crossing and Section 6 funding resources	A	2	2	Baseline	_	_	_	USFWS, NMFS
O3.2	Conduct workshops and trainings on ESA requirements	A	2	2	Baseline	_	_	_	USFWS, NMFS
O3.3	Increase the number of received proposals to federal funding opportunities that support salmon recovery efforts by increased communication and outreach to stakeholders.	A	2	2	Baseline	_	_	_	USFWS, NMFS

FEDERAL/TRIBAL COORDINATION ACTIONS									
T1.0	**Continued Federal/Tribal Engagement and Coordination**								
T1.1	Strengthen the government-to-government relationship with tribal nations and fulfill federal trust obligations.	A, B, D	1	1-4	Baseline	—	—	—	NMFS, USFWS, Tribes
T1.2	Ensure continued tribal representation in the co-management of Atlantic salmon.	A, B, D	1	1-4	Baseline	—	—	—	NMFS, USFWS, Tribes

CONSERVATION HATCHERY ACTIONS									
H1.0	**Implement methods necessary to maintain and promote genetic diversity of salmon populations in the hatcheries**								
H1.1	Conduct Annual Fish Health, Disease, and Biosecurity Activities related to conservation hatcheries annual activities.	C	1	2	Baseline	—	—	—	USFWS
H1.2	Capture, collect and maintain captive, domestic, and sea run broodstock as necessary to preserve and maximize the genetic diversity of the GOM DPS and enhance, to the extent possible, the effective population size of the GOM DPS.	A, E	1	2	Baseline	—	—	—	USFWS, Maine DMR

H1.3	Produce Atlantic salmon to be stocked as eggs and fry to increase freshwater selection and representation of locally adapted stocks, and minimize the loss of family groups during parr broodstock collections.	A, E	1	2	Baseline	—	—	—	USFWS, Maine DMR
H1.4	Produce Atlantic salmon to be stocked as parr and smolts to increase marine selection and representation of locally adapted stocks, and minimize the loss of family groups during sea run adult broodstock collections.	A, E	1	2	Baseline	—	—	—	USFWS, Maine DMR
H1.5	Investigate and implement alternative hatchery practices that increase survival of hatchery product in the wild and promote resilience to climate variability.	A, E	2	2	Baseline	—	—	—	USFWS, NMFS, Maine DMR
H1.6	Identify and implement hatchery practices that minimize the effects of domestication on remaining wild stocks of Atlantic salmon (examples might include selective breeding and marking programs).	A, E	2	2	Baseline	—	—	—	USFWS, Maine DMR
H1.7	As necessary and appropriate for salmon recovery, develop broodstock programs in watersheds that currently do not have locally adapted breeding populations within the GOM DPS (e.g. Kennebec and Androscoggin rivers).	A, E	2	2	Baseline	—	—	—	USFWS, NMFS, Maine DMR

H2.0	**Provide hatchery product necessary to support science, research and assessments that are needed to evaluate recovery efforts and assess threats to the continued survival of the species**								
H2.1	Identify by life stage, the numbers of GOM DPS origin Atlantic salmon that can be allocated to support survival studies at FERC dams, and other research and assessment efforts without compromising the hatcheries efforts to prevent extinction of the species and support recovery efforts.	A	2	2	Baseline	—	—	—	USFWS
H2.2	As appropriate and within the scope of H2.1, provide eggs to support research, threat assessments and recovery efforts for Atlantic salmon. This could include programs at private hatcheries, industry partners or academic institutions.	A, D	2	2	Baseline	—	—	—	USFWS, NMFS, Maine DMR, Academia
H2.3	As appropriate and within the scope of H2.1, produce Atlantic salmon to support upstream and downstream fish passage studies at hydroelectric and other fish passage structures/barriers within the GOM DPS.	A	2	2	Baseline	—	—	—	USFWS, NMFS, Maine DMR

GENETICS ACTIONS									
G1.0	**Annually characterize all Atlantic salmon collected for use as broodstock for origin determination and genetic variation**								
G1.1	As needed, genetically screen Atlantic salmon that are suspected to originate from aquaculture escapes	A, B, D	1	2	Baseline	_	_	_	USFWS, MDMR
G1.2	Prioritize and implement ongoing genetic data analysis needs with respect to management goals and with the potential of considering new techniques and approaches.	D	1	2	Baseline + Calculated	$75,000	$375,000.00	Calculated cost would allow for new techniques and analysis	USFWS
G1.3	Manage data resulting from production, stocking, and genetic evaluation to facilitate program assessment and monitoring.	D	1	2	Baseline	_	_	_	USFWS
G1.4	Use genetic analyses to inform and improve best hatchery management practices.	D	1	2	Baseline	_	_	_	USFWS
G.20	**Use of genetic data to evaluate and inform recovery**								
G.21	Genetically analyze and evaluate management practices relating to DPS recovery.	D	1	2	Calculated	$50,000	$ 250,000.00	Assumes supplies and salaries to do up to 1500 samples per year	USFWS, NMFS, MDMR
G2.2	Use genetic analyses to guide efforts to increase distribution and abundance of locally adapted stocks among vacant habitats in the DPS	A, D	1	2	Calculated	$50,000	$250,000.00	Assumes supplies and salaries to do up to 1500 samples per year	USFWS, NMFS, MDMR

FUNDING PROGRAM ACTIONS									
FP1.0	**Provide funds through federal grant programs that support recovery efforts for Atlantic salmon.**								
FP1.1	Continue to provide funding through NMFS and U.S. Fish and Wildlife ESA Section 6 programs that supports State and Tribal sponsored programs that benefit threatened and endangered species	A	2	2, 3	Expert Opinion	$500,000.00	$2,500,000.00	Based on best professional estimate of average funding demand on an annual basis	NMFS, USFWS
FP1.2	Continue to provide funding through NMFS's Habitat Restoration Centers' Coastal and Marine Habitat Restoration Grants for projects that promote productive and sustainable fisheries, improve the recovery and conservation of protected resources, and promote healthy ecosystems and resilient communities through the restoration of coastal habitats	A	2	2, 3	Expert Opinion	$1,500,000.00	$7,500,000.00	Based on best professional estimate of average funding demand on an annual basis	NMFS
FP1.3	Continue to provide funding through NMFS's Habitat Blue Print in support of restoration efforts on the Penobscot River	A	2	2, 3	Expert Opinion	$200,000.00	$1,000,000.00	Based on best professional estimate of average funding demand on an annual basis	NMFS
FP1.4	Provide funding to support actions identified in SHRU-specific restoration work plans	A	2	2, 3	Expert Opinion	$200,000.00	$1,000,000.00	Based on best professional estimate of average funding demand on an annual basis	Maine DMR, USFWS, NMFS
FP1.5	Provide funding, as available, for efforts that promote salmon conservation by minimizing interactions between Atlantic salmon and non-native fish.	A	2	2,3	Expert Opinion	$500,000.00	$ 2,500,000.00	Based on best professional estimate of average funding demand on an annual basis	Maine DMR, Maine IF&W, USFWS

PART V. TIME AND COST ESTIMATES

J. Time to Delisting

Recovery of the GOM DPS of Atlantic salmon is projected to take 75 years. This accounts for approximately 15 generations of salmon and is based on an assumed upper limit of available resources for implementation of recovery actions. It should be noted that both this time estimate and the cost estimate below are unavoidably speculative, given the uncertainties surrounding recovery of this DPS.

Estimating the time and cost for reclassification is equally difficult. The earliest possible time to reclassification is estimated to be 10 years (approximately two generations of salmon).

K. Cost of Recovery

Incremental costs of recovery are calculated at 5-year intervals. We estimate annual baseline costs that support staff, hatchery operations, fulfilling our obligations in implementing the ESA including Section 7 and Section 10, and active monitoring and assessment of population status and trends as approximately $8.6 million/year. We have estimated that the annual costs of implementing recovery actions over and above those actions covered under the baseline budget at $24 million per year, or approximately $120,000,000.00 over the next 5 years (2019 - 2023). Beyond five years, our ability to estimate costs become considerably more uncertain. One possibility we may be able to assume is that most of the cost of implementing recovery actions that address the significant threats to the species (dams, climate change, road crossings, marine survival and the West Greenland Fishery) will likely be borne over the next 15 -years as they are our highest priority actions that require our most immediate attention. Under this scenario, the estimated cost to address the high priority actions over 15 years in conjunction with the baseline costs would be in the range of $446 million. We may also be able to assume that the baseline cost of $8.6 million/year (discounting inflationary costs) may continue until populations become less dependent on hatcheries whereby the need for hatchery support and hatchery assessments would decrease. If we assume a $3 million decrease in program budgets after 25 years, the estimated annual baseline cost would decrease to approximately $5.6 million per year. Based on all these assumptions the estimated total cost of recovery may be in the order of $858 million over the 75-year timeframe needed to achieve recovery.

We should also note that many of the most costly actions such as removing dams, installing fishways, and infrastructure improvements at road crossings will also afford direct benefits to many other species including commercially important alewives and American eel, and recreationally important species such as American shad. Some actions, such as infrastructure improvements at road crossings using stream simulation design that ensure fish passage for Atlantic salmon and other fish, has been shown to afford substantial societal and economic benefit relative to the initial investment at these crossings, by significantly increasing structural resilience to storm events (Gillespie et al. 2014). Other ancillary benefits of implementing recovery actions would also include improvements in water quality and flow in salmon rivers, enhanced understanding of sustainable management for numerous freshwater and marine resources that are part of the ecosystems that salmon live, and additional reduction in environmental stressors that affect salmon and the surrounding ecosystems that salmon depend on. We emphasize that this cost estimate involves a high degree of uncertainty about the actual trajectory of the recovery program over the long term. It is, therefore, highly subject to change and should not be used with any intent other than meeting our legal requirement to provide the public with our best understanding of the general level of effort and expense to achieve the plan's goal of recovering the Atlantic salmon GOM DPS.

L. Assessing Recovery Priority

The USFWS and NMFS have adopted separate processes for identify Recovery Priority. Both agencies use the recovery priority numbers to prioritize recovery planning and implementation. The recovery priority for each agency is reassessed at least biannually, as part of the agency's biennial reports to congress on recovering threatened and endangered species under the ESA

The USFWS and NMFS will use their processes to determine recovery priority for Atlantic salmon and will work collaboratively to ensure that any differences are clearly identified and explained. Both agencies will revisit these priority determinations on a biannual basis. This assessment, will inform prioritizing implementation of the actions outlined in this recovery plan.

Additionally, as part of the implementation of the ESA, we are obligated to carry out reviews of the status of the DPS every 5 years. NMFS and FWS follow joint guidance on the development of 5-year reviews. The 5-year review gathers current information on a species and determines whether recovery plan criteria have been met. NMFS announced initiation of a 5-year review of the status of Atlantic salmon in 2018. We expect that review will be published in 2019. In the 5-year review, we can determine whether the species should:

1. Be removed from the ESA
2. Be changed in status from an endangered species to a threatened species
3. Or, Maintain the species' current classification status

Any recommendation to reclassify or delist Atlantic salmon would have to proceed through a formal rule making process.

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APPENDIX: LIST OF POSTED SUPPORTING MATERIALS

- Companion Document
- Statement of Cooperation
- Consultation and Coordination with Indian Tribal Governments (EO 13175)
- Recovery Plan for the Gulf of Maine Distinct Population Segment of Atlantic Salmon (Salmo salar) (DRAFT). 2016
- Atlantic Salmon Recovery Framework
- Recovery Proposals Review and Approval Process
- Craig Brook and Green Lake National Fish Hatcheries Websites
- East Machias Aquatic Resource Center Website
- Final Atlantic Salmon Recovery Plan **2005**
- 2009 critical habitat rule
- 2009 Final Listing Rule
- SHRU-level workplans
- 2008 Strategic Plan for the Restoration of Diadromous Fish in the Penobscot River
- 2006 Broodstock Management Plan
- U.S. Forest Service Stream Simulation Methodology
- U.S. Atlantic salmon Assessment Committee Reports
- National Research Council's "Atlantic Salmon in Maine"