**UNITED STATES DEPARTMENT OF COMMERCE**

**National Oceanic and Atmospheric Administration**

NATIONAL MARINE FISHERIES SERVICE

GREATER ATLANTIC REGIONAL FISHERIES OFFICE

55 Great Republic Drive

Gloucester, MA 01930-2276

June 17, 2021

Kimberly D. Bose, Secretary

Federal Energy Regulatory Commission

888 First Street, N.E.

Washington, D.C. 20426

**RE: COMMENTS, RECOMMENDATIONS, PRELIMINARY TERMS AND CONDITIONS, and PRELIMINARY FISHWAY PRESCRIPTIONS for the Pejepscot Hydroelectric Project (FERC No. 4784)**

Dear Secretary Bose:

Enclosed is our preliminary prescription for fishways, pursuant to Section 18 [16 USC §811], recommended terms and conditions pursuant to Section 10(a) [16 USC §803(a)] and Section 10(j) [16 USC §803(j)] of the Federal Power Act for the Pejepscot Hydroelectric Project (P-4784) on the Androscoggin River, Maine (Attachment A). We are filing the preliminary prescription in response to the April 19, 2021, Notice of Application Ready for Environmental Analysis (REA), regarding Topsham Hydro Partners Limited Partnership’s final license application. Through this preliminary prescription, terms, and conditions, we act to preserve, protect, and restore diadromous fish in the Androscoggin River watershed consistent with management goals established by federal and state resource agencies. For American eel, an ecologically important catadromous fish that is commercially and culturally significant to coastal communities, we support the actions of the U.S. Fish and Wildlife Service to improve upstream and downstream passage, and we reserve authority to act in the future. Based on our interagency coordination, we expect that their terms, conditions, and recommendation will support our agency's goals for the species.

The Androscoggin River supports several diadromous fish species including multiple species listed under the Endangered Species Act of 1973, as amended, (Klopries, Deng, Lachmann, Schüttrumpf, & Trumbo) (Gulf of Maine distinct population segment (DPS) of Atlantic salmon, five DPSs of Atlantic sturgeon, and shortnose sturgeon). Each species serves a unique and important ecological function, including connecting the marine environment to freshwater and terrestrial ecosystems. Human activity has heavily affected these fish throughout their range over the past 250 years. As a result, diadromous fish populations are at historical lows. Our broader goals for the Androscoggin River include restoring and maintaining sustainable diadromous fish stocks within the Androscoggin River watershed, protecting fish habitat, and improving the prey base for offshore fish species, including groundfish in the Gulf of Maine. Improving fish passage facilities at the Pejepscot Project is a priority action to meet these goals.

The Androscoggin River is designated critical habitat for the Gulf of Maine DPS of Atlantic salmon. The GOM DPS of Atlantic salmon has been recognized by us as one of the nine speciesmost at risk of extinction in the near future and, as such, is one of the species highlighted in our “Species in the Spotlight: Survive to Thrive” initiative. Addressing the impacts of dams on Atlantic salmon and the ecosystems on which it depends is highlighted in the Species in the Spotlight action plan[[1]](#footnote-1), the ESA listing determination (74 FR 29344), and the Final Recovery Plan (USFWS and NMFS 2019). Section 7(a) (Hansen, Jacobsen2, & Lund1) of the ESA requires that federal agencies ensure that any actions they authorize, fund or carry out are not likely to jeopardize the continued existence of any listed species or destroy or adversely modify any designated critical habitat. An ESA section 7 consultation is necessary before you issue any license for this project. We anticipate you will initiate formal ESA section 7 consultation with us once there is sufficient clarity on the proposed action and adequate information about the anticipated effects to inform your biological assessment.

In formulating our responses to the Commission’s REA notice, we carefully considered our different authorities under sections 10 and 18 of the Federal Power Act. Section 10 does not grant us mandatory authorities for the purposes of decommissioning and dam removal. However, under section 10(a), we may recommend decommissioning and dam removal as our preferred alternative in this proceeding, and we do so for the reasons outlined in the attachment. Section 18 grants mandatory authorities to prescribe fishways (16 U.S.C. § 811). Should the Commission reject our section 10(a) recommendation for decommissioning and dam removal, it is imperative that fishways are satisfactorily designed and implemented as a means to achieve our basic resource goals and objectives. Therefore, we concurrently submit our preliminary section 18 prescription for fishways with the presumption that the existing project facilities may remain in place throughout a new license term.

By this letter, we provide notice pursuant to 18 CFR § 385.214(a), as amended, that we are intervening in this proceeding. We have a federal statutory responsibility for protection, mitigation, and enhancement of diadromous fish and their habitats affected by the results of this proceeding. We intervene for the purposes of becoming a party to represent our interests and those of the public in this proceeding. Service of process and other communications concerning this proceeding should be made to:

Regional Administrator

National Marine Fisheries Service

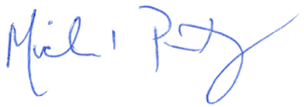
Greater Atlantic Regional Fisheries Office

55 Great Republic Drive

Gloucester, MA 01930

If you have questions or need additional information, please contact Matt Buhyoff in our Protected Resources Division (matt.buhyoff@noaa.gov).

Sincerely,



Michael Pentony

Regional Administrator

cc: Service List

Attachment A: United States Department of Commerce's Recommended Terms and Conditions and Preliminary Prescription for Fishways for the Pejepscot Hydroelectric Project (FERC No. 4784)

**Attachment A**

**United States Department of Commerce's Preliminary Prescription for Fishways for the Pejepscot Hydroelectric Project (P-4784)**

**BEFORE THE**

**UNITED STATES OF AMERICA**

**FEDERAL ENERGY REGULATORY COMMISSION**

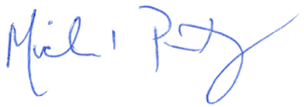
**Topsham Hydro Limited Partnership Pejepscot Hydroelectric Project**

**Androscoggin River  
Cumberland and Sagadahoc Counties  
Pejepscot and Topsham, Maine  
FERC No. 4784-106**

**United States Department of Commerce's**

**Preliminary Prescription for Fishways**

**Pursuant to Section 18 of the Federal Power Act**



\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**Michael Pentony, Regional Administrator**

**Greater Atlantic Regional Fisheries Office**

**United States Department of Commerce**

**National Marine Fisheries Service**

**55 Great Republic Drive**

**Gloucester, MA 01930**

Table of Contents

[1. INTRODUCTION 8](#_Toc74302512)

[2. ADMINISTRATIVE PROCESS, HEARING RIGHTS AND SUBMISSION OF ALTERNATIVES 8](#_Toc74302513)

[3. NMFS STATUTORY AUTHORITY 10](#_Toc74302514)

[4. GOALS AND OBJECTIVES 10](#_Toc74302515)

[4.1. Habitat 10](#_Toc74302516)

[4.2. Protected Resources 11](#_Toc74302517)

[4.3. NMFS Objectives for the Androscoggin River 11](#_Toc74302518)

[4.4. Atlantic States Marine Fisheries Commission 12](#_Toc74302519)

[4.5. State of Maine 13](#_Toc74302520)

[5. Species and Habitat Specific Goals and Objectives 14](#_Toc74302521)

[5.1. Alewife and Blueback Herring 14](#_Toc74302522)

[5.2. American Shad 15](#_Toc74302523)

[5.3. Atlantic Salmon 15](#_Toc74302524)

[5.4. Sea Lamprey 17](#_Toc74302525)

[5.5. Riparian and Aquatic Habitat 18](#_Toc74302526)

[6. CONSIDERATION OF CLIMATE CHANGE 18](#_Toc74302527)

[6.1. Climate Change Effects to Habitat for diadromous Species 18](#_Toc74302528)

[6.2. Potential Effects of Climate Change in the Project Area 20](#_Toc74302529)

[7. CONSIDERATION OF DAM REMOVAL 21](#_Toc74302530)

[8. FACTUAL BACKGROUND 23](#_Toc74302531)

[8.1. Project Specifics 23](#_Toc74302532)

[8.1.1. Project Description and Proposed Measures 23](#_Toc74302533)

[8.1.2. Project Operations 25](#_Toc74302534)

[8.1.3. Project Fishways 25](#_Toc74302535)

[8.1.4. Applicant Proposed Measures 27](#_Toc74302536)

[8.2. Androscoggin River Watershed 29](#_Toc74302537)

[8.3. Fish Resources – Historical 30](#_Toc74302538)

[8.4. Fish Resources – Present Day 30](#_Toc74302539)

[8.4.1. American Shad 31](#_Toc74302540)

[8.4.2. Alewife and Blueback Herring 32](#_Toc74302541)

[8.4.3. Atlantic Salmon 33](#_Toc74302542)

[8.5. Species Life History Summary 35](#_Toc74302543)

[8.6. Project Impacts - Fish Passage 36](#_Toc74302544)

[Downstream Passage 38](#_Toc74302545)

[8.6.1. Delayed Mortality 44](#_Toc74302546)

[9. MANDATORY CONDITIONS AND RECOMMENDATIONS 45](#_Toc74302547)

[9.1. Section 10(a) Consistency with Comprehensive Plans 45](#_Toc74302548)

[9.2. Section 10(j) Protection, Mitigation and Enhancement of Fish and Wildlife 48](#_Toc74302549)

[9.3. Section 18 Prescription for Fishways 51](#_Toc74302550)

[9.3.1. Upstream Fish Passage 52](#_Toc74302551)

[9.3.2. Downstream Fish Passage 60](#_Toc74302552)

[9.3.3. Seasonal Migration Windows 65](#_Toc74302553)

[9.3.4. Passage Performance Standards and Monitoring 67](#_Toc74302554)

[9.3.5. Fishway Design Review 68](#_Toc74302555)

[10. Reservation of Authority 69](#_Toc74302556)

[10.1. Upstream Fish Passage 69](#_Toc74302557)

[10.2. Sea Lamprey 70](#_Toc74302558)

[10.3. Standard Reservation 71](#_Toc74302559)

[11. ADMINISTRATIVE RECORD 71](#_Toc74302560)

[12. LITERATURE CITED 71](#_Toc74302561)

[13. Androscoggin River Fishway Reports 77](#_Toc74302562)

[14. RESOURCE MANAGEMENT PLANS 77](#_Toc74302563)

[15. FEDERAL REGISTER NOTICES 79](#_Toc74302564)

# INTRODUCTION

The U.S. Department of Commerce through the National Oceanic and Atmospheric Administration’s (NOAA) National Marine Fisheries Service (NMFS) hereby submits our Recommended Terms, Conditions, and Preliminary Prescription for Fishways for Topsham Hydro Partners Limited Partnership’s (L.P.) (Topsham Hydro or Licensee) Pejepscot Hydroelectric Project (P- 4784) in response to the Federal Energy Regulatory Commission’s (FERC or Commission) April 19, 2021, Notice of Application Ready for Environmental Analysis. This filing also includes a schedule for submitting modified prescriptions and recommendations. Comment and terms and conditions included here are supported by congressionally signed mandates and our agency mission for protecting and conserving diadromous fish species and their associated habitat. We are submitting this document to the Commission with an index to its Administrative Record. Documents not currently in the record will be filed under separate cover.

A number of species listed under the Endangered Species Act of 1973, as amended, (Klopries et al.) occur in the Androscoggin River watershed. These include the endangered Gulf of Maine (Lunetta, Cosentino, Montgomery, Beamer, & Beechie) distinct population segment (DPS) of Atlantic salmon, the endangered shortnose sturgeon, the threatened GOM DPS of Atlantic sturgeon, and the endangered New York Bight DPS of Atlantic sturgeon. The Androscoggin River has been designated as critical habitat for the GOM DPS of Atlantic salmon as far upstream as the Lewiston Falls Dam (74 FR 29300, June 19, 2009) and as critical habitat for Atlantic sturgeon as far upstream as the Brunswick Dam (82 FR 39160, August 17, 2017). The historical range of Atlantic salmon in the Androscoggin River is designated as Essential Fish Habitat (EFH) by the New England Fishery Management Council pursuant to the Magnuson-Stevens Fishery Conservation and Management Act.

# ADMINISTRATIVE PROCESS, HEARING RIGHTS AND SUBMISSION OF ALTERNATIVES

This preliminary prescription was prepared, and will be processed, in accordance with our regulations at 50 CFR 221 et seq. These regulations provide that any party to a license proceeding before the Commission in which the Department of Commerce exercises mandatory authority has both the right to a trial-type hearing on issues of material fact and the opportunity to propose alternatives to the terms contained in the preliminary prescription.

Any party to the proceeding may challenge the facts upon which our section 18 prescription is based by requesting a trial-type hearing within 30 days (50 CFR 221.4). The challenge is limited solely to the facts; the party may not use this process to contest the weight accorded to the facts or the opinions drawn from these facts by the agency. Agency expertise in forming its opinions and conclusions is entitled to deference under the law and the Commission lacks the authority to modify the Secretary of Commerce’s prescription. The prescription, however, including the opinions and conclusions upon which it is based, may be challenged in the Court of Appeals after the Commission issues its license.

Although a party may not use the trial type hearing process to challenge the agency’s prescriptive opinions and conclusions – in other words, the Licensee cannot challenge the deliberative choices made by the agency in the preliminary prescriptive process – a party may submit alternative prescriptions according to agency regulations at 50 CFR 221.70 et seq. Requests for a trial-type hearing or alternatives to the terms contained in this preliminary prescription must be submitted within 30 days of this filing to the following address: Kara Meckley, Chief, Habitat Protection Division, NMFS Office of Habitat Conservation, 1315 East-West Highway, F/HC2, Silver Spring, MD 20910; and electronically submitted to Kara.Meckley@noaa.gov.

Modified prescriptions, conditions, and other recommendations are due within 60 days of the close of the Commission’s National Environmental Policy Act (NEPA) comment period or in accordance with a schedule otherwise established by the parties to the licensing. We will file our analysis of any alternative prescriptions with the Commission at that time.

We will consider any comments on the preliminary prescription filed by any member of the public, state or federal agency, the Licensee, or other entity or person. Comments must be filed within 30 days of the filing of this preliminary prescription to the following address: Jennifer Anderson, Assistant Regional Administrator for Protected Resources, NMFS Greater Atlantic Regional Fisheries Office, 55 Great Republic Drive, Gloucester, MA 01930; and electronically submitted to nmfs.gar.Pejepscot@noaa.gov.

# NMFS STATUTORY AUTHORITY

The preliminary comments, recommendations, terms and conditions, and prescriptions herein are provided in accordance with the provisions of the Federal Power Act (FPA), 16 U.S.C. § 791 et seq., the Fish and Wildlife Coordination Act, 16 U.S.C. § 661 et seq., the Endangered Species Act (Klopries et al.), 16 U.S.C. §1531 et seq*.,* the National Environmental Policy Act (NEPA), 42 U.S.C. § 4321 et seq., Atlantic Coastal Fisheries Cooperative Management Act, 16 USC §§5101, et seq., and the Magnuson-Stevens Fishery Conservation and Management Act, 16 U.S.C. § 1801 et seq. NMFS interests in these proceedings are well founded in our engagement in fisheries management and restoration and ESA species protection and recovery planning. These statutory authorities afford us the responsibility for protecting and managing a variety of living marine resources that may be affected by the proposed relicensing including: alewife, blueback herring, American shad, Atlantic salmon, sea lamprey, and American eel. The downstream Brunswick Dam is the current upstream limit of Atlantic and shortnose sturgeon distribution in the Androscoggin River. The Brunswick Dam is also considered the likely historical upstream limit given the dam is built at the head of tide at Pejepscot Falls, a natural barrier to sturgeon passage (NMFS, 2017).

# GOALS AND OBJECTIVES

## Habitat

We are responsible for the stewardship of the nation’s living marine resources and their habitats. NMFS is responsible for the stewardship of the nation’s ocean resources and their habitat. The NMFS 2020-2023 Geographic Strategic Plan for New England and Mid-Atlantic includes goals for amplifying the economic value of commercial and recreational fisheries while ensuring their sustainability, and conserving and recovering protected species while supporting responsible fishing and resource development (NMFS, 2020).

Diadromous fish species, including American shad, alewife, and blueback herring, were historically important prey items for commercially important groundfish species (e.g., Atlantic cod, haddock) in the Gulf of Maine (Ames, 2004). The loss of prey may have hastened the decline of nearshore groundfish stocks. Large-scale restoration efforts in the Androscoggin River system, and elsewhere, have enhanced the abundance of diadromous fish species, and may aid in the restoration of Atlantic cod and other groundfish species.

## Protected Resources

A national goal of the NMFS Protected Resources Strategic Plan is to stabilize the most critically endangered species and improve populations of those species nearing recovery (NOAA, 2016). Preventing the extinction of Atlantic salmon is a national priority under the Species in the Spotlight program. The Species in the Spotlight effort is a component of the strategic plan focusing attention on the nine most critically endangered species in the country under our jurisdiction. Together with the U.S. Fish and Wildlife Service (USFWS), we (collectively, “the Services”) are charged with conserving and recovering species listed as threatened or endangered under the ESA. Recovery is the process of restoring listed species and the ecosystems upon which they depend to the point they no longer require the protections of the ESA. Goals and objectives specific to the Androscoggin River as stated below are based on our statutory authority and derived from our overarching long-term agency goals and objectives.

## NMFS Objectives for the Androscoggin River

Our principal objective for the Androscoggin River is to provide access to historical spawning, rearing, and migration habitats necessary for diadromous species to complete their life cycles and to ensure access to seasonal habitats necessary to contribute to the enhancement of the stocks. Modifications to Pejepscot Project facilities and project operations to ensure the safe, timely, and effective passage of migrating adults and juveniles past the Project, including passage necessary for dispersal and seasonal movement, will facilitate this principal objective.

In 2020, we issued our *Androscoggin River Watershed Comprehensive Plan for Diadromous Fishes* (Accession #20200414-5171; (NOAA, 2020). The purpose of that plan was to establish a framework that balances the restoration of diadromous fishes and the need for sustainable energy production, while defining goals to protect, conserve, and enhance Androscoggin River habitat and resources.

## Atlantic States Marine Fisheries Commission

The ASMFC acts to coordinate the conservation and management of 25 nearshore fish species. Commissioners, representatives of the state’s marine fisheries management agency, legislators and appointed stakeholder representatives for each state constitute the ASMFC. The commissioners deliberate policy regarding interstate fisheries management, fisheries science, habitat conservation, and law enforcement. In furtherance of their mission, the states work closely with their federal partners, including us. Through this forum, the states collaborate to ensure the sound management and conservation of shared coastal resources and the associated fishing and non-fishing public benefits. We are an active partner of the ASMFC. Agency representatives participate on several ASMFC committees and boards, including the Sturgeon Technical Committee and Management Board, Shad and River Herring Technical Committee and Management Board, Fish Passage Working Group, Assessment Science Committee, and Habitat Committee.

Management authority for American shad, blueback herring, alewife, and American eel lies with the coastal states and the Services, and is coordinated through the ASMFC. The ASMFC developed Interstate Fishery Management Plans (FMP) for these species under the authority of the Atlantic Coastal Fisheries Cooperative Management Act. There is an FMP for Atlantic sturgeon; Amendment I of the FMP prohibits any directed fishery or landings. Each FMP recognizes the depletion of stocks from overfishing, habitat loss (including the presence of dams), inconsistent management actions, and lack of data.

The goals and objectives of the ASMFC fishery management plans addressed here are consistent with our agency’s objectives for restoring runs of American shad, blueback herring, alewives, and American eel to historical habitat within the Androscoggin River watershed. Implementing fish passage protection measures at the Pejepscot Project is a critical step toward achieving our restoration goals.

The stated goal of the ASMFC American shad FMP is to “Protect, enhance, and restore Atlantic coast migratory stocks and critical habitat of American shad in order to achieve levels of spawning stock biomass that are sustainable, can produce a harvestable surplus, and are robust enough to withstand unforeseen threats.” (ASMFC, 2010). Objectives for attaining this goal include:

* Maximize the number of juvenile recruits emigrating from freshwater stock complexes.
* Restore and maintain spawning stock biomass and age structure to achieve maximum juvenile recruitment.

The stated goal of the ASMFC river herring FMP is to “Protect, enhance, and restore East Coast migratory spawning stocks of … alewife (*Alosa pseudoharengus*), and blueback herring (*A. aestivalis*) in order to achieve stock restoration and maintain sustainable levels of spawning stock biomass” (ASMFC, 2009). Objectives for attaining this goal include:

* Prevent further declines in alewife and blueback herring abundance.
* Promote improvements in degraded or historical alosine critical habitat throughout the species’ range.

The stated goal of the ASMFC American eel FMP is to “ Conserve and protect the American eel resource to ensure its continued role in the ecosystems while providing the opportunity for its commercial, recreational, scientific, and educational use” (ASMFC, 1999). Specifically, the FMP aims to:

* Maximize the number of juvenile recruits emigrating from freshwater stock complexes.
* Restore and maintain spawning stock biomass and age structure to achieve maximum juvenile recruitment.

## State of Maine

The State of Maine’s Department of Marine Resources (MDMR), Division of Sea-Run Fisheries and Habitat mission is to “protect, conserve, restore, manage and enhance diadromous fish populations and their habitat in all waters of the State; to secure a sustainable recreational fishery for diadromous species; and to conduct and coordinate projects involving research, planning, management, restoration or propagation of diadromous fishes.” MDMR has identified the following sea-run fish species of most management concern: Atlantic salmon, American shad, alewife, blueback herring, American eel, shortnose sturgeon, Atlantic sturgeon, rainbow smelt, sea lamprey, sea-run brook trout, and striped bass.  Several of these sea-run fish currently use the habitat within the Pejepscot Project area, including Atlantic salmon, alewife, American shad, and American eel.

Maine’s fishery management in the Androscoggin River is guided in part by the *Draft Fisheries Management Plan for the Lower Androscoggin River, Little Androscoggin River, and Sabattus*  (MDMR & MDIFW, 2017)The goal of that plan is to protect, conserve, and enhance the fisheries resources of the Androscoggin River for their intrinsic, ecological, economic, recreational, scientific, and educational values and for use by the public. Management goals for the Androscoggin River from Brunswick Dam to Lewiston Falls, which includes the Pejepscot Project, include:

* Manage the river reach as a migratory pathway for alewife, American shad, blueback herring, Atlantic salmon, American eel, striped bass, and sea lamprey and for sustained production of adult anadromous species.
* Manage species in accordance with the ASFMC’s Interstate Fisheries Management Plan for American shad, and river herring, and American eels, and Species Protection Plans (SPPs) for Atlantic salmon.
* Provide recreational opportunities for anadromous and freshwater sport fisheries.

# Species and Habitat Specific Goals and Objectives

The following discussion outlines our goals and objectives for diadromous species restoration in the Androscoggin River watershed.

## Alewife and Blueback Herring

Alewife and blueback herring are iteroparous, diadromous species occurring in waters of the eastern United States. Alewife and blueback herring inhabit a smaller range of the Androscoggin River Watershed impeded by dams and stream crossings, though both species continue to use the watershed. The Androscoggin River estuary currently has blueback herring and alewife runs and supports some blueback herring spawning grounds. The main channel of the Androscoggin River is primarily a migratory corridor with limited spawning grounds for alewife. On the mainstem Androscoggin River, blueback herring are limited to upstream migration by Lewiston Falls (MDMR and MDIFW, 2017). Our management goal is to maximize production of river herring in the Androscoggin River by providing access to historical spawning and rearing habitat in the watershed through safe, timely, and effective passage at barriers. We anticipate the Androscoggin River will produce approximately one million blueback herring and exceed 700,000 adult alewife annually once habitat in the Little Androscoggin and Sabattus drainages are accessible (NOAA, 2020).

## American Shad

American shad are an iteroparous, diadromous species occurring in waters of the eastern United States. There are over 62 river miles of potential American shad habitat in the Androscoggin River, but only 30 miles are currently accessible to shad, due to dam construction (MDMR, 2014). Our management goal is to maximize production of American shad in the Androscoggin River by providing access to spawning and rearing habitat in the watershed. We anticipate the Androscoggin River will produce over 125,000 returning American shad per year once spawning habitat in the Little Androscoggin and Sabattus drainages are accessible (NOAA, 2020).

## Atlantic Salmon

Atlantic salmon are a diadromous species occurring in waters of the northeast United States; the GOM DPS is listed as endangered under the ESA and is the only remaining population in the U.S. Our goal for the GOM DPS of Atlantic salmon is to recover the species by increasing their abundance, genetic diversity, and distribution and to eventually remove the species from the list of endangered species (USFWS & NMFS, 2019a). Our management objective for this relicensing is to eliminate, or minimize to the extent practicable, the effects of the Pejepscot Project on the GOM DPS of Atlantic salmon and its critical habitat. Restoring endangered Atlantic salmon to the point where it is a secure, self-sustaining member of its ecosystem is a primary goal of our endangered species program (USFWS & NMFS, 2019a).

The GOM DPS consists of three Salmon Habitat Recovery Units (SHRUs): Merrymeeting Bay, Penobscot Bay, and Downeast Coastal. The Androscoggin River is within the Merrymeeting Bay SHRU. Each SHRU must achieve specific recovery criteria for the downlisting or delisting of the GOM DPS (USFWS & NMFS, 2019a). The draft SHRU Specific Implementation Strategy (USFWS & NMFS, 2019b) for the Recovery Plan indicates that the Merrymeeting Bay SHRU is important to salmon recovery for the following reasons:

* The Merrymeeting Bay SHRU contains a wide range of diverse habitats that are necessary for supporting an abundant, diverse, and resilient population of Atlantic salmon.
* The Sheepscot River in the Merrymeeting Bay SHRU contains the southernmost locally adapted stock of Atlantic salmon.
* The Merrymeeting Bay SHRU has tremendous capacity for river herring production that likely conveys many ecological benefits to Atlantic salmon (Saunders, Hachey, & Fay, 2006).

*Critical Habitat*

Critical habitat is the specific areas within the geographic area occupied by the species at the time it was listed, which contain the physical or biological features that are essential to the conservation of endangered and threatened species and that may need special management or protection. The final rule designating critical habitat for the GOM DPS identified physical and biological features (PBFs) essential for the conservation of Atlantic salmon (74 FR 29300; June 19, 2009) (Table 1).

**Table 1.** Physical and Biological Features of Atlantic salmon Critical Habitat.

|  |  |
| --- | --- |
| **PBFs for Spawning and Rearing (S&R) Habitat** | |
| ***S&R 1*** | Deep, oxygenated pools and cover (*e.g.*, boulders, woody debris, vegetation, etc.), near freshwater spawning sites, necessary to support adult migrants during the summer while they await spawning in the fall. |
| ***S&R 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. |
| ***S&R 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. |
| ***S&R 4*** | Freshwater rearing sites with space to accommodate growth and survival of Atlantic salmon parr. |
| ***S&R 5*** | Freshwater rearing sites with a combination of river, stream, and lake habitats that accommodate parr's ability to occupy many niches and maximize parr production. |
| ***S&R 6*** | Freshwater rearing sites with cool, oxygenated water to support growth and survival of Atlantic salmon parr. |
| ***S&R 7*** | Freshwater rearing sites with diverse food resources to support growth and survival of Atlantic salmon parr. |
| **PBFs for Migration (M) Habitat** | |
| ***M 1*** | Freshwater and estuary migratory sites free from physical and biological barriers that delay or prevent access of adult salmon seeking spawning grounds needed to support recovered populations. |
| ***M 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, and vegetation) to serve as temporary holding and resting areas during upstream migration of adult salmon. |
| ***M 3*** | Freshwater and estuary migration sites with abundant, diverse native fish communities to serve as a protective buffer against predation. |
| ***M 4*** | Freshwater and estuary migration sites free from physical and biological barriers that delay or prevent emigration of smolts to the marine environment. |
| ***M 5*** | Freshwater and estuary migration sites with sufficiently cool water temperatures and water flows that coincide with diurnal cues to stimulate smolt migration. |
| ***M 6*** | Freshwater migration sites with water chemistry needed to support sea water adaptation of smolts. |

Habitat areas designated as critical habitat must contain one or more physical and biological features within the acceptable range of values required to support the biological processes for which Atlantic salmon use that habitat. Both the proper functioning of ecosystem processes and the diversity and abundance of coevolved diadromous species are habitat elements that are essential to the persistence and recovery of endangered Atlantic salmon. The entirety of the Pejepscot Project area is designated as critical habitat for Atlantic salmon.

## Sea Lamprey

Sea lamprey are a semelparous, diadromous species occurring in waters of the eastern United States. Sea lamprey are native to coastal rivers of Maine, including the Androscoggin River. There exists scant historical abundance and distribution regarding sea lamprey in the Androscoggin River is, but habitat likely extended to Snow Falls in the Little Androscoggin River and to Rumford Falls in the mainstem Androscoggin River. Our management goals and objectives for sea lamprey in the Androscoggin River focus on improving access to historical spawning and nursery habitat throughout the drainage by providing safe, timely, and effective passage at barriers.

## Riparian and Aquatic Habitat

Agency objectives for protecting riparian and aquatic habitats include avoiding, minimizing, and mitigating the direct, indirect, and cumulative effects of the Pejepscot Project on riparian and aquatic habitats and habitat functions. This includes accounting for the Project’s effects on the recruitment and transport of large woody material (LWM). The physical and biological features for designated Atlantic salmon critical habitat include freshwater migration sites with woody debris cover (74 FR 29300, June 19, 2009). The Final Recovery Plan for Atlantic salmon identifies the reduction of habitat complexity associated with the lack of large wood and boulders as a stressor related to the threat of species viability (USFWS & NMFS, 2019a).

# CONSIDERATION OF CLIMATE CHANGE

On January 4, 2016, we issued revised guidance for the treatment of climate change in NMFS Endangered Species Act decisions (NMFS, 2016). The guidance provides seven policy considerations pertaining to: (1) future climate conditions and uncertainty; (Hansen et al.) projecting climate change effects on the future status of species; (3) evaluating the adequacy of existing regulatory mechanisms to reduce greenhouse gas emissions; (4) making critical habitat designations in a changing climate; (U.S.Fish and Wildlife Service) future benefits; (6) responsiveness and effectiveness of management actions in a changing climate; and (7) incorporating climate change in project designs. Measures within this prescription are intended to mitigate the potential impacts of climate change for critically endangered Atlantic salmon and the full suite of diadromous fish by ensuring safe and timely access to climate resilient habitat upstream of the Project.

## Climate Change Effects to Habitat for diadromous Species

Alterations in stream temperatures, volume, velocity, and other abiotic characteristics affected by climate change and the presence of dams can influence larval and juvenile fish development, as well as the ecology and biota of the river (Hare et al., 2016; Spence, Lomnicky, Hughes, & Novitzki, 1996). The slowing of free-flowing water by dams can exacerbate the effects of climate change by altering streamflow temperature via increased water residence times (e.g., reduced flow velocity) and decreased daily temperature fluctuations (Bergkamp, McCartney, Dugan, McNeely, & Acreman, 2000; Hare et al., 2016). The distribution, abundance and composition of many benthic invertebrate and fish communities are determined by water velocity. Fluctuating water levels may delay migration, impact spawning conditions, and reduce or expose spawning and rearing habitat (Beiningen, 1976). Lower water levels may also concentrate fish and increase predation and competition among species (Spence et al., 1996). Any forage species that are temperature dependent may also shift in distribution as water temperatures warm.

Since fish maintain a body temperature almost identical to their surroundings, thermal changes of a few degrees Celsius can critically affect biological functions in salmonids (USFWS & NMFS, 2005). While some fish populations may benefit from an increase in river temperature for greater growth opportunity, there is an optimal temperature range and a limit for growth after which salmonids will stop feeding due to thermal stress (USFWS & NMFS, 2005). Thermally stressed fish may also become more susceptible to mortality from disease (Clews, Durance, Vaughan, & Ormerod, 2010).

Atlantic salmon are among the two most vulnerable species to climate change in the Northeast U.S. Continental Shelf (Hare et al., 2016). This is due to factors including habitat specialization, dependence on both freshwater and marine resources, sensitivity to water temperatures, and complex spawning cycles (Hare et al., 2016). American shad, blueback herring, and alewife were identified in the same report as highly vulnerable to the anticipated effects of climate change.

Atlantic salmon are cold-water fish and have a thermal tolerance zone where activity and growth is optimal (DeCola, 1970). Temperature can be a stimulant for salmon migration, spawning, and feeding (Elson, 1969). Temperature can also significantly influence egg incubation success or failure, food requirements and digestive rates, growth and development rates, vulnerability to disease and predation, and may be responsible for direct mortality (Spence et al., 1996; Whalen, Parrish, & McCormick, 1999). When temperatures exceed 23o C, adult Atlantic salmon can cease upstream movements, seeking refuge in cooler water (Baum, 1997). Salmon mortalities have been associated with daily average temperatures of 26 to 27o C (Baum, 1997). Thus, increasing sea and river temperatures could have a significant impact on sea-run fish abundance, reproduction, and distribution in the Androscoggin River watershed.

Atlantic salmon may be especially vulnerable to the effects of climate change in New England, since the areas surrounding many river catchments where salmon are found are heavily populated and have already been affected by a range of stresses associated with agriculture, industrialization, and urbanization (Elliott, Coe, Helfield, & Naiman, 1998). Climate effects related to temperature regimes and flow conditions determine juvenile salmon growth and habitat (Friedland, 1998). One study conducted in the Connecticut and Penobscot Rivers, where temperatures and average discharge rates have been increasing over the last 25 years, found that dates of first capture and median capture dates for Atlantic salmon have shifted earlier by about 0.5 days per year (Juanes, Gephard, & Beland, 2004). These consistent shifts correlate with long-term changes in temperature and flow (Juanes et al., 2004). Temperature increases are also expected to reduce the abundance of salmon returning to home waters, particularly near the southern edge of the geographic range (Beaugrand & Reid, 2003).

## Potential Effects of Climate Change in the Project Area

The global mean temperature has risen 0.85°C from 1880 to 2012; the linear trend over the last 50 years is nearly twice that for the last 100 years (IPCC, 2007, 2014). Precipitation has increased nationally by 5 centimeters (cm), associated with an increased frequency of heavy downpours (Melillo, Richmond, & Yohe, 2014). Observed changes in marine systems thought to be associated with global climate change; these changes include ocean acidification, decreased productivity, altered food web dynamics, shifting species distributions, among others (Hoegh-Guldberg & Bruno, 2010).

The Intergovernmental Panel on Climate Change (IPCC) models predict that Maine’s annual temperature will increase another 1.7–2.8 °C by 2050 (Fernandez et al., 2015)[[2]](#footnote-2). The IPCC models also predict that precipitation will continue to increase across the Northeast U.S. by 5–10 percent by 2050, although the distribution of this increase is likely to vary across the climate zones (Fernandez et al., 2015); model predictions show greater increases in precipitation within interior Maine. Total accumulated snow is predicted to decline in Maine especially along the coast where total winter snow loss could exceed 40 percent relative to recent climate (Fernandez et al., 2015). Since 2004, the rate of increase in sea surface temperature in the Gulf of Maine has accelerated to 0.23 °C per year; a rate faster than 99 percent of the world’s oceans (Fernandez et al., 2015).

Beyond the general information on model predictions for the Northeast U.S. and the State of Maine, fine scale predictions on how climate change will impact the Pejepscot Project area is not available. As there is significant uncertainty in the rate and timing of change as well as the effect of any changes experienced in the project area due to climate change, it is difficult to predict the impact of these changes on any particular species. However, based on the IPCC model information for Maine, it is possible that changing seasonal temperature regimes could result in changes to the timing of seasonal migrations for all diadromous fish in the Androscoggin River watershed. Ensuring access to a diversity of suitable habitat, including climate resilient habitats, is essential for the continued survival and recovery potential of diadromous species. Safe, timely, and effective passage at the Pejepscot Project, and ultimately passage at each barrier to migration, will support our restoration goals by promoting access to a greater expanse and diversity of spawning, rearing and nursery habitat that is expected to support population resiliency in light of changing conditions.

# CONSIDERATION OF DAM REMOVAL

Throughout this document, and in ample filings contained in the licensing administrative record, we describe our thorough consideration of the factors related to the Project's effects on fisheries, and the need for fish passage. Within this relicensing process, we consider decommissioning and subsequent removal as a reasonable alternative that the Commission must analyze. Dam removal has well defined benefits for fish passage, water quality, and habitat restoration in support of ecological functions and values, commercial and recreational fisheries, and sustainable coastal communities. Without man-made barriers to impede essential fish movements, all fish may move freely and naturally, according to their life history adaptations for fulfilling their biological requirements.

*Background on diadromous fishes in the watershed--* Diadromous species, including American shad, blueback herring, alewife, Atlantic salmon, and American eel, were abundant in the Androscoggin River before dam construction began. With construction of a low-head dam in 1807 at the Androscoggin River head-of-tide, diadromous species began to decline. Atlantic salmon could pass over the low-head dam and continue upstream. Construction of higher dams caused the complete extirpation of Atlantic salmon above tidal waters in 1844 (NOAA, 2020).

Both our Androscoggin River Watershed Comprehensive Plan as well as the state of Maine’s Draft Fisheries Management Plan for the Androscoggin River clearly identifies the lack of safe, timely, and effective passage at dams as a significant detriment to the diadromous fishery (MDMR & MDIFW, 2017). The Final Recovery Plan for Atlantic salmon identifies dams and their related effects as a significant threat to species viability (USFWS & NMFS, 2019a). The Atlantic salmon critical habitat designation defines freshwater and estuary migration sites free from physical and biological barriers that delay or prevent emigration of smolts to the marine environment as a physical and biological feature of critical habitat (74 FR 29300, June 19, 2009). Spawning and rearing habitat exists upstream of the Pejepscot Dam. Existing dams, including the Pejepscot Dam, prevent or inhibit access to historically productive habitat.

Dam removal would address the following ecosystem functions and values:

*Loss of migration, spawning, rearing and nursery habitat* –The Pejepscot Dam impedes passage of diadromous species. The dam limits the ability of these fish to fully realize the potential productivity in the watershed. Dam removal would contribute to mitigation of cumulative effects (e.g., delay, passage inefficiencies, downstream mortality, and increased predation) of multiple barriers in the watershed; whereas, modification of the Project to improve fish passage efficacy would maintain these negative effects to some degree. Fish passage measures do not fully mitigate hydroelectric project effects (FERC 2004; Accession #20041008-0140). Dam removal would be a key step in the comprehensive planning efforts by us, the USFWS, the State of Maine, and other stakeholders for restoring diadromous fish.

*Ecosystem and societal functions* – Diadromous fish support key ecological functions as a mechanism for nutrient transport, prey for commercially and recreationally important fish, and baitfish for the lobster industry. We expect modifications or removal of all dams in the Lower Androscoggin River to generate substantial commercial and recreational fishing benefits, ranging from $5.8 to $14.8 million (NOAA, 2020). Dam removal will support restoration of these key species in support of these ecological and social functions and values.

*Habitat loss due to impoundment effects* – Dams inundate lotic habitat that alters ecosystem structure and function (Poff et al., 1997). The Pejepscot Dam impounds approximately 225 acres of lotic habitat that under a natural condition would be higher gradient river habitat that is more suitable for salmonids and other diadromous species. Considering the number of impoundments in the Androscoggin River watershed, transforming the degraded river reach back into high quality habitat would alleviate some of the cumulative effects of multiple dams; thereby, rebalancing the public benefits of energy production within the basin and fisheries production.

# FACTUAL BACKGROUND

## Project Specifics

The following description is from the Final License Application for the Pejepscot Project (Accession #20200131-5356).

### Project Description and Proposed Measures

The Pejepscot Project is located at river mile 14 and is the second dam on the mainstem of the Androscoggin River, located approximately 4 miles upstream of the Brunswick Hydroelectric Project and 3.25 miles downstream of the Worumbo Hydroelectric Project. The Pejepscot Project includes a 225-acre impoundment, a 560-foot long dam with a height of 47.5 feet, and a rock- and gravel-filled, timber-crib, overflow structure with a sheet-pile cutoff to bedrock along the upstream side.

Spillway capacity is provided by operating the gates on the crest of the dam. The crest is equipped with five, 96-foot-long by 3-foot-high, hydraulically operated, bascule gates separated by concrete piers. The bascule gates are constructed of steel, and can be operated automatically by the PLC or manually to maintain pond levels. In either mode, the gates can be adjusted to any level between 0-100 percent. The Project has a spillway discharge capacity of 95,000 cubic feet per second (cfs). Overtopping of the dam does not occur until the headwater reaches elevation (El.) 81 feet (ft.), at which point the spillway discharge is approximately 110,000 cfs.

The Project includes two powerhouses—an original power house constructed in 1898 and a newer powerhouse that was constructed from 1985 to 1987. The original powerhouse contains three rehabilitated horizontal Francis units (identified as Nos. 21, 22, and 23) with a combined output capacity of about 1.58-MW. Each unit has four 36-inch Francis runners attached to a single turbine shaft, each with a rotational speed of 180 revolutions per minute (rpm). The maximum flow through each turbine is 350 cfs. These units do not have the ability to selectively operate with fewer than four turbine runners. However, one of the Francis units was damaged several years ago and the turbine shaft was cut so that only two runners on that particular unit are now in operation. Wicket gates are used to adjust the flow settings of the units. The newer powerhouse contains vertical-shaft, low speed, adjustable-blade, propeller type (Kaplan) turbine-generator unit (identified as Unit No. 1) rated at 12.3-MW, with one runner containing four blades and 18 ft. in diameter; it rotates at 81.8 rpm. The minimum and maximum flow through the turbine is 1,170 and 7,550 cfs, respectively. The rated head of the unit is 24 ft. Wicket gates are used to adjust the flow settings of the unit.

The Project has two separate intake structures, the old powerhouse intake and the new powerhouse intake, both of which are integral with the powerhouses. The old powerhouse intake is constructed of concrete, and has 1.5-inch clear spacing on the trashrack. The trashracks have a top elevation of 69.7 ft. and extend down to an elevation of 43.3 ft. The racks are approximately 71.4 ft. wide. The new powerhouse intake is constructed of concrete and has 1.5-inch clear spacing at the top of the trashrack and 2.5-inch clear spacing at the bottom. The bar racks have a top elevation of 61.35 ft. and extend down to an elevation of 36.0 ft. The racks are approximately 91.6 ft. wide. The 1.5-inch clear spacing extends from elevation 61.35 ft. to elevation 55.1 ft. (total of 6.25 ft.). The remaining portion of the bar rack from elevation 55.1 ft. down to elevation 36.0 ft. (total of 19.1 ft.) has clear spacing of 2.5-inches.

### Project Operations

The Pejepscot Hydroelectric Project (Project) operates as a run-of-river facility, and the impoundment experiences little fluctuation during normal operations, wherein Unit 1 is operated on a pond level control, maintaining a normal full pond elevation of 67.2 feet U.S. Geological Survey (USGS) datum during normal operations. When Unit 1 nears its maximum flow capacity of 7,550 cubic feet per second (cfs), one or more of the three small units (Units 21, 22 and 23) is manually started. The small units are mainly operated during high spring runoff and after large storm events that increase river flow.

Inflows in excess of the hydraulic capacity of the units are passed at the dam spillway. Inflows to the Project exceed the maximum capacity of the units approximately 25 percent of the time, on average. When the pond level reaches El. 69.0 (1.5 ft. above the spill gates), the gates begin to lower starting with Gate 1, closest to the powerhouse. The gates operate on pond level control and as flow increases, they maintain the pond level of El. 69.0 until all five gates are open. When the flow starts decreasing and the pond level drops to El. 68.0 the gates start to close to maintain a level above El. 68.0. When all five gates are closed, the pond is again on turbine pond level control until the pond level exceeds El. 69.0.

The Project is required to release a continuous minimum flow of 1,710 cfs, as measured immediately downstream from the Project powerhouse, or inflow to the impoundment, whichever is less, minus process water (approximately 5 million gallons per day (MGD) or 9.3 cfs) and 100 cfs for pond level control.

### Project Fishways

*Existing Upstream Passage*

The upstream fish passage facility is a vertical lift (elevator) that lifts migratory fish in a hopper about 30 feet vertically from near the powerhouse tailrace to the impoundment level. The fish lift is designed to pass 85,000 American shad and 1,000,000 river herring annually. The hopper is constructed of steel and is approximately 20 feet long and 7 feet wide with a sloping bottom that assists in removal of the fish from the hopper. The hopper has a capacity of approximately 1,000 gallons. The inlet to the hopper is a V-trap about 8 inches wide by 8 feet high. In front of the entry gate there are four attraction pumps under a grating that create an additional flow up to 160 cfs through the entry channel to attract the fish to the lift. These pumps can be sequenced to change the volume of water passing through the entry channel, depending on the flow out of the powerhouse tailrace. The hopper discharges the fish into a metal flume about 6 feet wide and 8 feet high. The flume is approximately 110 feet long from the lift hopper to the gate at the dam. Along the flume is a viewing window to observe the fish along with a crowding panel that moves the fish closer to the window for viewing. There is a continuous flow of about 30 cfs from the impoundment to the hopper to attract the fish to the impoundment.

The upstream fish passage is operated annually from April 15 to November 15. The lift is operated automatically, except under high water conditions when it is operated manually, to lift the fish hopper every two hours beginning at 8 a.m. for a total of five lifts per day. The four attraction pumps are set by the station operator; the number of pumps operating is determined based on the flow coming through the turbine and out the tailrace. When river flows are less than

1,700 cfs, one pump is operated (total attraction flow 70 cfs). When river flows are between

1,700 and 3,500 cfs, two pumps are operated (total attraction flow 110 cfs). When river flows are between 3,500 and 5,200 cfs, three pumps are operated (total attraction flow 150 cfs). Finally, when river flows are greater than 5,200 cfs, four pumps are operated (total attraction flow 190 cfs). The total of 190 cfs (attraction flow from four pumps (160 cfs) plus an additional 30 cfs provided from the impoundment via the exit trough) represents approximately 2.2% of the

Project maximum turbine discharge capacity (8,600 cfs). When river flows are 15,000 cfs (impoundment El. of approximately 69.5-70.0 ft.) or higher, the fishway is shut down.

A preset weir in the channel provides an attraction flow through the flume and hopper. The flume from the hopper to the impoundment is opened when the seasonal operation is started for passage of diadromous fish. The gates in the channel that allow fish to be counted through the observation window are left open unless they are being used for counting. Fish within the lift are not routinely counted and, historically, the counting facilities have only been used for efficiency tests of the lift.

*Existing Downstream Passage*

The downstream fish passage facilities consist of two steel entry weirs, one on either side of the

Unit 1 turbine intake. Each entry weir has an invert elevation of 65.5 ft. From each weir, an outlet pipe conveys downstream migrating fish in water down to the tailwater. The weir gates are 4 feet wide and are part of an inlet box with the outlet pipe located on the side opposite the weir. The left-side (northerly) weir has a 30-inch diameter steel transport pipe that is approximately 185 feet long. The right-side (southerly) weir has a 24-inch diameter steel transport pipe that is approximately 60 feet long. Both pipes have a free discharge to the water below the dam. Each downstream bypass can pass approximately 13 cfs, 29 cfs, and 87 cfs at headpond elevations of 66.5 ft. (low), 67.2 ft. (normal), and 69.0 ft. (high), respectively. This assumes that the entrance gate at each downstream bypass is in the fully opened position. The clear spacing of the grizzly racks at the entrance to the downstream bypasses is approximately 7 inches. There is one horizontal steel member on the grizzly racks at an approximately elevation of 67.3 ft.

### Applicant Proposed Measures

*Proposed Upstream Fishways*

Topsham Hydro proposes the following measures related to upstream fish passage:

* Operate the existing fish lift on the following lift cycle frequency beginning in the first full passage season after the effective date of the new license:
  + April 15 to May 15 and following passage of the first fish at the downstream Brunswick Project, the lift will be operated once every two hours.
  + May 16 through June 15, the lift will be operated once every hour.
  + June 16 through July 1, the lift will be operated every 2 hours.
  + July 2 through November 15, the lift will be operated once a day following passage of salmon at Brunswick if not already identified passing though Pejepscot.
* Develop a plan and schedule, in consultation with resource agencies, containing potential physical and/or operational modifications to be constructed/implemented no later than Year 3 of the new license, to address factors (i.e., internal and external attraction flow hydraulics and acoustics) that may be impacting upstream passage of migratory fish species.
  + In conjunction with this proposal, the Licensee proposes to conduct one season of fish lift efficiency testing for adult river herring during the fourth full passage season after the effective date of the new license.
* Continue video camera monitoring of Atlantic salmon utilizing the Pejepscot fish lift
* Conduct an upstream passage effectiveness study of adult Atlantic salmon when at least 40 adult Atlantic salmon of Androscoggin River origin are counted at the Brunswick fishway for two consecutive years.
* Install and operate a temporary American eel ramp after the first passage season after license issuance and for three passage seasons to identify a suitable location for a permanent upstream facility.
  + After siting is complete, as described above, the Licensee proposes to install and operate a permanent American eel ramp.

*Proposed Downstream Fishways*

Topsham Hydro proposes the following measures related to downstream passage:

* Discontinue the north (left bank) downstream fish bypass beginning in the second full passage season after the effective date of the new license; continue operation of south (right bank) downstream fish bypass.
* Install and operate a fish guidance system/debris boom to direct downstream migrants to a new bypass within bascule gate no. 1 (closest to the powerhouse) beginning in the second full passage season after the effective date of the new license.
* Open bascule gate no. 1 50% to provide approximately 500 cfs of spill at night (2000 – 0700 hours) during the month of May.
* Conduct one season of efficiency testing for juvenile alosines once the proposed downstream fish guidance system is installed and the modifications to bascule gate no. 1 have been completed.
* Conduct one season of efficiency testing for Atlantic salmon smolts once the proposed downstream fish guidance system/debris boom is installed and the modifications to bascule gate no. 1 have been completed.
* Reduce the operational setting for Unit 1 (unit turndown) to approximately 3,480 cfs (resulting in intake approach velocities of less than 1.5 fps) for eight hours during the night (8:00 pm to 4:00 am) between September 1 and October 31 annually to enhance downstream eel passage.

*Other Proposed Measures*

* Topsham Hydro will develop, in consultation with stakeholders, a mitigation measure to address the potential for stranding in pools below bascule gate no. 5. The measure will generally consist of Operations staff visually inspected these pools following spill events and as necessary taking remediation action should stranded fish be identified.
* Topsham Hydro proposes a trash boom, to be installed as part of the proposed downstream fish guidance system, to facilitate the sluicing of a greater proportion of this debris downstream past the Project.

## Androscoggin River Watershed

The Androscoggin River is Maine’s third largest river and drains 3,530 square miles. The majority (80 percent) of the drainage is located within Maine, while the remainder is in New Hampshire. The Androscoggin River runs 178 miles from the Magalloway River at Umbagog Lake to the Kennebec River at Merrymeeting Bay, which extends another 20 miles before reaching the Gulf of Maine. The Androscoggin River drops more than 1,500 feet from its origin to tidewater. There are three major tributaries in the lower Androscoggin watershed: the Little Androscoggin River, the Sabattus River, and the Little River. Numerous lakes and ponds within the Sabattus and Little Androscoggin drainage provide abundant spawning habitat for alewife, rearing habitat for juvenile alewife and eels, and growth habitat for adult eel. Within the Sabattus drainage, 2,168 acres of potential spawning habitat exist, while 7,357 acres are present within the Little Androscoggin drainage (NOAA, 2020). Additionally, dam impoundments along the Androscoggin and Little Androscoggin rivers provide lentic habitat for diadromous fishes (NOAA, 2020).

## Fish Resources – Historical

Diadromous species, including American shad, blueback herring, alewife, Atlantic salmon, and American eel, were abundant in the Androscoggin River before dam construction began. American shad, blueback herring, and alewife are collectively referred to as alosine, which refers to their subfamily name Alosinae. With construction of a low-head dam in 1807 at the Androscoggin River head-of-tide, diadromous species began to decline. Atlantic salmon could pass over the low-head dam and continue upstream. Construction of higher dams caused the complete extinction of Atlantic salmon above tidal waters in 1844 (MDMR and MDIFW 2017). Severe water pollution virtually eliminated the remaining populations of migratory species in the tidal portion of the river. Alewife and American shad that continued to reproduce in the 6-mile stretch of river below Brunswick supported significant commercial fisheries until the 1920s. By the early 1930s, severe water pollution from upstream industries and municipalities had caused the decline of these commercial fisheries. With the passage of the 1972 Water Quality Act, subsequent improvements were made to the river’s water quality in the 1970’s (McFarlane 2012). These efforts combined with active fisheries management by MDMR (including an anadromous fish restoration program and stocking of species into historical habitat), have allowed for the existence of recreational fisheries for American shad and striped bass in the Androscoggin River estuary.

## Fish Resources – Present Day

The present day abundance of diadromous species is a small percentage of historical abundance. However, restoration efforts during the past 40 years associated with regulated water quality standards, installation of fish passage facilities, and dam removals on the mainstem and tributaries have resulted in an improvement in these conditions. With the passing of the Clean Water Act, water quality conditions in the Androscoggin River improved substantially such that aquatic connectivity, rather than water quality, remains the largest obstacle to a restored diadromous fishery (MDMR and MDIFW 2017). Following installation of fish passage facilities in the 1970s and 1980s, the state of Maine began actively stocking alewife and blueback herring (collectively “river herring”) into spawning habitat throughout the watershed. Annual stocking of river herring by the state continues today. While these initial efforts to restore the diadromous fishery have realized some progress, much work remains to restore each species to areas in the watershed where they were historically abundant.

### American Shad

Coast-wide landings of American shad decreased dramatically from the early 1900s, when approximately 50 million pounds were being landed annually, to the 1980s when only 3.8 million pounds were being landed annually (ASMFC, 2010). In response to these dramatic declines in commercial landings, the ASMFC issued a FMP for American shad in 1985 recommending management measures that focused on regulating exploitation and promoting stock restoration efforts that would largely be left up to the discretion of individual states that had regulatory authority over the species (ASMFC, 2010). In 1994, the plan review team and management board determined that the original FMP was insufficient in protecting and restoring the remaining stocks, leading to the adoption of Amendment 1 to the FMP in 1999 (ASMFC, 2010). Amendment 1 established benchmarks that effectively created a ceiling for directed fishing mortality. This action was in effect until the adoption of Amendment 3 in 2010. Amendment 3 incorporates the recommendations of the ASMFC stock assessment (ASMFC, 2007) that accounted for combined human-induced instantaneous mortality (including directed fishing, dam-induced, pollution, and bycatch) and natural mortality to establish benchmark values for total instantaneous mortality. Under Amendment 3, states are required to monitor bycatch of American shad in jurisdictional waters and submit sustainable fisheries management plans for any areas that remain open to commercial or recreational fisheries. Amendment 3 also requires states and jurisdictions to submit a habitat plan regardless of whether their commercial fishery would remain open. The State of Maine produced a plan with Androscoggin River-specific information for American shad, including general threats, data availability, current work and recommended actions (MDMR, 2014).

According to the Maine American Shad Habitat Plan, there are over 62 river miles of potential American shad habitat in the Androscoggin River, but only 30 of these miles are currently accessible by shad, due to dam construction (MDMR, 2014). The primary impediment to restoring American shad distribution in the Androscoggin River Watershed is poor passage at the Brunswick Hydroelectric Project. The Brunswick Project is located at the head-of-tide and includes a vertical slot fishway, initially designed to pass 85,000 American shad annually (MDMR & MDIFW, 2017). Construction of the fishway was complete in 1983 and was one of the first vertical slot fishways designed to pass American shad on the east coast. However, when FERC issued the 1979 license for the Brunswick Project, the license did not require passage efficiency studies to achieve performance criteria. Since the fishway began operation, the number of American shad passing has been low; cumulatively, only 1,455 fish (as determined through visual observations, underwater video, and radio telemetry studies) passed through the fishway from 1985 to 2017. Most shad entering the fishway rarely pass beyond the corner pool (MDMR 2014). This number is incredibly low considering the approximately 8,000 adult shad and over 5 million fry stocked into historical spawning habitat above the Brunswick Project and the thousands of fish that swim in the Project tailrace every year (MDMR and MDIFW 2017). The Brunswick Project license expires in 2029, therefore we have a reasonable expectation that improvements to shad passage will be implemented at the Brunswick facility in the near future.

### Alewife and Blueback Herring

Alewife and blueback herring stocks across their range have declined considerably from their historical abundances (ASMFC, 2009). Both species serve as important prey for federally managed groundfish stocks (Ames, 2004). On August 5, 2011, we received a petition from the Natural Resource Defense Council to list alewife and blueback herring as threatened species. On August 12, 2013, we published a determination that listing alewife or blueback herring under the ESA was not warranted. However, we acknowledged that populations of both species are at historically low abundances and committed to revisiting the status of both species within 3 to 5 years (78 FR 48944, August 12, 2013). In March 2017, a D.C. district court vacated the finding on blueback herring under the ESA. On August 15, 2017, the Department of Commerce announced its intent to reinitiate the status review of alewife and blueback herring under the ESA (82 FR 38672, August 15, 2017). On June 19, 2019, we published a new determination that listing alewife or blueback herring under the Endangered Species Act was not warranted (84 FR 28630, June 19, 2019).

Alewife and blueback herring inhabit a smaller range of the Androscoggin River Watershed impeded by dams and stream crossings, though both species continue to use the watershed. The Androscoggin River estuary currently has blueback herring and alewife runs and supports some blueback herring spawning grounds. The main channel of the Androscoggin River is primarily a migratory corridor with limited spawning grounds for alewife. On the mainstem Androscoggin River, blueback herring are limited to upstream migration by Lewiston Falls (MDMR and MDIFW 2017). In recent years, the state has observed blueback herring spawning in the mainstem Androscoggin below the Brunswick Dam. There is no evidence of blueback herring spawning above the Brunswick Dam. Since few blueback herring enter the Brunswick fish ladder, their spawning habitat in the mainstem Androscoggin is considered inaccessible (MDMR and MDIFW 2017). In 2017, MDMR reported 41,923 river herring (mostly alewife) collected in the Brunswick fish trap (MDMR 2018). Fish passage counts occur at the Brunswick and Worumbo Hydroelectric Projects on the mainstem Androscoggin. Passage at Brunswick is highly variable and not meeting the restoration potential for the watershed (NOAA, 2020).

### Atlantic Salmon

Atlantic salmon conservation and restoration efforts have been underway for more than 150 years in Maine following stock depletions resulting from commercial fisheries, pollution, and habitat loss due to impassable dams. The Craig Brook National Fish Hatchery and later the Green Lake National Fish Hatchery established an artificial propagation and fish culture program in Maine. These programs have allowed Atlantic salmon to persist when many of Maine’s rivers were not suitable for salmon survival; they also allowed for maintenance of an economically important recreational fishery through the early 1990s. Today, the conservation hatchery and stocking program are preventing the extinction of the species. Currently there is no allowable fishery for sea-run Atlantic salmon in U.S. waters. In U.S. waters, the commercial fishery for Atlantic salmon closed in 1947 and the last recreational fishery for Atlantic salmon closed in 2008.

Atlantic salmon were initially listed as endangered by USFWS and NMFS under the ESA in 2000. This initial federal listing of Atlantic salmon as endangered (65 FR 69459, November 17, 2000) and original recovery plan put emphasis on making major improvements to the conservation hatchery and stocking programs, as well as expanding habitat conservation efforts (USFWS & NMFS, 2005). Conservation efforts included reducing the negative effects of aquaculture, protecting accessible freshwater habitats by reducing threats from water and land use practices, and identifying and mitigating the effects associated with poor water quality.

In 2009, the GOM DPS was expanded to include Merrymeeting Bay and the entire Penobscot River watershed (74 FR 29344, June 19, 2009). The 2009 listing rule called particular attention to dams and the inadequacy of regulatory mechanisms related to dams as two of the three primary threats to Atlantic salmon that resulted in the designation of the GOM DPS as endangered. Designation of critical habitat for the Gulf of Maine DPS of Atlantic salmon occurred at this time (74 FR 29300, June 19, 2009). Conservation actions in response to this new listing and designation of critical habitat built off previous efforts. The USFWS and NMFS issued a new recovery plan for Atlantic salmon on February 12, 2019 (USFWS & NMFS, 2019a). The recovery plan 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. The recovery approach 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. The recovery plan is based on two premises: first, that recovery must focus on rivers and estuaries located in the GOM DPS until the Services have a better understanding of the threats in the marine environment, and second, that survival of Atlantic salmon in the GOM DPS will be dependent on conservation hatcheries through much of the recovery process. In addition, the scientific foundation for the plan includes conservation biology principles regarding population viability, an understanding of freshwater habitat viability, and threat abatement needs. The recovery plan identifies dams in the GOM DPS as a primary threat to the survival and recovery of Atlantic salmon.

A number of efforts, supported by NMFS, the USFWS, the State of Maine, and hydropower licensees, are underway to improve survival of salmon migrating past hydropower projects, reduce delays during migration, and implement new or improved fish passage. Downstream and upstream fish passage improvement projects and fish passage studies are underway at many hydropower projects within the designated critical habitat for Atlantic salmon.

The abundance of Atlantic salmon in the GOM DPS is critically low. The proportion of fish that are of natural origin is low (10-year average is 12%), but appears stable or increasing (CMS, 2020; USASAC, 2019). The conservation hatchery program has prevented extinction. However, stocking of hatchery eggs, fry, and smolts has not contributed to an increase in the overall abundance of salmon and, to date has not been able to increase the naturally reared component of the GOM DPS. Continued reliance on the conservation hatchery program is expected to prevent extinction in the short term, but recovery of the GOM DPS cannot be accomplished without significant increases in naturally reared salmon. Significant improvements in freshwater and marine survival are necessary to increase the abundance of naturally reared salmon.

The Pejepscot Project is within the GOM DPS for Atlantic salmon and is within designated critical habitat. The Androscoggin River consists of 70,249 historic HUC10 habitat units. An estimated 24% (16,978 units) of these historic habitat units within the Androscoggin River system are considered to be occupied and occur in the lower Androscoggin River drainage (NMFS 2009). Based upon information collected at the downstream Brunswick Project and the upstream Worumbo Project, we know that Atlantic salmon have successfully used the upstream fish lift at the Pejepscot Project. Several tributaries exist between the Brunswick and Pejepscot projects that may contain Atlantic salmon habitat (MDMR, 2010, 2012). A potentially suitable spawning area was identified in the Androscoggin River mainstem downstream of the Pejepscot Project in the vicinity of Simpson Brook. Potential cold water refugia were identified in the vicinity of Simpson Brook downstream of the Pejepscot Project (approximately 0.72 km distant). Dams, such as the Pejepscot Project can kill or injure salmon and also can delay or prevent volitional up- and downstream migration, reducing their fitness.

## Species Life History Summary

The life history of each diadromous species is well documented in the literature. Summaries are included in past fishway prescriptions filed by NMFS (Accession #s 20190424-5024 and 20180628-5102) and remain accurate and relevant. Therefore, we provide the life history information by reference only.

## Project Impacts - Fish Passage

#### Upstream Passage

Dams and hydropower generation facilities on a river adversely affect the behavior, life cycle, and survival of diadromous fish. Historical runs of migratory fish across the northeastern United States were largely eliminated by dams, pollution, and over-fishing (ASMFC, 2009, 2010). Dammed river systems prevent the volitional passage of migrating fish. Diadromous species must negotiate fishways or be manually transported above barriers during upstream migrations to access suitable spawning and rearing habitat to complete their life cycle. Migration delay caused by fishways or trapping facilities can limit spawning success and the number of repeat spawning adults (Castro-Santos & Letcher, 2010).

Topsham Hydro conducted upstream passage effectiveness studies for adult river herring (i.e. alewife and blueback herring) and American shad, as well as a desktop evaluation of upstream passage for Atlantic salmon, as required by FERC’s July 3, 2018, Study Plan Determination (Accession #20180703-3022). The summary of these studies presented below is based upon information contained in Topsham Hydro’s Updated Study Report (Accession #20200710-5191)

*River Herring*

For river herring, overall fish lift effectiveness was calculated to be 19.8% (75% CI = 14.8-24.9%). The nearfield attraction rate, or the probability of an adult river herring moving from the tailrace region into the downstream entrance of the lift was 92.6% (75% CI = 88.5%-95.3%), and the internal efficiency, or the probability of an adult herring moving from the lift entrance to the lift exit was 19.8% (75% CI = 14.8-24.9%). The median duration of time it took for adult herring to successfully pass the Project was 1.6 days. An average of 36% of the cumulative residence duration was spent within the tailrace area immediately downstream of the powerhouse and in proximity to the fish lift. Conversely, an average of 64% of the cumulative residence time was spent within the region downstream of the dam spillway.

*American Shad*

For American shad, overall fish lift effectiveness was calculated to be 0%. Lacking adequate data to inform a Cormack Jolly-Seber (CJS) estimate of nearfield attraction, Topsham Hydro estimated nearfield attraction as the percentage of individuals detected in the nearfield/tailrace region to be subsequently detected at the fish lift entrance (32%). A total of 29 radio-tagged adult shad (22% of all tagged individuals) partially ascended the reach between Pejepscot and the release site but failed to approach the Project. Of those 29 individuals, 26 were determined to have eventually descended downstream to Brunswick and 18 of the 26 were subsequently detected at a monitoring station located 1.2 miles downstream of Brunswick Dam. The total time at large for this group of fish from release until their initial detection at Brunswick Dam was 30.7 hours to 28.3 days (median = 5.8 days). An average of 1% (range = 0 – 5%) of the cumulative residence duration was spent within the tailrace area immediately downstream of the powerhouse and in proximity to the fish lift. Conversely, an average of 99% (range = 95-100%) of the cumulative residence time was spent within the region downstream of the dam spillway.

*Atlantic salmon*

In its qualitative assessment, Topsham Hydro estimated that the Pejepscot lift would have a rate of effectiveness for passing adult salmon between that estimated at the Milford (greater than 95%) and Lockwood hydroelectric projects (79%). In the assessment, Topsham Hydro notes the differences in the frequencies of lift operation at the three facilities. Specifically, lifts at Milford generally occur two times per hour during the passage season (more frequently during periods of high fish passage). In comparison, the Lockwood and Pejepscot lift operations begin later (0700 or 0800 hrs.) and terminate earlier (1900 or 1800 hrs.). In general, 5-8 manually triggered fish lift events occur daily at Lockwood although that number can increase considerably during peak periods of upstream fish passage. Currently, a total of five lifts occur daily at Pejepscot, at a rate of one lift every two hours.

In 2011, MDMR radio tagged 21 adult salmon (12 wild and 9 hatchery raised) when they were trapped at the Brunswick Dam (MDMR 2012). Twenty-nine percent (6 out of 21) of these fish did not continue upstream, but instead proceeded downstream and out of the Androscoggin River soon after they were released, and at least four of the six continued their migration in the Kennebec River. Forty-three percent (9 out of 21) of the tagged fish successfully migrated past the Pejepscot Project, whereas fewer than 10% (2 out of 21) successfully passed all three dams in the lower Androscoggin (MDMR 2012). The remaining 29% (6 out of 21) passed the Brunswick Project but did not migrate any further in the river. The fact that only 10% (2 out of 21) of the tagged adult Atlantic salmon successfully migrated past all three of the lower dams in 2011 may indicate poor passage efficiencies at the Pejepscot and Worumbo Projects, but could also suggest that the salmon are poorly motivated to seek out upstream habitat. Adult salmon typically return to their natal streams to spawn, and therefore are considered highly motivated to reach those streams. With little documented salmon spawning in the lower Androscoggin River, it is reasonable to assume that most salmon that migrate to the Androscoggin are not returning to their natal streams, but rather exhibiting straying behavior (i.e. seeking out spawning areas outside of their natal habitat).

Our 2017 Biological Opinion (Accession #20170830-5113) issued to FERC regarding ongoing effects of the Pejepscot Project, examined the question of expected upstream passage efficacy for Atlantic salmon at the Pejepscot Project. Using information from the 2011 telemetry study conducted by MDMR, we conservatively estimated that the Pejepscot is at least 75% effective at passing prespawn Atlantic salmon (i.e., at least 75% of the Atlantic salmon motivated to move upstream past the Pejepscot Project will successfully do so) (NMFS, 2017).

### Downstream Passage

Adult and juvenile diadromous fish migrating downstream must locate and use bypass facilities, gates, spillways, or turbines to pass a hydroelectric project. Depending on site-specific conditions, downstream passage via these potential routes of egress can result in injury, delay, or mortality (Miracle, Denslow, Kroll, Liu, & Wang, 2009; Pracheil, DeRolph, Schramm, & Bevelhimer, 2016; Stich, Bailey, Holbrook, Kinnison, & Zydlewski, 2015). In addition, downstream migrants may experience impingement on hydraulic structures (e.g., trash racks) causing injury, delay, or mortality (Schilt, 2007).

Topsham Hydro conducted downstream passage studies for adult and juvenile river herring and American shad. Topsham Hydro also conducted downstream passage studies for Atlantic salmon smolts prior to the current relicensing—the most recent study was conducted in the spring of 2018 (Accession #20190326-4046). To our knowledge, there have been no studies carried out, and therefore there is no empirical information regarding the Project’s effects on downstream migrating adult Atlantic salmon.

Overall, the study results are consistent with our understanding of passage route survival for migratory fish as documented at many other hydro projects in the GOM DPS. That is, fish that pass via spill and through downstream fishways survive at a higher rate and in better condition than smolts that pass through turbines.

*Adult River Herring*

Whole-station downstream survival for adult river herring was estimated to be 88%. When specific passage routes for adult river herring at Pejepscot are considered, 100% (10 of 10), 85% (22 of 26), and 88% (42 of 48) of individuals respectively passing the dam via the downstream bypass, spill, and Unit 1 were determined to have survived to the first receiver below the Project. The median duration of time for adult herring to approach Pejepscot following release into the Project impoundment was 6.4 days (range = 3.5 hours to 21.2 days).

The majority of individuals passed downstream of the dam via Unit 1 (51%) or during periods of spill flow at the bascule gates (27%). Usage of the downstream bypass system was observed for 10 individuals and all entries into that system were identified to the left gate (looking downstream). A total of eight radio-tagged herring approached the dam but did not pass.

When the downstream transit durations for all radio-tagged river herring which passed Pejepscot and reached Brunswick Dam are considered, 94% transited the 4.5 mile reach in less than 36 hours.

*Adult American Shad*

Whole-station downstream survival for adult American shad was estimated at 82%. When specific passage routes for adult shad at Pejepscot are considered, 33% (1 of 3), 89% (8 of 9), and 82% (9 of 11) of individuals passing the dam via the downstream bypass, spill, and Unit 1 respectively, were determined to have reached the first receiver below the Project. Radio-tagged adult shad which approached Pejepscot but failed to pass downstream (n = 12) accounted for more losses within the Project reach than did mortality during dam passage.

The majority of adult shad (34%) failed to pass downstream of the Project following their initial detection at the dam. Approximately 9% of outmigrating shad used the downstream bypass. All instances of downstream passage by adult shad via spill (26% of all passage events) occurred during a narrow window from approximately 2300 on July 17 to 1000 on July 18 when Unit 1 went offline and spill flows were present at the bascule gates. Nearly a third of radio-tagged adult shad passing downstream at Pejepscot did so via Unit 1.

Project residence time prior to downstream passage ranged between 2.7 hours and 10.4 days (median = 127.9 hours; mean = 107.9 hours). However, of the radio-tagged adult shad which approached Pejepscot Dam, only 9% passed in fewer than 24 hours after initial detection and 26% in fewer than two days after initial detection. The majority of radio-tagged adult shad were resident upstream of Pejepscot for greater than 96 hours following their initial detection.

*Juvenile Alosines*

Downstream bypass effectiveness for juvenile alosines was estimated at 31% with a nearly even split in entry locations (i.e., entrances adjacent to the Unit 1 intake area to the left or right).

Topsham Hydro did not perform any quantitative studies of downstream survival for juvenile alosines, but instead produced a qualitative analysis indicating that turbine survival was expected to be high through Unit 1 (i.e. greater than 85%) and low-moderate for entrainment through the Francis units (i.e. lower than 85%).

The majority of radio-tagged juvenile alosines passed downstream of the dam via Unit 1 (68%). An additional 31% passed downstream via the downstream bypass system. When examined by entrance, 55% of radio-tagged juvenile alosines using the downstream bypass system were determined to have used the left gate (as determined looking downstream). The remaining 45% of individuals did so via the right entrance.

The median residence duration was longer for individuals released in the eastern third of the river (powerhouse side; 0.7 hours) versus those released in the western third of the river (spillway side; 0.4 hours). Of the radio-tagged alosines which approached Pejepscot Dam, 100% passed in fewer than 24 hours after initial detection. When the full duration of time from release until arrival at Brunswick (~4.7 miles) is considered, tagged juvenile alosines did so in a median time of 32.4 hours (25th percentile = 21.5 hours; 75th percentile = 50.3 hours).

*Juvenile Atlantic salmon*

Topsham Hydro conducted survival studies at the Project between 2013 and 2015 to obtain site specific empirical evidence regarding the effects of the Project on outmigrating smolts. The primary goal of these studies was to evaluate the route of passage and survival of smolts. Study objectives included determination of survival rates, route of passage, migration delay, and travel time. In years when spill was more limited, tagged smolts used the powerhouse route (77.4% in 2013 and 69.8% in 2015)[[3]](#footnote-3). When flows were much higher and passage over the spillway was more available, most smolts used the spillway route (64% in 2014)[[4]](#footnote-4). The highest bypass efficiency occurred in 2014 (36.4%) at the Pejepscot Project, likely due to higher flows directing many more smolts over the spillway rather than through the turbines, as compared to the other study years. The whole-station passage survival of smolts was also evaluated in this three-year study using a paired release-recapture study model. Whole station survival was estimated at 100 percent in 2013, 91.3 percent in 2014, and 86.3 percent in 2015. Upon review of the 2013 study results, we found several issues with study design and implementation that we determined make the study results unreliable (THPLP 2013, p. 44-45). To account for these study issues, Topsham Hydro utilized the background/control survival rate from the upstream Worumbo Project (75.5%) that year to revise the dam passage survival estimate. This produced a revised total station survival of 81.4 percent for 2013.

In a December 22, 2016, letter to FERC, Topsham Hydro requested that FERC amend the license for the Pejepscot Project to incorporate the provisions of a six-year Species Protection Plan (SPP) for Atlantic salmon (2017-2022). The SPP included a plan to modify downstream operations to improve survival for Atlantic salmon smolts wherein Topsham Hydro would open the section of hinged gate closest to the powerhouse to provide approximately 500 cfs of spill at night (2000 – 0700 hours) during the month of May, which represents the peak smolt migration period. This change was implemented in the spring of 2017.

In 2018, Topsham Hydro conducted an additional smolt survival study to evaluate the effect of the operational modification. Results of that study indicate the majority of radio-tagged smolts passed Pejepscot via spill (41.0%; 71 out of 173) or through Unit 1 (31.8%; 55 out of 173). A total of 25 (14.5%) radio-tagged smolts passed downstream of Pejepscot via the bypass system. In all instances, radio-tagged smolts using the downstream bypass at Pejepscot utilized the entrance on the upstream side of the Unit 1 intake rack (at a point between intakes for Francis units 21-23 and Unit 1). Usage of the Project Francis units (2.3%; 4 out of 173) was limited during 2018. The whole station survival measured at the Project was 98.7%. Although Topsham Hydro adjusted the measured Project survival in their study report to account for background levels of mortality from other sources (e.g., predation), we are not incorporating the adjustment here as the background survival was actually lower than the measured survival at the Project.  Therefore, it is our determination that it did not accurately represent background levels of mortality during the study.  As spill was available through much of the study, it is unclear whether the spilling of an additional 500 cfs by the lowering of a hinged gate at night made a difference in the overall survival.

Cumulatively, dams can significantly delay smolt outmigration, especially in low water years, because the individual fish must search and find an available passage route. Delays can lead to mortality of Atlantic salmon by creating conditions that increase the risk of predation (Blackwell & Juanes, 1998), and can also reduce overall physiological health or physiological preparedness for seawater entry and oceanic migration (Budy, Thiede, Bouwes, Petrosky, & Schaller, 2002). Various researchers have identified a “smolt window” or period of time in which smolts must reach estuarine waters or suffer irreversible negative effects (McCormick, Hansen, Quinn, & Saunders, 1998). Late migrants lose physiological smolt characteristics due to high water temperatures during spring migration. Similarly, artificially induced delays in migration from dams can result in a progressive misalignment of physiological adaptation of smolts to seawater entry, smolt migration rates, and suitable environmental conditions and cues for migration. If so, then these delays are expected to reduce smolt survival (McCormick et al., 1998). Given these delayed effects of dam passage, we anticipate that the mortality estimates derived from the Licensee’s studies should be considered an underestimate of what is actually occurring.

*Adult Atlantic Salmon (Kelts)*

There is no empirical information regarding the project’s potential effects on kelts. The Final License Application (FLA) summarizes the results of a desktop evaluation of fish entrainment and turbine survival. That evaluation concluded that, with the exception of the largest adults, all Atlantic salmon are susceptible to entrainment based on their ability to fit through the trash rack spacing. With rack spacing of 1.5 inches (current spacing of the rack in front of the Francis units and in front of Unit 1, from the surface to a depth of approximately 6 feet), it is expected that any salmon over 14 inches (i.e. adult salmon) would potentially be excluded from entrainment. With rack spacing of 2.5 inches (current spacing of the rack in front of Unit 1 beginning at a depth of approximately 6 feet), it is expected that any salmon over 24 inches would be excluded from potential entrainment. In general, passage through the Francis units is far more likely to result in injury or mortality than passage through Unit 1 (Kaplan). For example, predicted survival for a 12-inch fish entrained into the Francis units is 2.2%, compared to a predicted survival 95.6% through Unit 1. Intake velocities in front of the Francis units (0.6 fps) and Unit 1 (3.25 fps) are not high enough to involuntarily entrain or impingement of adult salmon; however, salmon could voluntarily choose to migrate downstream using the Francis unit intakes, particularly during periods of limited spill.

Empirical kelt studies conducted in the lower Penobscot River documented that most kelts passed the dams in spilled water, typically over the spillways, but also through gates and sluices (Hall & Shepard, 1990). Alden Lab (2012) has modeled the current survival rates of kelts at the dams on the Penobscot River, based on turbine entrainment, spill mortality estimates and bypass efficiency. Alden Lab’s analysis accounted for both immediate and delayed mortality associated with dam passage. Through the three months of outmigration, Alden Lab indicates that mean survival rates at 14 of the dams (Medway is excluded) on the Penobscot range between 61% and 93%. In combination with the desktop evaluation above, we consider this the best available scientific information regarding the project’s potential effect on kelts.

### Delayed Mortality

In addition to direct mortality sustained by Atlantic salmon at the Pejepscot Project, some smolts experience delayed mortality in the estuary attributable to their experience at the Project. Studies have investigated what is referred to as latent, delayed, or hydrosystem delayed mortality, which occurs in the estuary or ocean environment and is associated with passage through one or more hydro projects (Budy et al., 2002; Haeseker, McCann, Tuomikoski, & Chockley, 2012; ISAB, 2007; Schaller & Petrosky, 2007; Stich, Zydlewski, Kocik, & Zydlewski, 2015). .

Budy et al. (2002) examined the influence of hydropower experience on estuarine and early ocean survival rates of juvenile salmonids migrating from the Snake River to test the hypothesis that some of the mortality that occurs after downstream migrants leave a river system may be due to cumulative effects of stress and injury associated with multiple dam passages. The primary factors leading to hydrosystem stress (and subsequent delayed mortality) cited by Budy et al. (2002) were dam passage (turbines, spillways, bypass systems), migration conditions (e.g., flow, temperature), and collection and transport around dams, all of which could lead to increased predation, greater vulnerability to disease, and reduced fitness associated with compromised energetic and physiological condition. More recent studies have corroborated the indirect evidence for hydrosystem delayed mortality presented by Budy et al. (2002) and provided data on the effects of in-river and marine environmental conditions (Haeseker et al., 2012; Schaller & Petrosky, 2007). Based on an evaluation of historical tagging data describing spatial and temporal mortality patterns of downstream migrants, Schaller and Petrosky (2007) concluded that delayed mortality of Snake River Chinook salmon was evident and that it did not diminish with more favorable oceanic and climatic conditions. Estimates of delayed mortality reported in this study ranged from 75% to 95% (mean = 81%) for the study years of 1991-1998 and 6% to 98% (mean = 64%) for the period of 1975-1990. Haeseker et al. (2012) assessed the effects of environmental conditions experienced in freshwater and the marine environment on delayed mortality of Snake River Chinook salmon and steelhead trout. This study examined seasonal and life-stage-specific survival rates of both species and analyzed the influence of environmental factors (freshwater factors included: river flow spilled and water transit time; marine factors included: spring upwelling, Pacific Decadal Oscillation, and sea surface temperatures). Haeseker et al. (2012) found that both the percentage of river flow spilled and water transit time influenced in-river and estuarine/marine survival rates, whereas the Pacific Decadal Oscillation index was the most important factor influencing variation in marine and cumulative smolt-to-adult survival of both species. Also, freshwater and marine survival rates were shown to be correlated, demonstrating a relation between hydrosystem experience on estuarine and marine survival. The studies on Pacific salmon described above clearly support the delayed-mortality hypothesis proposed by Budy et al. (2002).

Stich et al. (2015) conducted an analysis on nine years (2005 to 2013) of Atlantic salmon smolt movement and survival data in the Penobscot River to determine what effect several factors (e.g., release location and date, river discharge, photoperiod, gill NKA enzyme activity[[5]](#footnote-5), number of dams passed) have on survival through the estuary (Stich, Zydlewski, et al., 2015). They determined that estuary survival decreased as the number of dams passed during freshwater migration increased from two to nine. They estimated that each dam passed in the Penobscot led to a mortality rate of 6% in the estuary. This mortality was attributed to migratory delay and sublethal injuries (such as scale loss) sustained during dam passage. These effects make smolts more susceptible to predation and disease.

No studies have addressed the amount of hydrosystem delayed mortality that occurs on the Androscoggin River. However, as the projects are similar in scale, configuration, and operation to those studied in the Penobscot River, it is reasonable to assume that delayed mortality occurs. Based on its similarity to the hydro dams on the Penobscot (in terms of passage route alternatives and the presence of turbines) we assume that the Pejepscot Dam will have the same delayed mortality rate described by Stich et al (2015) (i.e., 6%); that is, we expect that of the smolts that successfully pass the dam, 6% will die in the estuary due to delayed effects of that dam passage.

# MANDATORY CONDITIONS AND RECOMMENDATIONS

## Section 10(a) Consistency with Comprehensive Plans

Section 10(a)(1) of the FPA requires the project adopted by the Commission to be, in its judgment, the "best adapted to a comprehensive plan for ... beneficial public uses, including … purposes referred to in section 4(e) ..." 16 USC §803(a)(1). This includes consideration of adequate protection, mitigation and enhancement of fish and wildlife, including related spawning grounds and habitat 16 USC §803(a). Section 10(a)(Hansen et al.) requires that, in making this determination, the Commission consider the recommendations of federal agencies exercising jurisdiction over resources of the state in which the project is located (16 USC §803(a)(Hansen et al.)). Our interest at the Pejepscot Project is safe, timely, and effective fish passage for the benefit of diadromous fish species, as well as habitat considerations for migration, spawning, and rearing.

In fulfilling the balancing provisions of section 10(a) of the FPA, FERC guidance states that it must consider the economics of hydropower projects in terms of a project's current operating costs as compared to likely alternative power (72 FERC ¶ 61,027 (1995)). The Project's power benefits are to be evaluated as previously licensed, and under the new license with the mitigation and enhancement measures set forth in the recommendations, prescriptions, and conditions under FPA sections 10(j) and section 18.

The Androscoggin River watershed once produced large runs of Atlantic salmon, American shad, blueback herring, and alewife, as well as other sea-run fish including shortnose and Atlantic sturgeon (MSPO, 1993). Diadromous fish once contributed to substantial commercial, recreational, and subsistence harvests (MSPO, 1993) that were economically important to coastal communities. Anadromous fish production within the Androscoggin River experienced dramatic declines throughout the past 150 years. Plans including the Atlantic salmon recovery plan (2019) and the Androscoggin River Comprehensive Plan for Diadromous Fish (2020), highlight the importance of fish passage and habitat restoration as critical to supporting a restored anadromous fishery. Spawning, rearing, and migratory habitat exists above the Pejepscot Project. Existing dams inhibit access to those historical habitats. Atlantic salmon were virtually extirpated from their historical range within the Androscoggin River watershed. Accordingly, a decision to decommission and remove the Pejepscot Project and thereby remove a significant barrier to recovering an endangered species, and support the restoration of several anadromous fish, would fulfill the Commission’s mandate under the FPA to ensure the best comprehensive use of a waterway.

As a federal agency responsible for managing anadromous fish and their habitat, we recommend the Commission fully consider the substantial resource benefits that would accrue from restoring the aquatic resources of the Androscoggin River impacted by the operation of hydroelectric facilities such as the Pejepscot Project. If the Commission determines decommissioning and removing the Pejepscot Project ensures the best comprehensive use of a waterway, then we recommend the Licensee develop and implement a plan to decommission and remove the Pejepscot Project and restore the riverine corridor within 10 years of any new license order.

The dam removal option is a better alternative from the perspective of habitat functions and values such as fish passage, water quality, and habitat suitability. Without artificial barriers to block volitional fish movement and behavior, all fish may move freely and naturally, according to their life history adaptations. Implementing this decommissioning and dam removal recommendation would go a long way to reversing decades of degradation and stalled recovery efforts in the Androscoggin River. Dam removal would alleviate the direct Project related impacts on survival past the Project, thereby reducing cumulative mortality within the system; loss of habitat, thermal alteration, water quality impairment, and predation due to impoundment; reductions in nutrient and energy exchange between freshwater and marine ecosystems; alteration of the natural hydrologic regime; restriction to sediment and large woody material transfer. Addressing these dam related impacts on fisheries resources and habitat through dam removal would significantly advance a comprehensive approach to protecting and restoring commercially and culturally important public trust resources. Therefore, this perspective should be afforded full consideration in the National Environmental Policy Act analysis.

Our section 10(a) recommendation for decommissioning and removal of the Pejepscot Project is consistent with the management goals and restoration of public trust resources under Commission approved comprehensive plans that include, but are not limited to:

* Atlantic States Marine Fisheries Commission. 2009. Amendment 2 to the Interstate Fishery Management Plan for shad and river herring (River Herring), Arlington, Virginia. May 2009.
* Atlantic States Marine Fisheries Commission. 2010. Amendment 3 to the Interstate Fishery Management Plan for shad and river herring, (American Shad) Arlington, Virginia. February 2010.
* Maine State Planning Office. 1992. Maine Comprehensive Rivers Management Plan. Volume 4. Augusta, Maine. December 1992.
* National Marine Fisheries Service. 2019. Recovery Plan for the Gulf of Maine Distinct Population Segment of Atlantic Salmon. Hadley, Massachusetts. January 2019.
* NOAA Fisheries. 2020. Androscoggin River Watershed Comprehensive Plan for Diadromous Fish. Greater Atlantic Region Policy Series 20-01. NOAA Fisheries Greater Atlantic Regional Fisheries Office - www.greateratlantic.fisheries.noaa.gov/policyseries/. 136 pp

Whether through dam removal or implementation of our fishway prescription, successful restoration of diadromous fish into historical habitat will substantially enhance the depressed stocks and support the recovery potential of endangered Atlantic salmon. In lieu of the preferred option - dam removal and habitat restoration – fishways are a necessary precursor and a fundamental element of any successful restoration action. In lieu of dam removal, our long-term resource goals and objectives can only be achieved via effective fishways. Therefore, we are filing the preliminary section 18 prescriptions for fish passage facilities necessary to achieve safe, timely, and effective passage.

## Section 10(j) Protection, Mitigation and Enhancement of Fish and Wildlife

The following Section 10(j) recommendations are for the protection, mitigation of damages to, and enhancement of fish and wildlife resources and their habitat at the Pejepscot Project. These recommendations are consistent with state and federal management goals and objectives for restoring, protecting, and enhancing fish and wildlife resources in the Androscoggin River watershed, and are based on our assessment of Project related impacts on those resources. Evidentiary support for these recommendations is contained in the Commission’s administrative record and cited herein. Recommendations submitted by us pursuant to Section 10(j) of the FPA must be accepted by the Commission, as conditions to any license(s) issued, unless, after giving due weight to our subject matter expertise, the Commission finds, based on substantial evidence in the record, that the recommendations are inconsistent with the FPA.

1. Within one year of license issuance, the Licensee should develop a plan for the management of large woody material (LWM) at the Project in consultation with the agencies that will include: a) provisions for storage of beneficial LWM and disposal of unused debris, if determined necessary in consultation with resource agencies; and b) if necessary, guidelines and measures for the sorting, disbursement, and transport of stored LWM with priority given to habitat enhancement projects in the Androscoggin River or its tributaries. The LWM Plan should be updated annually, in consultation with the agencies.

*Rationale*

Large woody material (LWM) is a critical element of a properly functioning lotic ecosystem. LWM influences geomorphic processes that can increase the heterogeneity of physical habitat, thereby imparting beneficial biological effects (Smith, 1996). LWM also provides instream structure and serves as an important source of nutrients that support primary biological productivity. The Pejepscot Project is located within designated critical habitat for Atlantic salmon. The physical and biological features for Atlantic salmon critical habitat specifically include freshwater migration sites with woody debris cover (74 FR 29300, June 19, 2009). Coastal Maine watersheds are largely LWM-limited (Magilligan et al., 2016). The Final Recovery Plan for Atlantic salmon identifies the reduction of habitat complexity associated with the lack of large wood and boulders as a stressor related to the threat of species viability (USFWS & NMFS, 2019a). The Pejepscot Project traps mobilized woody material. The Licensee proposes the installation of a boom which will sluice some amount of LWM downstream of the Project, however, LWM will continue to be periodically removed and disposed. Therefore, the Project would continue to impose a negative effect upon aquatic habitat and a physical and biological feature of critical habitat for endangered Atlantic salmon. An LWM Plan, created and updated in consultation with the agencies, will provide the means necessary for a needs-based source of material for potential habitat enhancement projects throughout the Androscoggin watershed to mitigate for Project-related impacts to LWM recruitment and mobility.

1. Operate the facilities at the Project in a run-of-river mode in which outflow from the Project impoundment, including spillage, leakage, lockage, fish passage, etc. is equal to the inflow to the impoundment to the extent possible. Maintain a minimum continuous flow of 1,710 cfs or inflow, whichever is less, through the turbine units, fish passages and/or over the spillway as available or appropriate. The Project should minimize fluctuations of the reservoir, within one foot of the top of the flashboards on a regular basis, or within one foot of the permanent crest when replacing flashboards. Compliance for both minimum flow and pond level should be based upon continuous measurement.

*Rationale*

Run of river operations more closely reflect normal flow conditions, mitigating to some degree the environmental impacts associated with the impoundment and project operations. Flow fluctuations after storm events are more gradual at a run of river dam, minimizing the occurrence of stranding of fish, flushing of biota and alteration of stream channel configuration (Hunter, 1992). Furthermore, native biota have evolved to survive in a dynamic river system such that natural flow variations have little impact on downstream fish and invertebrates (Hunter, 1992). Fish have adapted to utilize specific habitat types during various life stages. Maintaining natural stream hydrology protects spawning and refuge habitat and minimizes the occurrence of stranding of juvenile and adult life stages (Hunter, 1992). The Licensee proposes to operate the Project run-of-river and with a minimum flow of 1,710 cfs, and we support those proposals with this recommendation. However, the Licensee also proposes that compliance requirements for both minimum flow and pond level be changed to reflect an hourly average, instead of as a continuous measurement. We are not supportive of this change, as biota respond to flow fluctuations (which may include the lack of sufficient flows) in real time. Therefore, hourly average reporting could fail to identify flow or headpond fluctuation “excursions” that have real-world impacts upon our trust resources.

1. Within one year of license issuance, the Licensee should develop a plan, in consultation with the resource agencies to eliminate the risk for fish stranding in the bedrock area below bascule gate no. 5. The plan will detail actions to modify stranding pools to eliminate risk.

*Rationale*

In 2018, Topsham Hydro conducting a stranding evaluation study that identified several potential fish stranding pools in the bedrock outcrop blow bascule gate no. 5 of the Project dam. The Licensee proposes to develop a stranding plan, however, its proposed plan appears to limit potential corrective actions to inspections and physical removal of fish following spill events. The bedrock outcrop area of the Project is highly hazardous, such that the Licensee would not allow for close inspection of the area by study observers (including NMFS personnel) during conduct of the study. For this reason, we are concerned about practicality, efficacy, and safety of any plan that would require Project personnel to access that area with any regularity. Our recommended measure instead calls for physical modification of identified stranding pools (i.e. excavation of egress channels) to address the documented stranding risk. This recommendation would both be more effective in terms of reducing stranding impacts over the term of any new license and would also reduce the safety risk to Project personnel.

## Section 18 Prescription for Fishways

We hereby submit the following preliminary prescription for fishways pursuant to Section 18 of the FPA, 16 USC §811. Section 18 of the FPA states in relevant part that, “the Commission must require the construction, maintenance, and operation by a Licensee of...such fishways as may be prescribed by the Secretary of Commerce or the Secretary of the Interior.” Congress provided guidance on the term “fishway” in 1992 when it stated as follows:

“The items which may constitute a ‘fishway’ under Section 18 for the safe and timely upstream and downstream passage of fish must be limited to physical structures, facilities, or devices necessary to maintain all life stages of such fish, and Project operations and measures related to such structures, facilities, or devices which are necessary to ensure the effectiveness of such structures, facilities, or devices for such fish.” Pub.L. 102-486, Title XVII, § 1701(b), Oct. 24, 1992.

We base the following mandatory fishway prescription on the best biological and engineering information available at this time, as described in the explanatory statements that accompany each prescription. We developed the basis for this prescription over a period of several years with our biological and engineering staff, in consultation with the Licensee, the USFWS and other entities that participated both in this relicensing proceeding and in prior informal section 7 consultation. We fully considered a broad array of issues in formulating the preliminary prescription for fishways. Our conclusion that the prescription for fishways is justified, is based on, but not limited to, the following primary points: (1) numerous long-standing resource agency management and restoration goals are achieved through fish passage, (Hansen et al.) a well-documented historical presence of robust diadromous fish populations within the Androscoggin River watershed prior to dam construction, (3) professional experience across the region demonstrates that diadromous fish will be motivated to migrate above barriers such as the Pejepscot dam when effective passage is provided, (4) access to the spawning, rearing and migration habitat above the Pejepscot Project is necessary for the recovery and restoration of diadromous fish, including the critically endangered Atlantic salmon, (U.S.Fish and Wildlife Service) consideration of the cumulative impacts on migratory fish and their habitat resulting from a heavily dammed riverine system, and (6) state and federal comprehensive plans indicate the significant potential for diadromous fish populations in the Androscoggin River watershed once fish passage and habitat restoration is accomplished. Specific citations and detailed explanations in support of these reasons are found in the text of this prescription.

We support each prescription measure with substantial evidence contained in the record of pre-filing consultation, and subsequent updates, compiled and submitted in accordance with the Commission’s procedural regulations. The explanatory statements included with each prescription summarize the supporting information and analysis supporting the prescription. We include an index to the administrative record for this filing herein, and reserve the right to file updated and supplemental supporting information as needed.

### Upstream Fish Passage

1. Within two years of license issuance, the Licensee shall replace the existing vertical entrance gate with a bottom-opening flap gate. The gate shall be designed in consultation with NMFS and U.S. FWS to accommodate the full 160 cfs of attraction water or more with the top of the gate positioned a minimum of 3.0 feet below the tailrace elevation under varying river flows and maintain an entrance velocity within the 4-6 ft/s range for alosines and up to 8 ft/s for Atlantic salmon and a drop at the entrance approximately 0.8 feet normally with the capability of increasing up to 1.5 to 2.0 feet. Upon license issuance, the licensee shall operate the attraction water system at full capacity, regardless of unit discharge, unless monitoring studies indicate different operations are warranted.

*Rationale*

Restoration of diadromous fish is a resource goal for the Androscoggin River watershed, consistent with the 2017 Draft Fisheries Management Plan for the Lower Androscoggin River, 2019 Atlantic Salmon Recovery Plan, and 2020 Androscoggin River Watershed Comprehensive Plan. The requirement for safe, timely, and effective fish passage facilities in this licensing proceeding is necessary to support our broader restoration goal for the watershed. Upstream efficacy studies performed as part of this licensing proceeding demonstrated very poor passage efficacy for river herring (19.8%) and ineffective (0%) passage for American shad. River herring did appear able to locate the fishway entrance with regularity, with a nearfield attraction of 92.6%. However, American shad rarely approached the fishway (32% nearfield attraction).

Beginning in February 2020, Topsham Hydro convened a series of collaborative discussions with us, U.S. FWS, and MDMR to evaluate and discuss preliminary results of fish passage studies. Of particular concern were poor passage results for river herring and American shad. Collectively, the agencies determined that available information was not suitable to determine, with any confidence, the causal mechanisms responsible for the poor efficacy of the fishway for river herring, or the complete inefficacy of the fishway for American shad. On June 2, 2020, the agencies collectively provided Topsham Hydro a document that defined additional information needs and studies necessary to better understand the poor functioning of the fishway. That document included: 1) a request for result from a 2004 study of upstream efficacy at the Project that was previously unreported; 2) requests for information regarding facility operations during the implementation of the upstream passage study; and 3) a request for three new studies (radio telemetry, CFD modeling, and a facility sound study). On August 10, 2020, in comments on the Updated Study Report, we formally requested that FERC require those three additional studies. In its October 30, 2020 Study Determination, FERC only required CFD modeling and a facility sound study, stating that it “would be more reasonable to first evaluate noise and hydraulic conditions in the fish lift prior to completing any additional telemetry studies.”

On March 30, 2021, Topsham Hydro submitted the results of its facility sound study, and CFD modeling study. Regarding sound at the facility, the results did not show the existence of ultrasonic noise that may deter adult alosines, and specifically American shad, from entering the fish lift. The CFD modeling exercise demonstrated that fishway entrance jet velocities can occasionally exceed that which is recommended for river herring (6 fps).

The study performed by Topsham Hydro did not reveal any hydraulic conditions that would necessarily impede or prevent passage for alosines, including American shad on a consistent basis. However, a 2019 study demonstrated that the type of entrance gate that we specify above provides a hydraulically clear path of entry and that American shad specifically demonstrated a preference for such entrance gates relative to vertical gates, such as those currently in place at the Pejepscot Project (Mulligan, 2019). Furthermore, we note that design and specifications of the entrance gate that we are requiring are consistent with fishway design guidelines set forth by the U.S. FWS (USFWS, 2017).

Based on the best scientific information available at this time, we conclude that a bottom-opening entrance gate, as described above, in combination with our required modifications to operational frequency of the existing fish lift, as described in #2 below, could potentially satisfy the standard of a safe, timely and effective fishway. We have confidence based on experience that this design will function for the full suite of diadromous species. However, given that: 1) American shad demonstrated poor attraction to the vicinity of the fishway entrance; and 2) FERC did not require any study to evaluate the hypothesis that increased lift timing would sufficiently impact overall fishway efficacy for river herring and American shad, we acknowledge there is some uncertainty that implementation of these measures alone will potentially satisfy the standard of a safe, timely, and effective fishway. To address this uncertainty, our adaptive requirements include the construction of additional fishway entrances and/or fishways in the event that monitoring demonstrates its necessity. Our required monitoring and adaptive protocol are necessary to ensure the upstream fishway meets or exceeds standards for safe, timely, and effective passage (see Section 9.3.4 for monitoring requirements).

1. The Licensee shall operate the existing upstream fish lift on the following lift cycle frequency beginning in the first full passage season after the effective date of the new license:
   1. Upon the passage of the first fish at the downstream Brunswick Project or by May 1 to July 31: lift frequency and facility operating hours will be determined on an annual basis, prior to the fish passage season in consultation with NMFS, MDMR, and U.S. FWS[[6]](#footnote-6). Lift frequency may vary from every 15 minutes during peak migration periods to once every 2 hours. Both lift frequency and operating hours will be adaptively managed based upon site-specific conditions, in consultation with the above resource agencies.
   2. August 1 – November 15: lift frequency and facility operating hours will be determined on an annual basis, prior to the fish passage season, in consultation with NMFS, MDMR, and U.S. FWS. Lift frequency may vary from every 15 minutes to once a day, upon any passage of salmon at Brunswick Dam during the passage season (May 1-November 15). Both lift frequency and operating hours will be adaptively managed based upon site-specific conditions, in consultation with the above resource agencies.

*Rationale*

As described above, studies indicated poor and potentially ineffective passage for river herring and American shad. Fish lift fishways, such as the fishway in place at the Project, dictate the rate at which fish may pass upstream via lift’s cycle timing, or the frequency with which the lift operates. At present, the Pejepscot fish lift cycles infrequently with a total of five lift cycles per day between the hours of 0800 and 1800. Topsham Hydro proposes to increase the frequency of lift cycles to conform to the following schedule:

* + April 15 to May 15 and following passage of the first fish at the downstream Brunswick Project, the lift will be operated once every two hours.
  + May 16 through June 15, the lift will be operated once every hour.
  + June 16 through July 1, the lift will be operated every 2 hours.
  + July 2 through November 15, the lift will be operated once a day following passage of salmon at Brunswick if not already identified passing through Pejepscot.

Assuming Topsham Hydro intends to maintain its current operational hours of 0800 to 1800, its proposal provides only one additional lift per day over current practices from April 15 to May 15 and June 16 through July 1. From May 16 to June 15, Topsham Hydro’s proposal would effectively double the number of daily lifts (from 5 to 10). Given that FERC did not require our requested study to evaluate the effect of the proposed lift timing, we are unable to empirically evaluate the effect of the proposed lift cycle on passage of river herring. However, in a hypothetical scenario where we assume similar conditions to those experienced during conduct of the upstream efficacy studies performed during relicensing, and assuming that the upstream passage of fish is equally distributed throughout the day, we can estimate that passage efficacy would roughly double for river herring (i.e. approximately 40%). Given that Topsham Hydro’s study demonstrated a 0% lift efficacy for American shad, very little nearfield attraction to the fishway, and given that FERC did not require our requested study to evaluate the effect of the proposed lift timing, it is unclear what benefit, if any, Topsham Hydro’s proposed lift cycle timing would afford in terms of passage for that species. Similarly, the absence of empirical information concerning the efficacy of the fishway for Atlantic salmon or sea lamprey make evaluations of Topsham Hydro’s proposal difficult to evaluate, though in general, we would expect more frequent lift cycles to improve fishway efficacy.

Topsham Hydro’s proposed lift frequency would be expected to provide some minor benefit to overall lift efficacy. However, its proposal does not reflect the potentially substantial nature of the current lack of effectiveness of the fishway as evidenced by empirical information, nor does it allow for any adaptation of operations to conform to site-specific conditions with regard to fish migrations. Furthermore, the proposed lift frequency pales in comparison to the lift frequency at the Milford fish lift, a similar facility located on the Penobscot River in Maine that lifts a minimum of 36 cycles per day from 0400 to 2200. As described below in section 9.3.4, we anticipate performance standards for alosine will be similar to those required on other river systems (e.g. Turner’s Falls, FERC No. 1889, Connecticut River), such that upstream passage efficiency will be at least 70% within 48 hours of a fish approaching the Project works. Given that Pejepscot lies in the lower mainstem Androscoggin amidst multiple other dams within spawning and rearing habitat for several sea-run species, its contribution to the cumulative impact of passage survival in the system is not insignificant. Given the above and our goal for the restoration of diadromous in the Androscoggin watershed, we believe that our prescribed lift frequency would allow the lift frequency of the facility to adapt to local site conditions. In doing so, we would expect more frequent lift cycles during peak migration times (up to 15 minutes per cycle), thereby capitalizing on the fishway’s capabilities in terms of improving efficacy and timeliness of fish passage during periods when fish are actively migrating, which has implications upon improving the overall condition of diadromous fish migrating through a river system with multiple hydropower projects (Caudill et al, 2007; Castro-Santos & Letcher, 2010). This approach could also potentially reduce the number of lifts during periods of lesser migratory activity during migration periods for Atlantic salmon, river herring, and American shad (Table 2). The adaptive approach to the frequency of lifts, as well as the hours of facility operation that we specify are consistent with the operation of the Milford facility on the Penobscot River, which demonstrated a 65.1% upstream passage efficacy for alewife in 2019 (Normandeau, 2020).

From July 2 to November 15, Topsham Hydro proposes to operate the fish lift once a day following the passage of salmon at Brunswick, if not already identified passing through Pejepscot.. Following spawning in the fall, Atlantic salmon kelts may immediately return to the sea, or over-winter in freshwater habitat and migrate in the spring, typically April or May (Baum 1997). While salmon migration and habitat use studies are limited in the Androscoggin River, a number of studies have been conducted in the Penobscot River that are relevant to the Androscoggin River. Specifically, adult Atlantic salmon returns are most common in June on the Penobscot River (MDMR 2007, 2008), and have been tracked with telemetry and observed to stop migration and seek thermal refuge when temperatures exceed 22°C (Holbrook, 2007). Adult salmon have also been observed falling back and out of the river during periods of very high water temperatures (Shepard 1995, Holbrook 2007). After spawning, kelts have been observed in the lower Penobscot River in November (USASAC, 2007). For these reason, we expect that adult salmon could be moving throughout the river any time through late fall. In an evaluation of the behavior of upstream migrating Atlantic salmon at a fish lift on the Penobscot River, Izzo et al, (2016) noted that the behavior of tagged salmon was similar to the behavior of other studies, where “tagged fish rapidly approach[ed] the entrance after arriving at the dam, and then [made] multiple visits to the entrance before successfully being trapped and lifted.” These observations comport with our professional experience that Atlantic salmon rarely demonstrate holding behavior at fishway entrances. Given the above, we find that Topsham Hydro’s proposal to operate the fishway once a day would be inadequate to ensure that any adult Atlantic salmon would be permitted to volitionally move upstream to satisfy any of its biological requirements, consistent with the physical and biological features of migratory habitat, as defined in the Atlantic salmon critical habitat designation. Our required modification to adaptively manage lift frequency upon the passage of any Atlantic salmon at the downstream Brunswick facility, would ensure greater opportunity for the passage of salmon at the Pejepscot Project, such that it could reliably function as migratory habitat.

We further support this position on the factual background herein and the following facts:

1. Diadromous fish historical habitat has been identified in many reaches of the Androscoggin River watershed (Foster & Atkins, 1867).
2. Atlantic salmon, American shad, blueback herring, and sea lamprey currently have access to spawning, rearing, and migratory habitat in the Androscoggin River.
3. MDMR has stocked alewife in the lower Androscoggin watershed since 1983 (MDMR and MDIFW, 2017). This effort results in juveniles imprinted to spawning habitat within the Androscoggin River. Those juveniles surviving to maturity and returning to the Androscoggin River will home to natal habitat. Those adults will require safe, timely, and effective passage past the Pejepscot Project to access those natal waters.
4. MDMR has secured two separate grants to move forward on gaining volitional fish access past the five dams in the Sabattus River[[7]](#footnote-7). Under the first grant, DMR has contracted with two engineering firms to complete dam removal or fishway designs for each of the five dams by the end of 2022. Under the second grant, DMR will complete removal of one barrier and the partial removal and installation of a technical fishway within the Sabattus River, Maine. This project will be completed in 2022 and will increase access to high quality fish habitat, increase overall aquatic connectivity in the Androscoggin River drainage, restore several river miles of impoundments to free-flowing river, and improve water quality (personal communication).
5. We have been engaged in settlement negotiations with KEI (Maine) Power Management (II) LLC (KEI) and agency partners for projects on the Little Androscoggin River since 2017.  From the outset, our mutual goal has been to develop a broad settlement agreement for the Little Androscoggin River that addresses all three of KEI’s FERC licensed projects in the watershed.  While we all continue to work towards this goal, our trust responsibilities require us to remain fully engaged in the FERC relicensing process for all three Little Androscoggin projects unless and until a final settlement has been reached.  Specifically, we provided our Section 18 modified fishway prescription to FERC for the Lower Barker Project (P-2808) in 2018[[8]](#footnote-8), and we provided comments on the Draft License Application for the Upper Barker Project (P-3562) in May, 2021[[9]](#footnote-9).  The relicensing process for the Marcal Project (P-11482) will begin in 2032.  Through each of these regulatory processes, our goal is to work with agency partners to restore fish passage in the Little Androscoggin River.
6. Dams such as the Pejepscot dam are an impediment to upstream migration of diadromous fish (74 FR 29300, June 19, 2009; 74 FR 29344, June 19, 2009; 78 FR 48944, August 12, 2013)
7. Properly designed and located fishways, with suitable near-field and far-field attraction are capable of passing Atlantic salmon, sea lamprey, American shad, and river herring upstream of dams (Bunt, Castro‐Santos, & Haro, 2012; Larinier, 2002; Larinier & Marmulla, 2004; NMFS, 2011; USFWS, 2017).

Conclusion

Based on the best scientific information available at this time, we conclude that our required upstream passage measures would reasonably address existing project effects and should satisfy the standard of a safe, timely, and effective fishway. We have confidence based on experience that the required design features will function for the full suite of diadromous species. Our required monitoring and adaptive protocol are necessary to ensure the upstream fishway meets or exceeds standards for safe, timely, and effective passage operation (see Section 9.3.4 for monitoring requirements).

### Downstream Fish Passage

The Licensee shall construct, operate, and maintain downstream fish passage facilities for diadromous fish species that provide safe, timely, and effective downstream passage consistent with the performance standards described in Section 9.3.4. The downstream passage facilities shall be operational within two years of the issuance of the new license.

The Licensee has proposed, and we are requiring, the following measures to improve the downstream passage facility for alosines and Atlantic salmon at the Pejepscot dam:

1. Install and operate a fish guidance system/debris boom, designed in consultation with NMFS, MDMR, and U.S. Fish and Wildlife, to direct downstream migrants to a new bypass within bascule gate no. 1 beginning in the second full passage season after the effective date of the new license.
2. Open bascule gate No. 1 (closest to the powerhouse) 50% to provide approximately 500 cfs of spill at night (2000 – 0700 hours) during the month of May.

In addition to the Licensee’s proposed actions, we are requiring the following:

1. Maintain availability and use of the north (left bank) downstream fish bypass, throughout the term of any subsequent license. If new information indicates that continued operation of the north bypass is unnecessary or unwarranted, after consultation with NMFS, U.S. Fish and Wildlife, and MDMR, the licensee may request discontinuation of the north bypass for FERC approval.
2. If the defined performance standards (section 9.3.4) cannot be met with the above proposed and required measures within the monitoring period defined therein, additional adaptive measures will be implemented to further reduce fish injury and mortality to meet the defined performance standards. Such adaptive measures may include, but not be limited to the installation of an Alden-style weir and/or rigid rack structure(s) with close spacing of 1-inch or less.

These protection measures are consistent with criteria used nationally (NMFS, 2011; USFWS, 2017). The Licensee shall keep the downstream passage facilities in proper order and clear of trash, logs, and material that would hinder flow and passage. Anticipated maintenance shall be performed in sufficient time before a migratory period such that fishways can be tested and inspected and will operate effectively prior to the migratory periods. Additional measures specific to Atlantic salmon may also be required depending on the outcome of the ESA section 7 consultation and requirements of any Incidental Take Statement issued as part of the anticipated Biological Opinion.

Design review of any new downstream fish passage facility shall follow the process outlined in Section 9.3.5. Fishway Design Review such that modifications can be implemented and operational within two years of license issuance.

*Rationale*

Dedicated fish passage facilities are necessary to protect diadromous species emigrating past the Project. Improvements in safe, timely, and effective passage at this project will be essential to support recovery of Atlantic salmon and the restoration of our other diadromous trust species. We base this position on the factual background herein and the following:

1. Downstream migrating diadromous species are exposed to direct and indirect project related impacts (Brookfield, 2016; Franke et al., 1997).
2. Downstream passage survival is a critical component to achieving recovery goals for ESA-listed Atlantic salmon (Nieland et al., 2013; USFWS & NMFS, 2019a).
3. Downstream migrating adults and juvenile Atlantic salmon and alosines require protection from project operations that result in injury and mortality (Franke et al., 1997; Hecker, Amaral, Stacey, & Dixon, 2007; Larinier, 2000; Taylor & Kynard, 1985) (74 FR 29344, June 19, 2009, 78 FR 48944, August 12, 2013).

Entrainment Prevention (Guidance Boom)

The Licensee proposes to install a guidance boom, designed in consultation with the resource agencies, to prevent entrainment into the Project powerhouses. Guidance booms have been shown to be relatively effective at reducing turbine entrainment for surface-oriented migrants at other projects in Maine including at the Lockwood, Hydro Kennebec, and Weston Projects. The bypass efficiency for juvenile salmon at the Lockwood Project increased to an average of 53% (2013-2015) with the installation of a guidance boom with 10-foot rigid panels placed upstream of the powerhouse (Brookfield, 2016).

*Route selection*

Studies conducted in support of relicensing indicated that a majority of juvenile alosines (68%) adult river herring (51%) utilized Unit 1 as a downstream passage route, while The 2018 study of downstream passage for salmon smolts found that a majority of smolts (41%) passed via spill, with 31.8% using Unit 1. The 2018 smolt study found that smolts utilized the Francis units very infrequently (2.3%). However, the Francis units were not in operation at Pejepscot during the spring 2019 downstream study, so empirical information regarding survival through those units is not available. The FLA notes that one or more Francis unit was in operation during 13%, 16%, and 48% of the active fall outmigration periods.

*Survival*

In general, the desktop and/or empirical study found that the safest passage routes for fish were via the spillway or downstream bypass, followed by Unit 1, with the Francis units representing the least safe route. In 2018, a study of Atlantic salmon smolts measured a 98.7% whole station survival at the Project[[10]](#footnote-10). Downstream whole station survival for adult river herring was empirically estimated at 88% and for adult American shad, 82%. Topsham Hydro did not perform any quantitative studies of downstream survival for juvenile alosines, but instead produced a qualitative analysis indicating that turbine survival was expected to be high through Unit 1 (i.e. greater than 85%) and low-moderate for entrainment through the Francis units (i.e. lower than 85%). Juvenile alosines are smaller and narrower than smolts (Scott & Scott, 1988). Similar to smolts, alosines are weak swimmers and orient with the flow (Bell, 1991). Given juvenile alosines are smaller than smolts and turbine entrainment is related to fish size, we would expect that whole-station downstream passage survival rates of juvenile alosines through the Project’s propeller units would be similar or higher than that observed for smolts.

*Synthesis*

Renkawitz et al. (2012) monitored migration depth of outmigrating salmon smolts in the Penobscot River in 2005. Although they did not document movements in freshwater habitat, the study reach began in the upper estuary (beginning at the location of the former Veazie Dam) where the salinity is considered negligible (Renkawitz, Sheehan, & Goulette, 2012). The study determined that smolts generally migrate within the upper 16-feet (5-meters) of the water column. Lacking freshwater specific data, we assume that smolts in the mainstem are generally swimming within 16 feet of the surface, but that they can make use of the entire water column. Similarly, Hedger et al. (2009) found that migrating Atlantic salmon kelts frequently traveled within 16 feet of the surface (Hedger et al., 2009). For American shad, Stier and Crance (1985) suggested that for all life history stages, including juveniles, the optimum range for river depth is between 5 and 20 feet (Stier & Crance, 1985). Therefore, while limited empirical information exists, we expect that the proposed guidance boom could prompt avoidance behavior of some proportion of downstream migrating fish and prevent entrainment of those fish into Project turbines. The Licensee has specified that the proposed guidance boom will include 10 foot panels, except for the last 30 feet of the boom to the crest gate that will include 5 foot panels. Generally, guidance booms do not achieve sufficient depth to prevent even fish that are typically surface-oriented from sounding under the panels. Therefore, we expect that some proportion of fish would still be entrained into Project turbines, with some of those being killed.

Topsham Hydro has proposed to install a new bypass within bascule gate No. 1 and subsequently discontinue the north (left bank) downstream fish bypass. We acknowledge that the implementation of our required guidance boom may reduce the proportion of fish that utilize the existing north downstream fish bypass. However, as we note above, guidance booms are not sufficient to completely exclude fish. Existing information, as summarized above in section 8.6, demonstrates that a relatively significant proportion of salmon smolts, adult river herring, and juvenile alosines utilized the north bypass. Furthermore, the bypass appears to be a relatively safe route of passage with a demonstrated survival of 100% for adult river herring; the entrance to the north bypass is located adjacent to the Francis units, the least safe route for migratory fish passage. Given the above, our requirement to maintain the existing north bank downstream fish bypass would ensure that multiple, safe, downstream migration routes are available to migrating fish. Our requirement would allow for discontinuation of the north bypass, should future information indicate that its use is unnecessary or unwarranted, as determined in consultation with the resource agencies.

The hydro turbines and particularly the Francis units, are demonstrably the least safe passage route for migrating fish at the Pejepscot Project. As described above, while we agree with the Licensee that the proposed guidance boom may provide some beneficial effects, including behavioral guidance towards the spillway and downstream bypass, we are not certain that the measure will adequately protect the downstream migrating fish species identified in this document from becoming entrained. Furthermore, we acknowledge that guidance booms may not be effective for species such as American eel, who exhibit a wide range of depths during outmigration (Haro et al, 2000); this prescription does not specifically address biological requirements for American eel. To address this uncertainty, our adaptive requirements may include the installation of a rigid rack structure in front of Unit 1 and/or the Francis units with spacing of 1-inch or less, in the event that monitoring demonstrates its necessity. Our required monitoring and adaptive protocol are necessary to ensure the upstream fishway meets or exceeds standards for safe, timely, and effective passage This close rack spacing is consistent with U.S. FWS guidelines for the exclusion of salmon smolts (USFWS, 2017) and this spacing is expected to be narrow enough to also exclude salmon kelts and most adult alosines. The installation or planned installation of close-spaced racks is common for hydropower projects in Maine as a measure for the protection of Atlantic salmon and other diadromous species, including at projects associated with Brookfield or its subsidiaries (Brown’s Mill, FERC No. 5613; Ellsworth, FERC No. 2727; Mattaceunk, FERC No. 2520; Milford, FERC No. 2354; Orono, FERC No. 2710; Stillwater, FERC No. 2712).

Conclusion

Based on the best scientific information available at this time, we conclude that the proposed downstream passage protection measures with our required additional measures could reasonably address existing project effects and should satisfy the standard of a safe, timely, and effective fishway. We have confidence based on experience that the required design features will function for the full suite of diadromous species. Our required monitoring and adaptive protocol are necessary to ensure the upstream fishway meets or exceeds standards for safe, timely, and effective passage operation (see Section 9.3.4 for monitoring requirements).

### Seasonal Migration Windows

Based on state-wide and Androscoggin River watershed specific data, approved fish passage protective measures shall be operational during the migration windows for each life stage of Atlantic salmon (adults, kelts, and smolts), and adults and juveniles of American shad, blueback herring, and alewife (Table 2). These dates may change based on new information and agency consultation.

Table 2. Summary of migration periods for which fish passage is required. The migration period for Atlantic salmon is dependent on presence and may be refined in consultation with the resource agencies.

|  |  |  |
| --- | --- | --- |
| Species | Upstream Migration  Period | Downstream Migration Period |
| Atlantic salmon | May 1–November 10 | April 1 – June 15 (smolts and kelts)  October 15 – December 31 (kelts) |
| American shad | May 15–July 31 | July 15 – November 30 (juveniles)  June 1 – July 31 (adults) |
| Alewife and Blueback herring | May 1–July 1 | July 15 – November 30 (juveniles)  June 1 – July 31 (adults) |

*Rationale*

1. Adult alosine in Maine rivers commonly migrate upstream between May and June, and as late as August and emigrate soon after spawning from June to early August (ASMFC, 2009, 2010; Brookfield, 2016; Loesch, 1987).
2. Juvenile alosine in Maine rivers typically emigrate in September and October but may emigrate as early as August and as late as December (Loesch, 1987; Mullen, Fay, & Moring, 1986; Weiss-Glanz, Stanely, & Moring, 1986).
3. Adult Atlantic salmon typically migrate to upstream spawning habitat beginning in the month of April (Baum, 1997). Trap operations at the former Veazie Dam typically captured adult salmon from May to November (N. R. Dubé et al., 2011; N. R. Dubé, R. Dill, R.C. Spencer, M.N. Simpson, P.J. Ruksznis, K.A. Dunham, O.N. Cox, and K. Gallant, 2012)
4. Following spawning in the fall, Atlantic salmon kelts in Maine rivers typically return to the sea immediately, or over-winter in freshwater habitat and migrate in the spring, typically April or May (Baum, 1997).
5. Based on NMFS Penobscot River smolt trapping studies in 2000 - 2005, smolts migrate in Maine rivers between late April and early June with a peak in early May (Fay et al., 2006).

### Passage Performance Standards and Monitoring

The Licensee must monitor upstream and downstream fishways at the Pejepscot Dam. Monitoring will ensure fish passage protection measures are constructed, operated and functioning as intended for the safe, timely and effective passage of migrating fish. We will evaluate the results of the monitoring against performance standards developed for each species. Those performance standards are presently in development for alosines and Atlantic salmon. Based on the best available information from dam impact assessment on other rivers in the GOM DPS, the performance standard for Atlantic salmon will likely include a project survival standard consistent with other hydro projects in the GOM DPS, of at least 95% for upstream and downstream passage, with the passage standards also taking delay into consideration. We anticipate performance standards for alosines may be similar to those required on other river systems (e.g., Turner’s Falls, FERC No. 1889 on the Connecticut River), where upstream passage efficiency is required to be at least 70% within 48 hours of a fish approaching the Project works; and downstream passage survival is required to exceed 95%. We expect to finalize performance standards for Atlantic salmon during ESA consultation and in the development of monitoring plans. If information suitable to derive standards is available, we will incorporate such standards in our modified prescription. Existing information has demonstrated that passage efficacy at this facility may be influenced by hydrologic conditions (i.e. the availability of spill flows). Therefore, we have determined that monitoring over three year terms is necessary to adequately account for the effect of environmental variability as it relates to passage efficacy at the Project.

* Licensee will develop study design plans in consultation with NMFS and state and federal resource agencies. The Licensee must obtain approval from the resource agencies prior to filing with the Commission for final approval.
* Licensee must conduct all monitoring according to scientifically accepted practices.
* Licensee shall begin monitoring at the start of the first migratory season after each fishway facility is operational and shall continue for up to three years or as otherwise required through further consultation.
  + For downstream passage, achievement of the performance standard will be based on the average survival over three years of study. Additional evaluation may be necessary during the term of any new license if there are changes in operational or environmental conditions that could affect fishway efficiency.
  + For upstream passage, upon implementation of the required new entrance gate and required lift operations, the Licensee will conduct three years of study to adaptively manage the operation of the existing lift, in order to ascertain if the passage standards can be achieved with the prescribed measures. After the third study year, the Licensee shall consult with the fishery agencies to identify potential issues causing any continued inefficiency and to develop measures to resolve them. The Licensee shall conduct an additional three years of study following any modifications implemented as a result of this adaptive management.
* Licensee shall conduct studies to evaluate the effectiveness of fishways for juvenile and adult life stages of alosines and Atlantic salmon.
* Licensee shall provide monitoring study reports to the resource agencies for a minimum 30-day review and consultation prior to submittal to the Commission for final approval.
* The Licensee shall include resource agencies’ comments in the annual reports submitted to the Commission for final review.

### Fishway Design Review

Regarding construction of the required entrance gate or any fishway or appurtenant structure determined necessary through the adaptive management outlined in section 9.3.4, the Licensee shall submit design plans to NMFS for review during the conceptual, 30, 60 and 90 percent design stages. The Licensee shall incorporate into their schedule a minimum of 30 days of review time by resource agencies for each stage. The Licensee shall allow reasonable time to construct the fishway such that it is operational as prescribed. Following NMFS review, the Licensee shall submit final design plans to the Commission for final approval prior to the commencement of fishway construction activities. Once the fishway is constructed, final as-built drawings and specifications that accurately reflect the Project, as constructed, shall be filed with NMFS.

# Reservation of Authority

## Upstream Fish Passage

As described above, upstream efficacy studies performed as part of this licensing proceeding demonstrated very poor passage efficacy for river herring and ineffective passage for American shad. As also described above, limited empirical information suggests that the Project may also be ineffective for upstream migrating endangered Atlantic salmon. While information demonstrated that river herring appear able to locate the fishway entrance, American shad rarely approached the fishway. However, both river herring and American shad demonstrated significant attraction to the area downstream of the spillway at the Project (64% cumulative residence time for river herring and 99% cumulative residence time for American shad). For American shad, this attraction to the spillway area occurred in spite of limited spill conditions during the period of study.

Topsham Hydro has proposed developing a plan and schedule in consultation with the resource agencies containing physical and/or operational modifications to be constructed/implemented no later than Year 3 of any new license. We agree with Topsham Hydro that a consultative approach is reasonable. Our expectation is that the installation of our required new entrance gate and our required increase in the frequency of lift cycles, to be developed in consultation with the resource agencies, will increase the passage efficiency of the upstream fishway at the Project. However, FERC did not require our recommended study to evaluate the effect of increased lift frequency; thus, we are not able to evaluate the magnitude of the potential effect of that proposed measure with any degree of confidence. Furthermore, as described above, existing information indicates that both American shad and river herring are highly attracted to the area downstream of the spillway. Typically, in combination with information validating the ineffectiveness of an existing fishway, this sort of “false” attraction to a fishway would be indicative of the need for a new fishway or fishway entrance to pass diadromous fish upstream in a timely and effective manner. Therefore, we are not certain that the proposed single upstream fishway, with our required measures, will be sufficient to meet or exceed effectiveness standards.

We acknowledge that the downstream Brunswick Project (FERC No. 2284) likely serves as a significant bottleneck to the volitional passage of at least American shad and blueback herring in the lower Androscoggin River (NOAA, 2020); MDMR and MDIFW, 2017). We note that the license for the Brunswick Project expires on February 28, 2029. We expect that the fish passage issues currently plaguing the Brunswick Project will be addressed, in some manner, during relicensing for that project. However, it is impossible, at this time, for us to predict whether a subsequent license will be issued at Brunswick, and if so, what future requirements would be associated with any license. We expect that the Brunswick licensing decision and any future license requirements for that project could have an appreciable bearing on the design and operational expectations of any new fishway at Pejepscot. Thus, the uncertainty surrounding future Brunswick passage requirements present a significant impediment to our determination of an appropriate fishway at Pejepscot at this time.

For these reasons, we reserve our authority to prescribe an additional fishway, fishway entrance or entrances, or operational or facility modifications for the benefit of our trust resources at the Pejepscot Project. We will exercise our reserved authority after considering the requirements of Brunswick’s subsequent license, if the Pejepscot Project does not demonstrate effectiveness consistent with the passage performance standards and monitoring protocol defined in section 9.3.4. Given our understanding of FERC’s schedule for relicensing at Brunswick, we anticipate making our decision whether to exercise our reserved authority for the Pejepscot Project on or around February 28, 2029.

## Sea Lamprey

There is no information available to evaluate the current survival and passage efficiency of sea lamprey at the Pejepscot Project, nor the potential beneficial effects of our required measures. We also recognize that management objectives for sea lamprey may change during the term of the new license. If a management program for sea lamprey is initiated for the Androscoggin River during the license term, and post-licensing monitoring information or desktop evaluations demonstrate that survival and passage efficiencies at the Pejepscot Project are insufficient to achieve those management objectives, then the Licensee will need to modify operations or facilities that meet any standard established to achieve those objectives. Therefore, we reserve our authority to prescribe operational or facility modifications or additional fishways for the benefit of sea lamprey in the future.

## Standard Reservation

Thisprescription for fishways was developed in response to the proposals being considered by the Commission in this proceeding, our current policies and mandates, and our understanding of current environmental conditions at the Project. If any of these factors change over the term of the license, then we may need to alter or add to the measures prescribed in this licensing process. Therefore, we hereby reserve authority under Section 18 of the FPA to prescribe such additional or modified fishways at those locations and at such times as we may subsequently determine are necessary to provide for effective upstream and downstream passage of diadromous fish through the Project facilities. This reservation of authority includes, without limitation, our authority to amend this fishway prescription upon approval by us of such plans, designs, and completion schedules pertaining to fishway construction, operation, maintenance, and monitoring as may be submitted by the Licensee in accordance with the terms of the license articles containing such fishway prescriptions. We propose to reserve authority by requesting that the Commission include the following condition in any license it may issue for the Project:

*Pursuant to Section 18 of the Federal Power Act, the licensee shall build the fishways described in the National Marine Fisheries Service’ Prescription for Fishways at the Pejepscot Hydroelectric Project (FERC No.4784). The Secretary of Commerce reserves authority to prescribe additional or amended fishways as he may decide are required in the future.*

# ADMINISTRATIVE RECORD

Evidence to support our prescription for fishways is contained in the Administrative Record before the Commission. Citations to the extant record are provided below.

# LITERATURE CITED

Ames, E. P. (2004). Atlantic cod stock structure in the Gulf of Maine. *Fisheries, 29*(1), 10-28. doi:10.1577/1548-8446(2004)29[10:ACSSIT]2.0.CO;2

ASMFC. (1999). Amendment 1 to the Interstate Fishery Management Plan for Shad and River Herring. Report No. 35 of the Atlantic States Marine Fisheries Commission.

ASMFC. (2007). Fishery Management Report of the Atlantic States Marine Fishery Commission - American Shad Stock Assessment Report for Peer Review Volume II. Stock Assessment Report 07-01 supplement.

ASMFC. (2009). Fishery Management Report of the Atlantic States Marine Fishery Commission - Amendment 2 to the Interstate Fishery Management Plan for Shad and River Herring (River Herring Management).

ASMFC. (2010). Fishery Management Report of the Atlantic States Marine Fishery Commission - Amendment 3 to the Interstate Fishery Management Plan for Shad and River Herring (American Shad Management).

Baum, E. (1997). *Maine Atlantic salmon: a national treasure.* Atlantic Salmon Unlimited. Hermon, ME.

Beaugrand, G., & Reid, P. C. (2003). Long-term changes in phytoplankton, zooplankton, and salmon related to climate. *Global Change Biology, 9*, 801-817.

Beiningen, K. T. (1976). Fish Runs: . *Investigative Reports of Columbia River Fisheries Project*, 65p.

Bell, M. C. (1991). Fisheries handbook of engineering requirements and biological criteria. *DTIC Document. US Army Corps of Engineers, North Pacific Division*, 353.

Bergkamp, G., McCartney, M., Dugan, P., McNeely, J., & Acreman, M. (2000). Dams, ecosystem functions and environmental restoration. *Thematic Review II.1 prepared as an input to the World Commission on Dams, 1: 1-187*.

Blackwell, B. F., & Juanes, F. (1998). Predation on Atlantic salmon smolts by striped bass after dam passage. *North American Journal of Fisheries Management, 18*(4), 936-939.

Brookfield. (2016). Weston, Shawmut, and Lockwood Projects, Kennebec River, and Pejepscot and Brunswick Projects, Androscoggin River Evaluation of Atlantic Salmon Passage, Spring 2015. Prepared by Normandeau Associates, Inc.

Budy, P., Thiede, G. P., Bouwes, N., Petrosky, C. E., & Schaller, H. (2002). Evidence Linking Delayed Mortality of Snake River Salmon to Their Earlier Hydrosystem Experience. *North American Journal of Fisheries Management, 22*(1), 35-51. doi:10.1577/1548-8675(2002)022<0035:eldmos>2.0.co;2

Bunt, C., Castro‐Santos, T., & Haro, A. (2012). Performance of fish passage structures at upstream barriers to migration. *River Research and Applications, 28*(4), 457-478.

Castro-Santos, T., & Letcher, B. H. (2010). Modeling migratory energetics of Connecticut River American shad (*Alosa sapidissima*): implications for the conservation of an iteroparous anadromous fish. *Canadian Journal of Fisheries and Aquatic Sciences, 67*(5), 806-830.

Caudill, C. C., Daigle, W. R., Keefer, M. L., Boggs, C. T., Jepsen, M. A., Burke, B. J., … Peery, C. A. (2007). Slow dam passage in adult Columbia River salmonids associated with unsuccessful migration: Delayed negative effects of passage obstacles or condition-dependent mortality? Canadian Journal of Fisheries and Aquatic Sciences, 64, 979–995. https://doi.org/10.1139/f07-065

Clews, E., Durance, I., Vaughan, I. P., & Ormerod, J. (2010). Juvenile salmonid populations in a temperate river system track synoptic trends in climate. *Global Change Biology, 16*, 3271-3283.

CMS. (2020). *Collaborative Management Strategy for the Gulf of Maine Distinct Population Segment of Atlantic Salmon. Report of 2019 Activities.* Retrieved from <https://atlanticsalmonrestoration.org/resources/documents/cms-annual-reports-2020>

DeCola, J. N. (1970). Water quality requirements for Atlantic salmon. *Federal Water Quality Administration, Needham Heights, Mass.(USA). New England Basins Office*, 42.

Dubé, N. R., Dill, R., Spencer, R. C., Simpson, M. N., Cox, O. N., Ruksznis, P. J., . . . Gallant, K. (2011). *Penobscot River: 2010 Annual Report*. Retrieved from

Dubé, N. R., R. Dill, R.C. Spencer, M.N. Simpson, P.J. Ruksznis, K.A. Dunham, O.N. Cox, and K. Gallant. (2012). Penobscot River: 2011 Annual Report. xiv + 175.

Elliott, S. R., Coe, T. A., Helfield, J. M., & Naiman, R. J. (1998). Spatial variation in environmental characteristics of Atlantic salmon (Salmo salar) rivers. *Canadian Journal of Fisheries and Aquatic Sciences, 55*(S1), 267-280.

Elson, P. F. (1969). High temperature and river ascent by Atlantic salmon. *International Council for the Exploration of the Sea, M:12*, 9pp.

Fay, C., Bartron, M., Craig, S. D., Hecht, A., Pruden, J., Saunders, R., . . . Trial, J. G. (2006). *Status review for anadromous Atlantic salmon (Salmo salar) in the United States.*: Report to the National Marine Fisheries Service and U.S. Fish and Wildlife Service.

Fernandez, I. J., Schmitt, C., Stancioff, E., Birkel, S. D., Pershing, A., Runge, J., . . . Mayewski, P. A. (2015). *Maine's climate future: 2015 update. Orono, ME. University of Maine*. Retrieved from <http://digitalcommons.library.umaine.edu/climate_facpub/5>

Foster, N. W., & Atkins, C. G. (1867). Report of Commission on Fisheries.

Franke, G. F., Webb, D. R., Fisher, R. K., Mathur, D., Hopping, P. N., March, P. A., . . . Sotiropoulus, F. (1997). Development of environmentally advanced hydropower turbine system design concepts. *U.S. Department of Energy and Hydropower Research Foundation*.

Friedland, K. D. (1998). Ocean climate influences on critical Atlantic salmon (*Salmo salar*) life history events. *Canadian Journal of Fisheries and Aquatic Sciences, 55*(S1), 119-130.

Haeseker, S. L., McCann, J. A., Tuomikoski, J., & Chockley, B. (2012). Assessing Freshwater and Marine Environmental Influences on Life-Stage-Specific Survival Rates of Snake River Spring–Summer Chinook Salmon and Steelhead. *Transactions of the American Fisheries Society, 141*(1), 121-138. doi:10.1080/00028487.2011.652009

Hall, S., & Shepard, S. (1990). Report for 1989 evaluation studies of upstream and downstream facilities at the West Enfield Project (FERC #2600-010) *Bangor Hydro-Electric Company*, 23.

Hansen , L. P., Jacobsen2, J. A., & Lund1, R. A. (1997, 1997). *The incidence of escaped farmed Atlantic salmon, Salmo salar L., in the Faroese Fishery and estimates of catches of wild salmon*.

Hare, J. A., Morrison, W. E., Nelson, M. W., Stachura, M. M., Teeters, E. J., Griffis, R. B., . . . Bell, R. J. (2016). A vulnerability assessment of fish and invertebrates to climate change on the Northeast US continental shelf. *PLoS One, 11*(2), e0146756.

Haro, A., T. Castro-Santos, and J. Boubée. 2000. Behavior and passage of the silver-phase American eels, Anguilla rostrata at a small hydroelectric facility. Dana 12: 33- 42.

Hecker, G. E., Amaral, S. V., Stacey, P., & Dixon, D. A. (2007). Developing turbine blades to minimize turbine mortality. Waterpower. Paper No. 097. XV Chattanooga TN, HCI Publications Inc., Kansas City, MO.

Hedger, R. D., Hatin, D., Dodson, J. J., Martin, F., Fournier, D., Caron, F., & Whoriskey, F. G. (2009). Migration and swimming depth of Atlantic salmon kelts Salmo salar in coastal zone and marine habitats. *Marine Ecology Progress Series, 392*, 179-192.

Hoegh-Guldberg, O., & Bruno, J. F. (2010). The impact of climate change on the world’s marine ecosystems. *Science, 328*(5985), 1523-1528.

Hunter, M. A. (1992). Hydropower flow fluctuations and salmonids: a review of the biological effects, mechanical causes, and options for mitigation. *119*, 1-45.

IPCC. (2007). Climate Change 2007: The Physical Science Basis. . *Contribution of Working Group I to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change [Solomon, S., D. Qin, M. Manning, Z. Chen, M. Marquis, K.B. Averyt, M. Tignor and H.L. Miller (eds.)]. Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA*, 996.

IPCC. (2014). Climate change 2014 synthesis report. . *Contribution of Working Groups I, II and III to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change [Core Writing Team, R.K. Pachauri and L.A. Meyer (eds.)]. IPCC, Geneva, Switzerland*, 151.

ISAB. (2007). Latent Mortality Report: Review of Hypotheses and Causative Factors Contributing to Latent Mortality and their Likely Relevance to the “Below Bonneville” Component of the COMPASS Model. *ISAB 2007-1*.

Juanes, F., Gephard, S., & Beland, K. F. (2004). Long-term changes in migration timing of adult Atlantic salmon (Salmo salar) at the southern edge of the species distribution. *Canadian Journal of Fisheries and Aquatic Sciences, 61*(12), 2392-2400. doi:10.1139/f04-207

Klopries, E.-M., Deng, Z. D., Lachmann, T. U., Schüttrumpf, H., & Trumbo, B. A. Surface bypass as a means of protecting downstream-migrating fish: lack of standardised evaluation criteria complicates evaluation of efficacy. *Marine and Freshwater Research*.

Larinier, M. (2000). Dams and Fish Migration: dams, ecosystem functions and environmental restoration. *Environmental Issues, Dams and Fish Migration, Final Draft, June 30, 2000.*

Larinier, M. (2002). Biological factors to be taken into account in the design of fishways, the concept of obstructions to upstream migration. *Bulletin Francais de la Peche et de la Pisciculture*(364), 28-38.

Larinier, M., & Marmulla, G. (2004). *Fish passes: types, principles and geographical distribution–an overview.* Paper presented at the Proceedings of the second international symposium on the management of large rivers for fisheries.

Loesch, J. G. (1987). Overview of life history aspects of anadromous alewife and blueback herring in freshwater habitats. *American Fisheries Society Symposium, 1*, 89-103.

Lunetta, R. S., Cosentino, B. L., Montgomery, D. R., Beamer, E. M., & Beechie, T. J. (1997). GIS-based evaluation of salmon habitat in the Pacific Northwest. *PE&RS*, 1219-1229.

Magilligan, F., Graber, B., Nislow, K., Chipman, J., Sneddon, C., & Fox, C. (2016). River restoration by dam removal: Enhancing connectivity at watershed scales. *Elementa, 4*.

McCormick, S. D., Hansen, L. P., Quinn, T. P., & Saunders, R. L. (1998). Movement, migration, and smolting of Atlantic salmon (*Salmo salar*). *Canadian Journal of Fisheries and Aquatic Sciences, 55*(S1), 77-92.

MDMR. (2010). *2009 Brunswick Fishway Report. Augusta, ME. Accession #20100428-0097*.

MDMR. (2012). *2011 Brunswick Fishway Report. Augusta, ME. Accession #20120404-0003*.

MDMR. (2014). American Shad Habitat Plan. *Submitted to the Atlantic States Marine Fisheries Commission as a requirement of Amendment 3 to the Interstate Management Plan for Shad and River Herring*.

MDMR, & MDIFW. (2017). *Draft Fisheries Management Plan for the Lower Androscoggin River, Little Androscoggin River and Sabattus River*. Retrieved from

Melillo, J. M., Richmond, T., & Yohe, G. (2014). Climate change impacts in the United States: the third national climate assessment. *U.S. Global Change Research Program* 841 pp. doi:10.7930/J0Z31WJ2.

Miracle, A., Denslow, N. D., Kroll, K. J., Liu, M. C., & Wang, K. K. (2009). Spillway-Induced Salmon Head Injury Triggers the Generation of Brain αII-Spectrin Breakdown Product Biomarkers Similar to Mammalian Traumatic Brain Injury. *PLoS One, 4*(2), e4491.

MSPO. (1993). Kennebec River resource management plan: balancing hydropower generation and other uses. *Maine State Planning Office*, 201.

Mullen, D. M., Fay, C. W., & Moring, J. R. (1986). Species profiles: life histories and environmental requirements of coastal fishes and invertebrates (North Atlantic): alewife/blueback herring. *U.S. Fish and Wildlife Service Biological Report 82(11.56). U.S. Army Corps of Engineers, TR EL-82-4. 21 pp.*

Mulligan, K. B., Haro, A., Towler, B., Sojkowski, B., & Noreika, J. (2019). Fishway entrance gate experiments with adult american shad. *Water Resources Research, 55*. Retrieved from <https://doi.org/10.1029/2018WR024400>

Nieland, J. L., Sheehan, T. F., Saunders, R., Murphy, J. S., Lake, T. R. T., & Stevens, J. R. (2013). *Dam impact analysis model for Atlantic salmon in the Penobscot River, Maine*: US Department of Commerce, National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Northeast Fisheries Science Center.

Normandeau Associates, Inc. 2020. Effectiveness for Adult River Herring at the Milford Fish Lift Facility - 2019 Milford Project – FERC No. 2534. Prepared For Black Bear Hydro Partners, LLC. Portsmouth, NH

NMFS. (2011). Anadromous Salmonid Passage Facility Design. NMFS, Northwest Region, Portland, Oregon.

NMFS. (2016). *Revised guidance for the treatment of climate change in NMFS Endangered Species Act decisions. June 17, 2016.*

NMFS. (2017). Designation of Critical Habitat for the Gulf of Maine, New York Bight, and Chesapeake Bay Distinct Population Segments of Atlantic Sturgeon: ESA Section 4 (b)(2) Impact Analysis and Biological Source Document with the Economic Analysis and Final Regulatory Flexibility Analysis Finalized June 3, 2017.

NMFS. (2020a). *New England and Mid-Atlantic Geographic Strategic Plan 2020-2023*. Retrieved from <https://www.fisheries.noaa.gov/resource/document/noaa-fisheries-strategic-plans>

NOAA Fisheries. 2020. Androscoggin River Watershed Comprehensive Plan for Diadromous Fish. Greater Atlantic Region Policy Series 20-01. NOAA Fisheries Greater Atlantic Regional Fisheries Office - [www.greateratlantic.fisheries.noaa.gov/policyseries/.](http://www.greateratlantic.fisheries.noaa.gov/policyseries/) 136 pp.

NOAA. (2016). *NOAA Fisheries Protected Resources strategic plan: 2016 – 2020. Conserving America’s marine protected species. August 2016*.

PLTW. (2017). *Practical guidelines for incorporating adult Pacific lamprey passage at fishways*. Pacific Lamprey Technical Workgroup. White Paper. Retrieved from <https://www.fws.gov/pacificlamprey/mainpage.cfm>

Poff, N. L., Allan, J. D., Bain, M. B., Karr, J. R., Prestegaard, K. L., Richter, B. D., . . . Stromberg, J. C. (1997). The natural flow regime. *BioScience, 47*(11), 769-784.

Pracheil, B. M., DeRolph, C. R., Schramm, M. P., & Bevelhimer, M. S. (2016). A fish-eye view of riverine hydropower systems: the current understanding of the biological response to turbine passage. *Reviews in Fish Biology and Fisheries, 26*(2), 153-167.

Process, W. t. o. r. s. b. t. d. s. o. t. R. A. (1998). *ABSTRACTS-Interaction between wild and farmed Atlantic salmon in the maritime provinces*. Retrieved from

Renkawitz, M. D., Sheehan, T. F., & Goulette, G. S. (2012). Swimming depth, behavior, and survival of Atlantic salmon postsmolts in Penobscot Bay, Maine. *Transactions of the American Fisheries Society, 141*(5), 1219-1229.

Saunders, R., Hachey, M. A., & Fay, C. W. (2006). Maine's diadromous fish community: past, present, and implications for Atlantic salmon recovey. *Fisheries, 31*(11), 537-547.

Schaller, H. A., & Petrosky, C. E. (2007). Assessing Hydrosystem Influence on Delayed Mortality of Snake River Stream-Type Chinook Salmon. *North American Journal of Fisheries Management, 27*(3), 810-824. doi:10.1577/m06-083.1

Schilt, C. R. (2007). Developing fish passage and protection at hydropower dams. *Applied Animal Behaviour Science, 104*(3), 295-325.

Scott, W. B., & Scott, M. G. (1988). *Atlantic Fishes of Canada* (Vol. 219: 731p.): Canadian Bulletin of Fisheries and Aquatic Sciences.

Smith, R. D. (1996). Geomorphic effects of large woody debris in streams. *USDA Forest Service Technical Report, Pacific Northwest Research Station, Juneau, AK.*, 113-127.

Spence, B. C., Lomnicky, G. A., Hughes, R. M., & Novitzki, R. P. (1996). *An ecosystem approach to salmonid conservation*: ManTech Environmental Research Services, Corporation.

Stich, D. S., Bailey, M. M., Holbrook, C. M., Kinnison, M. T., & Zydlewski, J. D. (2015). Catchment-wide survival of wild-and hatchery-reared Atlantic salmon smolts in a changing system. *Canadian Journal of Fisheries and Aquatic Sciences, 72*(9), 1352-1365.

Stich, D. S., Zydlewski, G. B., Kocik, J. F., & Zydlewski, J. D. (2015). Linking behavior, physiology, and survival of Atlantic salmon smolts during estuary migration. *Marine and Coastal Fisheries, 7*(1), 68-86.

Stier, D. J., & Crance, J. H. (1985). *Habitat suitability index models and instream flow suitability curves: American shad*: National Coastal Ecosystems Team, Division of Biological Services, Research ….

Taylor, R. E., & Kynard, B. (1985). Mortality of juvenile American shad and blueback herring passed through a low-head Kaplan hydro-electric turbine. *Transactions of the American Fisheries Society, 114*, 430-435.

U.S.Fish and Wildlife Service, R. (1989). *Atlantic Salmon Restoration in new England, Final Environmental Impact Statement 1989-2021*. Newton Corner, MA: U.S. Fish and Wildlife Service, Region 5.

USASAC. (2019). *Annual report of the U.S. Atlantic Salmon Assessment Committee. Report No. 31 - 2018 Activities. Prepared for the U.S. Section to NASCO.*

USFWS. (2017). *Fish passage Engineering Design Criteria*. Retrieved from Hadley, MA:

USFWS, & NMFS. (2005). *Final recovery plan for the Gulf of Maine Distinct Population Segment of Atlantic salmon (Salmo salar). National Marine Fisheries Service (NMFS) and U.S. Fish and Wildlife Service (USFWS). November 2005*. .

USFWS, & NMFS. (2019a). *Recovery Plan for the Gulf of Maine Distinct Population Segment of Atlantic Salmon (Salmo salar): Final Plan for the 2009 ESA Listing*. US Fish and Wildlife Service, National Marine Fisheries Service

USFWS, & NMFS. (2019b). *SHRU Specific Recovery Implementation Strategy. Draft.* Retrieved from <https://atlanticsalmonrestoration.org/resources/documents/atlantic-salmon-recovery-plan-2015/appendix-to-recovery-plan/recovery-implementation-strategy/view>

Weiss-Glanz, L. S., Stanely, J. S., & Moring, J. R. (1986). Species Profiles: Life histories and environmental requirements of coastal fishes and invertebrates (North Atlantic) - American shad. *U.S. Fish and Wildlife Service Biological Report 82(11.59). U.S. Army Corps of Engineers, TR EL-82-4. 16 pp.*

Whalen, K. G., Parrish, D. L., & McCormick, S. D. (1999). Migration timing of Atlantic salmon smolts relative to environmental and physiological factors. *Transactions of the American Fisheries Society, 128*(2), 289-301.

# Androscoggin River Fishway Reports

MDMR has conducted monitoring of fish passage and management activities for more than 30 years. Licensees for mainstem hydropower facilities have also documented fish passage through seasonal counts and a number of studies. While not cited directly in this document, the data generated and conclusions developed therein were considered in our decision process. The fish passage studies are generally available on the FERC e-library. Those less accessible are provided within our administrative record.

# RESOURCE MANAGEMENT PLANS

In developing its terms and conditions, we considered the following resource management plans.

Atlantic States Marine Fishery Commission (ASMFC). 1985. Fishery management plan for the anadromous alosid stocks of the eastern United States: American shad, hickory shad, alewife, and blueback herring: phase II in Interstate Management Planning for migratory alosids of the Atlantic coast.

ASMFC. 1998. Fishery Management Report of the Atlantic States Marine Fishery Commission - American Shad Stock Assessment Peer Review Report.

ASMFC. 1999. Amendment 1 to the Interstate Fishery Management Plan for Shad and River Herring. Report No. 35 of the Atlantic States Marine Fisheries Commission.

ASMFC. 2000. Interstate Fishery Management Plan for the American Eel (*Anguilla rostrata*). Fishery Management Report No. 36 of the Atlantic State Marine Fisheries Commission.

ASMFC. 2007. Fishery Management Report of the Atlantic States Marine Fishery Commission - American Shad Stock Assessment Report for Peer Review Volume I. Stock Assessment Report 07-01 supplement.

ASMFC. 2007. Fishery Management Report of the Atlantic States Marine Fishery Commission - American Shad Stock Assessment Report for Peer Review Volume II. Stock Assessment Report 07-01 supplement.

ASMFC. 2009. Fishery Management Report of the Atlantic States Marine Fishery Commission - Amendment 2 to the Interstate Fishery Management Plan for Shad and River Herring (River Herring Management).

ASMFC. 2010. Fishery Management Report of the Atlantic States Marine Fishery Commission - Amendment 3 to the Interstate Fishery Management Plan for Shad and River Herring (American Shad Management).

ASMFC. 2012. River Herring Stock Assessment Report for Peer Review. Stock Assessment Report No. 12-2, Vol. I.

ASMFC. 2012. River Herring Stock Assessment Report for Peer Review. Stock Assessment Report No. 12-2, Volume II.

Maine Department of Marine Resources (MDMR). 2014. American shad habitat plan. Prepared by the Maine Department of Marine Resources. Submitted to the Atlantic States Marine Fisheries Commission as a requirement of Amendment 3 to the Interstate Management Plan for Shad and River Herring.

MDMR. 2014. Draft Kennebec River Atlantic Salmon Interim Restoration Plan 2015-2020. Maine Department of Marine Resources, Bureau of Sea-Run Fisheries and Habitat.

Maine Department of Marine Resources (MDMR) and Maine Department of Inland Fisheries and Wildlife (MDIFW). 2008. Strategic plan for the restoration of diadromous fishes to the Penobscot River. March 2008.

Maine Department of Marine Resources (MDMR). 2007. Atlantic salmon freshwater assessments and research. Semi-annual project report. NOAA grant NA06MNF4720078. May 1, 2007 - Oct. 30, 2007. Bangor, ME. Nov. 2007. 153 pp.

Maine Department of Marine Resources (MDMR). 2008. Atlantic salmon freshwater assessments and research. Semi-annual project report. NOAA grant NA06MNF4720078. May 1, 2008-0ct. 30, 2008. Bangor, ME. Nov. 2007. 96pp.

MDMR, and MDIFW. 2016. Fisheries management Plan for the Mousam River Drainage. Draft. Maine Department of Marine Fisheries and Maine Department of Inland Fisheries and Wildlife.

MDMR, and MDIFW. 2017. Draft Fisheries Management Plan for the Lower Androscoggin River, Kennebec River and Sabattus River. Maine Department of Marine Resources and Maine Department of Inland Fisheries and Wildlife.

Maine State Planning Office. 1993. Kennebec River resource management plan: balancing hydropower generation and other uses.

U.S. Fish and Wildlife Service, Maine Department of Inland Fisheries and Wildlife, Maine Atlantic Sea Run Salmon Commission and Maine Department of Marine Resources. 1987. Saco River Strategic Plan for Fisheries Management. January 1987.

# FEDERAL REGISTER NOTICES

32 Federal Register 4001 Office of the Secretary, Native Fish and Wildlife, Endangered Species (shortnose sturgeon). Federal Register 32(48):4001. March 11, 1967

65 FR 69459. Endangered and threatened species; final endangered status for a distinct population segment of anadromous Atlantic salmon (*Salmo salar*) in the Gulf of Maine. Department of the Interior Fish and Wildlife Service and Department of Commerce National Oceanic and Atmospheric Administration. Federal Register 65(223): 69459-69483. November 17, 2000

74 FR 29300. Endangered and threatened species; designation of critical habitat for Atlantic salmon (*Salmo salar*) Gulf of Maine Distinct Population Segment; Final Rule. Department of Commerce National Oceanic and Atmospheric Administration. Federal Register 74(117): 29300–29341. June 19, 2009

74 FR 29344. Endangered and threatened species; determination of endangered status for the Gulf of Maine Distinct Population Segment of Atlantic salmon, final rule. Department of the Interior Fish and Wildlife Service and Department of Commerce National Oceanic and Atmospheric Administration. Federal Register 74(117): 29344–29387. June 19, 2009

77 FR 5880. Endangered and threatened wildlife and plants; threatened and endangered status for Distinct Populations Segments of Atlantic sturgeon in the Northeast Region. Department of Commerce, National Oceanic and Atmospheric Administration. Federal Register 77(24): 5880-5912. February 6, 2012

78 FR 48944. Endangered and threatened wildlife and plants; endangered species act listing determination for alewife and blueback herring. Department of Commerce National Oceanic and Atmospheric Administration. Federal Register 78(155): 48944-48994. August 12, 2013

80 FR 60834. Endangered and threatened wildlife and plants; 12-month findings on petitions to list 19 Species as endangered or threatened species. Department of Interior U.S. Fish and Wildlife Service. Federal Register 80(195): 60834-60850. October 8, 2015

82 FR 38672. Endangered and threatened species; initiation of a status review for alewife and blueback herring under the Endangered Species Act (Klopries et al.). Department of Commerce, National Oceanic and Atmospheric Administration. 82(156):38672-38674. August 15, 2017

82 FR 39160. Endangered and Threatened Species Designation of Critical Habitat for the Endangered New York Bight, Chesapeake Bay, Carolina and South Atlantic Distinct Population Segments of Atlantic Sturgeon and the Threatened Gulf of Maine Distinct Population Segment of Atlantic Sturgeon Federal register 82(158): 39160-39274. August 17, 2017

84 FR 28630. Endangered Species Act Listing Determination for Alewife and Blueback Herring. Department of Commerce. National Oceanic and Atmospheric Administration. 84FR 28630. June 19, 2019

1. Available at: <https://www.fisheries.noaa.gov/resource/document/species-spotlight-priority-actions-2021-2025-atlantic-salmon> [↑](#footnote-ref-1)
2. For ESA decisions involving species influenced by climate change, NMFS will use climate indicator values projected under the Intergovernmental Panel on Climate Change (IPCC)'s Representative Concentration Pathway. [↑](#footnote-ref-2)
3. In 2013, river flows exceeded the Project’s hydraulic capacity approximately 9 days during the month of May. In 2015, river flows exceeded the Project’s hydraulic capacity approximately 3 days during the month of May. [↑](#footnote-ref-3)
4. In 2014, river flows exceeded the Project’s hydraulic capacity approximately 22 days during the month of May. [↑](#footnote-ref-4)
5. Gill Na+/K+-ATPase (NKA) in is involved in ion regulation in both freshwater and seawater. [↑](#footnote-ref-5)
6. We suggest that any changes to project operation be memorialized in periodic updates to the Project’s Operation and Maintenance plan, developed in consultation with the resource agencies. [↑](#footnote-ref-6)
7. <https://www.nfwf.org/programs/new-england-forests-and-rivers-fund>, <https://www.nfwf.org/sites/default/files/newengland/Documents/2019grantslate.pdf>, <https://www.nfwf.org/sites/default/files/2020-11/national-coastal-resilience-fund-2020-grant-slate.pdf>, <https://www.nfwf.org/programs/national-coastal-resilience-fund> [↑](#footnote-ref-7)
8. FERC Accession #20181102-5076 [↑](#footnote-ref-8)
9. FERC Accession #20210518-5132 [↑](#footnote-ref-9)
10. As described in section 8.6, although Topsham Hydro adjusted the measured project survival in their study report to account for background levels of mortality from other sources (e.g., predation), we are not incorporating the adjustment here, as the background survival was actually lower than the measured survival at the Project.  Therefore, we do not consider that background levels of mortality were accurately represented during the study.  [↑](#footnote-ref-10)