ENDANGERED SPECIES ACT SECTION 7 CONSULTATION

BIOLOGICAL OPINION

Agency:	Department of the Army, Corps of Engineers, New England District
Activity:	Proposed construction of the East Machias Aquatic Research Center and associated water intake structure in the East Machias River in East Machias, Washington County, Maine
Conducted by:	U.S. Fish and Wildlife Service, Maine Field Office [53411-2007-F-0094]
Date Issued:	July 12, 2007

Approved by:

_____

Lori H. Nordstrom
Field Supervisor
Maine Field Office
U.S. Fish and Wildlife Service

TABLE OF CONTENTS

INTRODUCTION

This constitutes the biological opinion (opinion) of the U.S. Fish and Wildlife Service (USFWS) on the proposed construction of the East Machias Aquatic Research Center in East Machias, Washington County, Maine by the Downeast Salmon Federation (DSF). The East Machias River occurs within the geographic range of the Gulf of Maine (GOM) Distinct Population Segment (DPS) of Atlantic salmon (*Salmo salar*). The U.S. Army Corps of Engineers (ACOE) is considering authorization of this project under Section 404 of the Clean Water Act (CWA) and Section 10 of the Rivers and Harbors Act (RHA). The ACOE's request for formal consultation was received on February 27, 2007.

This opinion is based on the following: (1) information provided in the ACOE's February 26, 2007 initiation letter and attachments in support of formal consultation under the ESA; (2) the August 9, 2006 permit application to the ACOE under Section 404 of the CWA and Section 10 of the RHA; (3) ■Final Endangered Status for a Distinct Population Segment (DPS) of Anadromous Atlantic Salmon (*Salmo salar*) in the Gulf of Maine• (65 FR 69459, Nov. 17, 2000); (4) Status Review for Anadromous Atlantic Salmon (*Salmo* salar) in the United States (Fay *et al.* 2006); (5) field investigations; (6) meetings between the USFWS, the ACOE, the National Marine Fisheries Service (NMFS), the Maine Atlantic Salmon Commission (MEASC) and the DSF and their consultant, Parish Geomorphic; and (7) other sources of information. A complete administrative record of this consultation will be maintained by the USFWS Maine Field Office in Old Town, Maine. The USFWS log number is 53411-2007-F-0094.

CONSULTATION HISTORY

January 4, 2006 – USFWS, MEASC, ACOE, and DSF, and Parish Geomorphic visit site of proposed EMARC in East Machias, Maine. Discussed the need for ESA compliance due to the presence of endangered Atlantic salmon in the East Machias River, either through Section 7 consultation with the ACOE or through a Section 10 permit (i.e., a recovery permit).

March 6, 2006 – Parish Geomorphic (consultant to DSF) submits EMARC Initial Investigation Draft Report, which describes the proposed project and state and federal permitting needs, with a focus on the construction of the water intake structure and impacts to Atlantic salmon in the East Machias River.

April 17, 2006 – Parish Geomorphic submits updated information on the design and construction of the water intake structure.

August 9, 2006 – DSF submits their permit application to the ACOE to construct the EMARC on the East Machias River.

August 16, 2006- Email from Norm Dube (MEASC) to Shawn Mahaney (ACOE) providing comments on the installation of the water intake structure and impacts on juvenile Atlantic salmon that inhabit the project area.

August 24, 2006 – USFWS and NMFS review permit application and inform ACOE that, based on current project design, formal Section 7 consultation for effects on Atlantic salmon is warranted. USFWS has determined that only the future operation of the hatchery can be covered under the existing Regional Director's Section 10 permit (which allows for Craig Brook National Fish Hatchery to transfer Atlantic salmon eggs to private hatcheries to aid in recovery efforts) and that construction of the facility must be reviewed under a Section 7 consultation with the ACOE.

October 31, 2006 – DSF submits revised permit application to the ACOE to address questions raised by USFWS and NMFS on effects of project on Atlantic salmon.

November 27, 2006 – Email from Wende Mahaney (USFWS) to Aaron Corr (Parish Geomorphic) clarifying the need for formal Section 7 consultation between the USFWS and the ACOE on the construction and operation of the EMARC. Future transfer of Atlantic salmon eggs from USFWS to EMARC will be authorized under the USFWS's existing ESA Section 10 permit.

February 27, 2007- USFWS receives February 26, 2007 letter from ACOE requesting initiation of formal Section 7 consultation for construction of the proposed EMARC.

March 9, 2007 – Letter from USFWS to ACOE acknowledging initiation of formal consultation. The Service's opinion is due to ACOE by July 12, 2007.

May 23, 2007 – NMFS requests site specific staff gage information from DSF to determine if the action area is affected by the influence of tide. This information will assist in analyzing the effect of water withdrawal on Atlantic salmon.

June 13, 2007 – NMFS and USFWS receive requested staff gage data from DSF.

June 14, 2007 – USFWS and NMFS meet with DSF to discuss plans for rearing East Machias River strain Atlantic salmon fry and process necessary to obtain eggs from the Craig Brook National Fish Hatchery.

BIOLOGICAL OPINION

I. DESCRIPTION OF THE PROPOSED ACTION

The ACOE is proposing to permit the construction of the East Machias Aquatic Research Center (EMARC) in East Machias, Washington County, Maine (Figure 1). The Downeast Salmon Federation (DSF) is proposing to convert an existing building on the shore of the East Machias River into an aquatic research, education, and hatchery facility that focuses on the conservation of Atlantic salmon. The proposed EMARC will be located in a building that formerly housed a generator facility owned by the Bangor Hydro Electric Company (Figure 2). The building is being remodeled to house a hatchery, freshwater aquatic laboratory, and other research and education-oriented facilities; work accomplished to date includes roof reconstruction, interior demolition, and construction of the septic system and parking area. In addition, over one hundred native trees and shrubs have been planted at the site.

The EMARC would raise river-specific Atlantic salmon eggs obtained from the USFWS's Craig Brook National Fish Hatchery and then stock the fry in appropriate habitat within the East Machias River watershed. This stocking would complement the ongoing Atlantic salmon stocking program in Maine, as coordinated by the USFWS, NMFS, and MEASC. The EMARC hatchery is proposing to operate using water taken directly from the East Machias River, necessitating the installation of a water intake system in the river. Hatchery waste water would be discharged back into the East Machias River downstream of the facility. EMARC proposes to use East Machias River water to enhance the successful hatching, rearing, and stocking of eggs spawned from East Machias River broodfish. If at some future time the EMARC proposes to use its hatchery to rear other life stages of Atlantic salmon (e.g., smolts) or other fish species, it may be necessary to reinitiate Section 7 consultation to consider affects to endangered Atlantic salmon that are not analyzed in this opinion (see Reinitiation Notice on page 28 of this opinion).

The rearing of endangered Atlantic salmon at the EMARC would be done under the existing authority of the Craig Brook National Fish Hatchery (CBNFH) pursuant to Section 10 of the ESA (i.e., their ESA recovery permit). CBNFH's recovery permit allows them to transfer eyed eggs to private hatcheries for rearing and stocking into their natal rivers. As specified in the Section 10 permit, DSF will need to obtain authorization from the Service before receiving any salmon eggs at the EMARC hatchery. DSF is currently working with CBNFH staff on the design and operating plan for the EMARC hatchery. The effects of rearing and stocking East Machias River Atlantic salmon by the EMARC on the Gulf of Maine DPS, which will contribute to the recovery of endangered salmon according to the Section 10 permit, will not be considered in this Section 7 consultation.

Water Intake Structure and Pipeline

The proposed water intake structure will be placed in the thalweg of the East Machias River, approximately 137.2 m (450 ft) upstream of the EMARC building. This location was chosen to ensure that there are adequate flow depths during low flow conditions and to ensure that water withdrawal occurs above the salt water wedge of the river. Approximately 21.3 m (70 ft) of two-10.2 centimeter (four inch) high density polyethylene (HDPE) water supply pipes will be buried

FIGURE 1. Location Map

FIGURE 2. Project Plan (from Parish Geomorphic, Ltd. for Downeast Salmon Federation)

45.7 to 61 cm (one and one-half to two ft) beneath the river bed starting at the submerged water intake structure. The pipes will exit the river channel (perpendicular to the bed) and proceed into a manmade penstock channel (part of the former generator facility), which runs parallel to the river channel. The two water supply pipes will then run on grade down the penstock channel for approximately 51.8 m (170 ft). From the downstream end of the penstock channel to the EMARC building connection, the pipes will be buried within the upland terrace in native materials to a depth of approximately 1.4 m (4.5 ft).

The water intake structure was designed using standards from the Alaska Department of Fish and Game to maximize protection of fish from impingement and entrainment (McLean 1988). The intake structure will consist of a collection box with a removable lid constructed of 1.3 centimeter (0.5 in) plate steel. The downstream face of the box will be covered by a trash grate. Two-2.4 millimeter (3/32 in) strainers will serve as the water intake for two-four inch HDPE pipes, which will transfer water from the collection box through the pipeline system and ultimately into the EMARC facility. The collection box will be anchored into the bottom of the river bed by at least 45.7 cm (1.5 ft). The collection box will displace approximately 0.8 square m (nine square ft) of river bottom. A data sonde may be affixed to the side of the collection box to allow monitoring of river water quality. Water will be withdrawn from the river at a rate of approximately 378.5 l per min (100 gal per min). The water intake structure was designed to meet the requirements of NMFS (1997) for passive screen systems, where low intake velocities and close-faced screening will minimize entrainment and impingement of Atlantic salmon and other fish species (Figure 3).

Installation of the water intake structure and supply pipes in the river will be done within a temporary cofferdam structure that will isolate the work area and minimize impacts of mechanical excavation on the river and its aquatic life. Instream work is proposed during August or early September when stream flows are generally low; instream work should be completed in less than one week. A “u-shaped” cofferdam of sandbags or concrete “jersey” barriers and impervious fabric will be constructed by hand labor from the shoreline out to slightly beyond the location of the water intake structure. A sump pump will be placed inside the cofferdam to dewater the work area and capture subsurface drainage during the construction work. A cofferdam will also be constructed at the downstream end of the penstock channel to allow the channel to serve as a settling basin for water pumped out of the river work area. If in the unlikely event flow is present in the penstock channel, the penstock will be completely isolated from river flows with sandbag or concrete cofferdams before the penstock is used as a settling basin. Silt fence will be installed along the banks of the East Machias River as appropriate. All sediment and erosion control measures will be inspected regularly during construction.

A fish evacuation plan will be implemented by MEASC, USFWS, or NMFS staff in conjunction with the construction and dewatering of all cofferdams (both in the river and in the penstock if necessary). Agency staff will ensure that Atlantic salmon juveniles and other fish species are netted and safely moved downstream below the action area.

The two water supply pipes will be buried approximately 45.7 to 61 cm (one and one-half to two ft) below the bottom of the East Machias River. The trench where the pipes are laid will be backfilled to re-create the natural river bottom, both in grade and bed material size (primarily

Figure 3. Details of water intake structure

boulder and cobble). When the pipes exit the river channel, the pipe route will take a 90 degree turn towards the southwest and proceed down the course of the old penstock channel towards the EMARC building. Approximately 7.6 m (25 ft) of river bank disturbed during construction will be stabilized with vegetated rip-rap after pipe installation is completed; approximately 60 cubic yards of stone rip-rap will be used. Containerized native shrub "whips" will be installed within the stone rip-rap at a density of four plants for every 1.7 square m (two square yd) of stone.

The penstock channel is a rock-lined chute that was constructed within the floodplain of the East Machias River in association with the former hydro-power generating station. The penstock and some of its concrete supports were previously removed. This channel currently has water flowing through it only during relatively high flows in the East Machias River. In conjunction with the removal of the nearby upstream dam on the East Machias River in 2000, some fill material was placed in the penstock channel in an attempt to restore a natural floodplain condition and to keep flows in the main river channel during times of low water (e.g., summer) (Figure 4).

The water pipes will be laid on top of the concrete foundations where they still exist in the penstock channel. Following installation of the pipes, the penstock channel (approximately 678.2 square m [7,300 square ft]) will be filled with gravel and cobble material (less than 20.3 cm [eight in] diameter; approximately 994 cubic m [1,300 cubic yd] of granular fill material) and then covered with a minimum of 10.2 cm (four in) of topsoil to achieve an appropriate grade. The fill material will be placed both to protect the pipes and to restore the penstock channel to a natural floodplain condition. Native plantings, including shrubs and tress, will be installed. Existing trees and shrubs on a small island between the river and the penstock channel will not be disturbed during construction.

The newly constructed floodplain will be protected from future overbank river flows with a section of vegetated rip-rap at both the upstream and downstream ends of the former penstock channel. Approximately 65.8 cubic m (86 cubic yd) of stone rip-rap will be installed and planted with native shrub "whips." This rip-rap will be placed in the dry and at an elevation above the normal high water mark of the East Machias River.

River water used at the EMARC hatchery will be returned to the river through an existing outfall pipe located on the north bank of the river approximately 152.4 m (500 ft) downstream of the proposed water intake structure. Water use by the hatchery will be non-consumptive, as all water will be returned to the river after use in hatching salmon eggs and rearing fry for release into the East Machias River.

A small amount of riparian vegetation may be lost during construction, particularly to allow access to work areas by construction equipment. Following construction, all disturbed areas will be replanted with native plant species. The entire construction project (installation of water intake structure and pipes, plus restoring a portion of the penstock channel to a more natural floodplain condition) will take approximately four weeks.

Figure 4. Penstock channel upstream of EMARC building where water pipes would be buried. The East Machias River can be seen in the background of the upper right hand corner of the photograph (Photo by Aaron Corr, Parish Geomorphic).

Action Area

The action area is defined as all areas to be affected directly or indirectly by the Federal action and not merely the immediate area (project area) involved in the proposed action (50 CFR 402.02). The action area must encompass all areas where both the direct and indirect effects of the proposed action would affect the GOM DPS of Atlantic salmon.

The proposed project will require work in the East Machias River for installation of the water intake system and pipeline system. Additional work for construction of the pipeline system will occur within the floodplain of the East Machias River in a manmade penstock channel that runs parallel to the river channel. Construction work will also take place near the shoreline of the East Machias River to install the water pipeline from the downstream end of the penstock channel to the EMARC building, where river water will be used to operate a hatchery and freshwater laboratory. Stream flows in the East Machias River will also be altered by withdrawal of river water for use at the EMARC; this water would then be discharged back into the river downstream of the facility.

Because the proposed project involves work in a flowing stream and impacts to a fish species (i.e., Atlantic salmon) that can move through the project site and utilize riverine habitat both upstream and downstream of the work area, the action area will include all of the East Machias River from a point 7.6 m (25 ft) upstream of the proposed sandbag cofferdam downstream to a point 61 m (200 ft) below the existing outfall structure. Therefore, the action area is approximately 231.6 m (760 ft) of the East Machias River channel, as well as floodplain and riparian areas within approximately 11 m (36 ft) of the western shoreline (i.e., the western edge of the penstock channel). The action area is used by both adult (migration) and juvenile (rearing and migration) Atlantic salmon.

II. STATUS OF THE SPECIES

The Status of the Species section presents biological information relevant to formulating this opinion and documents the effects of all past human and natural activities that have led to the current status of the species throughout its range.

Federally-listed species known to occur in Washington County, Maine include the threatened bald eagle (*Haliaeetus leucocephalus*)[1], the threatened Canada lynx (*Lynx canadensis*), and the endangered Atlantic salmon. The bald eagle nests in the town of East Machias and would be expected to forage for fish and waterfowl in the East Machias River. The nearest bald eagle nest site is located approximately one mile downstream of the project site on the western shoreline of the river (Bald eagle Essential Habitat 164C, as designated by the State of Maine). Because the proposed project is located well more than ¼ mile away from this nest, construction will not disturb nesting activities. Furthermore, the small scope of the construction area and the limited time of the construction work in or near the river will not affect the ability of bald eagles to forage in the East Machias River in the general project area. Consequently, the bald eagle will

[1] The USFWS removed the bald eagle from the Federal List of Endangered and Threatened Wildlife, effective August 8, 2007 (72 FR 37346, July 9, 2007).

not be affected by the project. The Canada lynx is not known to occur in the project area. Therefore, the bald eagle and Canada lynx will not be considered further in this consultation.

A. Species Description

The Atlantic salmon is an anadromous fish species that spends most of its adult life in the ocean but returns to freshwater to reproduce. The Atlantic salmon is native to the basin of the North Atlantic Ocean, from the Arctic Circle to Portugal in the eastern Atlantic, from Iceland and southern Greenland, and from the Ungava region of northern Quebec south to the Connecticut River (Scott and Crossman 1973). In the United States, Atlantic salmon historically ranged from Maine south to Long Island Sound. However, the Central New England DPS and Long Island Sound DPS have both been extirpated (65 FR 69459, Nov. 17, 2000).

The ESA considers the term "species" to include "any subspecies of fish or wildlife or plants, and any distinct population segment (DPS) of any species of vertebrate fish or wildlife that interbreeds when mature." Species sub-structure is particularly important to anadromous salmonids, because their strong homing capability fosters the formation of discrete populations exhibiting important adaptations to local riverine ecosystems and the watersheds that determine their character (Berst and Simon 1981; Utter 1981; Utter *et al.* 1993; Nielsen 1998).

A DPS of anadromous Atlantic salmon in the Gulf of Maine was listed by the USFWS and NMFS (collectively, the Services) as an endangered species on November 17, 2000 (65 FR 69459). The GOM DPS encompasses all naturally reproducing remnant populations of Atlantic salmon downstream of the former Edwards Dam site on the Kennebec River northward to the mouth of the St. Croix River. To date, the Services have determined that endangered Atlantic salmon populations are found in the Dennys, East Machias, Machias, Pleasant, Narraguagus, Ducktrap, and Sheepscot rivers and Cove Brook. The USFWS's GOM DPS river-specific hatchery-reared fish are also included as part of the listed entity. Critical habitat has not been designated for this species.

1. *Listing History*

In response to a petition submitted in 1993 to list Atlantic salmon under the ESA, the Services completed a review of the species' status in 1995 (USFWS and NMFS 1995). The Services concluded that there was a danger of extinction and later in 1995 published a proposed rule to list a GOM DPS of Atlantic salmon in seven Maine rivers as threatened (60 FR 50530, Sept. 29, 1995). In that proposed rule, the State of Maine was invited to prepare a plan to eliminate, minimize and mitigate threats to Atlantic salmon and their habitat. On December 18, 1997, the Services withdrew the proposed rule to designate the Atlantic salmon GOM DPS as threatened (62 FR 66325, Dec. 18, 1997). The withdrawal was based on an evaluation of the information then known about the biological status of the species, as well as consideration of ongoing actions by international, state, federal, and private entities, including the state's Atlantic Salmon Conservation Plan for Seven Maine Rivers (Conservation Plan) (Maine Atlantic Salmon Task Force 1997).

In January 1999, the Services received the State of Maine=s 1998 Annual Progress Report on implementation of the Conservation Plan. After review of the Annual Report, public comments, and a 1999 Atlantic salmon status review (AASBRT 1999), the Services determined that the species= status was more precarious than indicated by the available information at the time of their December 1997 determination not to list the species. On November 17, 1999, the Services proposed to list the Atlantic salmon GOM DPS, this time as an endangered species (64 FR 62627 Nov. 17, 1999). After review of public comments and consideration of the best available scientific and commercial information and data, the Services published a final rule on November 17, 2000 listing the Atlantic salmon GOM DPS as an endangered species (65 FR 69459, Nov. 17, 2000). A decision regarding whether or not to include Atlantic salmon that inhabit the mainstems of the Kennebec River above the former site of the Edwards Dam and the Penobscot River above the former site of the Bangor Dam was deferred by the Services during the listing decision pending genetic analyses of these populations.

In 2003, the Services convened a Biological Review Team (BRT) to 1) review and evaluate all relevant scientific information relating to the current DPS delineation; 2) determine the conservation status of the populations for which a decision was deferred in 2000; and 3) assess the relationship of the deferred populations to the currently listed GOM DPS. In September 2006, NMFS published a Notice of Availability that the BRT has completed its review of the biological status of Atlantic salmon in the United States (71 FR 55431, Sept. 22, 2006). The new Status Review (Fay *et al*. 2006) updates the 1999 Atlantic salmon Status Review and discusses the status of salmon in the Androscoggin, Kennebec, and Penobscot rivers relative to the currently listed GOM DPS. Based upon recent genetic studies, the new Status Review concludes that the GOM DPS should be comprised of all anadromous Atlantic salmon whose freshwater range occurs in the watersheds from the Androscoggin River northward along the Maine coast to the Dennys River and including all associated conservation hatchery populations used to supplement natural populations. NMFS is currently considering the information presented in the new Status Review to determine whether or not action under the ESA is warranted. If NMFS determines that a modification to the existing listing or a new listing is warranted, then a proposed rule will be published along with the rationale for that proposal.

B. Life History

1. *Freshwater Lifestages*

Adult Atlantic salmon ascend the rivers of New England beginning in the spring and continuing into the fall, with the peak occurring in June. Once an adult salmon enters a river, rising river temperatures and water flows stimulate upstream migration. When a salmon returns to its home river after two years at sea (referred to as 2-sea-winter or 2SW fish), it is approximately 75 cm long and weighs approximately 4.5 kg. A minority (10-20%) of Maine salmon return as smaller fish, or grilse, after only one winter at sea (1SW) and still fewer return as larger 3-sea-winter (3SW) fish. A spawning run of salmon with representation of several age groups ensures some level of genetic exchange among generations. Once in freshwater, adult salmon cease to feed during their up-river migration. Spawning occurs in late October through November.

Approximately 20% of Maine Atlantic salmon return to the sea immediately after spawning, but the majority overwinter in the river until the following spring before leaving (Baum 1997). Upon returning to salt water, the spawned salmon or kelt resumes feeding. If the salmon survives another one or two years at sea, it will return to its home river as a repeat spawner.

The salmon•s preferred spawning habitat is coarse gravel or rubble substrate (up to 8.5 cm in diameter) with adequate water circulation to keep the buried eggs well oxygenated (Peterson 1978). Water depth at spawning sites is typically between 30 and 61 cm, and water velocity averages 60 cm per second (Beland 1984). Spawning sites are often located at the downstream end of riffles where water percolates through the gravel or where upwellings of groundwater occur (Danie *et al.* 1984). Redds, the depression where eggs are deposited, average 2.4 m long and 1.4 m wide (Baum 1997). An average of 240 eggs is deposited per 100 m^2, or one ■unit• of spawning habitat (Baum 1997). Beland (1984) reported that the total original Atlantic salmon spawning and nursery habitat in Maine rivers was 398,466 units.

In late March or April, the eggs hatch into larval alevins or sac fry. Alevins remain in the redd for about six weeks and are nourished by their yolk sac. Alevins emerge from the gravel about mid-May, generally at night, and begin actively feeding. The survival rate of these fry is affected by stream gradient, overwintering temperatures and water flows, and the level of predation and competition (Bley and Moring 1988).

Within days, the free-swimming fry enter the parr stage. Parr prefer areas with adequate cover (rocks, aquatic vegetation, overhanging streambanks, and woody debris), water depths ranging from approximately ten to 60 cm, velocities between 30 and 92 cm per second, and temperature near 16EC (Beland 1984). Parr actively defend territories (Danie *et al.* 1984; Mills 1964; Kalleberg 1958; Allen 1940). Some male parr become sexually mature and can successfully spawn with sea-run adult females. Water temperature (Elliot 1991), parr density (Randall 1982), photoperiod (Lundqvist 1980), the level of competition and predation (Hearn 1987; Fausch 1988), and the food supply all influence the growth rate of parr. Maine Atlantic salmon produce from five to ten parr per unit of habitat (Baum 1997). Parr feed on larvae of mayflies and stoneflies, chironomids, caddisflies and blackflies, aquatic annelids and mollusks, as well as numerous terrestrial invertebrates that fall into the river (Scott and Crossman 1973).

In a parr•s second or third spring, when it has grown to 12.5-15 cm in length, 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 majority of parr (80%) remains in fresh water for two years, while the balance remains for three years (Baum 1997). The biochemical and physiological modifications that occur during smoltification prepare the fish for the dramatic change in osmoregulatory needs that comes with the transition from a freshwater to a saltwater habitat (Bley 1987; Farmer *et al.* 1977; Hoar 1976; USFWS 1989; and Ruggles 1980). As smolts migrate from the rivers between April and June, they tend to travel near the water surface where they must contend with changes in water temperature, pH, dissolved oxygen, pollution levels, and predation. Most smolts in New England rivers enter the sea during May and June to begin their ocean migration. It is estimated that Maine salmon rivers produce 19 fry per unit of habitat, resulting in five to ten parr per unit and ultimately three smolts per unit (Baum 1997).

2. *Marine Lifestages*

Atlantic salmon of U.S. origin are highly migratory, undertaking long marine migrations from the mouths of U.S. rivers into the northwest Atlantic Ocean, where they are distributed seasonally over much of the region (Reddin 1985). The marine phase starts with smoltification and subsequent migration through the estuary of the natal river. Upon completion of the physiological transition to salt water, the post-smolt stage grows rapidly and has been documented to move in small schools loosely aggregated close to the surface (Dutil and Coutu 1988). After entering into the nearshore waters of Canada, the U.S. post-smolts become part of a mixture of stocks of Atlantic salmon from various North American streams. Upon entry into the marine environment, post-smolts appear to feed opportunistically, primarily in the neuston (near the surface). Their diet includes invertebrates, amphipods, euphausiids, and fish (Hislop and Youngson 1984; Jutila and Toivonen 1985; Fraser 1987; Hislop and Shelton 1993).

Most of the GOM DPS-origin salmon spend two winters in the ocean before returning to streams for spawning. Aggregations of Atlantic salmon may still occur after the first winter at sea, but most evidence indicates that they travel individually (Reddin 1985). At this stage, Atlantic salmon primarily eat fish, feeding upon capelin, herring, and sand lance (Hansen and Pethon 1985; Reddin 1985; Hislop and Shelton 1993).

C. Population Dynamics

1. *Historical Abundance*

Anadromous Atlantic salmon were native to nearly every major coastal river north of the Hudson River in New York (Atkins 1874; Kendall 1935). The annual historic Atlantic salmon adult population returning to U.S. rivers has been estimated to be between 300,000 (Stolte 1981) and 500,000 (Beland 1984). The largest historical salmon runs in New England were likely in the Connecticut, Merrimack, Androscoggin, Kennebec, and Penobscot rivers.

By the early 1800s, Atlantic salmon runs in New England had been severely depleted due to the construction of dams, over fishing, and water pollution, all of which greatly reduced the species♠ distribution in the southern half of its range. Restoration efforts were initiated in the mid-1800s, but there was little success due to the presence of dams and the inefficiency of early fishways (Stolte 1981). There was a brief period in the late nineteenth century when limited runs were reestablished in the Merrimack and Connecticut rivers by artificial propagation, but these runs were extirpated by the end of the century (USFWS 1989). By the end of the nineteenth century, three of the five largest salmon populations in New England (in the Connecticut, Merrimack, and Androscoggin rivers) had been eliminated.

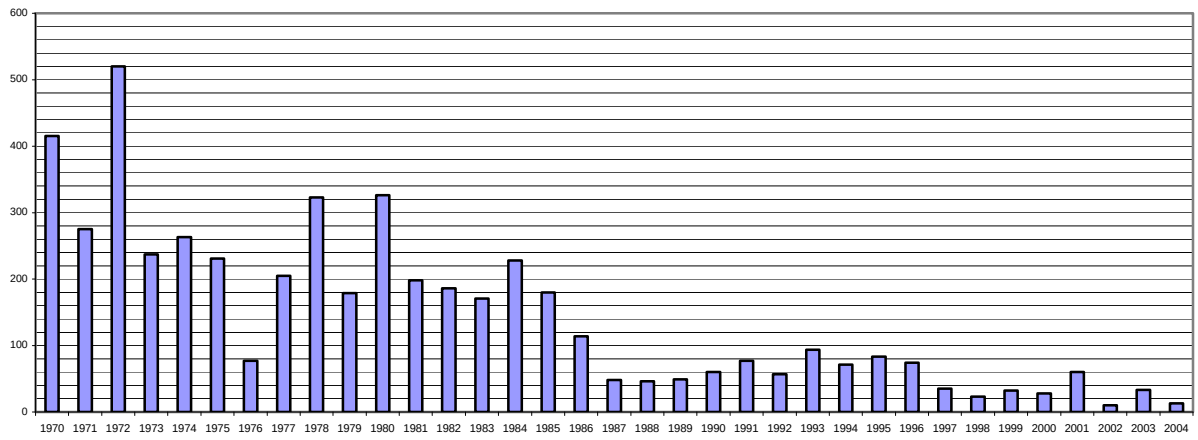
2. *Current Abundance*

As with most anadromous species, Atlantic salmon can exhibit temporal changes in abundance. Angler catch and trapping data from 1970 to 2004 provide the best available composite index of recent adult Atlantic salmon population trends within the GOM DPS rivers. These indices

indicate that there was a dramatic decline in the mid-1980s, and that populations have remained at low levels ever since. Figure 3 demonstrates this trend in the GOM DPS salmon population.

Total documented (rod and trap caught fish) natural (wild and stocked fry) GOM DPS spawner returns for 1995 through 2006 are as follows: 1995 (85); 1996 (82); 1997 (38); 1998 (23); 1999 (32); 2000 (28); 2001 (60); 2002 (16); 2003 (33); 2004 (13); 2005 (13); and 2006 (21) (USASAC 2007). These counts (as well as the counts shown in Figure 3) represent minimal estimates of the wild adult returns, because not all GOM DPS rivers have trapping facilities (e.g., weirs) to document spawner returns in all years. The counts of redds conducted annually by the MEASC demonstrate that salmon do return to those rivers for which no adult counts are possible. Since 2001, scientists have estimated the total number of salmon returning to the GOM DPS with a linear regression model. This estimate is calculated using capture data on GOM DPS rivers with current or historical trapping facilities (Dennys, Pleasant, and Narraguagus rivers), combined with redd count data from the other five GOM DPS rivers. Total return estimates based on these redd counts and trap data are 99 adults in 2001, 33 adults in 2002, 72 adults in 2003, 82 adults in 2004, 71 adults in 2005, and 79 adults in 2006 (at 90% probability).

Figure 3. Total Documented Natural (Wild and Fry Stocked) Spawner Returns from USASAC (2005) data (minimal estimates) for the GOM DPS 1970-2004.



Densities of young-of-the-year salmon (0+) and parr (1+ and 2+) generally remain low relative to potential carrying capacity. This depressed juvenile abundance is a direct result of low adult returns in recent years. Survival from the parr to the smolt stage has previously been estimated to range from 35-55% (Baum 1997). Research in the Narraguagus River, however, demonstrated at the 99% probability level that survival was less than 30% (Kocik *et al.* 1999). Survival from fry to smolt, based on results from hatchery fry stocking, is reported by Bley and Moring (1988) to range from about 1-12%; and survival from egg to smolt stage is reported by Baum (1997) to be approximately 1.25%.

In summary, naturally-producing Atlantic salmon populations in the GOM DPS are currently at extremely low levels of abundance. This conclusion is based principally on the fact that: 1) spawner abundance is below 10% of the number required to maximize juvenile production; 2)

juvenile abundance indices are lower than historical counts; and 3) smolt production is less than one-third of what would be expected based on the amount of habitat available. Counts of adults and redds in all rivers continue to show a downward trend from these already low abundance levels. Given recent estimates of spawner-recruitment dynamics, some researchers suggest that adult populations may not be able to replace themselves, and that populations would be expected to decline further (Beland and Friedland 1997).

D. Status of the Species and Factors Affecting its Environment

Atlantic salmon in the GOM DPS currently exhibit critically low spawner abundance, poor marine survival, and have been or are still confronted with a variety of threats, including artificially-reduced water levels, diseases and parasites, increased likelihood of predation because of low numbers of salmon and increased numbers of some predators, sedimentation of habitat, and genetic intrusion by commercially-raised Atlantic salmon that escape from freshwater hatcheries or marine cages. The Services listed the GOM DPS as endangered because of the danger of extinction created by inadequate regulation of agricultural water withdrawals, disease, aquaculture, and low marine survival (65 FR 69476, Nov. 17, 2000).

These and other factors, including conservation actions, affecting the current status of the Atlantic salmon GOM DPS are discussed in the following documents, which are hereby incorporated by reference: 1) Status Review for Anadromous Atlantic Salmon (*Salmo salar*) in the United States (Fay *et al*. 2006); 2) Final rule listing the Atlantic salmon as an endangered species (65 FR 69476, Nov. 17, 2000); 3) Final Biological Opinion to the U.S. Army Corps of Engineers on existing aquaculture permits (NMFS 2003); and 4) Recovery Plan for the Atlantic Salmon (NMFS and USFWS 2005).

At this time, the Services consider the Atlantic salmon a critically endangered species that is faced with a variety of threats including acidified water and associated aluminum toxicity, Atlantic salmon aquaculture off the coast of Maine, poaching of adults in DPS rivers, incidental capture of adults and parr by recreational anglers, predation, sedimentation of habitat, depletion of diadromous fish communities, and water withdrawals. No single factor can be pinpointed as the cause of the continuing decline of the DPS. Rather, all threats that were key factors in the listing determination, in combination with other recently identified threats, have the potential to adversely affect Atlantic salmon and their habitat. Continued research and assessment is needed to understand the impacts of and interactions among all the threats faced by the DPS. Not all threats are pervasive throughout the DPS rivers, and not all current threats would be expected to adversely affect the DPS if populations were stable (e.g., predation and competition). Despite a wide variety of conservation activities already completed or currently in progress by several government agencies and other conservation organizations, the GOM DPS has not shown any recent signs of population recovery. Population Viability Analysis was used to estimate the probablility of extinction for the GOM DPS (Fay *et al.* 2006). The likelihood of extinction ranges from 19% to 75% within the next 100 years (depending on the number of returning adults considered to represent extinction), even with continuation of current levels of hatchery supplementation.

III. ENVIRONMENTAL BASELINE

The Environmental Baseline provides a snapshot of a species health or status at a given time within the action area and is used as a biological basis upon which to analyze the effects of the proposed action. Assessment of the environmental baseline includes an analysis of the past and present impacts of all state, federal, or private actions and other human activities in the action area, the anticipated impacts of all proposed federal projects in the action area that have already undergone formal or early Section 7 consultation, and the impact of state or private actions that are contemporaneous with the consultation in process (50 CFR •402.02).

A. Status of the Species in the Action Area

The East Machias River is one of eight Gulf of Maine DPS rivers in which endangered salmon are currently known to occur. The East Machias River originates at Pocomoonshine Lake in the towns of Princeton and Alexander, Maine and flows southeasterly 37 miles to Machias Bay in East Machias, Maine (Dube and Fletcher 1982). The watershed drains an area of approximately 312 square miles.

The East Machias River watershed contains 1,697.9 units of mapped Atlantic salmon juvenile rearing habitat and 58.6 units of mapped spawning habitat. The segment of the river where the EMARC is proposed contains 152.1 units of juvenile rearing habitat (segment 6MAINST0.00-0.98, as designated in the Maine Atlantic Salmon Habitat Atlas 2006; http://apollo.ogis.state.me.us/maps). The nearest spawning habitat is located nearly 3 miles upstream in Chase Mill Stream near the outlet of Gardner Lake. Most of the mapped salmon spawning habitat in the East Machias watershed is located many miles further upstream of the action area, above Gardner and Hadley lakes.

Salmon populations in the East Machias River are monitored on a regular basis by the MEASC and the Services. Redd surveys are conducted annually to document spawning activity, but high water levels and poor visibility from fall precipitation can make surveys difficult or impossible. Recent redd surveys yielded the following counts in the East Machias River drainage: 24 (1999), ten (2000), five (2001), five (2002), one (2003), ten (2004), three (2005), and two (2006). At times, sexually mature hatchery broodstock are stocked back into the East Machias River; because they are considered excess to hatchery needs (102 in 2003, 97 in 2004, 148 in 2005, and 159 in 2006). Between 1967 and 1996, 626 adult salmon are documented to have returned to the East Machias River (Fey *et al.* 2006). In 2004, 24 adult salmon are estimated to have returned to the East Machias River based on redd survey data (Fey *et al.* 2006).

The MEASC conducts electrofishing surveys to monitor abundance of Atlantic salmon juveniles in the East Machias River (USASAC 2007). MEASC estimates the density of parr and young-of-year (YOY) for the entire drainage from multiple pass electrofishing surveys at established index sites on the river (Table 1). Recent juvenile density estimates (fish/100 m^2) for the section of the river containing the proposed EMARC facility are as follows: 1) for 2002, parr (1+ and older) = 7.88 and YOY (0+) = 17.4; and 2) for 2003, parr = 5.91 and YOY = 7.55 (Greg Mackey, MEASC, pers. comm.).

Table 1. Juvenile Population Estimates for the East Machias River (Basinwide), 2000-2006.

Year	Parr /100m^2	YOY/100m^2
2006	6.0	1.4
2005	8.4	6.0
2004	3.21	16.72
2003	5.09	9.41
2002	4.21	5.54
2001	8.33	32.9
2000	3.7	19.33

The East Machias River drainage is annually stocked with hatchery raised river-specific Atlantic salmon by the Services and the MEASC to aid in population recovery efforts. Table 2 gives recent juvenile stocking information for the East Machias River (USASAC 2006, 2007; Ernie Atkinson, MEASC, pers. comm.).

Table 2. Number of Juvenile Atlantic Salmon Stocked in the East Machias River, 2002-2007.

Year	Number of Fry Stocked in Entire Basin	Number of Fry Stocked Near EMARC Facility
2007	242,000	26,600
2006	199,000	23,053
2005	216,000	31,753
2004	319,000	55,000
2003	314,000	37,000
2002	236,000	48,695

As with the rest of the Gulf of Maine DPS, the salmon population in the East Machias River is extremely low and continues to demonstrate generally downward trends in abundance, despite ongoing conservation efforts such as stocking. For example, in 2004 the East Machias River only achieved eight percent of its Conservation Spawning Escapement goal of 200 spawners, a measure commonly used to describe the individual status of salmon populations (Fay *et al.* 2006).

B. Factors Affecting Atlantic Salmon in the East Machias River and the Action Area

The East Machias River is a relatively short coastal stream flowing out of Pocomoonshine Lake southeasterly for 37 miles to Machias Bay on the Atlantic Ocean, where it joins with the Machias River. The East Machias River watershed is 312 square miles. Thirty-two lakes and 287.1 miles of streams contribute to the drainage (htpp://www.pearl.maine.edu). Major tributaries include Seavey, Northern, and Chase Mills streams, all of which contain Atlantic salmon habitat.

The drainage is sparsely populated; East Machias, the largest town in the watershed, had a population of 1,298 in 2000. The major land cover type in the watershed is spruce-fir forest. Much of the land base is managed for production of forest products or blueberries.

Water quality in the East Machias River at the proposed EMARC facility is classified by the Maine Department of Environmental Protection as Class B, the state's third highest classification for fresh surface waters. Discharges in Class B waters cannot adversely impact indigenous aquatic life. In 1997, the USFWS tested freshwater mussels and fish in the East Machias River for the presence of polychlorinated biphenyls (PCBs) and other environmental contaminants (Mierzykowski and Carr 1998). Results did not show any elevated levels of trace elements, PCBs, or organochlorine pesticides.

High summer water temperatures may be a limiting factor for Atlantic salmon in the East Machias drainage (Dube and Fletcher 1982; NMFS and USFWS 2005). In 2006, there were 46 days at three monitoring locations in the drainage where stream temperature exceeded 22.5º C (72.5° F; the temperature at which normal juvenile salmon feeding is disrupted) and nine days at one monitoring location where stream temperature exceeded 27º C (80.6° F; the temperature at which juvenile are expected to seek cooler refugia and may experience some mortality from prolonged exposure) (MEASC 2006). The relationship of current water temperatures to historic temperatures is not known and the cause(s) of warm water temperatures is not well understood.

Atlantic salmon populations in the East Machias River were historically impacted in a variety of ways, including the following: 1)hydro-electric power generation at the East Machias dam, which was constructed in 1926, produced power until the lates 1950's, breached in 1973, and was finally removed in 2000; 2) construction of numerous other artificial dams in the watershed, with varying degrees of fish passage capability and impacts on downstream flows; 3) commercial blueberry production; and 4) forest management practices, including clear cuts, log drives, construction of logging roads, and the use of herbicides (Dube and Fletcher 1982). Removal of the East Machias dam provides unimpeded access up to the outlet of Gardner Lake on Chase Mills Stream (where there is a functional fish ladder) and up to the upper reaches of the watershed at the outlets of Crawford Lake (Pokey Dam with a fish ladder) and Barrows Lake (abandoned dam with an inoperable fish ladder).

Voluntary reporting of adult Atlantic salmon caught by anglers in the East Machias River showed an average yearly catch of 21 salmon from 1953-1981, with a high of 85 adults in 1981 (Dube and Fletcher1982). Recreational fishing for Atlantic salmon in the state of Maine was discontinued on December 28, 1999. Currently, poaching of adult salmon and incidental take of parr and adult salmon by recreational anglers likely impact the salmon population in the East Machias River to an unknown degree.

Since 1999, non-point source (NPS) pollution sites have been documented by various agencies and organizations within the East Machias River watershed. Many of these NPS sites are associated with small, seasonal land management roads that are typically 2.4 to 3.7 m (eight to 12 ft) wide with a gravel surface. These roads are prone to NPS pollution due to erosion on the road surface, roadside ditches, or bank erosion at stream crossings. To date, 221 NPS sites have been identified and 54 of them have been restored (Barry Southard, Washington County Soil and

Water Conservation District, pers. comm.). Among the impacts that these NPS sites have on salmon and their habitat are sedimentation of gravel used by spawning adults or juveniles, loss of riparian vegetation and associated warming of stream water temperature, obstructions to fish passage (e.g., hanging or poorly aligned culverts), and addition of nutrients (primarily phosphorus and nitrogen) that can degrade water quality.

The possible effects of acidification on Atlantic salmon, particularly from episodic declines in pH and increases in aluminum associated with precipitation and runoff events, has been identified as an issue of concern in several Gulf of Maine DPS rivers, including the East Machias River (Maine TAC 2002). The MEASC, in cooperation with the Maine Department of Environmental Protection, is currently collecting baseline pH data for the East Machias River. The historic or current impact of acidification on the salmon population in the East Machias River is unknown.

IV. EFFECTS OF THE ACTION

This section of the opinion analyzes the direct and indirect effects of the proposed action on the GOM DPS of Atlantic salmon, together with the effects of other activities that are interrelated or interdependent (50 CFR 402.02, June 30, 1986). Indirect effects are those that are caused by the proposed action, are later in time, but are still reasonably certain to occur. Interrelated actions are those that are part of a larger action and depend upon the larger action for their justification. Interdependent actions are those that have no independent utility apart from the action under consideration.

A. Effects from Construction of Water Intake Structure and Associated Water Supply Pipeline

All instream work in the East Machias River for the installation of the water intake structure and water supply pipeline will be conducted in the dry behind a sand bag or "jersey" barrier (concrete) cofferdam. This cofferdam will be constructed by hand labor and will be placed on an impervious membrane to facilitate removal from the river bed. Within the proposed instream work area, the East Machias River is primarily large boulders and cobbles (D95 = 61 cm [24 in] and D15 = 7.6 cm [3 in]).

Atlantic salmon may be killed or more likely temporarily disturbed, displaced, or injured by instream work activities. Although isolation of a stream work area with a cofferdam is a conservation measure intended to minimize the adverse effects of construction activities on Atlantic salmon and their habitat, any fish present in the proposed cofferdam area will, nevertheless, be impacted. These salmon will either be temporarily disturbed or displaced so that they move away from the instream work area, or they will be captured inside the cofferdam and then handled and released downstream outside of the action area according to a fish evacuation plan.

Capturing and handling salmon causes physiological stress and can cause physical injury, although these effects can be kept to a minimum through proper handling procedures. To minimize any injury or stress to captured salmon, a staff member from the MEASC, USFWS, or

NMFS must be on-site during construction and dewatering of the cofferdam; only agency staff who are experienced in handling Atlantic salmon, will be allowed to handle fish. Handling stress will be minimized by using 1) minimal handling time; 2) minimal time that fish are held out of the water; and 3) transfer containers with aerated stream water of ambient temperature. The DSF, its consultants, or its contractors may not handle any Atlantic salmon during the course of this construction project.

Given the yearly stocking of thousands of fry (26,600 in 2007) in the immediate vicinity of the proposed work area, it is highly likely that some juvenile Atlantic salmon (0+ and older) will be present in the action area during the proposed instream work window from July 15 to September 30. The cofferdam that will be used for installation of the water intake structure and water supply pipeline will temporarily displace about 92.9 square m (1000 square ft) of juvenile rearing habitat for about one week. This is slightly less than one unit of juvenile rearing habitat (100 m^2). Based on recent juvenile salmon estimates in this stretch of the East Machias River, about six or seven parr (1+ or older) or between seven and 17 YOY (0+) would be expected in the work area. Dewatering of the cofferdams will also result in the loss of aquatic invertebrates within the isolated stream channel area. Although this area would be expected to support a healthy community of invertebrates that provide food for Atlantic salmon parr, impacts are expected to be relatively minor given the small size of the work area relative to the entire East Machias River channel in the action area.

Adult Atlantic salmon that are migrating upstream to access spawning habitat could be present in the action area during the time of instream construction. Given the low numbers of adults returning to the East Machias River in recent years and that this river is considered to have an "early" run of returning adults (generally from May through mid-July) (Baum 1997), it is unlikely that an adult would be present. Furthermore, there will be about 10.7 m (35 ft) of open river channel between the outer edge of the cofferdam and the opposite river bank through which adult salmon could pass while the cofferdam is in place. Accounting for the cofferdam and assuming a mean August discharge of 2.3 cms (81 cfs), the water depth in the actively flowing portion of the channel would be approximately 61 cm (two feet) deep.

About 7.6 m (25 ft) of river bank will be disturbed during installation of the water supply line and then stabilized with vegetated riprap. Although a few existing shrubs and some herbaceous vegetation will be removed from the river bank during construction, these plants will be replaced by native shrub "whips" installed within the riprap. Although riprap along stream banks can increase stream water temperatures due to solar radiation, the small amount of riprap proposed will not have a measurable effect on water temperature in the East Machias River, given the already relatively open nature of the river in this location and considering the proposed shrub plantings. Furthermore, this minor vegetation removal should not result in any input of sediment into the East Machias River, as long as appropriate erosion control BMPs, such as silt fence, are employed.

Because the instream work area will be isolated by cofferdams, the impact of noise from construction equipment used to install the water intake structure and pipeline are expected to be very minimal, if any. According to information provided to the USFWS by the Federal Highway Administration during a Section 7 consultation on a bridge replacement project in Maine, noise

from construction equipment does not carry from the air into the nearby water column (USFWS 2005).

Approximately 678.2 square m of the penstock channel will be filled following installation of the water supply pipeline and then revegetated with plants species native to the local river floodplain. Although the penstock channel can provide habitat for juvenile salmon during high river flows, the loss of this habitat is not expected to adversely affect Atlantic salmon given the small size of the area, the artificial nature of this habitat, and the availability of abundant juvenile habitat nearby in the main river channel. Furthermore, the availability of habitat in the penstock channel was likely reduced when the penstock channel was partially filled in association with removal of the East Machias dam in 2000 (i.e., the increase in surface elevation in the penstock channel would require higher river flows to provide adequate water flowing down the penstock for salmon to use the habitat). Restoration of a more natural floodplain in the area of the former penstock channel should result in an overall improvement to the East Machias River ecosystem in the action area.

B. Water Quality Effects

Instream construction activities can result in temporary increases of suspended solids within the stream. Use of sandbag cofferdams to allow most of the construction work to be done in the dry and doing all instream work during the prescribed summer low-flow work window (July 15 to September 30) will minimize the amount of suspended solids entering the East Machias River. Turbid water from within the cofferdam will be pumped into the dry penstock channel (isolated by cofferdams so that it serves as a settling basin) to avoid sedimentation impacts to the river. Careful installation, maintenance, and removal of the cofferdam will minimize the amount of construction-related sediment in the East Machias River. A very small amount of sediment could be released downstream when the sandbag cofferdam is removed. This potential sedimentation event is expected to be very short in duration and involve a minute amount of finer sediments, particularly considering the very coarse nature of the sediment in this reach of the East Machias River. Therefore, impacts on Atlantic salmon from sedimentation would be negligible.

Potential adverse effects of increases in stream turbidity on Atlantic salmon could include the following: 1) reduction in feeding rates; 2) increased mortality; 3) physiological stress; 4) behavioral avoidance of the work area; 5) physical injury (e.g., gill abrasion); and 6) reduction in macroinvertebrates as food. An increase in stream turbidity may provide temporary enhancement of cover conditions, which could result in less susceptibility to predation (Danie *et al.* 1984). Because of the minor amount of construction-related sediment expected to reach the East Machias River and because of the small number of salmon expected to be in the action area, turbidity-related effects are expected to be minor and very short-term.

The contractor will use a spill prevention and control plan designed to avoid any impacts to the East Machias River from hazardous chemicals associated with construction, such as diesel fuel, oil, lubricants, and other hazardous materials. All refueling or other construction equipment maintenance will be done at a location consistent with the spill plan and at least 30.5 m (100 ft) from the shoreline of the East Machias River. For this project, the contractor plans to conduct all

refueling operations off-site. Petroleum-based materials, such as diesel fuel and oil, contain polycyclic aromatic hydrocarbons (PAHs). PAHs can be acutely toxic to salmonids and other aquatic organisms at high exposure levels or can cause sublethal effects at lower exposures (Albers 2003).

C. Effects from River Water Withdrawal and Use

Removing water for hatchery purposes at the EMARC will result in decreased stream flow in the East Machias River for approximately 152.4 m (500 ft) between the water intake structure and the effluent outfall. According to the DSF, EMARC will use 378.5 liters per minute (lpm) (100 gallons per minute) of water during hatchery operations. At the proposed withdrawal rate of 378.5 lpm, water surface elevations in the 152.4 meter (500 ft) reach are expected to decrease by about 3.2 mm (about 1/8 inch). Water velocities could be reduced by 0.9 cm/second (0.03 ft/second). During an extreme low flow event in the East Machias River, such as 7Q10, a 378.5 lpm withdrawal rate equates to about 1.5% of stream flows. Return of unaltered river water through an existing outfall pipe below the EMARC facility is not expected to have any effects on Atlantic salmon or their habitat.

Aquatic habitat in the reach of river between the intake structure and effluent outfall is characterized as moderate gradient, riffle habitat with cobble and boulder substrates. As this reach of river is located just upstream of head-of-tide in the East Machias River, stream hydraulics (i.e., water depths and velocities) are influenced by changing tidal conditions. Based upon water surface elevation data collected at the site on June 8-9, 2007, the lower half (approximately 76.2 m [250 ft]) of the reach is backwatered during high tides in the estuary. At high tides, water depths in the lower 76.2 m (250 ft) of the reach increased from 2.54 cm (1 inch) to as much as 40.6 cm (16 in). As such, the slight decrease in water depths (3.2 mm [1/8 inch]) in this river reach caused by water withdrawals at EMARC are not expected to significantly affect salmon habitat in the lower reach. Incoming tides will increase water surface elevations (depths), essentially compensating for any loss of water withdrawn for use at the facility.

Although water depths in upper 76.2 m (250 ft) of the river reach may experience a loss of 3.2 mm (1/8 inch) of depth due to water withdrawal for use at EMARC, this is also not expected to cause significant adverse affects to listed Atlantic salmon since a) the reach will remain suitable for passage by migrating adults and smolts; b) eggs are not likely to be present in the reach since suitable spawning habitat is not present; and c) except during extreme low flow periods, adequate amounts of fry and parr habitat will remain suitable. During low flow periods, such as 7Q10 in the East Machias River, some loss of habitat for fry and parr is expected to occur in the upper 76.2 m (250 ft) of this river reach. Although USFWS does not have information concerning the exact loss of weighted usable area for fry and parr as a result of water withdrawals for EMARC, the loss is expected to be small considering a 378.5 lpm (100 gpm) withdrawal rate equates to 1.5% of stream flow at 7Q10 and only 76.2 m (250 ft) of stream will be affected.

D. Effects of Fish Entrainment and Impingement

Water intake structures are known to entrain migrating juvenile and adult salmonids. Juvenile salmonids can also become impinged on water intake screens. Entrainment can lead to fish death and injury by direct contact with water pumps, shear forces, cavitation, turbulence, or pressure changes. Impingement of fish can lead to bruising, descaling, and other injuries. Impingement, if prolonged, repeated, or occurring at high velocities, also causes mortality.

Adequately designed screens on intake structures can minimize impacts on migrating Atlantic salmon. According to the DSF, the intake structure at EMARC will be designed to conform to NMFS' Fish Screening Criteria for Anadromous Salmonids (January 1997). Specifications at the intake structure will require a 2.4 mm (3/32 inch) maximum screen face material and approach velocities less than 3.7 m/minute (0.2 ft/second). The screen will be oriented vertically, which will also reduce the likelihood of entrainment and impingement. These specifications are known to protect the smallest life stage (fry) of Atlantic salmon expected in this reach of the East Machias River. Therefore, it is extremely unlikely that any entrainment or impingement of Atlantic salmon will occur as a result of the intake structure at EMARC.

V. CUMULATIVE EFFECTS

Cumulative effects include the effects of future state, tribal, local or private actions that are reasonably certain to occur in the action area considered in this opinion. Future federal actions that are unrelated to the proposed action are not considered in this section, because they require separate consultation pursuant to Section 7 of the ESA.

The USFWS is not aware of any non-federal actions that are reasonably certain to occur in the action area considered in this opinion. Given the nature of the action area (i.e., a stretch of river channel) any future activity within the river is likely to require a federal permit from the Corps and would therefore be subject to Section 7 consultation as necessary.

VI. CONCLUSION

The proposed action will adversely impact Atlantic salmon and its habitat in the East Machias River by temporarily disturbing fish during instream construction activities (including possibly trapping some fish inside cofferdams), temporarily making some habitat unavailable during instream construction activities, and resulting in the permanent loss of a very minor amount of juvenile rearing habitat (0.8 square m [nine square ft]) from the water collection box anchored in the river bottom. All of these impacts are expected to affect primarily juvenile Atlantic salmon that are residing in the action area or adults that are migrating upstream through the action area. The proposed action will result in the take of listed Atlantic salmon in the East Machias River.

Therefore, after considering the environmental baseline, the effects of the proposed action, and the potential for future cumulative effects in the action area, the USFWS has concluded that the proposed project is not likely to jeopardize the continued existence of the GOM DPS of Atlantic salmon throughout all or a significant portion of its range. As no critical habitat has been

designated for the Atlantic salmon pursuant to Section 4 of the ESA, no critical habitat will be adversely modified or destroyed.

VII. INCIDENTAL TAKE STATEMENT

Section 9 of the ESA prohibits the take of endangered species without special exemption. The term "take" is defined to include harass, harm, pursue, hunt, shoot, wound, kill, trap, capture or collect, or to attempt to engage in any such conduct. Harm is further defined by the Services to include an act that actually kills or injures wildlife. Such acts may include significant habitat modification or degradation that results in death or injury to a listed species by significantly impairing essential behavioral patterns, including breeding, feeding, or sheltering. The term "harass" is defined by the USFWS as intentional or negligent actions that create the likelihood of injury to listed species to such an extent as to significantly disrupt normal behavior patterns which include, but are not limited to, breeding, feeding or sheltering. (NMFS has not defined the term "harass" in its ESA regulations.) Incidental take is defined as take that is incidental to, and not the purpose of, the carrying out of an otherwise lawful activity. Under the terms of Section 7(b)(4) and Section 7(o)(2), taking that is incidental to and not intended as part of the agency action is not considered to be prohibited taking under the ESA, provided that such taking is in compliance with the terms and conditions of this Incidental Take Statement (ITS).

A. Amount or Extent of Take

The USFWS anticipates that a small number of juvenile Atlantic salmon will be taken as a result of the proposed actions addressed in this opinion. This take will be the result of instream work activities, including the placement and dewatering of cofferdams. As discussed above, the effects of the proposed water withdrawal from the East Machias River are expected to be very small and would not result in the take of any Atlantic salmon.

Any Atlantic salmon captured during cofferdam installation will be properly handled and moved downstream outside of the work area by fishery agency personnel. The amount of anticipated take is small because of the currently low population of salmon in the East Machias River and because of the limited size of the action area and the footprint of the proposed cofferdam (92.9 m^2). Recent juvenile salmon estimates (see page 17 in this opinion) in the East Machias River near the action area range from 5.91 to 17.4 fish per unit of habitat (one unit = 100 m^2).

Based on the size of the anticipated instream work area and recent juvenile salmon population estimates by the MEASC for this area of the East Machias River, the USFWS anticipates that no more than 17 juvenile Atlantic salmon will be taken as a result of the proposed project. This take level represents the maximum recent juvenile population estimate for the East Machias River in the vicinity of the proposed action for one unit of habitat, which is only slightly larger than the footprint of the proposed cofferdam (100 m^2 versus 92.9 m^2). Most, if not all, of this take will occur when salmon are captured and removed from the instream work area. With the use of proper capture and handling techniques, lethal take of salmon should be very little if any. During 2004 juvenile population estimates in GOM DPS rivers, the MEASC handled 6,372 juvenile salmon and experienced mortality rates of 0.78% for YOY and 0.08% for parr (Fay *et al.* 2006).

This ITS specifically does **not** authorize the take (lethal or non-lethal) of any adult Atlantic salmon. Any adult salmon in the action area during project construction would be expected to continue upstream migration unaffected by the construction activities, and water withdrawals for use by the hatchery are not expected to affect adult migration through the action area. Any take associated with future hatchery operations at the EMARC (i.e., related to receiving and rearing Altantic salmon eggs from the USFWS) will be covered under the existing Section 10 recovery permit for the Craig Brook NFH.

B. Reasonable and Prudent Measures

The measures described below are nondiscretionary and must be implemented by the ACOE (or the DSF) in order for the exemption in Section 7(o)(2) to apply. The ACOE has a continuing duty to regulate the activity covered by this incidental take statement. The USFWS considers the following reasonable and prudent measure to be necessary and appropriate to minimize take of the Atlantic salmon:

• Minimize the adverse effects to Atlantic salmon in the East Machias River by employing construction techniques that avoid or minimize adverse effects to water quality, aquatic or riparian habitats, and other aquatic organisms.

C. Terms and Conditions

In order to be exempt from the prohibitions of Section 9 of the ESA, the ACOE and DSF must comply with the following terms and conditions, which implement the reasonable and prudent measures described above, and outline the required reporting/monitoring requirements. These terms and conditions are nondiscretionary.

1. Hold a pre-construction meeting with the contractor(s) to review all procedures and requirements for avoiding and minimizing impacts to Atlantic salmon and to emphasize the importance of these measures for protecting salmon.

2. Minimize the potential for impacts to Atlantic salmon and their habitat by conducting all instream work from July 15 to September 30 (of any given year) during periods of low stream flows.

3. A fish evacuation plan must be implemented by staff from the MEASC, USFWS, or NMFS during construction and dewatering of all cofferdams to remove juvenile Atlantic salmon from the work area. The DSF must give at least two weeks notice to these agencies before beginning construction of the cofferdams. The primary agency point-of-contact will be Mr. Jason Czapiga of the MEASC in Bangor, ME (207-561-5613).

4. The contractor will follow a spill prevention and control plan that requires all refueling or adding of other fluids to be done in an appropriate location at least 30.5 m (100 ft) away from the East Machias River.

5. ACOE staff should carefully monitor the actions described in this opinion and document the

level of incidental take, with a report provided to the USFWS, to ensure that the project is minimizing the take of Atlantic salmon.

VIII. CONSERVATION RECOMMENDATIONS

Section 7(a)(1) of the ESA directs federal agencies to utilize their authorities to further the purposes of the ESA by carrying out conservation programs for the benefit of endangered and threatened species. Conservation recommendations are discretionary agency activities to minimize or avoid adverse effects of a proposed action on listed species or critical habitat, to help implement recovery plans, or to develop information.

1. As activities at the EMARC expand in the future (e.g., research activities, expansion of hatchery activities), the ACOE should collaborate with the DSF to evaluate water use needs for the facility and then ensure adequate instream flows (volume, velocity, depth, and temperature) to protect Atlantic salmon and their habitat in the East Machias River.

2. Consistent with the Recovery Plan for Atlantic salmon (NMFS and USFWS 2005), the ACOE should collaborate with state and federal agencies to conduct Instream Flow Incremental Methodology (IFIM) studies on the East Machias River. Results of IFIM studies could then be used to determine flow requirements for juvenile Atlantic salmon in the East Machias River.

3. Consistent with the Recovery Plan for Atlantic salmon, the ACOE should work with other federal and state agencies and conservation organizations to identify and conduct stream restoration projects in the East Machias River watershed that would benefit Atlantic salmon and other aquatic organisms.

In order for our agency to be kept informed of actions to minimize or avoid adverse effects or to benefit listed species or their habitats, please notify the USFWS Maine Field Office if the ACOE implements of any of these conservation recommendations.

IX. REINITIATION NOTICE

This concludes formal consultation for the ACOE's proposed permitting of the East Machias Aquatic Research Center in East Machias, Maine. As provided in 50 CFR •402.16, reinitiation of formal consultation is required when discretionary federal agency involvement or control over the action has been retained (or is authorized by law), and if: (1) the amount or extent of incidental take is exceeded; (2) new information reveals effects of the agency action that may affect listed species or critical habitat in a manner or to an extent not considered in this opinion; or (3) the agency action is subsequently modified in a manner that causes an effect to the listed species or critical habitat not considered in this opinion; or (4) a new species is listed or critical habitat designated that may be affected by the action. In instances where the amount or extent of incidental take is exceeded, any operations causing such take must cease, pending reinitiation.

Literature Cited

Albers, P.H. 2003. Petroleum and individual polycyclic aromatic hydrocarbons. Pages 341-371 in Hoffman, D.J., B.A. Rattner, G.A. Burton, Jr., and J. Cairns, Jr. (eds.). 2003. Handbook of Ecotoxicology. CRC Press. Boca Raton, FL.

Allen, R. 1940. Studies on the biology of the early stages of the salmon (*Salmo salar*): growth in the river Eden. J. Animal Ecol. 9(1):1-23.

Atkins, C.G. 1874. On the salmon of eastern North America, and its artificial culture. Pages 227-335 in United States Commission of Fish and Fisheries Report of the Commissioner for 1872 and 1973, part II. Washington.

Baum, E.T. 1997. Maine Atlantic salmon - a national treasure. Atlantic Salmon Unlimited, Hermon, Maine.

Beland, K. 1984. Strategic plan for management of Atlantic salmon in the state of Maine. Atlantic Sea Run Salmon Commission, Bangor, Maine.

Beland, K. and K. Friedland. 1997. Estimating freshwater and marine survival for Atlantic salmon cohorts spawned in 1989-1991, Narraguagus River, Maine. American Fisheries.

Berst, A.H. and R. Simon. 1981. Introduction to the proceedings of the 1980 Stock Concept International Symposium (STOCS). Can. J. Fish. Aquat. Sci. 38(12):1457-1458.

Bley, P.W. 1987. Age, growth, and mortality of juvenile Atlantic salmon in streams: a review. Biological Report 87(4). U.S. Fish and Wildlife Service, Washington, D.C.

Bley, P.W. and J.R. Moring. 1988. Freshwater and ocean survival of Atlantic salmon and steelhead: a synopsis. Biological Report 88(9). Maine Cooperative Fish and Wildlife Research Unit, Orono.

Danie, D.S., J.G. Trial, and J.G. Stanley. 1984. Species profiles: life histories and environmental requirements of coastal fish and invertebrates (North Atlantic) – Atlantic salmon. U.S. Fish Wildl. Serv. FW/OBS-82/11.22. U.S. Army Corps of Engineers, TR EL-82-4. 19 pp.

Dube, N.R. and J.S. Fletcher. 1982. The East Machias river: an Atlantic salmon river management report. Atlantic Sea Run Salmon Commission, Bangor, ME.

Dutil, J.-D. and J.-M. Coutu. 1988. Early marine life of Atlantic salmon, *Salmo salar*, postsmolts in the northern Gulf of St. Lawrence. Fish. Bull. 86(2):197-211.

Elliot, J.M. 1991. Tolerance and resistance to thermal stress in juvenile Atlantic salmon, *Salmo salar*. Fresh. Biol. 25:61-70.

Farmer, G.J., D. Ashfield and J.A. Ritter. 1977. Seawater acclimation and parr-smolt

transformation of juvenile Atlantic salmon, *Salmo salar*. Freshwater and Anadromous Division, Resourc. Branch, Fish. Mar. Serv., Tech. Rep. Serv. MAR/T-77-3

Fausch, K.D. 1988. Tests of competition between native and introduced salmonids in streams: what have we learned? Can. J. Fish. Aquat. Sci. 45(12):2238-2246.

Fay, C., M. Bartron, S. Craig, A. Hecht, J. Pruden, R. Saunders, T. Sheehan, and J. Trial. 2006. Status review for anadromous Atlantic salmon (*Salmo salar*) in the United States. Report to the National Marine Fisheries Service and U.S. Fish and Wildlife Service. 294 pages.

Fraser, P.J. 1987. Atlantic salmon, *Salmo salar* L., feed in Scottish coastal waters. Aquaculture Fish. Manage. 18(2):243-247.

Hansen, L.P. and P. Pethon. 1985. The food of Atlantic salmon, *Salmo salar* L., caught by long-line in northern Norwegian waters. J. Fish Biol. 26:553-562.

Hearn, W.E. 1987. Interspecific competition and habitat segregation among stream-dwelling trout and salmon: a review. Fisheries 12(5):24-21.

Hislop, J.R.G. and R.G.J. Shelton. 1993. Marine predators and prey of Atlantic salmon (*Salmo salar* L.). Pages 104-118 in D. Mills, editor. Salmon in the sea and new enhancement strategies. Fishing News Books, Oxford.

Hislop, J.R.G. and A.F. Youngson. 1984. A note on the stomach contents of salmon caught by longline north of the Faroe Island in March 1983. ICES C.M. 1984/M:17.

Hoar, W. S. 1976. Smolt transformation: evaluation, behavior, and physiology. J. Fish. Res. Board of Canada. 33(5):1233-1252.

Jutila, E. and J. Toivonen. 1985. Food composition of salmon post-smolts (*Salmo salar* L.) in the Northern part of the Gulf of Bothnia. ICES C.M. 1985/M:21.

Kalleberg, H. 1958. Observations in a stream tank of territoriality and competition in juvenile salmon and trout (*Salmo salar* L. and *S. trutta* L.). Report/Institute of Fresh-Water Research, Drottningholm 39:55-98.

Kendall, W.C. 1935. The fishes of New England: the salmon family. Part 2 - the salmons. Memoirs of the Boston Society of Natural History: monographs on the natural history of New England. Vol. 9(1). Boston, Massachusetts.

Kocik, J.F., K.F. Beland and T.F. Sheehan. 1999. Atlantic salmon overwinter survival and smolt production in the Narraguagus River. O-99-NEC-1. Woods Hole, MA.

Lundqvist, H. 1980. Influence of photoperiod on growth of Baltic salmon parr (*Salmo salar* L.) with specific reference to the effect of precocious sexual maturation. Can. J. Zool. 58(5):940-944.

Maine Atlantic Salmon Task Force. 1997. Atlantic salmon conservation plan for seven Maine rivers (MASCP). Augusta, ME.

Maine Atlantic Salmon Commission (MEASC). 2006. Atlantic salmon freshwater assessment and research semi-annual project report NOAA grant NA06NMF4720078. Bangor, ME.

Maine Technical Advisory Committee (TAC), Ad Hoc Committee on Water Quality. 2002. Water quality issues as potential limiting factors affecting juvenile Atlantic salmon life stages in Maine rivers. 31 pp.

McLean, R.F. 1998. Water Intake Structures: an alternative to traditional screened-box enclosures for the protection of fish. Alaska Department of Fish and Game, Habitat and Restoration Division. Technical Report 97-8.

Mierzykowski, S.E. and K.C. Carr. 1998. Environmental contaminants in fish and mussels from Meddybemps Lake, the Dennys River, and East Machias River. USFWS. New England Field Office. Spec. Proj. Rep. FY98-MEFO-1-EC. Old Town, ME.

Mills, D.H. 1964. The ecology of young stages of Atlantic salmon in the River Bran, Rosshire. Dept. Agric. Fish. Of Scotland, Freshwater Salmon Fish. Res.

Nielsen, J.L. 1998. Population genetics and the conservation and management of Atlantic salmon (*Salmo salar*). Can. J. Fish. Aquat. Sci. 55(1):145-152.

National Marine Fisheries Service (NMFS). 1997. Fish screening criteria for anadromous salmonids. Southwest Region. 12 pages.

National Marine Fisheries Service (NMFS). 2003. Final Biological Opinion to the Corps of Engineers on the Proposed Modification of Existing Permits Authorizing the Installation and Maintenance of Aquaculture Fish Pens Within the State of Maine. Gloucester, MA.

National Marine Fisheries Service (NMFS) and U.S. Fish and Wildlife Service (USFWS). 2005. Recovery plan for the Gulf of Maine distinct population segment of the Atlantic salmon (*Salmo salar*). National Marine Fisheries Service, Silver Spring, MD.

Peterson, R.H. 1978. Physical characteristics of Atlantic salmon spawning gravel in some New Brunswick, Canada streams. Can. Fish. Mar. Serv. Tech. Rep. No. 785:1-28.

Randall, R.G. 1982. Emergence, population densities, and growth of salmon and trout fry in two New Brunswick streams. Can. J. Zool. 60(10):2239-2244.

Reddin, D.G. 1985. Atlantic salmon (*Salmo salar*) on and east of the Grand Bank. J. Northwest Atl. Fish. Soc. 6(2):157-164.

Ruggles, C.P. 1980. A review of downstream migration of Atlantic salmon. Canadian Technical Report of Fisheries and Aquatic Sciences. Freshwater and Anadromous Division.

Schaffer, W.M. and P.F. Elson. 1975. The adaptive significance of variations in life history among local populations of Atlantic salmon. Ecology 56:577-590.

Scott, W.B. and E.J. Crossman. 1973. Atlantic salmon. Pages 192-197 in Freshwater Fishes of Canada (Bulletin 184). Department of Fisheries and Oceans, Scientific Information and Publications Branch, Ottawa.

Stolte, L. 1981. The forgotten salmon of the Merrimack. Department of the Interior, Northeast Region, Washington, D.C.

U.S. Atlantic Salmon Assessment Committee (USASAC). 2005. Annual report of the U.S. Atlantic salmon Assessment committee: Report No. 17- 2004 Activities. 2002/14. Woods Hole, MA.

U.S. Atlantic Salmon Assessment Committee (USASAC). 2006. Annual report of the U.S. Atlantic salmon assessment committee: Report No. 18 – 2005 Activities. 2006/18. Gloucester, MA.

U.S. Atlantic Salmon Assessment Committee (USASAC). 2007. Annual report of the U.S. Atlantic salmon assessment committee: Report No. 19 – 2006 Activities. 2007/19. Gloucester, MA.

USFWS (U.S. Fish and Wildlife Service). 1989. Final environmental impact statement 1989-2021: restoration of Atlantic salmon to New England rivers. Department of the Interior, U.S. Fish and Wildlife Service, Newton Corner, MA.

USFWS (U.S. Fish and Wildlife Service). 2005. Final biological opinion to the Federal Highway Administration on the proposed replacement of a bridge over Cathance Stream on Route 86 in Marion Township, Washington County, Maine. Old Town, ME.

USFWS (U.S. Fish and Wildlife Service). 2007. Endangered and threatened wildlife and plants; removing the bald eagle in the lower 48 states from the list of endangered and threatened wildlife. Federal Register 72 (130): 37346-37372.

USFWS (U.S. Fish and Wildlife Service) and NMFS (National Marine Fisheries Service). 1995. Endangered and threatened species; proposed threatened status for a distinct population segment of anadromous Atlantic salmon (Salmo salar) in seven Maine rivers. Federal Register 60 (189): 50530-50539.

USFWS (U.S. Fish and Wildlife Service) and NMFS (National Marine Fisheries Service). 1995. Status review for anadromous Atlantic salmon in the United States.

USFWS (U.S. Fish and Wildlife Service) and NMFS (National Marine Fisheries Service). 1997.

Endangered and threatened wildlife and plants; withdrawal of proposed rule to list a distinct population segment of Atlantic salmon (Salmo salar) as threatened. Federal Register 62 (243): 66325-66338.

USFWS (U.S. Fish and Wildlife Service) and NMFS (National Marine Fisheries Service). 1999. Endangered and threatened species; proposed endangered status for a distinct population segment of anadromous Atlantic salmon (*Salmo salar*) in the Gulf of Maine. Federal Register 64 (221): 62627-62641.

USFWS (U.S. Fish and Wildlife Service) and NMFS (National Marine Fisheries Service). 2000. Endangered and threatened species; final endangered status for a distinct population segment of anadromous Atlantic salmon (*Salmo salar*) in the Gulf of Maine. Federal Register 65 (223): 69459-69483.

Utter, F.M. 1981. Biological criteria for definition of species and distinct intraspecific populations of anadromous salmonids under the U.S. Endangered Species Act of 1973. Can. J. Fish. Aquat. Sci. 38(12):1626-1635.

Utter, F.M., K. Hindar and N. Ryman. 1993. Genetic effects of aquaculture on natural salmonid populations. Pages 144-165 in K. Heen, R.L. Monahan, and F. Utter, editors. Salmon aquaculture. Fishing News Books, Oxford.