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

APR 10 2018

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 Prescription for Fishways for the Ellsworth Hydroelectric Project (FERC No. 2727)

Dear Secretary Bose:

Enclosed is our preliminary prescription for fishways (Attachment A), pursuant to Section 18 [16 USC §811], and terms and conditions pursuant to Section 10(j) [16 USC §803(j)], of the Federal Power Act for the Ellsworth Hydroelectric Project (P-2727) on the Union River, Maine. We are filing the preliminary prescription in response to the February 9, 2018, Notice of Application Ready for Environmental Analysis, regarding Black Bear Hydro Partners, LLC's final license application. Through this preliminary prescription, we act to preserve, protect and restore anadromous fish in the Union River watershed. The enclosed prescription is 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 for American eel and we reserve authority to act in the future. We also include comments on the Final License Application and Updated Study Reports (Attachment B).

The Union River supports several diadromous fish species including three species listed under the Endangered Species Act (ESA) (Atlantic salmon, Atlantic sturgeon, and shortnose sturgeon) and three species recognized by us as Species of Concern (alewife, blueback herring, and rainbow smelt). Each species serves a unique and important ecological function by 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 Union River include sustainable anadromous fish stocks within the Union 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 Ellsworth Project is a priority action to meet these goals.

The Union River is designated critical habitat for Gulf of Maine distinct population segment of Atlantic salmon. Atlantic salmon has been recognized by us as one of the eight species most 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, the ESA listing determination and draft recovery plan. Section 7(a)(2) 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 concurrent with issuance of the draft National Environmental Policy Act document.

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 anadromous 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 Dan Tierney in our Protected Resources Division (dan.tierney@noaa.gov or 207-866-3755).

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 Ellsworth Hydroelectric Project (FERC No. 2727)

Attachment B: National Marine Fisheries Service's Comments on Final License Application and Updated Study Reports of Black Bear Hydro Partners, LLC for the Ellsworth Hydroelectric Project (FERC No. 2727)

ATTACHMENT A

UNITED STATES DEPARTMENT OF COMMERCE'S RECOMMENDED TERMS AND CONDITIONS, AND PRELIMINARY PRESCRIPTION FOR FISHWAYS FOR THE ELLSWORTH HYDROELECTRIC PROJECT (FERC NO. 2727-086)

BEFORE THE

UNITED STATES OF AMERICA

FEDERAL ENERGY REGULATORY COMMISSION

Black Bear Hydro Partners, LLC,	)	**Union River**
Applicant	)	**Hancock County**
	)	**Ellsworth, Waltham, Mariaville, and**
	)	**Fletchers Landing Township, Maine**
	)	**FERC No. 2727-086**

UNITED STATES DEPARTMENT OF COMMERCE'S PRELIMINARY PRESCRIPTION FOR FISHWAYS PURSUANT TO SECTION 18 OF THE FEDERAL POWER ACT

Approved this 10th day of April, 2018, by:

For **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

1. 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 and Conditions and Preliminary Prescription for Fishways for Black Bear Hydro Partners' (Black Bear or Licensee) Ellsworth Hydroelectric Project (P- 2727) in response to the Federal Energy Regulatory Commission's (FERC or Commission) February 9, 2018, Notice of Application Ready for Environmental Analysis. This filing also includes a schedule for submitting modified prescriptions and recommendations. Comments and terms and conditions included here are supported by congressionally signed mandates and our agency mission for protecting and conserving these and all target anadromous 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, (ESA) occur in the Union River watershed. These include the endangered Gulf of Maine (GOM) 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 entire Union River watershed has been designated critical habitat for the GOM DPS of Atlantic salmon (74 FR 29300, June 19, 2009). Additionally, three species designated by us as Species of Concern occur in the river (alewife, blueback herring, and rainbow smelt). The Species of Concern designation indicates that we have concerns regarding the current status and/or threats, or have insufficient information available to indicate whether listing under the ESA is warranted. The historical range of Atlantic salmon in the Union 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.

2. 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: Chief, Habitat Protection Division, NMFS Office of Habitat Conservation, 1315 East-West Highway, F/HC2, Silver Spring, MD 20910.

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: Regional Administrator, NMFS Greater Atlantic Regional Fisheries Office, 55 Great Republic Drive, Gloucester, MA 01930.

3. NMFS STATUTORY AUTHORITY

The following statutes afford us the authority to protect and manage a variety of living marine resources that may be affected by the proposed relicensing, including alewife, blueback herring, American shad, Atlantic salmon, Atlantic and shortnose sturgeon, sea lamprey and American eel.

3.1. MAGNUSON-STEVENS FISHERY CONSERVATION AND MANAGEMENT ACT (AS AMENDED) (16 USC §§1801, et seq.)

The 1996 amendments to the Magnuson-Stevens Fishery Conservation and Management Act set forth a number of mandates for NMFS, regional fishery management councils, and other federal agencies to identify and protect important marine and anadromous fish habitats. Fishery management councils, with assistance from us, are required to designate EFH for all federally-managed species. EFH is defined as "those waters and substrate necessary to fish for spawning, breeding, feeding or growth to maturity." Federal action agencies which fund, permit, or carry out activities that may adversely impact EFH are required to consult with us regarding the potential effects of their actions on EFH, and to respond in writing to our recommendations. In addition, we may comment on any state agency activities which would impact EFH. Adverse effects may include direct or indirect physical, chemical, or biological alterations of the waters or substrate and loss of, or injury to, benthic organisms, prey species and their habitat, and other ecosystem components, if such modifications reduce the quality and/or quantity of EFH.

3.2. ENDANGERED SPECIES ACT OF 1973 (AS AMENDED) (16 USC §§1531, et seq.)

Section 7(a)(1) of the ESA requires federal agencies to use their authorities to further the conservation of listed species. ESA section 7(a)(2) states that each federal agency shall, in consultation with the Secretary of Commerce or Interior, as appropriate, insure that any action they authorize, fund, or carry out is not likely to jeopardize the continued existence of a listed species or result in the destruction or adverse modification of designated critical habitat. Any discretionary federal action that may affect a listed species or its critical habitat must undergo ESA section 7 consultation. Issuance of a hydroelectric project license by the Commission is an action that requires ESA section 7 consultation.

3.3. Atlantic Coastal Fisheries Cooperative Management Act (as amended) (16 USC §§5101, et seq.)

The purpose of the Atlantic Coastal Fisheries Cooperative Management Act is to provide for more effective conservation of coastal fish species that are distributed across the jurisdictional boundaries of the Atlantic states and the federal government. These coastal fish species, including blueback herring and alewife (collectively, "river herring"), American shad, and American eel, are managed by various boards of the Atlantic States Marine Fisheries Commission (ASMFC). The ASMFC creates fishery management plans and recommends management action to the states and NMFS.

3.4. Fish and Wildlife Coordination Act (as amended) (16 USC 661, et seq.)

The Fish and Wildlife Coordination Act provides that wildlife conservation shall receive equal consideration and be coordinated with other features of water resource development programs. A federal action agency, such as FERC, must consult with us and consider the conservation of wildlife resources by preventing loss and damage to such resources. In addition, action agencies must consider providing for the development and improvement of wildlife resources in connection with such water-resource development. We may provide recommendations to the federal action agency; the action agency is required to give these recommendations full consideration.

3.5. National Environmental Policy Act (as amended) (42 USC §§4321, et seq.)

NEPA and its implementing regulations require federal action agencies to analyze the direct and indirect environmental effects and cumulative impacts of project alternatives and connected actions. NEPA requires the federal action agency to conduct a comparative evaluation of the environmental benefits, costs, and risks of the proposed action, and alternatives to the proposed action.

3.6. Federal Power Act (as amended) (16 USC §§791a, et seq.)

3.6.1. Section 10(a) Consistency with Comprehensive Plans

Under Section 10(a), the Commission must consider a project's consistency with federal and state comprehensive plans for improving, developing, or conserving a waterway.

Comprehensive plans include management and restoration of fish and habitat resources. The Commission must ensure that hydropower projects are consistent with a comprehensive plan for improving or developing a waterway and for other beneficial public use. Under Section 10(a)(1), a project in a river basin must serve the public interest, not just power generation. Section 10(a) requires the Commission to solicit recommendations from resource agencies and Indian tribes (if affected by the project) on how to make a project more consistent with federal or state comprehensive plans. The Commission will give consideration to a plan that a federal or state agency has adopted under its own authority, if the plan: (1) is a comprehensive study of one or more of the beneficial uses of the river; (2) specifies the standards, data, and methodology used; and, (3) is filed with the Commission's Secretary before Section 10(a) conditions are established for a given project.

3.6.2. Section 10(j) Recommendations for Fish, Wildlife and Habitat

Under section 10(j), licenses for hydroelectric projects must include conditions to protect, mitigate damages to, and enhance fish and wildlife resources, including related spawning grounds and habitat. These conditions are to be based on recommendations received from federal and state fish and wildlife agencies. The Commission is required to include such recommendations in the license unless it finds that they are inconsistent with Part I of the Federal Power Act (FPA) or other applicable law, and that alternative conditions adequately address fish and wildlife issues. Before rejecting an agency recommendation, the Commission must attempt to resolve the inconsistency, giving due weight to the agency's recommendations, expertise, and statutory authority. If the Commission does not adopt a section 10(j) recommendation, in whole or in part, it must publish findings that adoption of the recommendation is inconsistent with the purposes and requirements of Part 1 of the FPA or other applicable provisions of law, and that conditions selected by the Commission adequately and equitably protect, mitigate damages to, and enhance fish and wildlife and their habitats.

3.6.3. Section 18 Prescriptions for Fishways

Section 18 grants to the Department of Commerce and the Department of the Interior unilateral authority to prescribe fishways. Section 18 states that the Commission must require construction, maintenance, and operation by a Licensee, at the Licensee's own expense, of such fishways, as may be prescribed by the Secretary of Commerce or the Secretary of the Interior. Within the Department of Commerce, the authority to prescribe fishways is delegated to the NMFS Regional Administrator.

4. Goals and Objective

4.1. NMFS

We are responsible for the stewardship of the nation's living marine resources and their habitats. The NMFS Habitat Enterprise Strategic Plan (NMFS 2016a) includes long-term goals for resilient coastal ecosystems and conserving habitat for protected resources. Our agency goals strive for aquatic habitats and the species that inhabit them to be sustainable in the face of future challenges. Working toward the long-term sustainability of all species will help ensure commercial, recreational and cultural access for present and future generations; non-consumptive uses of living marine resources continue to support vibrant coastal communities and economies; and that species of cultural and economic value are sustained. Objectives under this long-term goal for healthy oceans include: recovered and healthy marine and coastal species; healthy habitats that sustain resilient and thriving marine resources and communities; improved understanding of ecosystems to inform resource management decisions; and sustainable fisheries and safe seafood for healthy populations and vibrant communities.

Anadromous 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, Ames and Lichter 2013). The decline of nearshore groundfish stocks may have been hastened by the loss of prey (Ames 2004, Ames and Lichter 2013). Restoration efforts throughout the range of diadromous species, including improvements to fish passage in the Union River, are anticipated to enhance the abundance of anadromous fish species, and may, in turn, aid in the restoration of cod and other groundfish species.

A national goal of the NMFS Protected Resources Strategic Plan (NOAA 2016) is to stabilize the most critically endangered species and improve populations of those species nearing recovery. Preventing the extinction of Atlantic salmon has been identified as a national priority under the Species in the Spotlight program. The Species in the Spotlight effort is identified within the strategic plan to focus attention on the eight most critically endangered species in the country under our jurisdiction. Together with the U.S. Fish and Wildlife Service (U.S. FWS), 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. As noted above, a number of species listed under the ESA occur in the Union River watershed including the endangered GOM 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 Union River watershed also falls within the designated critical habitat for Atlantic salmon. Recovery plans have been prepared for Atlantic salmon (USFWS and NMFS 2016) and shortnose sturgeon (NMFS 1998); both plans note the need to better manage the threats posed by dams to these species and the ecosystems on which they depend.

Goals and objectives specific for the Ellsworth Project, stated below, are based on our statutory obligations under the ESA as well as our overarching long-term agency goals and objectives.

4.2. NMFS Objectives for the Ellsworth Project

The Ellsworth Project is a FERC licensed hydroelectric dam on the Union River in Maine. Our principal objectives for the Ellsworth Project are to provide access to historical spawning, rearing, and migration habitats, and to provide safe downstream passage of outmigrating juveniles and post-spawn adults. Both of these objectives must be met in order for anadromous species to complete their life cycles. These objectives can be met by modifications to Project facilities and operations necessary to ensure the safe, timely, and effective passage of migrating adults and juveniles past the Project, including passage necessary for dispersal and seasonal movement.

4.3. Atlantic States Marine Fisheries Commission

The ASMFC acts to coordinate the conservation and management of 25 nearshore fish species. Each state is represented by commissioners, representatives of the state's marine fisheries management agency, legislators and appointed stakeholder representatives. 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 fish under the authority of the Atlantic Coastal Fisheries Cooperative Management Act. There is also an ASMFC FMP for Atlantic sturgeon; however, the species has since been listed under the ESA and fishing is currently prohibited. The plans were developed in recognition of 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 following ASMFC FMPs are consistent with our agency's objectives for restoring runs of American shad, blueback herring, American eel, and alewives in the Union River.

Goals and objectives of the shad and river herring FMP include (ASMFC 1985):

- Promote, in a coast-wide manner, the protection and enhancement of shad and river herring stocks on the Atlantic seaboard.
- Regulate exploitation to achieve fishing mortality rates sufficiently low to ensure sustainability of the stocks.
- Improve habitat accessibility and quality, including addressing fish passage needs at dams and other obstructions, improving water quality, addressing river flow allocations to support habitat needs, and preventing mortality at water withdrawal facilities.

- Initiate stocking programs in historical alosine habitat that do not presently support natural spawning migrations, expand existing stock restoration programs, and initiate new programs to enhance depressed stocks.

Goals and objectives of the American Eel FMP include (ASMFC 2000):

- Protect and enhance the abundance of American eel in inland and territorial waters of the Atlantic states.
- Contribute to the viability of American eel spawning populations.
- Improve knowledge of American eel habitat use at all life stages through mandatory reporting of harvest and effort by commercial fishers and dealers, and enhanced recreational fisheries monitoring. Increase understanding of factors affecting eel population dynamics and life history through increased research and monitoring.
- Protect and enhance American eel abundance in all watersheds where eel now occur.
- Where practical, restore American eel to those waters where they had historical abundance but may now be absent by providing access to inland waters for glass eel, elvers, and yellow eel and adequate escapement to the ocean for pre-spawning adult eel.
- Investigate the abundance level of eel at the various life stages, necessary to provide adequate forage for natural predators and support ecosystem health and food chain structure.

4.4. 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: alewife, American eel, American shad, Atlantic salmon, Atlantic sturgeon, blueback herring, rainbow smelt, sea lamprey, sea-run brook trout, shortnose sturgeon, and striped bass. Several of these sea-run fish use the habitat within the Ellsworth Project area, including alewife, blueback herring, American shad, Atlantic salmon and American eel.

4.5. Species Specific Goals and Objectives

The following discussion outlines our goals and objectives for anadromous species restoration in the Union River. This section will focus on the species of management concern to NMFS that we believe historically used habitat upstream of Ellsworth Falls (in the approximate location of the existing Ellsworth Dam and its impoundment); as well as species designated as threatened or endangered under the ESA that fall under NMFS jurisdiction.

4.5.1. Alewife and Blueback Herring

We have designated river herring (both alewife and blueback herring) as a Species of Concern. Our management goals and objectives for river herring in the Union River include safe, timely and effective passage to access spawning and rearing habitat to ensure a sustainable run. The MDMR currently stocks adult alewife and blueback herring trapped at the Ellsworth Dam fish trap into Leonard and Graham Lakes. This stocking program maintains a population of adult river herring imprinted to the Union River for ecological benefits and a commercial harvest. MDMR caps the number of river herring stocked in the lakes. This cap is re-assessed annually and has increased from 4,500 in 1983 to 315,000 in 2015 (URFCC 2015, Final License Application). The limit on stocking remained 315,000 in 2016 and 2017; we expect it to stay at this level for the foreseeable future.

4.5.2. American Shad

American shad are an iteroparous, anadromous species occurring in waters of the eastern United States. Although shad were historically present in the Union River (MDIFW and MDMR 1982), the construction of dams, including the Ellsworth and Graham Dams, may have reduced their available habitat. The historical abundance and distribution of American shad in the Union River is uncertain, as it is unknown whether the species could pass above Ellsworth Falls. However, based on the distribution of American shad in other Maine rivers, we expect that the species may once have had access to much of the watershed. Our agency goal for American shad is to promote a sustainable population throughout their range. Presently, there is no management activity for American shad in the Union River.

4.5.3. Atlantic Salmon

Atlantic salmon are an anadromous species occurring in waters of the northeast United States. Our goal for the GOM DPS of Atlantic salmon is to enhance their recovery potential by seeking improvements to the project that would allow for increased abundance, genetic diversity and distribution of Atlantic salmon (NMFS and USFWS 2016) and eventual removal from the list of endangered species. Our management objective for this re-licensing is to ensure that the continued operation of the Ellsworth Project is not likely to jeopardize the continued existence of the GOM DPS of Atlantic salmon, or destroy or adversely modify its critical habitat. The recovery goals, objectives and criteria contained in the 2016 draft Recovery Plan for the GOM DPS consider abundance, genetic diversity and distribution. 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 (NMFS and USFWS 2016).

In the GOM DPS there are three Salmon Habitat Recovery Units (SHRUs). These include the Merrymeeting Bay, Penobscot Bay and Downeast Coastal SHRUs. The Union River is located within the Downeast Coastal SHRU. Each recovery unit must achieve specific recovery criteria for the downlisting or delisting of the GOM DPS (USFWS and NMFS 2016). The draft Recovery Plan indicates that the Downeast Coastal SHRU is important to salmon recovery for the following reasons (NMFS and USFWS 2016):

- The Downeast SHRU contains five of the seven remaining locally adapted genetic stocks in the GOM DPS, accounting for a significant component of the GOM DPS's genetic diversity.
- Of the five rivers in the Downeast SHRU that contain locally adapted stocks, there are no hydroelectric projects and only one mainstem dam, which may partially account for why the stocks in these rivers have managed to persist albeit at very low numbers.
- The Downeast SHRU represents an important link between two large river basins that once supported very large populations of Atlantic salmon – the Penobscot and the St.

John. The Downeast SHRU is important to assure that the GOM DPS does not become too distant and isolated from other Atlantic salmon populations.

- The combination of granite bedrock, glacial eskers and moraines, vast peat bogs and relatively flat topography makes the hydrology and water chemistry of the Downeast SHRU unique to the GOM DPS. These unique features would suggest that Atlantic salmon in these rivers may contain unique genes well adapted for this area and therefore should warrant their preservation.

The Plan also outlines the best opportunities for achieving the recovery strategy objectives in this SHRU:

- The entire Dennys, East Machias, Machias, Pleasant, and Narraguagus Rivers have abundant suitable habitats with locally adapted populations of Atlantic salmon.

- The West Branch Union River has abundant, suitable spawning and nursery habitats for Atlantic salmon.

Based on salmon habitat modelling (Wright et al. 2008), there are only three dams in the Downeast Coastal SHRU where improvements could result in access to a sufficient amount of habitat to achieve the minimum amount of accessible habitat necessary for salmon recovery (i.e. 30,000 habitat units per SHRU) (USFWS and NMFS 2016). Two of the dams are associated with the Ellsworth Project (Ellsworth and Graham Lake Dams), whereas the third is the Cherryfield Dam on the Narraguagus River.

4.5.4. AMERICAN EEL

American eel are native to the coastal rivers of Maine, including the Union River. The historical abundance and distribution of American eel in the Union River is unknown. Therefore, our management goals and objectives for this species in this watershed focuses on improving access to historical nursery habitat for juveniles and providing safe, timely, and effective adult eel emigration at barriers.

4.5.5. Sea Lamprey

Sea lamprey are native to coastal rivers of Maine, including the Union River. The historical abundance and distribution of sea lamprey in the Union River is unknown. Therefore, our management goals and objectives for this species in this watershed focuses on improving access to historical nursery habitat for juveniles and providing safe, timely, and effective adult lamprey emigration at barriers.

4.5.6. Atlantic and Shortnose Sturgeon

Atlantic and shortnose sturgeon are anadromous species occurring in waters of the eastern United States. The upper limit of the historical range of Atlantic and shortnose sturgeon in the Union River is assumed to be Ellsworth Falls, which is in the vicinity of the existing Ellsworth Dam (Houston et al. 2007). Shortnose sturgeon were listed as endangered throughout their range from Canada to Florida in 1967 (32 FR 4001, March 11, 1967), and the species remained on the endangered species list with the enactment of the ESA in 1973. Five distinct population segments of Atlantic sturgeon are listed under the ESA (threatened GOM DPS, and endangered New York Bight, Chesapeake Bay, Carolina and South Atlantic DPSs) (77 FR 5880 and 77 FR 5914, February 6, 2012). Individuals from the GOM and New York Bight DPSs potentially occur in the Union River watershed. Critical habitat for the GOM DPS of Atlantic sturgeon was designated in 2017 (82 FR 39160, August 17, 2017); however, the habitat within the Union River was not included. The listed U.S. DPSs do not include Atlantic sturgeon spawned in Canadian rivers.

4.6. 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 Ellsworth Project on riparian and aquatic habitats and habitat functions. This includes providing instream flows necessary to protect native anadromous species and their habitat in the project area to:

- optimize suitable habitat for spawning, rearing, and incubation;
- restore channel-forming processes and riparian ecological function; and,

- facilitate the efficient migration of spawning adults, safe and timely emigration of juveniles, and movement of juveniles between feeding and sheltering areas.

5. Consideration of Climate Change

On January 4, 2016, we issued revised guidance for the treatment of climate change in NMFS ESA decisions (NMFS 2016b). The guidance provides seven policy considerations pertaining to: (1) future climate conditions and uncertainty; (2) 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; (5) future benefits; (6) responsiveness and effectiveness of management actions in a changing climate; and (7) incorporating climate change in project designs. On August 1, 2016, the Council on Environmental Quality issued guidance to assist federal agencies in their consideration of the effects of climate change when evaluating proposed federal actions (CEQ 2016). 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 access to broader range and diversity of habitat. Ensuring access to a broad range and variety of habitat will support climate resilience.

5.1. 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 et al. 2014). With respect to the marine environment, observed changes in marine systems thought to be associated with global climate change include ocean acidification, decreased productivity, altered food web dynamics, shifting species distributions, among others (Hoegh-Guldberg and Bruno 2010). Information on future impacts of climate change in the project area is discussed below.

Information on how climate change will impact the Ellsworth Project area is limited. 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). The IPCC models predict that precipitation will continue to increase across the Northeast 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).

As there is significant uncertainty in the rate and timing of climate related change as well as the effect of climate change in the project area, it is difficult to predict the impact of those changes on any particular species. It is possible that changing seasonal temperature regimes could result in shifting seasonal migrations for all diadromous fish in the Union River. Presumably, if water temperatures warm earlier in the spring, and water temperature is a primary spawning cue, spawning migrations and spawning events could occur earlier in the year. For example, temperatures and average discharge rates have been increasing over the last 25 years in the Penobscot and Connecticut Rivers (Juanes et al. 2004). One study found that dates of first capture and median capture dates for Atlantic salmon have shifted earlier by about 0.5 days per year, and these consistent shifts are correlated with long-term changes in temperature and flow (Juanes et al. 2004). However, because migration is not triggered solely by water temperature, but also by river flow (which is affected by climate change), it is not possible to predict how any change in water temperature or river flow alone will affect the seasonal movements of migrating fish through the action area.

5.2. Climate Change Effects to Habitat for Anadromous 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 (Spence et al. 1996, Hare et al. 2016). 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 (Spence et al. 1996, Bergkamp et al. 2000). 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 (NMFS and USFWS 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 (NMFS and USFWS 2005). Thermally stressed fish may also become more susceptible to mortality from disease (Clews et al. 2010).

Atlantic salmon are among the two most vulnerable species to climate change in the Northeast U.S. Continental Shelf; bay scallop being the other species (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 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 et al. 1998). Climate effects related to temperature regimes and flow conditions determine juvenile salmon growth and habitat (Friedland 1998). 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 and Reid 2003).

6. FACTUAL BACKGROUND

6.1. PROJECT SPECIFICS

6.1.1. PROJECT LOCATION

The Ellsworth Project is located on the Union River in the City of Ellsworth and the Towns of Mariaville, Otis, and Waltham in Hancock County Maine. The Project consists of two dams; the Ellsworth Dam (also known as Leonard Lake Dam) and the Graham Lake Dam, approximately

3.5 miles upstream. The Ellsworth Dam impounds the 90-acre Leonard Lake reservoir and the Graham Lake Dam impounds the approximately 10,000-acre Graham Lake reservoir. There are no generating facilities at the Graham Lake Dam. The Ellsworth Dam and powerhouse are at the head of tide approximately 3 miles upstream of the Union River Bay, which flows into the Atlantic Ocean. The drainage area of the watershed at the Ellsworth dam is 547 square miles.

6.1.2. PROJECT DESCRIPTION

The Ambursen-style Ellsworth Dam and powerhouse was constructed in 1907 by the Bar Harbor and Union River Power Company. The company merged with Bangor Hydro-Electric Company in 1925. Bangor Hydro owned the facility until the de-regulation of the electrical generating industry in the state of Maine in 1999. The plant was then owned by Pennsylvania Power and Light until Black Bear (a subsidiary of ArcLight Capital Partners) purchased the dam in 2007. In 2013, Brookfield Renewable Energy purchased the facility and continues to own it. The facility was last licensed in 1987.

The original facilities of the Ellsworth Dam consisted of two generation units (now termed Units No. 2 and 3). A third generation unit (now termed Unit No. 1) was added in 1919 and a fourth unit (Unit No. 4) was added in 1923 at the same time as construction of Graham Lake Dam. The horizontal turbines for Units No. 2 and 3 were replaced with vertical turbines in 1938, and the majority of the associated penstocks were also replaced at that time. The open forebay was replaced with a new intake structure and longer penstocks in 1990.

An Ambursen dam is otherwise known as a slab and buttress dam and consists of an inclined concrete slab on the upstream side of a series of buttresses. The force of the impounded water acts downward onto the slab and the vertical component of the force is transferred downward to the buttresses and to the ground beneath the dam. A gravity dam is a dam that is filled with material such as concrete and not only relies on the force of the water but mainly on the gravity force of the fill material to prevent sliding and overturning. The Ellsworth Dam was partially filled with concrete in the early 1990s creating a gravity type dam in the non-overflow section of the dam.

The dam is 377 feet long including a 275-foot spillway, and has a maximum height of 60 feet. The overflow spillway has a top of flashboard elevation of 66.7 feet. The permanent crest of the overflow spillway is at elevation 64.5 feet, thus the flashboards are 2.2 feet high. There is no other means to spill water at the site other than over the spillway. The capacity of the overflow spillway is approximately 17,000 cfs at a water surface elevation of 71.0 feet. Adjacent to the overflow spillway, the non-overflow section includes a gatehouse and a 10-foot diameter vertical penstock that serves turbine-generator Unit No. 1. Adjacent to the housed intake for Unit No. 1, the non-overflow section also connects to an intake structure containing three additional penstocks: two 8-foot diameter penstocks serving turbine-generator Units No. 2 and 3, and one 12-foot diameter penstock serving turbine-generator Unit No. 4. Each intake includes trashracks and slide gates. The four turbine-generator units contained in the Ellsworth powerhouse have a total FERC-authorized nameplate capacity of 8.9 megawatts and an average annual generation of 30,511 Megawatt-hours. Unit 1 turbine is a four bladed vertical propeller with a speed of 200 rpm and a runner diameter of 4.65 feet rated at 2,850 kW. The Unit 1 generator is rated at 3,125 kVA @ power factor 0.8; 2,500 kW. Unit 2 turbine is a vertical shaft Kaplan with four blades and a speed of 360 rpm and a runner diameter of five feet rated at 2,175 kW. The Unit 3 generator is rated at 2,500 kVA @ power factor 0.8; 2,000 kW. The Unit 3 turbine is vertical shaft Kaplan identical to Unit 2. The Unit 3 generator is identical to the Unit 2 generator. The Unit 4 turbine is identical to Unit 1 turbine. The Unit 4 generator is rated at 3,000 kVA @ power factor 0.8; 2,400 kW. This rating for the Unit 4 generator is different since the Unit 1 generator was rewound in recent years. The total hydraulic capacity of all 4 units is 2,460 cfs.

A fish trap facility consisting of a vertical slot fishway leading to a liftable trap is operated in the tailrace area of the Ellsworth Dam providing for trap and truck passage and the commercial harvest of river herring. The harvest is operated by the City of Ellsworth under a cooperative management agreement with MDMR.

The Graham Lake Dam was completed in 1924. The dam is 58 feet high and consists of a 670-foot long earthen dike and a concrete gate structure. It is a non-generating facility located approximately 3.5 miles upstream from the Ellsworth Dam. The concrete gate structure contains three 20-foot wide by 22.5-foot tall radial gates and an eight-foot wide sluice used for downstream fish passage. A flood control structure is located immediately downstream of Graham Lake Dam. The flood control structure consists of a concrete flood wall approximately 720 feet long, a 65-foot diameter steel cell (formerly part of the construction coffer dam) and a

71-foot-long wing wall extension that connects to the gate structure and serves as an emergency overflow spillway.

6.1.3. PROJECT OPERATIONS

The Ellsworth Project is licensed as a peaking plant, with water being released from the Graham Lake reservoir for generating electricity at the downstream Ellsworth powerhouse. However, typical operation of the plant by Brookfield and Black Bear has been to open the gates at Graham Lake Dam to maintain pond elevations close to the rule curve (Figure 1) regardless of peak or non-peak generating hours and generate with whatever water is available. During periods of high inflows, primarily in the spring and fall, the project may generate at full load up to 24 hours a day. The Project is operated automatically using a Programmable Logic Controller system. This system monitors and controls project operations including headpond levels. The project is operated remotely from Brookfield's control center in Marlborough, Massachussetts. The Project is monitored by the Licensee on a 24-hour basis and is typically visited three to five times each week by an operator. Daily logs document water elevation, flow and outages for the Project. The current license for the Ellsworth Project requires a continuous minimum flow of 105 cfs from July 1 through April 30 and 250 cfs from May 1 through June 30. The minimum flow requirements were set to support fish habitat, facilitate fish migration, and protect downstream water quality.

Graham Lake water surface elevations follow a rule curve (Figure 1). Annual water levels in Graham Lake are managed between elevations 93.4' and 104.2'. Drawdown of Graham Lake in the summer/fall and more extensively at the beginning of the year provides downstream flood control benefits.

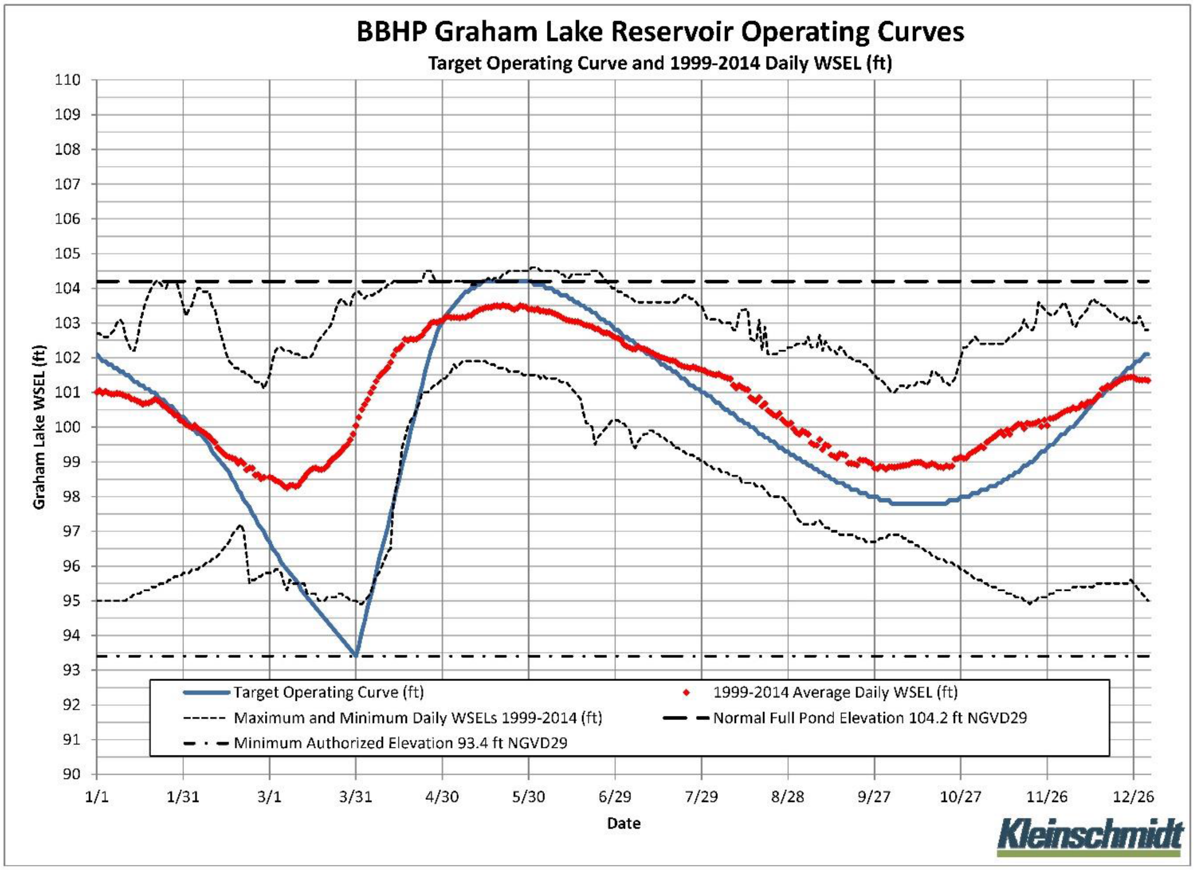

Figure 1. Graham Lake Target Operating Curve (source: Final License Application)

6.1.4. Project Fishways

6.1.4.1. Ellsworth Upstream Fish Passage

A fish trap was constructed at the Ellsworth Dam in 1972 to support the restoration of migratory fish to the Union River, and to support a commercial harvest (URFCC 2000). The trap is comprised of a 120-foot long, 8-foot wide vertical slot section leading to a trap and lift. The 3-foot wide entrance passes up to 50 cfs. Fish are captured in the wet when capturing alewives for stocking, or with a dry bucket when capturing alewives for harvest.

The entrance gate is adjusted, if required, to maintain a wave ripple effect that extends as far as possible out in the tailrace. This usually requires about an 18-inch differential between the fishway and tailrace water levels. The tailwater of the Ellsworth dam is influenced by tidewater. The entrance gate is manually adjusted with a handwheel or with an electric actuator with local controls. The entrance runs into a single gallery that runs along the driveway of the powerhouse. The first attraction pump is a Worthington Model 20KLD24 attraction water pump that is capable of passing up to 28 cfs through a pipe to the diffusion chamber above the trap. The second attraction pump, Flygt Model 4451, takes water from the tailrace and pumps it into the fishway just above the entrance gate area through a diffuser system with a capacity of approximately 22 cfs. This simulates more flow in the fishway for attracting fish to the entrance areas. The head differential between the attraction flow chamber and the tailwater should not exceed five feet. The fishway conveyance flow is approximately 50 cfs under normal operating conditions (BBHP 2015).

There are two fish trap hoppers used depending on whether it is being operated for alewife harvest or to capture river herring to stock in Graham and Leonard Lakes. One is of mostly solid metal construction, which allows water to remain in the hopper tank when lifted for stocking. The second hopper is constructed with metal screen material that allows for the water to drain off when the hopper is lifted from the hopper pit when the City of Ellsworth is selling alewives for lobster bait. When stocking or transporting, fish are lifted out of the hopper pit, in the metal hopper tank, and then transferred into one of two different transport tank types. Two round tanks used for river herring and a rectangular tank used for salmon. The round transport tanks have a volume of 99.5 cubic feet and the rectangular tank has a volume of 66 cubic feet. The river herring transport tanks are used in tandem as necessary, thereby allowing one to be enroute while the other is available at all times for fish entering the fishway.

A new license for the project was issued on December 28, 1987. The license included a requirement to develop a plan and schedule for fish passage installation, consistent with any prescription made by the Secretary of the Interior pursuant to Section 18 of the FPA. This initiated a series of actions leading to the “Comprehensive Fisheries Management Plan for the Union River” and formation of the Union River Fisheries Coordinating Committee (URFCC 2000, FERC 2002). The overall management goal of the Comprehensive Fisheries Management Plan was defined as “Management of all sport and commercial fish species in the Union River for optimum habitat utilization, abundance and public benefit.” The fish trap was identified as an interim measure “until such time as the information resulting from the assessments incorporated in the Plan allow for decisions regarding permanent fish passage measures at the Ellsworth Hydroelectric Project." (URFCC 2000).

6.1.4.2. Ellsworth Downstream Fish Passage

The downstream fish passage has three entrance weirs. Two entrance weirs are located at either end of the top of the turbine intake area for Units 2 through 4. The entrance weirs are three feet wide. The flow from these two weirs flow through a pipe and connects to the downstream sluiceway, which is located below the third entrance weir and is located on the overflow section of the dam. Each weir has stoplogs that control the flow of water through the entrance. The entrances are operated with about 21 inches of water over each entrance (approximately 20 cfs each). A variable speed recirculating pump, Flygt Model 4501, located in the pump pit in the downstream migrant pipe, is designed to send approximately 35 cfs back into the headpond. The recirculating pump is located beside the flume area before water enters the pipe and is conveyed to the sluiceway. The transportation flow from the pump pit is about 5 cfs. The third weir is beside the turbine intake for Unit No.1 (downstream spillway) located on the overflow section of the dam and passes about 20 cfs. The total fishway attraction flow is 60 cfs, which is comprised of 5 cfs from weirs 1 and 2, 35 cfs pumped back into the headpond, and 20 cfs through weir 3.

The trashracks at the intakes for Units 2 to 4 include 1-inch clear spacing for first 14 feet of depth, then 2.37 inch clear spacing for the remainder. The trashracks at the intake for Unit 1 includes 2.44 inch clear spacing. The water velocity into trashracks 2 through 4 is very high, averaging between 2 and 3 fps. The water velocity into trashracks for Unit 1 is normally less than 2 fps.

6.1.4.3. Graham Lake Dam Downstream Fishway

The downstream fishway at Graham Lake Dam consists of 4-foot wide gate inset to a larger 8-foot wide stop log gate slot. In 2017, an Alden type weir was installed in the gate slot to improve passage. The flow over the weir is dependent upon the pond elevation. All downstream fishways are operated from April 1 to December 31 as weather permits.

6.2. Fish Resources and Habitat

The following is a description of the historical and present day fisheries resources of the Union River, as well as a description of the fish habitat that supports those resources. This section will focus on the species of management concern to NMFS that historically used habitat upstream of Ellsworth Falls; as well as species designated as threatened or endangered under the ESA that fall under NMFS jurisdiction (i.e. Atlantic salmon, shortnose sturgeon, and Atlantic sturgeon). As discussed in section 4.5.6, it is assumed that neither Atlantic sturgeon nor shortnose sturgeon could access habitat above Ellsworth Falls historically (Houston et al. 2007).

The Union River watershed and its fish populations have been heavily impacted by a variety of human uses over the past 250 years, including harvest and industrialization of rivers. Many dams were constructed throughout the watershed to aid in the transport of timber and to power saw mills and other industries. The first dam on the mainstem of the river was built in 1765, but at one point there were as many as seven dams in the Ellsworth Falls area alone (Stern 2003). This all but ensured the extirpation of the sea-run fish populations in the Union River. Over the last century, all but two of the mainstem dams (the Ellsworth Dam and the Graham Lake Dam) have been removed. Fish passage was not provided into the mainstem of the river until 1974 when the fish trap was constructed at the Ellsworth Dam. The Graham Lake Dam continues to lack fish passage, although fish trapped at Ellsworth are trucked upstream of both dams.

Twelve diadromous fish species are found in the Union watershed (Table 1). Many of the river’s diadromous species historically supported commercial, recreational, and sustenance fisheries and have great cultural significance (Foster and Atkins 1867, Kendall 1914).

Table 1. Diadromous fish historic and current geographic distribution within the Union River watershed. Distribution information provided by the USFWS Gulf of Maine Coastal Program (Houston et al. 2007).

Species	Historic Range	Current Range
Atlantic salmon (endangered Gulf of Maine DPS)	**Throughout watershed**	**Union River below Ellsworth Dam; West Branch**
American shad	**Ellsworth Falls may have been impassable; if it was passable, shad likely occurred up to Mariaville Falls in the West Branch**	**Union River below Ellsworth Dam**
Alewife	**Mainstem Union River (including Green, Branch, and Webb Lakes); West Branch up to Brandy Pond; East Branch up to Great Falls**	**Union River below Ellsworth Dam; Graham Lake up the West Branch to Brandy Pond; East Branch up to Great Falls**
Blueback herring	**Ellsworth Falls may have been impassable; if it was passable, bluebacks likely occurred up to Mariaville Falls in the West Branch**	**Union River below Ellsworth Dam; some stocked with alewives in Graham Lake; some stocked in Leonard Lake**
American eel	**Throughout watershed; Downstream of Great Pond in the West Branch**	**Union River below Ellsworth Dam**
Sea Lamprey	**Throughout watershed**	**Union River below Ellsworth Dam**
Striped bass	**Union River below Ellsworth Falls**	**Union River below Ellsworth Dam**
Rainbow smelt	**Union River below Ellsworth Falls**	**Union River below Ellsworth Dam**
Sea-run brook trout	**Union River below Graham Lake**	**Union River below Ellsworth Dam**
Shortnose sturgeon (endangered)	**Union River below Ellsworth Falls**	**Union River below Ellsworth Dam**
Atlantic sturgeon (threatened GOM; endangered NY Bight)	**Union River below Ellsworth Falls**	**Union River below Ellsworth Dam**
Tomcod	**Union River below Ellsworth Falls**	**Union River below Ellsworth Dam**

6.2.1. Atlantic Salmon

The Union River is occupied by the federally endangered Atlantic salmon, and is within the designated critical habitat for the species. There are approximately 14,000 habitat units (1 unit=100 square meters) for Atlantic salmon within the watershed (Wright et al. 2008). Several sources document that there was an abundant run of Atlantic salmon within the Union River historically (Foster and Atkins 1869, MDIFG 1961, ASRSC 1982, MDIFW and MDMR 1982, Houston et al. 2007). The estimated number of returning Atlantic salmon adults before the construction of dams has been estimated to be between 622 and 1,037 by the Atlantic Sea-run Salmon Commission (ASRSC 1982), and approximately 1,550 by the Department of Inland Fisheries and Game (MDIFG 1961). Prior to the construction of dams, Atlantic salmon could access habitat throughout the Union River watershed, including the East Branch (URFCC 2016).

Stocking of juvenile salmon in the Union River drainage has been limited in recent years, but between 1971 and 1990 over 600,000 smolts and 250,000 parr were stocked into the system to promote a put and take fishery (Baum 1997). Additionally, in several years, captive broodstock were transferred to the river from the Green Lake National Fish Hatchery (approximately 3,000 adults were transferred between 1982 and 1993). Adult returns to the Ellsworth trap during the first decade (1974-1983) of operation were as high as 263 (average of 144 per year), but quickly dropped off with the reduction of smolt stocking in the mid-1980s (Baum 1997). Adults trapped at the Ellsworth dam were primarily taken back to the hatchery as broodstock.

6.2.1.1. Present Day

Atlantic salmon conservation and restoration efforts have been underway for more than 150 years in Maine following stock depletions resulting from non-sustainable commercial fisheries, pollution and habitat loss due to impassable dams. An artificial propagation and fish culture program was established in Maine first at the Craig Brook National Fish Hatchery and later at Green Lake National Fish Hatchery. These programs have allowed Atlantic salmon to survive during times 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. At this time, the 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. The commercial fishery for Atlantic salmon closed in 1947 and the last recreational fishery for Atlantic salmon closed in 2008.

The hatchery programs are now essential in preserving the genetic integrity of the last remaining Atlantic salmon populations in the United States. Efforts to restore river habitats to support Atlantic salmon started with the recognition that dams without fish passage were a major threat to the species. A number of federal laws were enacted that contributed to Atlantic salmon conservation, including the Federal Water Pollution Control Act of 1948, which subsequently became the Clean Water Act of 1972, and the Anadromous Fish Conservation Act of 1965. The Clean Water Act significantly curtailed pollution that had once caused rivers and streams in Maine to be toxic to both humans and fish, while the Anadromous Fish Conservation Act provided resources to install fishways on most of the mainstem dams in the Penobscot River, and remove or breach defunct dams in the Narraguagus, Machias, and Sheepscot Rivers. By all indications, these efforts were initially successful. Atlantic salmon returns began increasing by the early 1970s. Through the mid-1980s, between 2,000 and 3,000 adult returns were being documented on the Penobscot River, which contains the largest run of salmon in the GOM DPS.

In 1983, the state of Maine adopted its first prioritized, biologically based, statewide restoration and management plan for Atlantic salmon (Baum 1997). This plan was directed at building and maintaining a viable run of Atlantic salmon and supporting a fishery in the seven remaining rivers that contained wild Atlantic salmon. However, shortly thereafter, Atlantic salmon marine survival rates decreased significantly, leading to precipitous declines in Gulf of Maine salmon populations. By the 1990s, the salmon program had shifted towards stock preservation which included studies on genetics and to further understand why populations were declining. During this time, federal hatcheries transitioned to a program aimed at preserving the genetic diversity of remaining stocks. Other management and scientific efforts shifted towards more active conservation, including closing a commercial export fishery in Greenland that was thought to be central to the decline, and assessing freshwater habitats.

Although commercial fisheries for Atlantic salmon within the United States have been closed since 1947, fisheries continue within the species' migratory corridor off the coast of Canada and Greenland. To effectively address issues requiring international collaboration such as these distant water fisheries, the United States participates in the North Atlantic Salmon Conservation Organization (NASCO) and the International Council for the Exploration of the Seas (ICES). NASCO promotes the conservation, restoration, enhancement, and rational management of salmon stocks in the North Atlantic Ocean through international cooperation.

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 (NMFS and USFWS 2005) put emphasis on making major improvements to the conservation hatchery and stocking programs, as well as expanding habitat conservation efforts. Conservation efforts were also directed toward reducing aquaculture impacts, protecting accessible freshwater habitats by reducing threats from water and land use practices, and identifying impacts associated with water quality.

Prior to the listing in 2000, significant habitat improvements had been undertaken for many decades. A new emphasis towards connectivity began in the mid-2000s. This included improving connectivity by locating and removing culvert barriers, removing dams when possible, and installing fishways when dam removal was not feasible. In 2009, the GOM DPS was expanded to include Merrymeeting Bay and the entire Penobscot River watershed (74 FR 29344, June 19, 2009). Critical habitat for the GOM DPS of Atlantic salmon was designated at this time (74 FR 29300, June 19, 2009), including in the Union River. Conservation actions in response to this new listing and designation of critical habitat built off previous efforts. A new focus, however, was the effects of dams on the continued existence of Atlantic salmon. NMFS, USFWS and hydropower developers in the GOM DPS, as well as state resource agencies and tribes, worked together to craft plans to address survival past hydropower project and implementation of 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 conservation efforts of the past century, largely driven by regulatory measures, have afforded important conservation benefit to the GOM DPS and the entire suite of diadromous fish that coexist alongside Atlantic salmon. Without these efforts, salmon, along with many other diadromous species, would likely have been extirpated from Maine’s rivers and streams decades ago.

The abundance of Atlantic salmon in the GOM DPS has been low and either stable or declining over the past several decades. The proportion of fish that are of natural origin is small and displays no sign of growth. The conservation hatchery program has assisted in slowing the decline and helping to stabilize populations at low levels, but has not contributed to an increase in the overall abundance of salmon and has not been able to halt the decline of the naturally reared component of the GOM DPS. The GOM DPS of Atlantic salmon remains critically endangered.

6.2.1.2. DOWNEAST COASTAL SHRU

The Downeast Coastal SHRU encompasses fourteen HUC 10 watersheds covering approximately 1,852,549 acres within Washington and Hancock Counties in Eastern Maine. Within this SHRU there are five watersheds with extant Atlantic salmon populations that are actively managed for the species. As a complex, these rivers are typically small to moderate sized coastal drainages in the Laurentian Mixed Forest Province ecoregion (Bailey 1995). This commonality of zoogeographic classification makes coarse level descriptions of watersheds very similar between the rivers.

The Downeast Coastal SHRU contains approximately 54,933 habitat units within the designated critical habitat for Atlantic salmon. The Union River watershed contains 14,341 habitat units, which makes up approximately 26% of the total amount of critical habitat within the SHRU. Ninety-three percent of the habitat units within the Union River occur upstream of the Ellsworth Dam, and 73% occurs upstream of Graham Lake Dam (Wright et al. 2008). The Union River watershed is the second largest in the SHRU, containing as many habitat units as the East Machias and Narraguagus Rivers combined.

The draft Downeast Coastal SHRU Implementation Strategy incorporated within the draft Recovery Plan identifies the West Branch of the Union River as one of the best opportunities in the Downeast SHRU for achieving the recovery objectives (NMFS and USFWS 2016). As indicated above, providing fully accessible passage at the Ellsworth and Graham Lake Dams is one of very few ways to restore access to the minimum amount of habitat needed for recovery (USFWS and NMFS 2016). The West Branch has abundant, suitable spawning and nursery habitats for Atlantic salmon, while the lakes and ponds in the drainage provide considerable spawning and nursery habitats for river herring.

There is abundant suitable spawning and nursery habitat for Atlantic salmon above the Ellsworth Dam. As indicated above, the Union River and its tributaries have approximately 14,000 units of spawning and nursery habitat. The West Branch of the Union River has 5,400 units of high quality habitat. The West Branch has proven to be suitable for salmon spawning and rearing. According to a letter filed with FERC by MDMR (July 1, 2013), 288 captive-reared adult Atlantic salmon (134 females, 154 males produced from GOM DPS broodstock) were released to spawn in the West Branch in 2011. MDMR documented over 200 completed redds produced by those adults during a partial survey of spawning habitat. Juvenile salmon relative abundance from those redds was documented during single pass catch per unit effort electrofishing surveys in 2012 and 2013 (median of 2.6 young of year per minute in 2012, median of 0.6 parr per minute in 2013) in the West Branch (USASAC 2013, 2014). This level of production was comparable to other productive rivers in 2013, including the Piscataquis (0.7 parr per minute) and Sandy Rivers (0.4 parr per minute). The successful spawning and rearing in the Union in 2011 and 2012 did not lead to the expected increase in adult returns at the Ellsworth trap. No adult salmon were trapped at the Ellsworth Dam in 2016 as a result of the effort, which is in contrast to 39 adults returning to the Kennebec River in the same year as a result of stocking in the Sandy River in 2011 (USASAC 2017). The difference was likely the result of high downstream mortality of smolts at the Ellsworth Project (high mortality of smolts means fewer adults available to return to the river), and potentially to low capture effectiveness at the trap (see section 6.4. Project Impacts).

6.2.2. Alewife and Blueback Herring

Alewives were highly abundant in the Union River, and of considerable value as a prey fish for cod, haddock and other groundfish (Smith 1898, Ames 2004, Hall et al. 2012). It is unknown how large the historical runs in the Union River were before the construction of dams. The Statewide River Fisheries Management Plan (MDIFW and MDMR 1982) indicates that between 1971 and 1980 approximately 48,000 pounds a year were harvested from the river. However, the fish trap at Ellsworth was not constructed until 1974, and stocking into Graham Lake did not occur until even later. The Union River Comprehensive Fisheries Management Plan indicates that the potential production of the watershed it is 2.4 million (URFCC 2015). In an assessment contained within their Final License Application, Black Bear states that:

> *According to the Comprehensive Fisheries Management Plan for the Union River Drainage (Management Plan) there are eight lakes totaling 10,204 acres in surface area under active river herring management in the Union River drainage. Lake Leonard and Graham Lake comprise 7,983 surface acres (78%) of this total. The Management Plan estimates that the full river herring production capability of the seven Phase I lakes is approximately 2,398,011 fish of which 2,040,860 are harvestable surplus. River herring production estimates for Lake Leonard and Graham Lake is 1,875,958 fish (based on lake area), and is also 78% of the total river basin potential (URFCC 2015).*

It is important to note that the estimate of potential production is based on current conditions, which includes two artificial impoundments, and excludes several natural alewife lakes that are blocked by dams. Most notable of these are Green Lake and Branch Lake, which contain approximately 6,000 acres of alewife spawning habitat.

Historically, alewives could access habitat all the way up Brandy Pond, which is approximately 30 miles upstream of the Ellsworth Dam (Houston et al. 2007). Historical distribution of blueback herring in the Union River is not well documented because they were considered of lesser value, and are nearly indistinguishable from alewives in external appearance. The historical distribution of blueback herring is assumed to be the same as the historical distribution of American shad given their similarities in spawning behavior and habitat preferences (MDMR and MDIFW 2008). The upstream limit for both species has been identified as being near the confluence of Branch Lake Stream, which is approximately at the upper limit of Ellsworth Falls (Houston et al. 2007). It is unknown whether either shad or blueback herring could pass above these falls. The Falls, now partially inundated by the Leonard Lake impoundment, were 2.25 miles long with a 100 foot elevation change, which equates to a 0.8% stream slope (Stern 2003). Given this relatively low gradient, it is conceivable that shad and blueback herring could have navigated this set of falls, as they have successfully done on other rivers in the vicinity, including the Penobscot. However, it is also possible that a sharp drop existed within the 2-mile falls that precluded either species from accessing habitat upstream of the falls.

Alewife and blueback herring stocks across their range have declined considerably from their historical abundances (ASMFC 2009, NMFS 2013). Both species serve as important prey for federally managed groundfish stocks (Ames 2004). In addition, both species have been designated a Species of Concern by NMFS. On August 5, 2011, we received a petition from the Natural Resource Defense Council to consider listing alewife and blueback herring as threatened species. On August 12, 2013, we published a determination that listing alewife and blueback herring was not warranted at the time, but acknowledged that populations of both species were 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 that listing blueback herring under the ESA was not warranted. On August 15, 2017, we announced that we were initiating the development of a new status review for both species (82 FR 38672, August 15, 2017). Development of the status review is currently ongoing.

Given the lakes and ponds that are currently accessible to alewives after they are stocked in Graham Lake, the Union River has a production capacity of 2.4 million (URFCC 2015). To achieve this, the state of Maine requires that 315,000 alewives be trapped at the Ellsworth Dam and trucked to lakes above Graham Lake Dam. The increase in escapement from 150,000 to 315,000 alewives occurred in 2015, and it is unknown if it will be sufficient to achieve the target production capacity. All fish that are not trapped and trucked upstream to achieve the stocking goals are harvested out of the trap.

Blueback herring comprise a small portion of the herring run in the Union River (URFCC 2015). In order to promote the remnant stock in the lower river, the state of Maine requires that a minimum of 1,600 of the herring that return after June 10 be stocked upstream of Ellsworth Dam, as blueback herring run later than alewives.

6.2.3. AMERICAN SHAD

American shad once supported a major commercial fishery along the Atlantic coast and was one of the most valuable food fish before World War II (Rulifson et al. 1982). The Union River hosted a shad run prior to the construction of dams in the late 1700s (Foster and Atkins 1869, Wasson 1878, MDIFG 1961, ASRSC 1982). The *Anadromous Fisheries River Management Plan* (part of the “Statewide River Fisheries Management Plan” (MDIFW and MDMR 1982)) indicates that the Union River supported between 1,000 and 10,000 shad historically. The plan also indicates that the river supported a minor fishery for the species. A summary of information on fisheries in the Union River collected by the Maine Department of Inland Fisheries and Game in the 1950s indicated that the River contained abundant habitat for shad and could support a run of up to 15,000 (MDIFG 1961).

American shad likely could not access the East Branch of the Union River historically, but may have had access to the entire lower river, as well as much of the West Branch. The Maine Department of Inland Fisheries and Game conducted a survey of the streams and lakes in the 1950s and 1960s where they collected species and habitat information, including information on "…old dams and other possible barriers to fish migration" (MDIFG 1961). The survey did not reveal any potential barriers for American shad, except for Great Falls on the East Branch. However, more recent assessments of shad distribution have identified a more limited distribution for the species, suggesting that they could not access habitat above Ellsworth Falls (Houston et al. 2007, MDMR 2014). As indicated above, the damming of the river in the 1700s makes this difficult to verify.

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 completed 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 1999). 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.

The shad runs in the Union River were greatly reduced due to the construction of dams in the eighteenth and nineteenth centuries. The *Statewide River Fisheries Management Plan* indicates that there was a period of rapid decline in the 1820s, and that only a remnant stock remains below the Ellsworth Dam (MDIFW and MDMR 1982). Due to a lack of resources, the State of Maine does not actively manage American shad in the Union River; rather, the focus of management is on measures that are implemented for other species (URFCC 2015). Shad have been trapped at the Ellsworth dam in extremely low numbers (URFCC 2015). Given the low returns, MDMR has directed Black Bear to release all shad downstream of the project (MDMR 2014). The restoration plan for American shad from the head of tide to Graham Lake according to the *Statewide Fisheries Management Plan* is to "Maintain [the] existing run through cooperative program with the City of Ellsworth." (MDIFW and MDMR 1982). However, fish are not passed at the project and there is no active stocking program.

6.2.4. American eel

The fishery for American eel in Maine waters has occurred since the earliest colonial settlements. The onset of the elver fishery is relatively recent as market demand has increased dramatically for elvers. American eels are a highly valued food item in many Asian markets (Japan, China, Taiwan, and Korea). Subsequently, elvers are harvested and shipped to areas within Asia where they are cultured and reared to adult size for the food fish market. Due to recent intense market demand, elvers have now become the most valuable marine resource in Maine in terms of price per pound. Fishing for elvers occurs in the spring with a dip or fyke net. A license is required for elver fishing, and license issuance is heavily regulated (MDMR Regs. Chapter 32).

American eel populations in U.S. waters are at or near historically low levels due to overfishing, habitat loss, food web alterations, predation, turbine mortality, climate change factors, pollution and disease (ASMFC 2012). In 2015, the USFWS completed a Status Review of American eel (80 FR 60834, October 8, 2015). Based on the Status Review, USFWS concluded that, although populations are at low levels, the species did not warrant listing as threatened or endangered under the ESA

6.2.5. Sea Lamprey

Sea lamprey are native to Maine rivers and are expected to have inhabited nearly the entire watershed historically (Houston et al. 2007). Their historical and current distribution and abundance are largely unknown. In Maine, commercial fisheries did not target sea lamprey. Sea lamprey have been referred to as a "neglected species" that inhabits most rivers in the state (Atkins 1887). A harvest of sea lamprey existed in the 1970s and 1980s to support biological and medical research (Kircheis 2004).

6.2.6. Atlantic and Shortnose Sturgeon

Populations of shortnose and Atlantic sturgeon in the United States, including in Maine, suffered significant declines over the last century. Pollution and overfishing have been identified as principal reasons for the species decline. It is thought that neither species of sturgeon could historically access habitat above the site of Ellsworth Falls, in the vicinity of the Ellsworth Dam site. Both species may use the habitat in the river as a stopover as they migrate between larger river systems, such as the Penobscot and the St. John, but likely spend little time downriver of the dam (hours to days). There are no records of the species being trapped in the fishtrap at Ellsworth, which has been operational since 1974.

6.3. Species Life History Summary

This section will focus on the species of management concern to NMFS that historically used habitat upstream of Ellsworth Falls; as well as species designated as threatened or endangered under the ESA that fall under NMFS jurisdiction.

6.3.1. Atlantic Salmon

Adult Atlantic salmon return to Maine from the ocean with the objective of migrating to their natal stream and spawning. Adults ascend natal rivers beginning in the spring and will continue their ascent into the fall with the peak influx of adults occurring in June. Although spawning does not occur until late fall, the majority of Atlantic salmon in Maine enter freshwater between April and mid-July (Baum 1997, Collette and Klien-MacPhee 2002). Salmon that return in early spring spend nearly five months in the river before spawning; often seeking cool water refugia (e.g., deep pools, springs, and mouths of smaller tributaries) during the summer months.

In the fall, female Atlantic salmon selects a site for spawning. Spawning sites are positioned within flowing water allowing for percolation of water through the gravel where up-wellings of groundwater occur (Danie et al. 1984). These sites are most often positioned at the head of a riffle (Beland et al. 1982), the tail of a pool, or on the upstream edge of a gravel bar where water depth is decreasing and water velocity is increasing (White 1942, McLaughlin and Knight 1987) and where a hydraulic head of water allows for permeation of water through the redd.

The embryos develop in the redd for a period of 175 to 195 days (Danie et al. 1984). After eggs hatch in late March or April, the newly hatched salmon are referred to as larval fry, alevin or sac fry. Alevins remain in the redd for approximately six weeks after hatching and are nourished by their yolk sac (Danie et al. 1984). Alevins emerge from the gravel and begin active feeding in mid-May. At this stage they are termed fry. When fry reach approximately 4 cm in length, the young salmon are termed parr (Danie et al. 1984). Parr growth is a function of water temperature (Elliott 1991, Elliott and Elliott 2010), parr density (Randall 1982), photoperiod (Lundqvist 1980), interaction with other fish, birds and mammals (Bjornn and Reiser 1991), and food supply (Swansburg 2002). Parr movement may be quite limited in the winter (Cunjak 1988, Heggenes 1990); however, movement in the winter does occur (Hiscock et al. 2002) and is often necessary as ice formation reduces total habitat availability (Whalen et al. 1999). Parr have been documented utilizing riverine, lake, and estuarine habitats; incorporating opportunistic and active feeding strategies; defending territories from competitors including other parr; and working together in small schools to actively pursue prey (Pepper 1976, Pepper et al. 1984, Hutchings 1986, Gibson 1993, Dempson et al. 1996, Erkinaro et al. 1998, Marschall et al. 1998, Halvorsen and Svenning 2000, Klemetsen et al. 2003). Most parr remain in the river for two to three years before undergoing smoltification; the process in which parr go through physiological changes in order to transition from a freshwater environment to a saltwater marine environment.

In a parr’s second or third spring (age 1 or age 2 respectively), when it has grown to 12.5 to 15 cm in length, a series of physiological, morphological, and behavioral changes occur (Schaffer and Elson 1975). This process, called smoltification, prepares the parr for migration to the ocean and life in salt water. In Maine, the vast majority of wild/naturally reared parr remain in freshwater for two years (90 percent or more) with the balance remaining for either one or three years (USASAC 2005). Parr must reach a critical size of 10 cm total length at the end of the previous growing season to smoltify (Hoar 1988). Smolt transition into seawater is usually gradual as they pass through a zone of mixing from freshwater to the marine environment that occurs most frequently in the estuary. Smolts undergo smoltification while they are still in the river; therefore, they are pre-adapted to make a direct entry into seawater with minimal acclimation (McCormick et al. 1998). This is necessary under some circumstances where there is very little transition zone between some coastal rivers and streams and the marine environment. Naturally reared smolts in Maine range in size from 13 to 17 cm and most smolts enter the sea during May to begin their ocean migration (USASAC 2004). During this migration, smolts must contend with changes in salinity, water temperature, pH, dissolved oxygen, pollution levels, and predator assemblages, as well as barriers to safe and timely migration.

6.3.2. ALEWIFE

Alewives in the Gulf of Maine typically begin their upstream spawning migration in early May (Saunders et al. 2006) depending on when water temperatures exceed 10.5 °C (Loesch and Lund 1977). Alewives can migrate in vast numbers displaying schooling behavior that may overwhelm upstream fishways. Alewives have exhibited a preferred diel migratory behavior based on light and temperature (Mullen et al. 1986). In general, alewives migrate upstream during the day within a preferred temperature range (i.e. early year spawners will peak during the warmest time of the day and late year spawners will peak during the coolest time of the day). In Maine, the preferred temperature range is approximately 12 to 16 ° C (Kircheis et al. 2004). Alewives are able to spawn in a variety of lentic (standing water) habitats, but typically spawn in ponds and lakes connected to the Gulf of Maine (Mullen et al. 1986). Adult alewives emigrate shortly after spawning (Kircheis et al. 2004). Juvenile alewives live in freshwater for one to several months, emigrating from freshwater during August to as late as November (Saunders et al. 2006). Juvenile emigration is strongly correlated with precipitation events that result in transient decreases in water temperature and increases in stream flow (Gahagan et al. 2010). Juvenile emigration occurs in waves as large schools of fish, typically reaching estuarine habitats in a matter of days (Mullen et al. 1986). Adult alewives are fairly strong swimmers, but rarely leap out of the water column to pass obstacles. Unlike salmonids, alewives prefer streaming flow and may become disoriented by plunging and turbulent flows.

6.3.3. BLUEBACK HERRING

Blueback herring in the Gulf of Maine typically begin their upstream spawning migration in mid-May (Saunders et al. 2006) depending on when water temperatures exceed 14 °C (Loesch and Lund 1977). Blueback herring spawning migrations typically peak in mid-June, 3 to 4 weeks after the peak of the alewife spawning runs (Mullen et al. 1986). Post-spawn adults migrate rapidly downstream after spawning usually leaving the spawning area within five days (Loesch and Lund 1977). Juvenile blueback herring migrate to the ocean from August through November in the Gulf of Maine (Saunders et al. 2006). Juvenile emigration exhibits the same schooling and environmental cues as alewives (Mullen et al. 1986). Unlike alewives, blueback herring spawn and rear in lotic (flowing) habitats. Adult blueback herring are fairly strong swimmers, with abilities comparable to alewives adjusted for body size (Castro-Santos 2005). Generally, blueback herring do not leap or jump over obstacles. Blueback herring use streaming flow to pass impediments and may be avoided by plunging and turbulent flows.

6.3.4. AMERICAN SHAD

American shad are migratory anadromous fish that utilize freshwater rivers and streams for spawning and juvenile rearing. Their range extends along the East Coast from the Bay of Fundy, Canada to Florida (ASMFC 2010). They exhibit strong homing to their natal river and are capable of migrating long distances (e.g. 328.2 km or 204 mi. in the Connecticut River) up unimpeded rivers and streams (MDMR and MDIFW 2008, SRAFRC 2010, CRASC 2017). These strong homing tendencies lead to the development of discrete spawning stocks (Hasselman et al. 2013). Maturation of American shad in New England waters occurs between 3 to 5 years for males, and 4 to 6 years for females (Collette and Klien-MacPhee 2002); alewife and blueback herring mature between 3-5 years (Loesch 1987, Collette and Klien-MacPhee 2002). Adult shad begin to congregate along the coast and in estuaries when temperatures range from 3 to 15 ^{o}C. They engage in spawning when temperatures range between 8 and 26 ^{o}C; American shad require well oxygenated water of 5 milligrams per liter or more for successful spawning, egg and larval development (reviewed in (Stier and Crance 1985)). Their preferred spawning habitats are broad shallow water areas of rivers and streams over a clean sand and gravel substrate (reviewed in (Stier and Crance 1985)). Spawning has been documented in a wide range of water velocities ranging from 0.09 to 1.32 meters per second (m/s; reviewed in Stier and Crance 1985). Shad usually spawn at night or during overcast days. Most shad in the northern part of the species range are capable of spawning more than once and may live up to 10 years (MDMR 2014).

6.3.5. AMERICAN EEL

American eel commonly inhabits streams, rivers, lakes and ponds, tidal marshes and estuaries (Collette and Klien-MacPhee 2002). Juveniles typically seek muddy substrates and quiescent waters; however, they may settle in moving water habitats. Juvenile American eel can occupy nearly any habitat, including burrows, tubes, woody debris, the submerged or inundated man-made structures, and other shelter substrates (Facey and Van Den Avyle 1987). Their ability to traverse wetted surfaces for long distances provides opportunity to occupy habitat that would otherwise be inaccessible (Collette and Klien-MacPhee 2002, Shepard 2015).

6.3.6. SEA LAMPREY

Sea lamprey spawn in riffle sections of rivers with sandy and cobble substrate (Kelly and King 2001, Kircheis 2004). Sea lamprey construct spawning nests of gravel and small rocks in riffles by carrying stones with their mouths and creating a silt free nest with their bodies that may be as much as 25 cm deep and up to a meter long (Scott and Scott 1988, Kircheis 2004). In constructing their nests, lamprey carry stones from other locations and deposit them centrally in a loose pile within riffle habitat and further utilize body scouring to clean silt off stones already at the site (Kircheis 2004). The lamprey's silt-cleaning activities during nest construction engineer the substrate and may improve the "quality" of the surrounding environment with respect to potential diversity and abundance of macroinvertebrates (Kircheis 2004, Hogg et al. 2014).

Sea lampreys play a role in nutrient and sediment cycling (Kircheis 2004, Nislow and Kynard 2009, Hogg et al. 2014). The fact that lampreys die shortly after spawning results in the deposition of marine-origin nutrients deposition within rivers (Saunders et al. 2006, Nislow and Kynard 2009). Nutrients associated with decomposing lamprey likely enhance the primary production capability of the river, which is transferred throughout the trophic structure of the ecosystem.

6.4. Project Impacts

Abundant runs of sea run fish historically occurred upstream of the Ellsworth Project (MDIFG 1961, ASRSC 1982, MDIFW and MDMR 1982, Houston et al. 2007). Dams were constructed in the late 1700s (Wasson 1878, Stern 2003) and by the early 1800s the fisheries had undergone a significant decline (MDIFW and MDMR 1982). Most of the dams within the watershed have been removed, but the two dams that comprise the Ellsworth Project continue to obstruct access to the 547 square mile watershed.

6.4.1. Downstream Passage

The Ellsworth Project affects outmigrating diadromous fish by injuring and killing juveniles and adults directly though turbine entrainment and indirectly by creating stagnant water conditions in impoundments that support fish and bird predation. The Project's impoundments also alter water quality, stream channel migratory routes, and the timing and behavior of outmigrating fish. It has been suspected that the threat that the Ellsworth Project poses to outmigrating fish in the Union River greatly limits its potential to support abundant runs of sea-run fish (MDIFG 1961, ASRSC 1982, MDIFW and MDMR 1982). However, until recently there has been little empirical evidence to characterize that threat. Black Bear has conducted studies during the current relicensing to provide information that will inform decisions regarding fish passage improvements at the project. The studies are: 1) an American eel downstream survival study conducted in 2015; 2) an Atlantic salmon smolt survival study conducted in 2016 and 2017; and, 3) a turbine entrainment study using Hi-Z balloon tags conducted in 2017. Study reports for these studies are available in the FERC library, and are summarized below. The studies demonstrate that downstream survival for diadromous fish at the Ellsworth Project is poor. This conclusion is further supported by information filed by the Downeast Salmon Federation (DSF) and other members of the public that documents alewife and eel kills at the project annually since 2014 (URFCC 2018).

6.4.1.1. ATLANTIC SALMON SMOLT SURVIVAL STUDY

In 2016 and 2017 Black Bear conducted downstream smolt survival studies at the Ellsworth Project (BBHP 2016, 2017). Atlantic salmon smolts were radio tagged and released upriver of Graham Lake Dam. In 2016, the smolts were released above the Graham Lake reservoir to assess mortality rates through that component of the Project. In 2017, Black Bear made the decision to release the fish closer to the dam in order to ensure a sufficient sample size for estimating survival at Graham Lake Dam and Ellsworth Dam. The survival estimates for both years are summarized in Table 2. The two study years cannot be compared directly, as the field methods, statistical methods, and river conditions varied between years. Additionally, structural and operational changes were made at the Project between the two study years. Primarily, an entrance weir was attached to the upstream side of the Graham Lake Dam, and four sections of flashboards were lowered at the Ellsworth Dam. These modifications were made in 2017 in an attempt to increase smolt survival at the project.

Table 2. Salmon smolt survival through the Ellsworth Project river reaches in 2016 and 2017 (BBHP 2016, 2017).

Reach	2016	2017
Graham Lake	86%	NA
Graham Lake Dam	14%	78%
Leonard Lake	99%	98%
Ellsworth Dam	74%	74%
Cumulative Survival	9%	57%

The results indicate that survival at Graham Lake Dam was substantially higher in 2017 than it was in 2016. The results from 2017 also show a marked decrease in the migratory delay experienced by smolts while passing the two dams. It is unknown if the improvements made at Graham Lake Dam (namely the new entrance weir), or the increase in river flow (2.5x higher in 2017) is the reason for the decrease in mortality and delay. Regardless, the results are promising and suggest that the entrance weir is a good first step to making the needed improvements at the Ellsworth Project. Despite the improved passage at Graham Lake Dam, however, the cumulative downstream mortality at the Project observed in 2017 (57%) is insufficient to allow for the restoration of an Atlantic salmon run in the Union River. This survival rate is well below what has been observed at any other hydroelectric facilities within the GOM DPS for Atlantic salmon where studies have been conducted. For comparison, all four mainstem hydro projects in the lower Kennebec River *combined* had a survival of 82.4% based on a three year average from telemetry studies (BWPH 2015b).

6.4.1.2. TURBINE ENTRAINMENT STUDY

Recurrent fish kills of juvenile and adult alewives, as well as eels, continue to be a major problem at the Ellsworth Project. Large numbers of dead fish have been observed with injuries consistent with pressure injuries (i.e. missing eyes) (URFCC 2018, FERC submittal 20170810-5051 and 20161017-5030). In our November 30, 2016 letter to FERC, we expressed our concern with the recurring fish kills and asked Black Bear to characterize the nature and scale of the effect on river herring. We also raised the potential that listed Atlantic salmon may experience sublethal pressure injuries associated with turbine passage . Although Black Bear has yet to characterize the effect on river herring, they conducted a turbine entrainment study using brown trout to evaluate the effect that sublethal injuries could be having on salmonids.

The results of the study indicate that mortality rates of salmonids at both the small Kaplan units (#2 and #3) and the larger propeller units (#1 and #4) are high; with the Kaplans killing 37.6% and the propeller units killing 19.0% of the trout used in the study. The downstream bypass was also studied and was shown to have a mortality rate of 3.8%. The results also showed that in addition to differences in mortality rates, the smaller faster Kaplan units (#2 and #3) were causing more injuries (24.3%) than the larger slower units (#1 and #4) (11.1%). Most of the fish that were injured died within 48 hours of passage. A proportion of the injuries (27%) fish experienced through the smaller units were associated with pressure injuries (as opposed to mechanical injuries associated with blade strike), whereas none of the fish that went through the larger units experienced that type of injury. In their study report, Black Bear was not able to characterize the effect of pressure on river herring that pass through the turbines. Therefore, despite the abundance of documentation regarding pressure related injuries in juvenile alewives, there is no information available to suggest what proportion are being affected.

6.4.1.3. AMERICAN EEL DOWNSTREAM PASSAGE STUDY

In 2015, Black Bear tagged and tracked the movements of 47 adult American eels as they migrated downstream. The tagged eels were released by boat approximately 0.8 kilometers (0.5 miles) upstream of Graham Lake Dam at around sunset in three groups, starting on September 29; the last release was made on October 15 with monitoring continuing through November 12. Passage route and survival analyses were evaluated for both Graham Lake Dam and Ellsworth Dam. All 47 eels migrated through Graham Lake Dam and survived passage based on tag detections downstream at the Ellsworth Dam, a distance of approximately seven river kilometers (4.3 miles). All 47 tagged eels continued downstream of the Ellsworth Project, with 43 detected passing through the turbines. No eels were detected using the downstream fish bypass or turbine Unit 1, but four passed the project through an unidentified route based on detections further downstream. Turbine passage survival was 25% for turbine Unit 2, 47% for Unit 3, and 86% for Unit 4. Overall, 53% of the tagged eels survived passage at the Ellsworth development. These results are consistent with what was seen for Atlantic salmon in both 2016 and 2017 with the lowest survival detected through the two Kaplan units (#2 and #3).

6.4.1.4. FISH KILLS

The Downeast Salmon Federation (DSF) has documented injury and mortality of fish (alewife and American eel) at the Ellsworth dam annually between 2014 and 2017. They have filed their observation data with FERC, including information on the timing of observations, injury type, species observed, and estimates of the number of dead fish (URFCC 2018, FERC submittals 20170810-5051 and 20161017-5030). The information provided by DSF from the 2017 fish passage season (URFCC 2018) indicates that thousands of adults were observed dead downstream of the Ellsworth Dam in June of 2017, and that "10,000 or more" dead juveniles were documented in August 2017. Notwithstanding Black Bear's efforts to reduce the scope and scale of entrainment related injury and mortality, fish kill events continue to occur seasonally. The injured and dead fish show marks consistent with turbine entrainment (e.g. decapitation, lacerations, missing eyes, scale loss) (Figure 2). The proportion of outmigrating adult and juvenile river herring being affected remains unknown, as no study has occurred to address this question. The size difference between salmon, eels, and river herring makes a direct comparison between the results of the 2015-2017 downstream survival studies problematic. However, given the abundance of dead fish observed and the mortality rates in the other species studied, we assume that the proportion of alosines being killed through turbine passage is substantial.

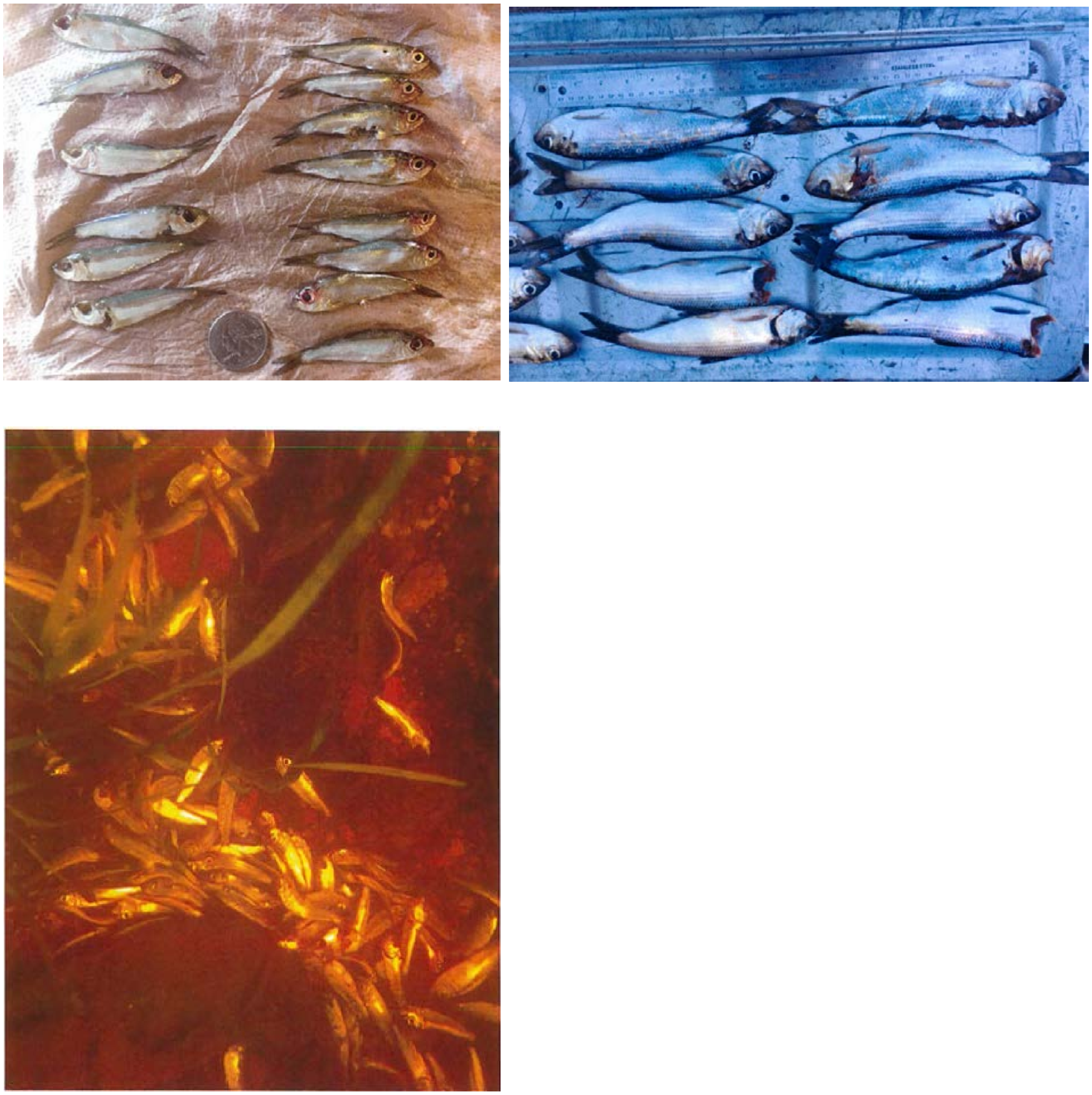

Figure 2. Dead alewives observed immediately below the Ellsworth Dam that show signs of turbine entrainment. Top left: dead juvenile alewives collected in October of 2017. Top right: dead adult alewives collected in June of 2017. Bottom: dead juvenile alewives observed during a dive survey in August 2017 (URFCC 2018).

The existing trapping facility is consistently able to capture the target escapement of alewives set by the State of Maine (currently 315,000). Regardless, it is reasonable to expect that mortality of post-spawn adults and juveniles at the dam is reducing the total number of herring that are returning to the Union River; however, the extent of that reduction is currently unknown. Currently, alewives captured in excess of the escapement target are trapped and harvested for lobster bait. In order for the Union River to reach its production potential, downstream mortality of alewives must be minimized to the extent practicable.

6.4.1.5. SUMMARY OF DOWNSTREAM PASSAGE IMPACTS

Quantitative downstream survival assessments have been conducted at the Ellsworth Project for Atlantic salmon and American eel. Additionally, qualitative observations of alosine and eel mortalities have been made for several years by DSF and Black Bear. The best available information indicates that passage through the turbines is killing or injuring a relatively high proportion of outmigrating fish, when compared to other hydroelectric dams in the State of Maine (BWPH 2015b). In order to remedy this situation, Black Bear must reduce turbine entrainment at the Ellsworth dam, and verify that the downstream fishways at both the Graham Lake dam and the Ellsworth dams are providing safe, timely and effective passage for diadromous fish.

6.4.2. UPSTREAM PASSAGE

The Ellsworth Project does not currently provide swim though volitional passage for any species of diadromous fish. Rather, fish are trapped at the Ellsworth Dam, loaded into trucks, and transported to habitat above the dams. River herring that aren't harvested are stocked into Graham Lake above Graham Lake Dam, whereas Atlantic salmon are driven up to the West Branch of the Union, above Graham Lake. The fish trap at Ellsworth has never been tested for any species of sea run fish. While it has been documented to trap shad, herring, and salmon, there is no empirical evidence regarding the proportion of fish that are able to pass, nor how long they are delayed prior to being captured.

6.4.2.1. ATLANTIC SALMON

The Union River once supported a run of the now federally endangered Atlantic salmon. The native run was extirpated with the construction of dams in the 18th and 19th centuries. Salmon smolts were stocked in the river in the 1970s and 1980s to support a recreational fishery and to provide broodstock to the hatchery. Due to lower than expected adult returns, largely attributed to passage problems at the Ellsworth Project (ASRSC 1982), smolt stocking ceased in the Union in 1990 (Baum 1997). It was clear at that time that the Ellsworth Project was the limiting factor is restoring Atlantic salmon in the Union River. The Atlantic Sea-Run Salmon Commission indicated that (ASRSC 1982):

> *Downstream passage of salmon smolts through the extensive flowages at Graham Lake and Leonard Lake appears to be the most critical limiting factor at this time…Considering the scope and magnitude of problems facing a restoration program in the Union River, combined with its potential for a limited run of adult fish, any attempt to establish a self-sustaining run of Atlantic salmon cannot be justified at this time. However, it may be possible in future years to restore an Atlantic salmon run to the Union River, if renovations are made to the existing trapping facility and sophisticated downstream fish passage facilities are constructed at the Ellsworth and Graham lake dams.*

The rarity of salmon in the GOM DPS is attributable to many factors, including poor marine and freshwater survival (USFWS and NMFS 2016). However, low salmon numbers in the Union River itself are attributable to poor upstream and downstream passage conditions at the Project. Until these problems are resolved, strays from other rivers are unlikely to be able to access spawning habitats upstream of the Ellsworth Dam. Additionally, the high mortality rate for downstream migrating smolts, combined with the lack of suitable upstream passage make any potential stocking program unsustainable until there are significant improvements to fish passage at the project.

The Union River watershed contains abundant critical habitat that has been identified by NMFS as containing features essential to the conservation of the species (74 FR 29300; June 19, 2009). As described in section 6.2.1, 26% of the critical habitat units within the Downeast Coastal SHRU occurs within the Union River. One of the essential features that characterizes critical habitat is “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." This feature is adversely affected by the lack of swim-through passage at the Ellsworth Project.

In order for endangered salmon to access habitat in the Union River under current conditions they need to be trapped and trucked above the Ellsworth Project. The trapping facility at the Project is problematic for a number of reasons:

- Trap and truck operations to transport migratory fish species can result in adverse impacts including injury, disorientation, disease and mortality, delay in migration, and interruption of the homing instinct (OTA 1995).
- As salmon are trucked to a particular location, they do not have the ability to self-select suitable habitat. Salmon are transported directly to the West Branch of the River, bypassing the Middle Branch, East Branch, as well as the smaller tributaries, where suitable spawning habitat exists. This adversely affects the functioning of the physical and biological features that were identified in the critical habitat designation for the species (74 FR 29300; June 19, 2009).
- Passage only occurs if and when staff are available to operate the trap, and transport the fish. Unlike with fish lifts, the operation of a trap can not be automated. This may substantially affect the opportunities for a fish to pass the project in a given day. For example, between 1976 and 1981 the ASRSC reported that the trap at Ellsworth was only operated for one or two days a week for two to six hours a day (ASRSC 1982). This means that migrating salmon would have to wait downstream of the dam for up to a week in between lifts.
- MDMR will not allow the trap to be operated for salmon once water temperatures exceed 23˚C since handling at that temperature causes extreme stress to the fish that can lead to mortality. During the years when the most salmon were trapped at the Ellsworth Project (an average of 127 salmon per year for the period between 1974-1980), 58% were trapped in the month of July (ASRSC 1982, MDMR 2017). Although there is no temperature gage in the Union River, July temperatures in the nearby Narraguagus River (approximately 26 miles east of the Union) average 23.1˚C (10 year average based on USGS stream gage 01022500). This information indicates that Atlantic salmon do migrate in the Union River during the warmest month of the year. Therefore, it is likely

that migrating salmon would have delayed access to their upstream habitat, and would potentially be exposed to dangerously high temperatures below the dam.

- Atlantic salmon, which need to be safely transported to habitat in the West Branch of the Union, are trapped along with thousands of river herring that are either trucked to Graham Lake or harvested for lobster bait. There is no structure in place to separate the salmon from the river herring. Rather, Black Bear personnel are on site for each lift to visually inspect the hopper to ensure that no salmon are being mishandled, stocked in the wrong location, or accidentally harvested. This is an untested method that relies entirely on detecting a salmon in a trap containing up to 5,200 alewives.
- A different fishway hopper system is installed for river herring harvest at the trap. The harvest hopper is dry when it lifts fish. The dry hopper presents a risk for Atlantic salmon captured with hundreds or thousands of river herring.
- Studies have shown that a proportion of Atlantic salmon that are trucked will drop downstream after they are released (Spencer et al. 2011, Askling 2015, Sigourney et al. 2015). This can be a problem if the salmon leaves the river prior to spawning, or if it drops down below a dam that lacks fish passage. Studies indicate that fallback rates vary a great deal. Sigourney et al. (2015) observed a 2.4-2.6% fallback rate for trucked salmon. Spencer et al. (2011) observed an 87.5% fallback rate. Askling (2015) found a 100% of fallback rate; with 39% moving below the dam where they were trapped. As Graham Lake Dam lacks fish passage, there is no mechanism for fish that drop back that far in the river to re-ascend to spawning habitat upstream unless the fish drops further down and past Ellsworth Dam and swims into the trap again.
- A report by the Atlantic Sea Run Salmon Commission (ASRSC 1982), as well as trap counts and notes provided by MDMR (MDMR 2017), indicate that it was common for adult salmon to refuse to enter the trap at the end of the fish ladder. To capture them, ASRSC staff would block off and dewater the vertical slot fishway, and then net the salmon out of the pools (ASRSC 1982). The ASRSC report further indicates that the "majority" of salmon were captured at the project in this manner.

We rely primarily on information gathered in the 1970s and 1980s regarding salmon passage effectiveness at the Ellsworth Dam, as those were the years when smolt stocking was occurring and fish were returning to the Union River in relatively large numbers. Although stocking effort has been reduced, it is still critical that the fish trap at the Ellsworth Dam effectively pass Atlantic salmon straying from other rivers within the GOM DPS. The draft Recovery Plan for Atlantic salmon (USFWS and NMFS 2016) states:

> *Atlantic salmon have strong homing characteristics that allow local breeding populations to become well-adapted to a particular environment. At the same time, limited straying does occur among salmon populations; this helps maintain population diversity through exchange of some genes between populations and allows for population expansion and recolonization of extirpated populations. Accommodating these life history characteristics and distributional needs should provide protection from demographic and environmental variation.*

Straying is a natural process that helps maintain population diversity through exchange of genes between populations and allows for population expansion and recolonization of extirpated populations. Atlantic salmon have a high degree of river of origin homing with straying rates of 1-3% (Baum 1997). This means that as many as 3 out of every 100 adult salmon may stray to a river other than the one where they were stocked or naturally reared.

The number of straying fish that enter a river is inversely proportional to the distance between that river and the source population (Pess et al. 2014). Thus, areas are more likely to receive strays if they are close to a source population. The Union River is close to both to the Penobscot (approximately 18 miles away) and Narraguagus (26 miles) rivers, which contain two of the largest runs of Atlantic salmon in the GOM DPS. Because of this, we would anticipate prespawn salmon from either of these rivers to stray to the Union. However, this has not been reflected in the trap counts at the Ellsworth Dam. In 2011, there was a substantial increase in marine survival for salmon in the GOM DPS, which led to a relatively large number of returning salmon. In that year, the Narraguagus River had 196 returning salmon and the Penobscot had 3,125 returns; approximately a 250% increase in returns over the previous year (USASAC 2011, 2012). With a 1 to 3% straying rate (Baum 1997), we would expect there to have been between 30 and 100 straying salmon between those two rivers, and given the proximity of the Union River would expect some of those strays to enter the Union River, but none were trapped at

Ellsworth. Even rivers that are stocked less intensively than the Union saw increases in the number of returning adults that year. The Androscoggin River, which is only stocked with 1,000 fry a year (4% of what is stocked in the Union), documented 44 returning salmon in 2011, most likely strays from the Kennebec River that only had 64 adult returns that year (USASAC 2012). Finally, all the smolts that are stocked in the Penobscot drainage (~550,000 per year) (Baum 1997, USASAC 2017) are raised from egg to smolt at the Green Lake National Fish Hatchery, which is within the Union River watershed upstream of the Ellsworth Dam. Atlantic salmon are believed to imprint to their natal river during the smolt stage. Since juvenile salmon destined to be stocked in the Penobscot River are raised in the Union River watershed until they are smolts, we would anticipate that some proportion of these fish would be more inclined to stray back to the Union, rather than to the Penobscot where they are stocked. All of this would suggest that Atlantic salmon are straying to the Union River on a regular basis. Despite this, very few have been captured in recent decades (only three salmon trapped between 2007 and 2017) (USASAC 2017). However, this does not necessarily mean that there are no adult salmon returning to the Union River as the adult salmon return data for the Ellsworth River is based entirely upon the number of fish caught in the Ellsworth trap. Given that 1) the Ellsworth fish trap may only capture 50% of adult salmon that approach Ellsworth Dam (USASAC 1991), 2) fish are only captured when the trap is being operated, which can be as little as once per week (ASRSC 1982), and not at all when temperatures exceed 23°C (URFCC 2015), 3) the difficulty in detecting salmon in a hopper full of river herring, 4) many salmon are unwilling to enter the hopper (ASRSC 1982, MDMR 2017), and 5) that salmon are expected to occur in the Union River based on straying and the presence of a stocking program, it is likely that more adult salmon have entered the Union River than have been documented.

Among the delisting criteria for Atlantic salmon outlined in the draft Recovery Plan is (USFWS and NMFS 2016):

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

As the Union River watershed comprises a quarter of the available critical habitat within the Downeast Coastal SHRU, it is necessary that safe, timely, and effective passage be implemented at the Ellsworth Project so that the above delisting criteria can be achieved.

The operation of the existing trap may lead to migratory delay, injury, and mortality of adult Atlantic salmon. The available information indicates that the trapping facility was not highly effective at attracting and capturing salmon in the years when salmon were returning to the river in high numbers (1970s and 1980s). It is unknown whether this was caused by faults with the structure or its operation, or both. The efficiency of the existing fishway entrance should be studied to determine whether it is effective at attracting Atlantic salmon. The purpose of the study would be to determine whether the existing entrance could be used as part of the swim through passage for Atlantic salmon, as described in Appendix E-7 of the Final License Application. Swim through fishways will need to be constructed and operational at both dams in order for the habitat within the river to allow for the recovery of Atlantic salmon.

6.4.2.2. ALEWIFE AND BLUEBACK HERRING

The trap at Ellsworth is currently operated to trap and transport the state of Maine's target escapement for river herring upstream into Graham Lake. The goal of the escapement is to provide an annual run of 2.3 million fish; with the fish in excess of the escapement goal being harvested as bait for the lobster industry (URFCC 2015). The escapement target is based on the production capacity of the currently accessible alewife habitat in the Union River watershed. This target has changed numerous times; most recently in 2015 when it was increased from 150,000 to 315,000. At current trapping effort, Black Bear has been able to achieve the escapement goal, although has yet to capture the full 2.3 million fish that the habitat has the capacity to produce. Black Bear has indicated in their Upstream Fish Passage Alternatives Study (Appendix E-7 of the FLA) that with the existing facility and trapping effort they can trap and transport 26,000 river herring a day. For a six-week alewife passage season, this equates to 1.1 million herring, which is well short of the 2.3 million target. Although it may be possible that the trap is capable of passing the full run, there is likely significant migratory delay. At peak capacity (26,000 fish per day), it would take the operators more than twelve weeks to pass 2.3 million river herring. This could be considerably longer than the average alewife run on the Union River, which generally concludes in late June (ASRSC 1982). The increase in the escapement goal in 2015 will not be detected in the return numbers until 2019 given the four-year life cycle of the species. Therefore, the ability of the trapping facility to handle the anticipated returns is unknown. Additionally, it is unknown how the state's management of the species will change over the license term. Modifications to the trap, such as an increase in the size of the hopper, may be necessary to achieve future population targets.

More historic alewife habitat may become available during the period covered by the new license. Fish passage improvements are currently being explored on Branch Lake Stream (the outlet stream to Branch Lake), and the barrier on Reed's Brook (the outlet stream to Green Lake) is a hydroelectric facility (FERC # P-7189) with a license that expires 2024. As in all relicensing proceedings, fish passage will be considered at this project. Assuming passage is restored to Branch Lake and Green Lake (both historic alewife habitat), an additional 6,000 acres of habitat will become available upstream of the Ellsworth Dam, which will increase the production capacity of the Union River to 3.8 million (235 fish per acre). As fish passage is anticipated at these lakes during the timeframe of the new license, FERC should consider the adequacy of the existing trapping facility to pass a significantly larger run than what is currently anticipated.

In the 1987 license for this project, FERC indicated that:

> *The use of the existing fish trap below Ellsworth dam for alewife harvest and restoration stocking, while important for achieving ASRSC [Atlantic Sea-Run Salmon Commission] short-term management objectives, is inadequate for upstream anadromous fish passage. Modifying the trap could improve its efficiency in collecting adult salmon broodstock and alewives for upstream passage, but it would be at the expense of increased incompatibility with salmon collection as alewife run size increases. Also, as the long-term restoration goal of approximately 1,000 salmon is pursued, the usefulness of the trap in achieving this goal would decrease further.*

In other words, increasing the alewife run in the Union River could negatively affect the efficiency of the existing facility at trapping Atlantic salmon as it will be crowded with thousands of alewives waiting to be trapped. For this reason, the existing trap should only be considered as an interim facility, to be replaced with a swim through fishway that can effectively pass the target river herring escapement, as well as endangered Atlantic salmon, and other diadromous fish. Atlantic salmon in particular must be able to pass the Project volitionally in order for them to achieve recovery, and to allow for the full functioning of the designated critical habitat for the species.

6.4.3. Riverine Processes

Riverine systems are dynamic. Physical and chemical attributes vary in space and time primarily as a result of the distribution of annual surface runoff from a watershed over time (Poff et al. 2010). The variability in flow and other environmental factors is required to sustain freshwater ecosystems (Poff et al. 1997). As such, flow regime is a primary determinant of the structure and function of aquatic ecosystems (Poff et al. 2010). Diadromous fish have evolved to take advantage of this variation (Pess et al. 2014). The complex life cycle of Atlantic salmon requires a diversity of well-connected habitat types to complete their life history (Fay et al. 2006).

Dams interrupt nearly every ecological process in a river by altering the flow of water, sediment, nutrients, energy, and biota (Ligon et al. 1995). The Commission acknowledged that the presence of dams throughout the nearby Penobscot River has altered the timing and magnitude of water flow (FERC 1996). Peaking and ponding result in long periods of low water below a project, often limited to minimum instream flow requirements with a FERC issued license and/or water quality certificate, followed by rapid, short-term flow increases as a project initiates generation. This variation in flow may affect a number of other stream variables including velocity, width and wetted perimeter of a river (Cushman 1985). These regulated flash flow events exceed natural flood conditions a river may experience on a seasonal basis and affect productivity of biota, passage efficiency for migratory finfish, water quality, habitat suitability, and sediment transport (Cushman 1985, Hunter 1992, Sale et al. 2000). Restoring the habitat-forming processes that native diadromous fish communities require offers the best hope of restoring the production capacity of these habitats. Dam removal offers the possibility of re-establishing many of the ecological processes in rivers (Magilligan et al. 2016). Dam removal, however, is not always socially or economically acceptable.

7. MANDATORY CONDITIONS AND RECOMMENDATIONS

7.1. 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). Section 10(a)(2) 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)(2)).

Between 1987 and 1997, a series of actions lead to the development of the "Comprehensive Fisheries Management Plan for the Union River" (CFMP) and formation of the Union River Fisheries Coordinating Committee (URFCC 2000, FERC 2002). The overall management goal of the Comprehensive Fisheries Management Plan was defined as "Management of all sport and commercial fish species in the Union River for optimum habitat utilization, abundance and public benefit." The fish trap was identified as an interim measure "until such time as the information resulting from the assessments incorporated in the Plan allow for decisions regarding permanent fish passage measures at the Ellsworth Hydroelectric Project" (URFCC 2000). The CFMP was revisited every five years to evaluate advances in data, which support a decision on fish passage. Since its inception, the CFMP and the coordinating committee lead to no significant changes in fish passage.

The Union River is one of 11 rivers prioritized in the FERC-approved comprehensive plan *Atlantic Salmon Restoration in New England, Final Environmental Impact Statement 1989-2021. U.S. Fish and Wildlife Service, 1989* for the restoration of "self sustaining populations of Atlantic salmon by the year 2021 A.D". This plan specifically references fish passage improvements at the Ellsworth Project for Atlantic salmon and alewives:

> *Fish passage facilities are necessary at both the Ellsworth and Graham Lake Dams. The existing trapping facility at the Ellsworth Dam is a multiple-anadromous species facility. Renovations will be required in order to initiate an efficient salmon trapping facility for the interim trucking of adults passed the dams. Downstream migrant facilities will be required at the Ellsworth Dam. The Graham Lake outlet dam will require upstream and*

downstream facilities for alewives that will also be adequate for the number of salmon expected to be restored to the Union River. In the interim, salmon will be trucked passed the Graham Lake dam.

Our interest at the Ellsworth Project for safe, timely and effective fish passage is addressed under Section 18 of the FPA.

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

The following preliminary Section 10(j) recommendations are for the protection, mitigation of damages to, and enhancement of fish and wildlife resources at the Ellsworth Project. These recommendations are consistent with state and federal management goals and objectives for restoring, protecting, and enhancing fish and wildlife resources in the Union River, 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.

We have no recommendations under 10(j) at this time. Additional protective measures or alternative actions may be necessary for Atlantic salmon pending analysis of the Commission's proposed action under section 7 of the ESA and conclusions of our anticipated Biological Opinion.

7.3. Section 18 Preliminary Fishway Prescription

We hereby submit the following preliminary fishway prescriptions 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.

The following mandatory fishway prescriptions are based on the best biological and engineering information available at this time, as described in the explanatory statements that accompany each prescription. This prescription has been developed over a period of several years by our biological and engineering staff, in close consultation with the Licensee, the U.S. FWS and other entities that participated in this relicensing proceeding. Each prescription is supported by 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 are intended to summarize the supporting information and analysis upon which these prescriptions are based. We include an index to the administrative record for this filing herein, and reserve the right to file updated and supplemental supporting information in conjunction with comments submitted on our preliminary prescription.

7.3.1. UPSTREAM FISH PASSAGE – ALOSINE

The licensee shall operate and maintain upstream fish passage facilities that pass alosine species in a safe, timely and effective manner. The state of Maine currently limits the number of alewife and blueback herring stocked into the watershed, and trap counts demonstrate that the facility is effective for meeting stocking goals. However, if the state of Maine increases the number of alewife and blueback herring stocked into the watershed to the point that the existing facility is no longer sufficient, than the licensee will need to build and operate fishways at the Ellsworth and Graham Lake Dams that meet the performance standards identified in Section 7.3.5. Likewise, management objectives for American shad may change during the term of the new license. If a management program for American shad is initiated for the Union River during the license term, then the licensee will need to demonstrate the trap or passage facility available at that time is safe, timely and effective for those fish. If the standards identified in 7.3.5 are not met, than the licensee will need to improve the existing structure to meet the performance standard or build and operate fishways at Graham Lake and Ellsworth that meet those performance standards. Timing of construction of any new fishway shall be consistent with requirements for upstream Atlantic salmon measures (Section 7.3.2). Therefore, we do not require any changes to the existing fish trap and truck facility at this time, although we reserve our authority to prescribe additional upstream fishways consistent herewith in the future.

The Licensee shall keep the fishways in proper order and shall keep fishway areas clear of trash, logs, and material that would hinder passage. Anticipated maintenance shall be performed in sufficient time before a migratory period such that fishways can be tested and inspected and will properly operate prior to the migratory periods.

Rationale

Restoration of anadromous fish is a long-standing resource goal for the Union River watershed. The original order issuing a license for the Ellsworth Project in 1987 contemplated fishways. The requirement for dedicated fish passage facilities that can achieve agency management goals is necessary to support our broader restoration goal for the watershed. The continued use of the existing trap facility will support our agency's mission goals for sustainable fisheries and coastal communities, as well as the state's current management goals.

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

a. Anadromous fish historical habitat has been identified in the Union River (Smith 1898).

b. Alewife and blueback herring have unimpeded access to the Ellsworth Dam at the head of tide.

c. The state of Maine has stocked alewife in lake habitat above Graham Dam since the 1970s (URFCC 2000, BREG 2015).

d. The existing stocking process at the Ellsworth Project supports current stocking goals and results in nominal mortality of stocked fish (BBHP 2014, URFCC 2018).

7.3.2. Upstream Fish Passage – Atlantic salmon

The Licensee shall operate and maintain upstream fish passage facilities that pass Atlantic salmon safely, timely and effectively during the term of this license. The present Ellsworth trap and truck facility is insufficient at passing salmon and will need to be replaced with a state of the art swim-through fishway, such as a vertical slot fishway, a Denil, an Ice Harbor fishway, or a fishlift (or their equivalent). We require installation and operation of effective upstream swim-through passage structures for Atlantic salmon at the Graham Lake Dam and Ellsworth Dam in years 13 and 15 of the new license, respectively. The Licensee shall meet with the resource agencies annually to discuss fishway operation, study results, and the siting, design, and construction of the new fishways. The Licensee may consult with the resource agencies prior to the specified dates to determine whether changes in management and restoration priorities would warrant a delay of fishway construction. Any changes to our prescribed fishways or delays in construction will require agreement with NMFS.

Until the new fishways are operational, the licensee must continue to operate the existing Ellsworth fishway. The Licensee shall keep the existing fishway – as well as any fishway constructed in the future - in proper order and clear of trash, logs, and material that would hinder passage. Anticipated maintenance shall be performed in sufficient time before a migratory period such that fishways can be tested and inspected and will properly operate prior to the migratory periods.

Additional protective measures or alternative actions may be necessary for Atlantic salmon pending analysis of the Commission’s proposed action under section 7 of the ESA and conclusions of our anticipated Biological Opinion.

Rationale

Restoration of Atlantic salmon is a long-standing resource goal for the Union River watershed. Smolt stocking occurred in the river until 1991. At that point, smolt stocking was reduced and then later terminated because few of the stocked smolts returned as adults (Baum 1997). The poor returns have been attributed to inadequate upstream and downstream passage at the Ellsworth Dam (ASRSC 1982). Salmon fry have continued to be stocked in the River through 2017. Based on the number of adults anticipated from fry stocking (between 0.1 and 2.2 per

10,000 fry stocked (USASAC 2017)) we would expect as many as five salmon a year returning to the Union River. In addition to returns from stocking, we expect that salmon occur in the Union River as a result of straying. With a straying rate of 3% (Baum 1997) from the runs on the nearby Narraguagus and Penobscot Rivers, we expect dozens of returning adults to be straying to nearby rivers. The 10-year (2007-2016) average number of returning salmon to the Penobscot River is approximately 1,200 adults (USASAC 2017). A 3% straying rate would mean that up to 36 adults could be straying to nearby rivers, including the Union River.

Despite the returns expected to the Union River from stocking and straying, very few adult salmon have been observed in the river. A failure to detect adult salmon may explain the difference between what we expect and what we observe. The adult salmon numbers for the Union River are based solely on the number of adult salmon that are caught in the Ellsworth Dam fish trap. However, the Ellsworth Dam fish trap data may underestimate the number of adult salmon in the river for at least two reasons. First, the trap may only capture 50% of salmon that approach Ellsworth Dam (USASAC 1991). We note that the 50% capture efficacy is based on older information, but this is the only information we have on capture efficacy and there is no data showing that conditions have changed for the better. Second, if salmon do enter the fishway it is possible that they are not detected due to overcrowding of the hopper. Third, the trapping facility is not operated when there isn't an operator present, nor when river temperatures exceed 23°C, which occurs regularly during the summer months (see section 6.4.2.1).

The requirement for dedicated fish passage facilities issued during this licensing proceeding is necessary to support our broader restoration goal for the Downeast Coastal SHRU for federally endangered Atlantic salmon. Time is needed, however, for: (1) implementation and evaluation of improvements to downstream passage protection measures, and (2) the evaluation of the existing trap entrance and, if necessary, alternate entrance locations. We know that downstream passage survival at this project is extremely low (BBHP 2016, 2017), which is a significant component of the failed productivity. Passing adult salmon upstream prior to fixing the problems with downstream passage will lead to unacceptable levels of mortality of those fish and their progeny as they migrate back to the marine environment (Nieland et al. 2013, Nieland et al. 2015). Therefore, waiting to achieve the downstream performance standard before improving upstream passage is prudent. Additionally, effectiveness studies at the Ellsworth Dam will be required to test the efficiency of the existing fishway entrance to attract adult salmon. If the existing entrance cannot attract and successfully pass the required proportion of adults than a new fishway should be sited based on the results of the telemetry studies and constructed as required. Fifteen years provides a suitable amount of time for the licensee to construct and evaluate the effectiveness of downstream measures at the Project, as well as to conduct an efficiency study to inform the location of the fishway entrance at the Ellsworth Dam. Effective passage at Graham Lake Dam needs to be verified prior to salmon being passed at the Ellsworth Dam otherwise they would pass Ellsworth Dam only to be trapped downstream of Graham Lake Dam where there is minimal spawning and rearing habitat. Therefore, construction of a fishway at Graham Lake Dam should be constructed two years prior to the construction of the swimthrough fishway at Ellsworth Dam (year 13 of the license) to allow time for an effectiveness study. We further support the need for a swimthrough fishway on the factual background herein and the following facts:

a. Anadromous fish such as salmon historical habitat has been identified in the Union River (Smith 1898).

b. Atlantic salmon have unimpeded access to the Ellsworth Dam at the head of tide, and strays from other rivers within the GOM DPS are expected (see section 6.4.2.1.)

c. Dams such as the Ellsworth and Graham Dams are an impediment to upstream migration of anadromous fish (74 FR 29300, June 19, 2009; 74 FR 29344, June 19, 2009; 78 FR 48944, August 12, 2013).

d. Properly designed and located fishways, with suitable near-field and far-field attraction are capable of passing Atlantic salmon and other species upstream of dams (Larinier 2002a, b, Larinier and Marmulla 2004, Bunt et al. 2012, NMFS 2012, USFWS 2017).

7.3.3. DOWNSTREAM FISH PASSAGE – ANADROMOUS SPECIES

The Licensee shall construct, operate and maintain downstream fish passage facilities for anadromous fish species that provide safe, timely and effective downstream passage consistent with the performance standards developed in the ESA consultation for Atlantic salmon and described in Section 7.3.5 for alosine. Modifications to the downstream passage facilities shall be operational within three fish passage seasons of the issuance of the new license.

The downstream passage facility at the Ellsworth dam shall be modified to incorporate the following improvements:

- Installation of a fish guidance system leading to a bypass surface entrance. The guidance system shall be comprised of a rigid hanging curtain or boom (of similar construction as the fish booms that are being used on the Kennebec river at Lockwood, Hydro Kennebec, and Shawmut power stations) leading to a modified surface entrance(s) for discharge through a bypass facility.
- Installation of 1-inch clear space trashracks or overlays at existing trashracks for Units 2, 3, and 4, such that no more than 1-inch clear spaced trashracks are present throughout the full depth of the intake opening.
- Prioritize operation of Unit 4 over Units 2 and 3 and curtail operation of Unit 1 during critical downstream fish passage seasons. The critical downstream fish passage seasons will be determined in consultation with the resource agencies.
- Modification of the existing downstream fish passage entrance to increase total fishway flow to 5% of station hydraulic capacity (approximately 120 cfs). The surface entrance should be modified to provide a minimum depth of three feet of water, and should be constructed with tapered walls similar to an Alden weir.
- Modification of the fish transport pipe to improve the discharge angle onto flume.
- Increase the height of the sides along the flume on the spillway to handle increased flow and to reduce spillover.
- If the defined performance standards (section 7.3.5) cannot be met with the above improvements, additional measures will be implemented to further reduce fish injury and mortality. Such measures may include increasing the depth of the guidance system, turbine curtailment or shutdowns, or modification of the spillway and/or the ledge at the base of the dam.

The downstream passage facility at the Graham Lake dam shall be modified to incorporate the following improvements:

- The Alden weir at Graham Lake Dam shall be modified in order to allow at least three feet of water over the weir under all headpond conditions. This can be accomplished by modifying the weir to be moveable in the vertical direction on floats or by mechanical means.

The Licensee shall keep the downstream passage facilities in proper order and clear of trash, logs, and material that would hinder 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 outcome of the ESA section 7 consultation and requirements of any Incidental Take Statement issued as part of the anticipated Biological Opinion.

The proposed action is inadequate for protecting downstream migrating anadromous fish. Anadromous fish are present; the impacts on those fish have been observed for alosine or quantified for Atlantic salmon (BBHP 2016, 2017). Therefore, our prescribed modifications will need to be implemented with the stated three-year time frame.

Rationale

Dedicated fish passage facilities are necessary to protect anadromous species migrating downstream past the Project. We base this position on the factual background herein and the following:

- Downstream migrating anadromous species are exposed to project related impacts (Franke et al. 1997, BBHP 2016, 2017).

- Mortality events have been observed during multiple seasons (see FERC docket # 20161017-5030, 20170810-5111).

- Downstream passage survival is a critical component to achieving recovery goals (Nieland et al. 2013).

- Downstream migrating adults and juvenile Atlantic salmon and alosines require protection from project operations that result in injury and mortality (Taylor and Kynard 1985, Franke et al. 1997, Larinier 2000, FERC 2004, Hecker et al. 2007) (74 FR 29344, June 19, 2009, 78 FR 48944, August 12, 2013).

7.3.4. SEASONAL MIGRATION WINDOWS

Fishways 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. The migratory seasons for anadromous fish are well known in the major rivers of the Northeast (Loesch 1987, ASMFC 2000). Based on state-wide and Union River watershed specific data, approved fish passage protective measures shall be operational during the follow migration windows:

a. Upstream alosine: May 1 to July 31

b. Upstream Atlantic salmon: May 1 – November 15

c. Downstream alosine: June 1 – November 30

d. Downstream kelt: April 1 to June 15 and October 17 – December 31 (or ice-in)

e. Downstream smolt: April 1 to June 15.

<u>Rationale</u>

a. Adult alosine in Maine commonly migrate upstream between May and June, and as late as August and outmigrate soon after spawning from June to early August (BWPH 2015a).

b. Juvenile alosine typically outmigrate in September and October but may migrate as early as August and as late as December (Mullen et al. 1986, Weiss-Glanz et al. 1986).

c. Trap operations at the Ellsworth Dam typically captured adult salmon from June to October (Baum 1997) because the trap was not operated for salmon until June in most years because of the alewife run, and because personnel were not available to operate the lift in November (ASRSC 1982). Salmon have been documented returning to the

Cherryfield Dam in the nearby Narraguagus River, as well as the former Bangor and Veazie Dams on the Penobscot River, between the months of May and November (Baum 1997).

d. 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).

e. Based on smolt trapping studies in the Narraguagus, Sheepscot, Piscataquis, and East Machias Rivers in 2011 - 2015, smolts migrate between late April and early June with a peak in early May (USASAC 2016).

7.3.5. MONITORING AND PASSAGE PERFORMANCE STANDARDS

Licensee must monitor upstream and downstream fishways at the Ellsworth and Graham Lake Dams. 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 alosine and Atlantic salmon. Based on the best available information from dam impact assessment on the Penobscot and Connecticut Rivers, this performance standard will likely include a total project survival of approximately 90%. Lastly, the following requirements are to ensure data collected reflect conditions 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 (Atlantic salmon and alosines) is operational and shall continue for up to three years or as otherwise required through further consultation.

- Licensee shall conduct studies to evaluate the effectiveness of fishways for juvenile and adult life stages of alosines and Atlantic salmon.
- Licensee shall be 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.

7.3.6. FISHWAY DESIGN REVIEW

The Licensee shall submit design plans to the resource agencies for review and consultation during the conceptual, 30, 60 and 90 percent design stages. Conceptual designs shall be provided to the agencies no later than two years before the anticipated operational date. Conceptual designs for the proposed full-depth 1" clear trash racks shall be provided at least six months prior to the first downstream passage season following issuance of any new license by FERC. Following resource agency approval, the Licensee shall submit final design plans to the Commission for final approval prior to the commencement of fishway construction activities; this filing must include all unaddressed resource agency comments. Once the fishway is constructed, final as-built drawings that accurately reflect the project as constructed should be filed with us and the USFWS.

7.4. RESERVATION OF AUTHORITY

This preliminary prescription 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 anadromous fish through the Project facilities, including without limitation, our authority to amend the following fishway prescriptions 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 Ellsworth Project (FERC No.2727). The Secretary of Commerce reserves his authority to prescribe additional or amended fishways as he may decide are required in the future.

8. ADMINISTRATIVE RECORD

Evidence to support our preliminary prescription for fishways is contained in the Administrative Record before the Commission, and the additional materials being provided under separate cover. Citations for the extant record are provided below.

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USASAC. 2016. Annual report of the U.S. Atlantic Salmon Assessment Committee. Report No. 28 - 2015 Activities. Prepared for U.S. section to NASCO. March 2016.

USASAC. 2017. Annual report of the U.S. Atlantic Salmon Assessment Committee. Report No. 29 - 2016 Activities. Prepared for U.S. section to NASCO. February 2017.

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Weiss-Glanz, L. S., J. S. Stanely, and J. R. Moring. 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., D. L. Parrish, and S. D. McCormick. 1999. Migration timing of Atlantic salmon smolts relative to environmental and physiological factors. Transactions of the American Fisheries Society 128:289-301.

White, H. 1942. Atlantic salmon redds and artificial spawning beds. Journal of the Fisheries Board of Canada 6:37-44.

Wright, J., J. Sweka, A. Abbott, and T. Trinko. 2008. GIS-Based Atlantic Salmon Habitat Model. Appendix C in: NMFS (National Marine Fisheries Service). 2008. Biological valuation of Atlantic salmon habitat within the Gulf of Maine Distinct Population Segment. DRAFT. NOAA National Marine Fisheries Service, Northeast Regional Office, Gloucester, MA.

10. UNION RIVER FISHERIES COORDINATING COMMITTEE REPORTS

We used the annual Union River Fisheries Coordinating Committee reports and Comprehensive Management Plans to inform our decision process. Each document is available on the FERC docket. We provide the following reports comprehensive plans within our administrative record filing.

Union River Fisheries Coordinating Committee (URFCC). 2000. Comprehensive Fishery Management Plan for the Union River Drainage 2000 - 2005

URFCC. 2002. 2000-2001 Annual Report of the Union River Fisheries Coordinating Committee.

URFCC. 2003. 2002 Annual Report of the Union River Fisheries Coordinating Committee.

URFCC. 2004. 2003 Annual Report of the Union River Fisheries Coordinating Committee.

URFCC. 2005. 2004 Annual Report of the Union River Fisheries Coordinating Committee.

URFCC. 2006a. 2005 Annual Report of the Union River Fisheries Coordinating Committee.

URFCC. 2006b. Comprehensive Fishery Management Plan for the Union River Drainage 2006 - 2010.

URFCC. 2007. 2006 Annual Report of the Union River Fisheries Coordinating Committee.

URFCC. 2008. 2007 Annual Report of the Union River Fisheries Coordinating Committee.

URFCC. 2009. 2008 Annual Report of the Union River Fisheries Coordinating Committee.

URFCC. 2010a. 2009 Annual Report of the Union River Fisheries Coordinating Committee.

URFCC. 2010b. Comprehensive Fishery Management Plan for the Union River Drainage 2011 - 2014.

URFCC. 2012. 2011 Annual Report of the Union River Fisheries Coordinating Committee.

URFCC. 2013. 2012 Annual Report of the Union River Fisheries Coordinating Committee.

URFCC. 2014. 2013 Annual Report of the Union River Fisheries Coordinating Committee.

URFCC. 2015a. 2014 Annual Report of the Union River Fisheries Coordinating Committee.

URFCC. 2015b. Comprehensive Fishery Management Plan for the Union River Drainage 2015 - 2017.

URFCC. 2016. 2015 Annual Report of the Union River Fisheries Coordinating Committee.

URFCC. 2017. 2016 Annual Report of the Union River Fisheries Coordinating Committee

URFCC. 2018. 2017 Annual Report of the Union River Fisheries Coordinating Committee

11. RESOURCE MANAGEMENT PLANS

In developing its preliminary terms and conditions, we considered the following resource management plans; most are cited throughout the document. All are compiled under the FERC docket #20170530-0009 for the Mattaceunk Project (P-2520).

Atlantic States Marine Fisheries 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. Washington D.C. XVIII+ 347pp.

ASMFC 1990. Fishery Management Plan for Atlantic Sturgeon. Report No. 17 of the Atlantic States Marine Fisheries Commission. November 1990.

ASMFC 1998a. Amendment 1 to the Interstate Fishery Management Plan for Atlantic Sturgeon. Report No. 36 of the Atlantic States Marine Fisheries Commission. July 1998.

ASMFC. 1998b. 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. April 1999.

ASMFC. 2000. Interstate Fishery Management Plan for American Eel. Fishery Management Report No. 36 of the Atlantic States Marine Fisheries Commission. April 2000.

ASMFC. 2007a. 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. 2007b. 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. 2012a. River Herring Stock Assessment Report for Peer Review. Stock Assessment Report No. 12-2, Vol. I. May 2012.

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

ASMFC. 2012c. Stock assessment overview: river herring. May 2012.

ASMFC. 2012d. American eel benchmark stock assessment. Stock assessment report No. 12-01. May 2012.

ASMFC. 2014. Addendum IV to the interstate fishery management plan for American eel. October 2014.

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.

MDMR and MDIFW. 2009. Operational Plan for the Restoration of Diadromous Fishes to the Penobscot River. Prepared for the Atlantic Salmon Commission (ASC). July 2, 2009.

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

National Marine Fisheries Service (NMFS). 2016a. NOAA Fisheries Habitat Enterprise Strategic Plan: 2016-2020.

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

NOAA. 2016.NOAA Fisheries Protected Resources strategic plan: 2016 – 2020. Conserving America's marine protected species. August 2016.

New England Fisheries Management Council (NEFMC). 1987. Fishery Management Plan for Atlantic salmon. October 1987.

U.S. Atlantic Salmon Assessment Committee (USASAC). Annual reports of the U.S. Atlantic Salmon Assessment Committee. Report Nos. 22-28.

12. FEDERAL REGISTER NOTICES

The following Federal Register Notices were used to inform our decision process. All are compiled under the FERC docket #20170530-0009 for the Mattaceunk Project (P-2520).

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

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.

72 FR 4967. Endangered and Threatened Wildlife and Plants; 12-Month Finding on a Petition to List the American Eel as Threatened or Endangered. Department of the Interior Fish and Wildlife Service. 72(22): 4967-4997. February 2, 2007.

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.

77 FR 5914. Endangered and Threatened Wildlife and Plants; Final Listing Determinations for Two Distinct Population Segments of Atlantic Sturgeon (*Acipenser oxyrinchus oxyrinchus*) in the Southeast. Department of Commerce, National Oceanic and Atmospheric Administration. Federal Register 77(24): 5914-5982. 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.

81 FR 18639. Endangered and Threatened Wildlife and Plants; draft recovery Plan for the Gulf of Maine Distinct Population Segment of Atlantic salmon. Department of Interior U.S. Fish and Wildlife Service. Federal Register 81(62): 18639 - 18642. March 31, 2016.

ATTACHMENT B

NATIONAL MARINE FISHERIES SERVICE'S COMMENTS ON FINAL LICENSE APPLICATION AND UPDATED STUDY REPORTS OF BLACK BEAR HYDRO PARTNERS, LLC FOR THE ELLSWORTH HYDROELECTRIC PROJECT (FERC NO. 2727)

National Marine Fisheries Service's Comments on Final License Application and Updated Study Reports of Black Bear Hydro Partners, LLC for the Ellsworth Hydroelectric Project (FERC No. 2727)

On December 31, 2015, Black Bear Hydro Partners, LLC (Black Bear or Licensee) filed a Final License Application for a new major license at the Ellsworth Hydroelectric Project on the Union River in Maine. Below are our comments on their application and updated study reports.

1. FINAL LICENSE APPLICATION COMMENTS

1. Page E4-4: Endangered Species Act. In addition to endangered Atlantic salmon, endangered shortnose and threatened GOM DPS of Atlantic sturgeon also occur in the project area. The entire project area is also located within designated critical habitat for Atlantic salmon.

2. Page E4-35: The Union River Comprehensive Fisheries Management Plan (2015) indicates that the reach between Leonard Lake and Graham Lake Dam is “managed as a migratory pathway for Atlantic salmon.” This is not currently the case, given the high downstream mortality at both dams, and the lack of volitional upstream passage. The Union River is designated critical habitat for Atlantic salmon, and the lack of a safe “migratory pathway” adversely affects how that habitat functions. In order for the river to be adequately managed for migratory fish, the Ellsworth Project must provide safe, timely, and effective upstream and downstream passage.

3. Page E-4-45: Black Bear states “From review of the limited bathymetry data of the original river channel that has been inundated by Lake Leonard there may be steep gradient reaches that would have historically kept Atlantic and shortnose sturgeon from accessing the Union River above the site of the Ellsworth Dam.” Black Bear does not cite any references to support for this statement. Regardless, as sturgeon occur downstream of the dam and are known to be capable of accessing fishways, it is possible that they could be captured in the fish trap. A sturgeon handling plan should be incorporated into the license articles and FERC

should assess ’s Biological Assessment so that we can consult on effects to the species under section 7 of the ESA.

4. Page E-4-50: The description of the downstream bypass incorrectly describes the transport pipe as “…leading to a plunge pool immediately downstream of the dam.” As stated elsewhere, the pipe discharges water perpendicular into the top of the spillway sluice, which runs 60 feet down the face of the spillway into the plunge pool.

5. Page E-4-53: The last paragraph on this page indicates that the tailrace is tidally influenced. This is correct, but we note that the river is mapped as being freshwater for approximately 0.75 miles downstream of the dam. This reach is mapped as riverine by the National Wetland Inventory (https://www.fws.gov/wetlands/Data/Mapper.html).

6. Page E-4-57: Black Bear states, “There is very little, if any, adverse impact to the resident fish or diadromous fish from the current or proposed operating regime for the Ellsworth Project.” This statement is demonstrably false. Field studies conducted by Black Bear, and documented fish kills between 2014 and 2017, show that the current operating regime negatively impacts alewives, eels, and salmon. Although upstream passage studies have not been conducted, the Maine Department of Marine Resources (MDMR) trap counts from 1974 to 2016 indicate that it was not uncommon for adult salmon to hold below the trap in the fish ladder (MDMR 2017). These fish were captured by netting them out of the dewatered fishway. The U.S. Atlantic Salmon Assessment Committee assumed that the Ellsworth trapping facility was only 50% effective at trapping in salmon in 1990 (USASAC 1991). Although this was not based on empirical studies, it can be considered the best professional judgement of the salmon biologists that were operating the facility in the years when salmon were being stocked and trapped in the Union.

7. Page E-4-61: This is a discussion on the effectiveness of the upstream trapping facility for Atlantic salmon. This section does not mention the ineffectiveness of the upstream fishway during the years when adult salmon were at their peak in the river. MDMR trap counts and notes indicate that it was common for adult salmon to refuse to enter the trap at the end of the fishway. MDMR staff would block off the vertical slot fishway, and then net the salmon out

of the pools. Although notes were not taken regularly, there is sufficient information to suggest this was an issue. For example, in 1978, at least 67 of the 147 Atlantic salmon captured at the project were netted out of the pools downstream of the hopper (MDMR 2017). The Atlantic Sea-Run Salmon Commission (ASRSC 1982) also referenced this as a problem in their profile of the Union River. Changes have been made to the facility since then (e.g. new hopper), so it is unknown to what extent the problem may have been resolved.

8. Page E-4-61: Black Bear states that only a small amount of habitat suitable for American shad is located upstream of the Ellsworth Dam. This is consistent with the MDMR's Shad Habitat Plan (MDMR 2014). Black Bear also states that there is no information on historic use of the river by shad. This is not correct. One component of the Statewide River Fisheries Management Plan (MDIFW and MDMR 1982), a FERC-approved comprehensive plan, is the Anadromous River Fisheries Management Plan. This plan indicates that historically the Union supported a shad population (up to 10,000). Shad were depleted by the 1820s due to the construction of dams. Although abundance data is lacking, several sources support that the river hosted a shad run prior to the construction of dams (Foster and Atkins 1869, Wasson 1878, MDIFG 1961, ASRSC 1982).

9. Page E-4-62: The information provided indicates that few Atlantic salmon were historically trapped when temperatures exceed 23˚C (73˚ F). Black Bear cites 2002 to 2005 data for this analysis; a period when an average of only four salmon were captured at the project per year. During this period, the trap was not operated when temperatures exceeded 23˚C. It is unclear how Black Bear can conclude that few salmon are trapped above that threshold when the trap was not being operated during the higher temperature period. Contrary to their statement, the historical information demonstrates that salmon could be migrating in the river in the warm summer months. Although there is no temperature gage in the Union River, July temperatures in the nearby Narraguagus River average 23.1˚C (10 year average based on USGS stream gage 01022500). During the years when the most salmon were trapped at the Ellsworth Project (an average of 127 salmon per year for the period between 1974-1980), 58% were trapped in the month of July (ASRSC 1982, MDMR 2017) when we would expect that water temperatures approached or exceeded 23˚C. The fish trap historically did not

operate during the alewife run (May-June), since alewives would quickly fill the trap and there was no means of moving them. This information indicates that Atlantic salmon do migrate in the Union River during the warmest month of the year. Until a swim through fishway is constructed at the project, Black Bear will need to develop a plan to be approved by the agencies regarding how they intend to safely transport migrating salmon when the temperature exceeds 23˚C.

10. Page E-4-62: Black Bear states, “The upstream passage alternatives analysis also considered agency concern regarding effective passage of salmon during the river herring harvest operations and the potential for migration delay due to fishway crowding or infrequent trap and transport operation. Under current operations, the trap and hopper are visually inspected for Atlantic salmon and if one is spotted, the hopper is left in the water and the salmon is dip-netted out and placed in a holding tank.” It is unclear how a single salmon could be observed in a trap that contains up to 5,200 alewives. The effectiveness of this method is untested and likely unreliable. Evaluating the ability to identify an individual salmon among river herring needs to be a component of any upstream passage effectiveness studies conducted for Atlantic salmon.

11. Page E-4-69: Black Bear states, “Estimated survival past both dams was 74.8 – 75.6 percent for adult eel, 91.5 – 92.6 percent for adult river herring, 94.7 – 95.2 percent for smolts, and 97.0 – 98.1 percent for juvenile river herring.” These estimates were based on desktop analyses and do not account for indirect mortality. Black Bear has conducted three studies (downstream passage studies for eels and salmon smolts, and a turbine entrainment study using brown trout) that provide site specific survival estimates at the Ellsworth Project. Although downstream alosine studies were not conducted, the field studies conducted with salmon, eel, and brown trout, as well as documentation of adult and juvenile fish kills, suggest that the analysis provided in the FLA overestimates survival of all species, and therefore underestimates the Project related impacts on these fish.

12. Page E-4-72: Black Bear states, “Due to the rarity of these species at the Project, normal operations would not affect shortnose or Atlantic sturgeon.” We do not concur with this

determination. The rarity of a species does not necessarily relate to the effect on the species. Both species are listed under the Endangered Species Act precisely because they are rare. The capture of sturgeon within the fish trap would adversely affect that individual. A sturgeon handling plan should be incorporated into FERC's proposed action and assessed in the Biological Assessment so that we can consult on effects to the species under section 7 of the ESA.

13. Page E-4-73 Proposed Environmental Measures: Black Bear proposes to make improvements in fish passage at the Ellsworth project dependent on the "development of the agencies' resource management plans." The restoration of fisheries in the Union River is already envisioned in several plans. The Comprehensive Fishery Management Plan filed with FERC on February 27, 2015 states that the Union River will be managed as a migratory pathway for Atlantic salmon and other fish species (URFCC 2015). The Maine Department of Inland Fisheries and Game's 1961 report, entitled *Union River: Fish Management and Restoration,* addresses the restoration of American shad, river herring, and Atlantic salmon in the Union River. It identifies downstream survival through both dams comprising the Ellsworth Project, as well as their impoundments, as being the biggest challenge in restoring diadromous fish to the river (MDIFG 1961). We have stated in the draft recovery plan for Atlantic salmon that restoring connectivity is crucial for species recovery, particularly within the designated critical habitat, where the criteria specify a minimum amount of suitable habitat that must be accessible in order for recovery to be achieved (USFWS and NMFS 2016). The implementation plan and SHRU workplan (components of the draft recovery plan) specifically reference the need for improved passage at the Ellsworth Project, and indicate that the West Branch of the Union has some of the greatest recovery potential in the Downeast Recovery Unit. The FERC-approved comprehensive plan *Atlantic Salmon Restoration in New England, Final Environmental Impact Statement 1989-2021. U.S. Fish and Wildlife Service, 1989* states that fish passage improvements should be made at both Graham Lake Dam and Ellsworth Dam (see comment #20).

We assume that Black Bear confused the term 'management plan' with stocking plan since management plans are currently in place. Assuming Black Bear did mean stocking plan, we disagree that a stocking plan should be a prerequisite for fish passage improvements at the Ellsworth Project, and note that none of the above referenced management plans indicate that it should be. Project related impacts limit the restoration of diadromous fish. The resource agencies have known for decades that restoration of Atlantic salmon in the Union River will not occur until passage issues at the Ellsworth Project are fixed (ASRSC 1982; MDIFG 1961). Survival estimates provided by the smolt survival studies in 2016 and 2017 (8.6% and 57.6% survival, respectively) confirm that restoration of Atlantic salmon in the Union River is not possible without addressing these passage issues. Stocking salmon into the river before remediating passage issues would be a waste of resources, and would lead to an unnecessary loss of a critically endangered species. Regardless of stocking, upstream and downstream passage that mitigates the existing impacts on critical habitat in the Union River is needed before the Union River can undergo natural recolonization by adult salmon straying from the nearby Narraguagus and Penobscot Rivers. Therefore, improvements in upstream and downstream passage should be implemented and evaluated as soon as feasible.

14. E-4-73, Cumulative Effects: The licensee claims that the Leonard and Graham Lake impoundments contribute significantly to the alewife potential of the drainage. While true, they fail to mention that the construction of dams likely led to a reduction of the potential production for other species of fish in the river, including blueback herring, Atlantic salmon, and American shad, that rely on riverine habitat for spawning rather than lake habitat.

15. Appendix E-2-6, NMFS Comment #1: Black Bear states that “USGS maintains a [stream] gage on the West Branch of the Union River.” This statement is false. According to the USGS website, this gage is inactive. The installation of a flow gauge is critical to our understanding of how this project influences the natural flow regime of the Union River.

16. Page 10 of Appendix E-7 (Upstream Fish Passage Alternatives Study): It is indicated that a “different fishway hopper system is installed” for harvest at the trap. The harvest hopper is dry when it lifts fish. This is not described adequately in the application. Being lifted in a dry hopper presents an injury and mortality risk for all species, including salmon.

17. Page 15 of Appendix E-7 (Upstream Fish Passage Alternatives Study): The document indicates: “Under current operations, the trap and hopper are visually inspected for Atlantic salmon and if one is spotted, the hopper is left in the water and the salmon is dip-netted out and placed in a holding tank.” Despite the upstream passage study that was conducted, we suspect that because of the overwhelming number of alewife compared to Atlantic salmon, visually inspecting the hopper is not an effective method for detecting salmon at the project. No salmon were observed entering the fishway during the passage study, which is not unexpected due to limited stocking upstream, and to passage inefficiencies at the trap.

18. Page 15 of Appendix E-7 (Upstream Fish Passage Alternatives Study): Black Bear indicates that the existing trap can achieve the alewife target of 2.3 million using the existing facility. However, they also report that the trap passes up to 26,000 alewife a day. At that rate, the capacity of the fish trap for a six-week alewife run is approximately 1.1 million (26,000 x 42 days), well short of the target. On page 17 of Appendix E-7, the licensee indicates that “While the hopper currently in use at Ellsworth (61 cubic feet during lifting) is smaller than the calculated capacity above, a larger hopper (and a larger hoist) could be fabricated and installed at the existing facility that would meet the 166 cubic foot criteria.” We would support improvements to the existing trap such as increased capactiy.

19. Page 16 of Appendix E-7 (Upstream Fish Passage Alternatives Study): Black Bear indicates that upstream passage at the Ellsworth Dam has proven to be “reliable and functional.” Black Bear has yet to provide sufficient evidence that this is the case for Atlantic salmon. Additionally, the trap and truck facility does not mitigate the impacts on critical habitat as it does not provide volitional passage.

    There is information available that suggests that the trapping facility was not 100% effective when salmon were returning to the Union River in relatively large numbers. At that time (1970s and 1980s), a high proportion of salmon had to be netted out of the ladder because they would not enter the hopper (ASRSC 1982, MDMR 2017). The U.S. Atlantic Salmon Assessment Committee has made the assumption that the Ellsworth trapping facility is only 50% effective at trapping salmon (USASAC 1991).

Every salmon captured at the trap is trucked to habitat in the West Branch of the Union River. Given the effects of trap and truck, we do not accept it as a long term approach for passing federally listed Atlantic salmon within its designated critical habitat. The use of the trap is appropriate only for the period of time needed for downstream passage to be remedied, and for an evaluation of upstream passage efficiency at the existing entrance. This entrance could still be used if the ladder is modified to allow for swim through passage of Atlantic salmon.

20. Page H-17, Section 2.8.2: The licensee indicates that the FERC-approved comprehensive plan *Atlantic Salmon Restoration in New England, Final Environmental Impact Statement 1989-2021. U.S. Fish and Wildlife Service, 1989* does not include the Union River. This is incorrect. The Union River is one of 11 rivers prioritized in the plan for the restoration of "…self sustaining populations of Atlantic salmon by the year 2021 A.D". This plan explicitly references the Ellsworth Project on page 32:

    Fish passage facilities are necessary at both the Ellsworth and Graham Lake Dams. The existing trapping facility at the Ellsworth Dam is a multiple-anadromous species facility. Renovations will be required in order to initiate an efficient salmon trapping facility for the interim trucking of adults passed the dams. Downstream migrant facilities will be required at the Ellsworth Dam. The Graham Lake outlet dam will require upstream and downstream facilities for alewives that will also be adequate for the number of salmon expected to be restored to the Union River. In the interim, salmon will be trucked passed the Graham Lake dam.

21. Page H-7, Section 2.8.2 (Maine Rivers Policy and Maine Rivers Study): The licensee discusses the relevance of the Maine Rivers Policy of 1987, a FERC-accepted comprehensive plan, on the Ellsworth Project. Black Bear indicates that "…the section of the Union River on which the Project is located is not one of the listed river segments meriting special protection." While it is true that the section containing the dam in not included, the policy does include the West Branch of the Union River between Route 181 and Great Pond. The function of habitat in the headwaters of the Union River is influenced by the ability of the Ellsworth Project to effectively pass the native suite of diadromous fish. Black Bear also

neglects to mention this segmentation of the watershed on page H-8 where they address the Maine River Study (also known as the State of Maine Comprehensive Rivers Management Plan, May 1987 – Volume 2). Black Bear indicates that the reach containing the project is rated as a "C", but does not explain that the West Branch is rated as a "B," and is thus considered an "outstanding river segment."

2. Study Report Comments

2.1. 2017 Atlantic Salmon Smolt Survival Study

We appreciate Black Bear modifying the study report to reflect our comments on the draft. The final report adequately addresses many of the comments/questions that we submitted on the draft. Overall, the information provided in these study reports (in addition to the 2016 smolt study report) confirms that existing fish passage at the project is not adequate. The results confirm the assumptions of state and federal fisheries biologists (ASRSC 1982, MDIFG 1961) that downstream passage mortality at the Ellsworth Project is a limiting factor in the recovery of Atlantic salmon runs in the Union River. Our comments on the final versions of the two studies are below.

This study was designed as a passage survival study, and does not account for dam-related mortality of smolts in the impoundments of the two dams. In the 2016 study, Black Bear determined that 14% of the study fish died prior to reaching the Graham Lake Dam. It is possible that the higher flow in the river in 2017 (2.5x the flow in 2016) would have led to smolts moving faster through the impoundments, which might have led to higher survival. Unfortunately, smolt survival was not measured through the impoundment in 2017, so we do not have the data to support that hypothesis. It is unknown what the background mortality rate is within the Union River. Given the effects of the dams, there are no free flowing reaches of sufficient length downriver of where the West Branch flows into Graham Lake. To accurately address the effect of the Graham Lake impoundment, a study will need to be completed that compares survival in the West Branch of the Union to the survival through the Graham Dam impoundment.

On page F-2, Black Bear addresses our comment that Black Bear should use the survival of all study fish released upstream of the two dams to adjust the survival estimates, rather than just the fish released downstream of Graham Lake Dam. Black Bear made the requested modification in the final report. For the reasons described in our comment, we believe that adjusting survival in this manner better represents the actual survival at the project. Therefore, we will consider those survival estimates (77.9% at Graham Lake Dam; 74.0% at the Ellsworth Dam) as the best available information on the survival at the project in 2017. We therefore conclude that cumulative survival at the project in 2017 (excluding dam-related impoundment mortality) was 57.6%. This is a significant improvement over the 2016 results (10% cumulative survival). The entirety of the gain in survival was observed at the Graham Lake Dam. It is likely that the installation of the new entrance weir at the Graham Lake Dam led to improved attraction and, thus, higher passage rates. However, it is possible that the higher flow in 2017 (2.5x the median flow in May of 2016) contributed to the increased passage efficiency. More study will be necessary to understand how the flow relates to the rate of passage at Graham Lake Dam.

Despite the overall increase in survival, the 2017 results did not show improved survival at the Ellsworth Dam. Survival between the two years is essentially the same (roughly 74%) despite two supposedly safer passage routes (Unit 1 and the spillway) being made available in 2017 that were not available in 2016. Additionally, the 2017 estimate includes a background mortality adjustment, which the 2016 estimate does not. This would suggest that the survival in 2017 was actually worse at the Ellsworth project than what occurred at the project in 2016.

As indicated in our March 20, 2017 letter to FERC objecting to the second year of study, installing the entrance weir did not resolve the issues for outmigrating salmon at the project. Further modifications and studies at the Graham Lake and Ellsworth Dams will be needed to ensure that Black Bear is adequately minimizing effects to Atlantic salmon. The current low survival rates reported in the study report (in addition to the dam-related mortality in the impoundment) makes it impossible for the Union River to support a recovered run of Atlantic salmon without significant improvements to project fishways.

Although background mortality in the Union River is quite high, the Ellsworth Project is responsible for the majority of salmon smolt mortality. The unadjusted mortality through the dam reaches in 2017 was 61.9%. The study indicates that more than two-thirds of that mortality is associated with dam passage.

On page F-3, Black Bear responded to our comment asking that they distinguish mortality between the two passage routed at Graham Lake Dam (i.e. the downstream bypass and the Tainter gates). They reported the information in Section 4.1.5.3. The results indicate that of the smolts that passed the dam via the bypass 92.4% survived; whereas, 100% of the smolts that passed the gates survived. These estimates were adjusted for background levels of mortality associated with predation. Although the sample size is small, the difference in the survival rate between the two routes should be considered when developing additional remedies to reduce mortality at the dam. We do not have route specific mortality rates from 2016 with which to compare the 2017 results; however, the overall passage survival in 2016 at Graham Lake Dam was much lower (59%). Given the results from 2017, it is possible that much of this mortality is associated with fish passing via the bypass. Additional studies with sufficient sample sizes will be needed to adequately assess the efficacy and safety of the two passage routes.

2.2. 2017 Hi-Z Tag Turbine Entrainment Study

This study appears to have been well conducted, and the injury assessment provides invaluable information regarding the sublethal effects (injury, loss of equilibrium) of turbine and bypass passage the Ellsworth Project.

On page 86 and 87, Black Bear responded to our comments that address the need to characterize the pressure-related passage effects on river herring. This study was conducted in large part due to concern that the pressure effects seen in river herring might be affecting listed salmon as well. Although we appreciate Black Bear's willingness to do the study, the fact that river herring were not studied limits the value of the study. We made a comment on the study plan requesting that Black Bear address to effects to river herring to the extent practicable (filed with FERC on March 31, 2017). Black Bear responded by indicating that they would "…provide a discussion of potential impacts to juvenile clupeids based on previous HI-Z evaluations at hydro locations with similar characteristics to the Ellsworth passage routes" (Black Bear Study Plan 3-31-2017). However, Black Bear's response in this study report makes it clear that such an evaluation is meaningless given the difference in the rotation speed and blade length of the Ellsworth turbines and other hydro projects. Additionally, the report states that "… passage survival is lower and passage-related injury rates [for salmonids] are higher for the Kaplan turbine evaluated at Ellsworth Dam (i.e., Unit 2) than previously estimated rates for other hydroelectric facilities" (page 18 of Hi-Z study report). Given that the effects of passage through Units 2 and 3 are not comparable to similar projects, it is impossible to draw conclusions regarding river herring on this basis. This is unfortunate as results of shoreline surveys suggest that the effect on river herring may be significant (URFCC 2017). Further studies using river herring will therefore be necessary to adequately characterize this effect.

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