NATIONAL MARINE FISHERIES SERVICE
ENDANGERED SPECIES ACT
BIOLOGICAL OPINION

Agency: US Army Corps of Engineers

Activity Considered: Construction of a Coal Tar Remediation Project in Bond Brook in Augusta, Maine by Central Maine Power
F/NER/2010/06537

Conducted by: National Marine Fisheries Service
Northeast Region

Date Issued: Oct 17, 2011

Approved by: [signature]

TABLE OF CONTENTS

1. INTRODUCTION AND BACKGROUND

This constitutes the biological opinion (Opinion) of NOAA's National Marine Fisheries Service (NMFS) on the effects of the construction of a coal tar abatement project in Bond Brook in Augusta, Maine as proposed by Central Maine Power (CMP) in accordance with Section 7 of the Endangered Species Act (ESA), as amended (16 U.S.C. 1531 et seq.). CMP has applied for authorization from the U.S. Army Corps of Engineers (ACOE) to place fill below the high water line of Bond Brook in conjunction with the remediation of coal tar deposits throughout a 400-foot segment of the stream. The ACOE is proposing to issue a permit to CMP under Section 10 of the Rivers and Harbors Act. This Opinion is based on information provided in the ACOE's February 9, 2011 Biological Assessment and additional information provided on March 30, 2011. A complete administrative record of this consultation will be kept at the NMFS Northeast Regional Office. Formal consultation was initiated on May 9, 2011.

1.1. Consultation History

July 13, 2010 NMFS, ACOE, CMP and ARCADIS-US met to discuss the coal tar remediation project on Bond Brook in Augusta. NMFS agreed to the June 1 to October 1 work window.

December 7, 2010 ARCADIS-US submitted a copy of the 30% Natural Resources Protection Act (NRPA) permit application to NMFS for review.

December 9, 2010 Representatives from NMFS, ACOE, CMP, ARCADIS-US, Greater Augusta Utility District (GAUD), Maine Department of Environmental Protection (MDEP), Maine Department of Marine Resources (MDMR) and the US Fish and Wildlife Service (USFWS) attended a meeting to review the 30% design and the NRPA permit and to discuss the consultation process. NMFS determined formal consultation was the appropriate process to follow.

December 17, 2010 NMFS and USFWS requested additional information after review of the NRPA permit application.

January 4, 2011 Representatives from NMFS, USFWS, ACOE, MDEP, MDMR, CMP and ARCADIS-US attended an on-site meeting to discuss the CMP coal tar remediation project. A discussion was held over the proposed brook remedy and construction approach.

January 28, 2011 ARCADIS-US provided technical site reports regarding contaminant sampling in the project area to ACOE, USFWS and NMFS.

January 31, 2011 NMFS received a copy of the 90% NRPA permit application, in addition to the additional information requested on December 17th.

February 9, 2011 NMFS and USFWS received copies of the draft Biological Assessment for review.

March 10, 2011	NMFS, USFWS, ARCADIS-US, CMP and ACOE met to discuss the draft Biological Assessment and to discuss concerns over the proposed brook remedy.
March 30, 2011	ARCADIS-US submitted information requested at the March 10th meeting regarding construction techniques and the HEC-RAS modeling information used when sizing the stone for the brook remedy.
May 9, 2011	ACOE requested initiation of formal Section 7 consultation for the CMP coal tar remediation project in Bond Brook.
June 29, 2011	NMFS submitted a letter to ACOE indicating that all of the information required to initiate a formal consultation for the project had been received. In this letter NMFS noted that the date that the initiation request was received (May 9, 2011) will serve as the commencement of the formal consultation process.

1.2. Relevant Documents

The analysis in this Opinion is based on a review of the best available scientific and commercial information. Specific sources are listed in Section 12 and are cited directly throughout the body of the document. Primary sources of information include: 1) information provided in the ACOE's May 9, 2011 initiation letter and BA (received on February 9, 2011) in support of formal consultation under the ESA, and additional information provided by CMP on March 30, 2011; 2) the final rule designating Endangered Status for a Distinct Population Segment of Anadromous Atlantic Salmon (*Salmo salar*) in the Gulf of Maine (65 FR 69459; Nov. 17, 2000); 3) Status Review for Anadromous Atlantic Salmon (*Salmo salar*) in the United States (Fay et al. 2006); 4) Determination of Endangered Status for the Gulf of Maine Distinct Population Segment of Atlantic salmon; Final Rule (74 FR 29345; June 19, 2009); 5) Designation of Critical Habitat for Atlantic salmon Gulf of Maine Distinct Population Segment (74 FR 29300; June 19, 2009); 6) Final Recovery Plan for Shortnose Sturgeon (December, 1998).

1.3. Application of ESA Section 7(a)(2) Standards – Analytical Approach

This section reviews the approach used in this Opinion in order to apply the standards for determining jeopardy and destruction or adverse modification of critical habitat as set forth in Section 7(a)(2) of the ESA and as defined by 50 CFR §402.02 (the consultation regulations). Additional guidance for this analysis is provided by the Endangered Species Consultation Handbook, March 1998, issued jointly by NMFS and the USFWS. In conducting analyses of actions under Section 7 of the ESA, NMFS takes the following steps, as directed by the consultation regulations:

- Identifies the action area based on the action agency's description of the proposed action (Section 2);
- Evaluates the current status of the species with respect to biological requirements

indicative of survival and recovery and the essential features of any designated critical habitat (Section 3);

- Evaluates the relevance of the environmental baseline in the action area to biological requirements and the species' current status, as well as the status of any designated critical habitat (Section 4);
- Determines whether the proposed action affects the abundance, reproduction, or distribution of the species, or alters any physical or biological features of designated critical habitat (Section 5);
- Determines and evaluates any cumulative effects within the action area (Section 6); and,
- Evaluates whether the effects of the proposed action, taken together with any cumulative effects and the environmental baseline, can be expected, directly or indirectly, to reduce appreciably the likelihood of both the survival and recovery of the affected species, or is likely to destroy or adversely modify their designated critical habitat (Section 7).

In completing the last step, NMFS determines whether the action under consultation is likely to jeopardize the ESA-listed species or result in the destruction or adverse modification of designated critical habitat. If so, NMFS must identify a reasonable and prudent alternative(s) (RPA) to the action as proposed that avoids jeopardy or adverse modification of critical habitat and meets the other regulatory requirements for an RPA (see 50 CFR §402.02). In making these determinations, NMFS must rely on the best available scientific and commercial data.

The critical habitat analysis determines whether the proposed action will destroy or adversely modify designated or proposed critical habitat for ESA-listed species by examining any change in the conservation value of the primary constituent elements of that critical habitat. This analysis focuses on statutory provisions of the ESA, including those in Section 3 that define "critical habitat" and "conservation", in Section 4 that describe the designation process, and in Section 7 that set forth the substantive protections and procedural aspects of consultation. Although some "properly functioning" habitat parameters are generally well known in the fisheries literature (e.g., thermal tolerances), for others, the effects of any adverse impacts are considered in more qualitative terms. The analysis presented in this Opinion does not rely on the regulatory definition of "adverse modification or destruction" of critical habitat issued in the 9th Circuit Court of Appeals (Gifford Pinchot Task Force et al. v. U.S. Fish and Wildlife Service, No. 03-35279, August 6, 2004).

2. PROJECT DESCRIPTION AND PROPOSED ACTION

2.1. Project Overview

The former Augusta Gas Works was located on Mount Vernon Avenue adjacent to Bond Brook, approximately 600-feet upstream from the confluence of Bond Brook with the Kennebec River in Augusta. The former manufactured gas plant (MGP) site is currently owned by Rockingham Electric Supply Company and has been redeveloped with a warehouse and associated parking areas at the north and south end of the warehouse building.

The former MGP produced coal gas and carbureted water gas from the 1850s until the early 1950s. CMP purchased the facility in approximately 1911 and sold the facility in 1949. The

MGP consisted of a gas manufacturing building, a coal shed, several small outbuildings, horizontal oil tanks, and gas holders at the north and south ends of the property. All onsite above-grade buildings and structures were demolished in 1959; however, foundations and other buried structures remain below grade.

During expansion of its warehouse in 1999, Rockingham Electric encountered soil containing residual MGP-related compounds and notified CMP. CMP took responsibility for testing and disposal of this soil. In April of 1999, CMP voluntarily managed the disposal of approximately 600 tons of soil containing apparent MGP-related materials. In 2002, CMP submitted the site for inclusion in the Maine Department of Environmental Protections (MDEP) Voluntary Remedial Action Program (VRAP) and has since conducted investigations of MGP-related materials in the subsurface of the site and in the adjacent banks and sediments of Bond Brook.

From 2002 to 2010, several studies were conducted, including contaminant analyses of brook sediment, surface water and pore water. In addition, an upland investigation, a benthic community survey, a tar mat assessment, and an odor survey have been conducted. Borings were conducted in 2010 to determine the presence and depth of MGP-related materials in the segment of the brook around the former MGP.

Summary of Findings

Data from the borings on the former MGP site indicate that there are MGP residuals beneath the site, primarily within and adjacent to the former north and south gas holders. The MGP residuals in the western bank of Bond Brook generate intermittent sheen and odor in the Brook. This MGP material includes oil like material and tar like material; these materials are believed to be in a stable, equilibrium condition.

The shallow sediment environment in this part of Bond Brook extends from the brook bed surface to a depth of at least 4 to 6 inches. It consists predominantly of sand, gravel and cobbles. The shallow sediment has low concentrations of PAHs with a chemical composition reflecting urban impacts rather than MGP impacts from the former gas works site. The shallow sediment environment supports a community of benthic organisms, the abundance and diversity of which do not appear to correlate with the PAH concentration in shallow sediments or PAH and cyanide concentrations in underlying pore water. Data from 2004 showed the benthic community adjacent to the site having a lower abundance and diversity than the community upstream. However in 2005, the benthic community abundance and diversity were higher adjacent to the site than upstream. The shallow sediment environment represents the majority of the biologically active zone in Bond Brook. Recent data showed that 97% of the sediment-dwelling organisms live in the upper 6 inches of the sediment profile.

The deep sediment environment begins 6-inches below the stream bed elevation and goes down 20 + feet to bedrock. The concentration of PAHs increases in the deeper sediment and the chemical composition of these PAHs are similar to the PAHs present beneath the former gas works site. The MGP-related PAHs are believed to have migrated beneath the brook from the former gas works site under the influence of groundwater flow and the slope of the bedrock.

Few if any benthic organisms were found in deeper sediments upstream of the site outside of MGP-related influences.

Summary of Remedial Action

The remedial action consists of two primary components:

- Bank remedy: This will involve the placement of a Reactive Core Mat (RCM) and armoring along approximately 450 linear feet of the western bank of Bond Brook and related activities required to facilitate construction (e.g., grading, hydraulic bypass, anchoring); and
- Brook remedy: This will consist of placing approximately 6 inches of clean fill over the bottom of Bond Brook within an 18,000 square foot area. The sediment cover material will generally consist of washed stone, with a mixture of stone sizes ranging from approximately 2 to 6 inches, including allowance for some larger, boulder-sized stones which may already exist within the brook.

2.2. Construction Activities

As described above, this project will involve placing RCM along the western bank of Bond Brook and placing sediment material in the brook itself in order to contain coal tar residuals produced by the adjacent MGP. CMP's proposed project will entail placing approximately 0.5 acres (20,200 sf) of permanent fill below the high water line of Bond Brook. In addition, there will be temporary impacts due to the placement of cofferdams and bypass structures necessary to ensure that the work areas are isolated from stream flow (Table 1). After construction these structures will be removed as soon as possible and normal flow conditions will resume. In addition to in-stream impacts, there will be shoreline impacts associated with the clearing (and corresponding restoration) of the stream bank in order to provide equipment access.

The construction of this project will occur between June 1 and October 1. The bank remedy will be completed in two to three months and the brook remedy will take an additional two weeks.

Table 1. Impacts to Bond Brook associated with CMP's proposed coal tar remediation project.

	Project Impacts (sf)	
	Permanent	*Temporary*
Bank Remedy		
Riparian	5,700	6,100
Stream	2,200	0
Brook Remedy		
Riparian	0	0
Stream	18,000	0
Bypass Options		
Open		
Riparian	0	5,700
Stream	0	10,600
Pipe		
Riparian	0	0
Stream	0	9,800

Site preparation activities will include installing erosion and sediment controls and water management measures. Erosion and sediment controls will be consistent with the Maine Erosion and Sediment Control BMPs (MDEP 2003). During active work periods and throughout the duration of the project, the temporary erosion and sediment controls will be inspected, maintained, and/or modified by the contractor on a regular and as-needed basis. Temporary erosion and sediment controls will be maintained until revegetation activities have provided a final surface cover.

Following the installation of erosion and sediment controls, a portion of the west bank of Bond Brook will be cleared to provide access to the sloped work areas. Workers will remove existing vegetation in the proposed area to the minimum extent necessary to complete the work. Whenever reasonably possible, mature trees will be left in place and protected from damage during construction.

In-water Activities

Workers will install a hydraulic by-pass system within Bond Brook to divert water around the active work area along the west bank of Bond Brook, allowing for relatively dry working conditions. Additional trenches or low berms and dewatering pumps may be installed to capture groundwater discharge and seepage from underneath the hydraulic bypass system. Contaminated water will be treated in accordance with regulatory requirements and discharged appropriately.

The temporary hydraulic bypass system is anticipated to consist of one of two options; an open-channel bypass system or a piped bypass system. The temporary bypass system will be able to convey up to approximately 100 to 200 cubic feet per second (cfs) of flow prior to overtopping, which is estimated to comfortably convey some rainfall events, but not as much as a two-year flood event (which amounts to approximately 750 cfs of flow). Either option will allow construction work to be performed on the western bank of Bond Brook in relatively dry conditions.

The temporary bypass system will likely be installed in the wet. The contractor will ensure that appropriate and adequate erosion and sediment controls are in place prior to start of installation. The contractor will utilize appropriate construction methods and equipment to minimize disturbance of existing stream bed materials during installation.

Option A: Open-Channel Bypass System

Construction would begin with the placement of a stone leveling pad using material similar to that proposed for the sediment cover and placement of 4.5-foot high Jersey barriers along the top of the pad. This configuration would allow for a bypass flow capacity of approximately 100 to 150 cfs. It would likely be necessary to also line the back side (water side) of the barrier to minimize infiltration from the channel into the work area. This liner would be anchored along the top edge or inside of the Jersey barriers and extend down the face of the barriers, across the channel bottom, and up the opposite (eastern) bank, serving also to protect the channel bottom and opposite bank from erosion. This option will temporarily affect 0.24 acres (10,600 sf) of stream bed, and approximately 0.13 acres (5,700 sf) of riparian habitat on the eastern bank of Bond Brook.

Option B: Piped Bypass System

The piped bypass system would consist of a headwater and tailwater structure set at the upstream and downstream limits of construction, respectively, connected by two 60 inch diameter smoothbore high density polyethylene (HDPE) pipes, which would convey all of the Bond Brook flow. The bypass would be approximately 500 feet long. This would allow for a bypass flow capacity of approximately 150 to 200 cfs, while also protecting the work area from backflow during typical high tides on the Kennebec River. This option will temporarily affect 0.22 acres (9,800 sf) of stream bed. The pipes will be placed on a crushed stone leveling pad at approximately a 0-1% slope. The culvert elevation at the outlet is anticipated to be 6 inches above the mean low water (MLW) mark.

Erosion and Sediment Control

Silt curtains will be installed to reduce the potential for downstream transport of suspended sediments. To reduce potential impacts to fish passage, silt curtains will be used only during the installation of the bypass system, and will be removed following the bypass system installation. The bypass system itself will then serve as the project's sediment control measure. Due to the potential for overtopping events during construction, oil booms will be installed prior to the start of in-water work, and will be used and maintained throughout the project duration. The oil booms will be installed as close as practical to the downstream end of the project area in the deeper pool area.

Surface Water Monitoring Plan

According to CMP's Surface Water Monitoring Plan, turbidity monitoring will be conducted for the duration of the project. At a minimum, turbidity readings will be taken at these times:

- Prior to placement of any equipment or materials in the work area
- Following placement of equipment and materials but prior to work activities
- At the beginning of each work day, two hours after in-water work has been initiated
- Every hour during work activities
- At the end of each work day after activities have been completed in the work area

Measurements will be taken at sites 100 feet upstream, 100 feet downstream and 150 feet downstream of the project limits. If turbidity levels at the lowermost downstream location exceed, or are equal to, twice the turbidity levels of the upstream location, measures will be taken to reduce the amount of sediment being released. If inspection results indicate that the sediment control system appears to be intact and functioning properly, the method of construction activities may be adjusted or work may be halted if it appears that the exceedance of the threshold was a result of work activities.

Bank Remedy

This component of the remedy includes installation of a RCM. Reno mattresses (which are a type of gabion) will be placed over the RCM to protect it. This work will be conducted within a dewatered cofferdam, or above mean high water (MHW).

Debris in the limits of the work area will be removed and transported to an appropriate off-site facility for disposal. The banks will be prepared for RCM placement by clearing, grubbing, and regrading the bank soils. Limited excavation of a portion of the existing tar mat and/or adjacent MGP-impacted soil areas may be required to facilitate containment of the tar mat. Where excavation is required, it is anticipated that conventional earth-moving equipment (e.g., excavators, loaders) will be used in the dry.

Following site preparation, a shallow anchor trench will be excavated along the toe of slope as part of the RCM and Reno mattress installation. The maximum length of open anchor trench will be limited to approximately 60 feet at any given time. The maximum trench depth will be 2 feet. Excavated materials, and any water pumped from the anchor trenches, will be treated and disposed of in accordance with applicable regulatory requirements.

Three layers of RCM will be placed over the existing tar mat and in adjoining areas along approximately 450 linear feet of stream bank on the western side of the stream. Each layer of RCM and/or geotextile will be temporarily anchored at the top of the prepared slope using sand bags or other anchors until the Reno mattresses are installed, filled with stone, and anchored. Adjacent RCM panels will be "shingled" in the downstream and downhill directions. Sealing clay will be placed in the seams between adjoining RCM panels. The total disturbance along the stream banks associated with the placement of the RCM mats will be approximately 0.33 acres (14,400 sf). Of this impacted area, 0.05 acres (2,200 sf) is below MHW. Although the MLW level was selected as the minimum lower bound of the area to be covered by the RCM, it may extend beyond this point in some locations for constructability purposes.

Six-inch thick Reno mattresses will be installed to limit further bank erosion and to protect the RCM. The Reno mattresses will extend up the slope to the top of the tar mat or the eroded slope. The Reno mattresses will be anchored into the brook bed, using reinforcements driven into the slope. Once they are anchored, the mattresses will be filled using 2.5 to 4-inch diameter crushed stone. As noted above, an anchor trench will be excavated into the base of the slope to improve stability at the mattress toe.

Brook Remedy

The sediment cover and artificial riffle construction (cross vanes) will be installed following completion of the bank remedy. An approximately 6-inch thick sediment cover will be installed over the bed of the brook using appropriately sized conventional construction equipment. Sediment cover material will generally consist of washed stone, with a mixture of stone sizes ranging from approximately 2 to 6-inches. Larger, boulder-sized stones that may already exist within the brook will be allowed to protrude through the sediment cover. The sediment cover will total approximately 325 cubic yards of fill in an area of approximately 0.41 acres (18,000 sf).

Two cross vanes will be constructed by placing a series of boulders in a V-shaped configuration, with the tip of each V pointed upstream. A cross vane (or constructed weir) is an intentionally-designed rock weir installed to establish a grade control, reduce stream bank erosion, help facilitate the transport of finer sediment and maintain channel stability. Based on the hydraulic modeling, the downstream end of the project (station 5+75) is frequently the portion that exhibits the greatest velocity and shear stress (essentially, the likelihood that the sediment will begin to move). The installation of the cross vanes in this area would place larger stone in the area of greatest stress, reduce velocity and shear stress in the reach immediately upstream and serve as a transition between the covered and non-covered stream bed. The two cross vanes will be constructed upstream and downstream of the area of concern; the first will be placed at the downstream extent of the sediment cover (approximately 5+85 to 6+25), and the second will be placed approximately 100 feet upstream of the first (approximately 4+75 to 5+00). To construct the cross vanes, large boulders will be placed near the banks, with progressively smaller stones placed towards the middle of the stream to help direct flow toward the center of the channel. The cross vane arms will be constructed at an approximate angle of 20 to 30 degrees from the channel bank. The vanes will be allowed to naturally fill in with smaller bed material, over time, which is expected to promote further stability of the structures. Stone sizes for the vanes will range from approximately 6 inches (near the center of the channel) to approximately 18 inches (near the banks). The stones will be embedded in the sediment cover, so that the 6 inch stones at the center of each cross vane will barely protrude above the sediment cover.

Portions of the sediment cover may be installed at the start of construction to facilitate construction of the hydraulic bypass system. Such materials would be incorporated into the final sediment cover upon removal of the hydraulic bypass system, and would be re-graded to a uniform and nominal 6 inch thickness.

The sediment cover will be placed within the dewatered cofferdam on the western side of the brook, but will be placed in the wet on the eastern side of the brook after the bypass is removed.

The work area will be isolated using block nets or turbidity curtains and fish will be removed according to an approved fish evacuation plan prior to the placement of the fill in the wet.

Upon completion of the sediment cover, a final as-built survey will be performed to verify sediment cover thickness.

Site Restoration

The staging areas and fill placed to facilitate access will be removed and disposed of at an appropriate off-site disposal facility. Disturbed areas, with the exception of the 0.13 acres permanently affected by the Reno mattresses, will be restored to preconstruction conditions, including, but not limited to, regrading, tree planting, and/or seeding.

Restoration of this area will utilize an upland seed mix to assist in the stabilization of placed soils along the bank slope. Three species of container trees of at least 4 feet in height and five species of container shrubs and live cuttings of up to 4 feet in height will be planted throughout the restoration area at a density of 100 trees and 100 shrubs per acre. In addition, two species of vine will be planted at a density of 25 vines per acre at the top of the RCM to promote the creation of a visual barrier of the RCM as the vines grow to extend over the RCM.

Maintenance and Monitoring

Following completion of remedial construction, CMP will monitor the performance and maintain the integrity of the remedial components. Monitoring of the remedies will occur annually during the spring and summer at low tide. The bank remedy will be monitored to determine whether or not the RCM is functioning as designed (i.e. no sheens or odors) and that the mattresses do not cause significant erosion. The brook remedy will be monitored to determine whether or not the benthic community has reestablished in the new sediment, as well as for signs of erosion. In addition, a fish passage assessment should be conducted at low tide to verify that no new barrier to fish passage has been formed by the addition of the cover.

If less than 85% ground cover is found during monitoring, the area will be reseeded. Vegetation restoration monitoring will occur the first full growing season following construction.

Fish Evacuation

To minimize the probability of trapping an adult Atlantic salmon within the work area, a fish evacuation protocol will be followed prior to the commencement of in-water work. ARCADIS-US submitted a revised evacuation plan to NMFS on March 30, 2011 that details the procedure that will be followed to ensure that migrating Atlantic salmon are evacuated safely from the project area during construction. The plan entails daily visual surveys by qualified personnel to verify that there are no Atlantic salmon within the project area during the installation and removal of any in-water cofferdam or bypass structure. Additional surveys will be conducted on a weekly basis while the in-water structures are in place to document whether Atlantic salmon are being delayed by the blockage of the stream channel. If cofferdams overtop due to a high flow event, the cofferdam will be resurveyed for adult Atlantic salmon prior to dewatering.

If any Atlantic salmon are observed within the enclosed cofferdam, all in-water work will cease until the fish are safely removed from the work area. Only qualified fisheries biologists will be involved with the capture and relocation of any fish, if it becomes necessary. Evacuation of fish from the project area in Bond Brook will include two primary methods: 1) directing fish outside the project area by "herding," which is a method that does not involve active capture and handling of fish, and 2) using active sampling methods to physically capture and handle fish via seining or electrofishing techniques. Since capturing and handling Atlantic salmon can cause physiological stress, injury or mortality, all efforts will be made to herd the fish out of the area prior to any attempts to capture them.

2.3. Action Area

The action area is defined in 50 CFR 402.02 as "all areas to be affected directly or indirectly by the Federal action and not merely the immediate area involved in the action." The proposed coal tar remediation project reviewed in this Opinion involves work in approximately 0.4 acres of Bond Brook in the City of Augusta, in Kennebec County, Maine (Figure 1). Bond Brook is located within the Merrymeeting Bay Salmon Habitat Recovery Unit (SHRU) and the Kennebec River at Merrymeeting Bay watershed (HUC 10).

The action area includes some or all of the following:

- The area of stream that is temporarily isolated and dewatered within a cofferdam so that construction work can proceed in the dry;
- The area of stream where the 6 inch sediment cover (2-6 inch rock) will be placed in the wet;
- The area downstream of the cofferdam that would experience a temporary increase in sediment from construction activities, particularly during removal of the cofferdam;
- The area of riparian land along the stream bank where vegetation is removed to facilitate construction, including access of equipment to the stream; and,
- The area upstream of the project temporarily inaccessible to migrating Atlantic salmon.

Thus, the action area for this consultation encompasses all of Bond Brook. The Kennebec River was not considered part of the action area as no effects of the proposed action will extend into the River.

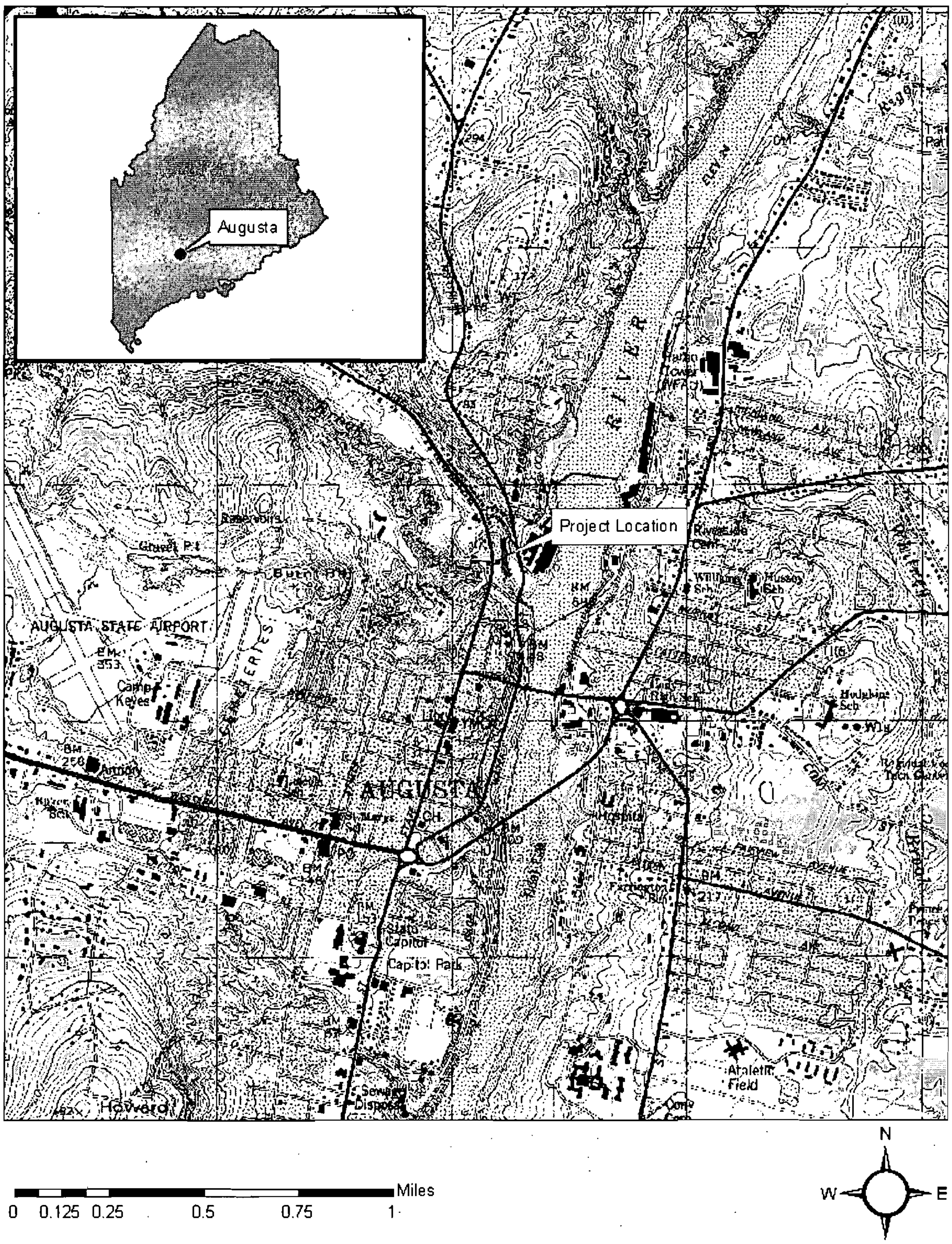

Figure 1. Location of the stream crossings associated with the coal tar remediation project being proposed by the Central Maine Power Company.

3. RANGEWIDE STATUS OF AFFECTED SPECIES AND CRITICAL HABITAT

This section will focus on the status of listed species within the action area, summarizing information necessary to establish the environmental baseline and to assess the effects of the proposed action on listed species. The Federally-listed Gulf of Maine Distinct Population Segment (DPS) of Atlantic salmon (*Salmo salar*) is known to occur in the action area. While listed shortnose sturgeon (*Acipenser brevirostrum*) are known to occur in the Kennebec River, they are not expected to occur in the action area due to a lack of suitable habitat in Bond Brook. Therefore, this species will not be considered further in this Opinion.

3.1. Gulf of Maine DPS of Atlantic Salmon

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 Gulf of Maine (GOM) Distinct Population Segment (DPS) of anadromous Atlantic salmon was initially listed by the USFWS and NMFS (collectively, the Services) as an endangered species on November 17, 2000 (65 FR 69459). A subsequent listing as an endangered species by the Services (74 FR 29344; June 19, 2009) included an expanded range for the GOM DPS of Atlantic salmon. The decision to expand the geographic range of the GOM DPS was largely based on the results of a Status Review (Fay et al. 2006) completed by a Biological Review Team (BRT) consisting of federal and state agencies and Tribal interests. Fay et al. (2006) concluded that the DPS delineation in the 2000 listing designation was largely appropriate, except in the case of large rivers that were excluded in the 2000 listing determination. Fay et al. (2006) concluded that the salmon currently inhabiting Maine's larger rivers (Androscoggin, Kennebec, and Penobscot) are genetically similar to the rivers included in the GOM DPS as listed in 2000, have similar life history characteristics, and/or occur in the same zoogeographic region. Further, the salmon populations inhabiting the large and small rivers from the Androscoggin River northward to the Dennys River differ genetically and in important life history characteristics from Atlantic salmon in adjacent portions of Canada (Spidle et al. 2003; Fay et al. 2006). Thus, Fay et al. (2006) concluded that this group of populations (a "distinct population segment") met both the discreteness and significance criteria of the Services' DPS Policy (61 FR 4722; Feb. 7, 1996) and, therefore, recommended the geographic range included in the new expanded GOM DPS. The final rule expanding the GOM DPS agreed with the conclusions of BRT regarding the DPS delineation of Maine Atlantic salmon.

The newly listed GOM DPS includes 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 wherever these fish occur in the estuarine and marine environment. The following impassable falls delimit the upstream extent of the freshwater range: Rumford Falls in the town of Rumford on the Androscoggin River; Snows Falls in the town of West Paris on the Little Androscoggin River; Grand Falls in Township 3 Range 4 BKP WKR on the Dead River in the Kennebec Basin; the un-named falls (impounded by Indian Pond Dam) immediately above the Kennebec River Gorge in the town of Indian Stream Township on the Kennebec River; Big Niagara Falls on Nesowadnehunk Stream in Township 3 Range 10 WELS in the Penobscot Basin; Grand Pitch on Webster Brook in Trout Brook Township in the Penobscot Basin; and Grand Falls on the Passadumkeag River in Grand Falls Township in the Penobscot Basin. The marine range of the GOM DPS extends from the Gulf of Maine, throughout the Northwest Atlantic Ocean, to the coast of Greenland.

Included in the GOM DPS are all associated conservation hatchery populations used to supplement these natural populations; currently, such conservation hatchery populations are maintained at Green Lake National Fish Hatchery (GLNFH) and Craig Brook National Fish Hatcheries (CBNFH), both operated by the USFWS. Excluded from the GOM DPS are landlocked Atlantic salmon and those salmon raised in commercial hatcheries for the aquaculture industry (74 FR 29344; June 19, 2009).

Species Description

Atlantic salmon have a complex life history that includes territorial rearing in rivers to extensive feeding migrations on the high seas. During their life cycle, Atlantic salmon go through several distinct phases that are identified by specific changes in behavior, physiology, morphology, and habitat requirements.

Adult Atlantic salmon return to rivers from the ocean and migrate to their natal stream to spawn. Adults ascend the rivers within the GOM DPS beginning in the spring. The ascent of adult salmon continues into the fall. Although spawning does not occur until late fall, the majority of Atlantic salmon in Maine enter freshwater between May and mid-July (Meister 1958; Baum 1997). Early migration is an adaptive trait that ensures adults have sufficient time to effectively reach spawning areas despite the occurrence of temporarily unfavorable conditions that naturally occur within rivers (Bjornn and Reiser 1991). Salmon that return in early spring spend nearly five months in the river before spawning, often seeking cool water refuge (e.g., deep pools, springs, and mouths of smaller tributaries) during the summer months.

In the fall, female Atlantic salmon select sites for spawning. Spawning sites are positioned within flowing water, particularly where upwelling of groundwater occurs, allowing for percolation of water through the gravel (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 the upstream edge of a gravel bar where water depth is decreasing, water velocity is increasing (McLaughlin and Knight 1987; White 1942), and hydraulic head allows for permeation of water through the redd (a gravel depression where eggs are deposited). Female salmon use their caudal fin to scour or dig redds. The digging behavior also serves to clean the substrate of fine sediments that can embed the cobble/gravel substrate needed for spawning and consequently reduce egg survival (Gibson 1993). As the female deposits eggs in the redd, one or more males fertilize the eggs (Jordan and Beland 1981). The female then continues digging upstream of the last deposition site, burying the fertilized eggs with clean gravel.

A single female may create several redds before depositing all of her eggs. Female anadromous Atlantic salmon produce a total of 1,500 to 1,800 eggs per kilogram of body weight, yielding an average of 7,500 eggs per 2 sea-winter (SW) female (an adult female that has spent two winters at sea before returning to spawn) (Baum and Meister 1971). After spawning, Atlantic salmon may either return to sea immediately or remain in freshwater until the following spring before returning to the sea (Fay et al. 2006). From 1967 to 2003, approximately 3 percent of the wild and naturally reared adults that returned to rivers where adult returns are monitored--mainly the Penobscot River--were repeat spawners (USASAC 2004).

Embryos develop in the redd for a period of 175 to 195 days, hatching in late March or April (Danie et al. 1984). Newly hatched salmon referred to as larval fry, alevin, or sac fry, remain in the redd for approximately 6 weeks after hatching and are nourished by their yolk sac (Gustafson-Greenwood and Moring 1991). Survival from the egg to fry stage in Maine is estimated to range from 15 to 35 percent (Jordan and Beland 1981). Survival rates of eggs and larvae are a function of stream gradient, overwinter temperatures, interstitial flow, predation, disease, and competition (Bley and Moring 1988). Once larval fry emerge from the gravel and begin active feeding they are referred to as fry. The majority of fry (>95 percent) emerge from redds at night (Gustafson-Marjanen and Dowse 1983).

When fry reach approximately 4 cm in length, the young salmon are termed parr (Danie et al., 1984). Parr have eight to eleven pigmented vertical bands on their sides that are believed to serve as camouflage (Baum 1997). A territorial behavior, first apparent during the fry stage, grows more pronounced during the parr stage, as the parr actively defend territories (Allen 1940; Kalleberg 1958; Danie et al. 1984). Most parr remain in the river for 2 to 3 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. Some male parr may not go through smoltification and will become sexually mature and participate in spawning with sea-run adult females. These males are referred to as "precocious parr."

First year parr are often characterized as being small parr or 0+ parr (4 to 7 cm long), whereas second and third year parr are characterized as large parr (greater than 7 cm long) (Haines 1992). Parr growth is a function of water temperature (Elliott 1991); parr density (Randall 1982); photoperiod (Lundqvist 1980); interaction with other fish, birds, and mammals (Bjornn and Resier 1991); and food supply (Swansburg et al. 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 using 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 (Gibson 1993; Marschall et al.1998; Pepper 1976; Pepper et al. 1984; Erkinaro et al. 1998; Halvorsen and Svenning 2000; Hutchings 1986; O'Connell and Ash 1993; Erkinaro et al. 1995; Dempson et al. 1996; Klemetsen et al. 2003).

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 naturally reared parr remain in freshwater for 2 years (90 percent or more) with the balance remaining for either 1 or 3 years (USASAC 2005). In order for parr to undergo smoltification, they must reach a critical size of 10 cm total length at the end of the previous growing season (Hoar 1988). During the smoltification process, parr markings fade and the body becomes streamlined and silvery with a pronounced fork in the tail. Naturally reared smolts in Maine range in size from 13 to 17 cm, and most smolts enter the sea during May to begin their first ocean migration (USASAC 2004). During this migration, smolts must contend with changes in salinity, water temperature, pH, dissolved oxygen, pollution levels, and predator assemblages. The physiological changes that occur during smoltification prepare the fish for the dramatic change in osmoregulatory needs that come with the transition from a fresh to a salt water habitat (Ruggles 1980; Bley 1987; McCormick and Saunders 1987; McCormick et al. 1998). The transition of smolts into seawater is usually gradual as they pass through a zone of fresh and saltwater mixing that typically occurs in a river's estuary. Given that smolts undergo smoltification while they are still in the river, they are pre-adapted to make a direct entry into seawater with minimal acclimation (McCormick et al. 1998). This pre-adaptation to seawater is necessary under some circumstances where there is very little transition zone between freshwater and the marine environment.

The spring migration of post-smolts out of the coastal environment is generally rapid, within several tidal cycles, and follows a direct route (Hyvarinen et al. 2006; Lacroix and McCurdy 1996; Lacroix et al. 2004, 2005). Kocik et al. (2009) documented smolt migrating with the tides primarily at night. Post-smolts generally travel out of coastal systems on the ebb tide and may be delayed by flood tides (Hyvarinen et al. 2006; Lacroix and McCurdy 1996; Lacroix et al. 2004, 2005). Lacroix and McCurdy (1996), however, found that post-smolts exhibit active, directed swimming in areas with strong tidal currents. Studies in the Bay of Fundy and Passamaquoddy Bay suggest that post-smolts aggregate together and move near the coast in "common corridors" and that post-smolt movement is closely related to surface currents in the Bay (Hyvarinen et al. 2006; Lacroix and McCurdy 1996; Lacroix et al. 2004). European post-smolts tend to use the open ocean for a nursery zone, while North American post-smolts appear to have a more near-shore distribution (Friedland et al. 2003). Post-smolt distribution may reflect water temperatures (Reddin and Shearer 1987) and/or the major surface-current vectors (Lacroix and Knox 2005). Post-smolts live mainly on the surface of the water column and form shoals, possibly of fish from the same river (Shelton et al. 1997).

During the late summer and autumn of the first year, North American post-smolts are concentrated in the Labrador Sea and off of the west coast of Greenland, with the highest concentrations between 56 °N. and 58°N. (Reddin 1985; Reddin and Short 1991; Reddin and Friedland 1993). The salmon located off Greenland are composed of both 1SW fish and fish that have spent multiple years at sea (multi-sea winter fish, or MSW) and includes immature salmon from both North American and European stocks (Reddin 1988; Reddin et al. 1988). The first winter at sea regulates annual recruitment, and the distribution of winter habitat in the Labrador Sea and Denmark Strait may be critical for North American populations (Friedland et al. 1993). In the spring, North American post-smolts are generally located in the Gulf of St. Lawrence, off the coast of Newfoundland, and on the east coast of the Grand Banks (Reddin 1985; Dutil and Coutu 1988; Ritter 1989; Reddin and Friedland 1993; and Friedland et al. 1999).

Some salmon may remain at sea for another year or more before maturing. After their second winter at sea, the salmon over-winter in the area of the Grand Banks before returning to their natal rivers to spawn (Reddin and Shearer 1987). Reddin and Friedland (1993) found non-maturing adults located along the coasts of Newfoundland, Labrador, and Greenland, and in the Labrador and Irminger Sea in the later summer and autumn.

Status and Trends of Atlantic Salmon Rangewide

The abundance of Atlantic salmon within the range of the GOM DPS has been generally declining since the 1800s (Fay et al. 2006). Data sets tracking adult abundance are not available throughout this entire time period; however, Fay et al. (2006) present a comprehensive time series of adult returns to the GOM DPS dating back to 1967. It is important to note that contemporary abundance levels of Atlantic salmon within the GOM DPS are several orders of magnitude lower than historical abundance estimates. For example, Foster and Atkins (1869) estimated that roughly 100,000 adult salmon returned to the Penobscot River alone before the river was dammed, whereas contemporary estimates of abundance for the entire GOM DPS have rarely exceeded 5,000 individuals in any given year since 1967 (Fay et al. 2006).

Contemporary abundance estimates are informative in considering the conservation status of the GOM DPS today. After a period of population growth in the 1970s, adult returns of salmon in the GOM DPS have been steadily declining since the early 1980s and stabilized at very low levels between 2001 and 2007. Between 2008 and 2011 there has been an increase in the abundance of returning salmon (Figure 2). The population growth observed in the 1970s is likely attributable to favorable marine survival and increases in hatchery capacity, particularly from GLNFH that was constructed in 1974. Marine survival remained relatively high throughout the 1980s, and salmon populations in the GOM DPS remained relatively stable until the early 1990s. In the early 1990s marine survival rates decreased, leading to the declining trend in adult abundance observed throughout 1990s. The increase in the abundance of returning salmon observed between 2008 and 2011 may be an indication of improving marine survival.

Adult returns to the GOM DPS have been very low for many years and remain extremely low in terms of adult abundance in the wild. Further, the majority of all adults in the GOM DPS return to a single river, the Penobscot, which accounted for 92 percent of all adult returns to the GOM DPS between 2001 and 2010. Of the 2169 adult returns to the GOM DPS in 2009, 1918 were the result of smolt stocking and only the remaining 251 were naturally-reared (USASAC 2010). The term naturally-reared includes fish originating from natural spawning and from hatchery fry (USASAC 2010). Hatchery fry are included as naturally-reared because hatchery fry are not marked; therefore, they cannot be distinguished from fish produced through natural spawning. Because of the extensive amount of fry stocking that takes place in an effort to recover the GOM DPS, it is possible that a substantial number of fish counted as naturally-reared were actually stocked as fry.

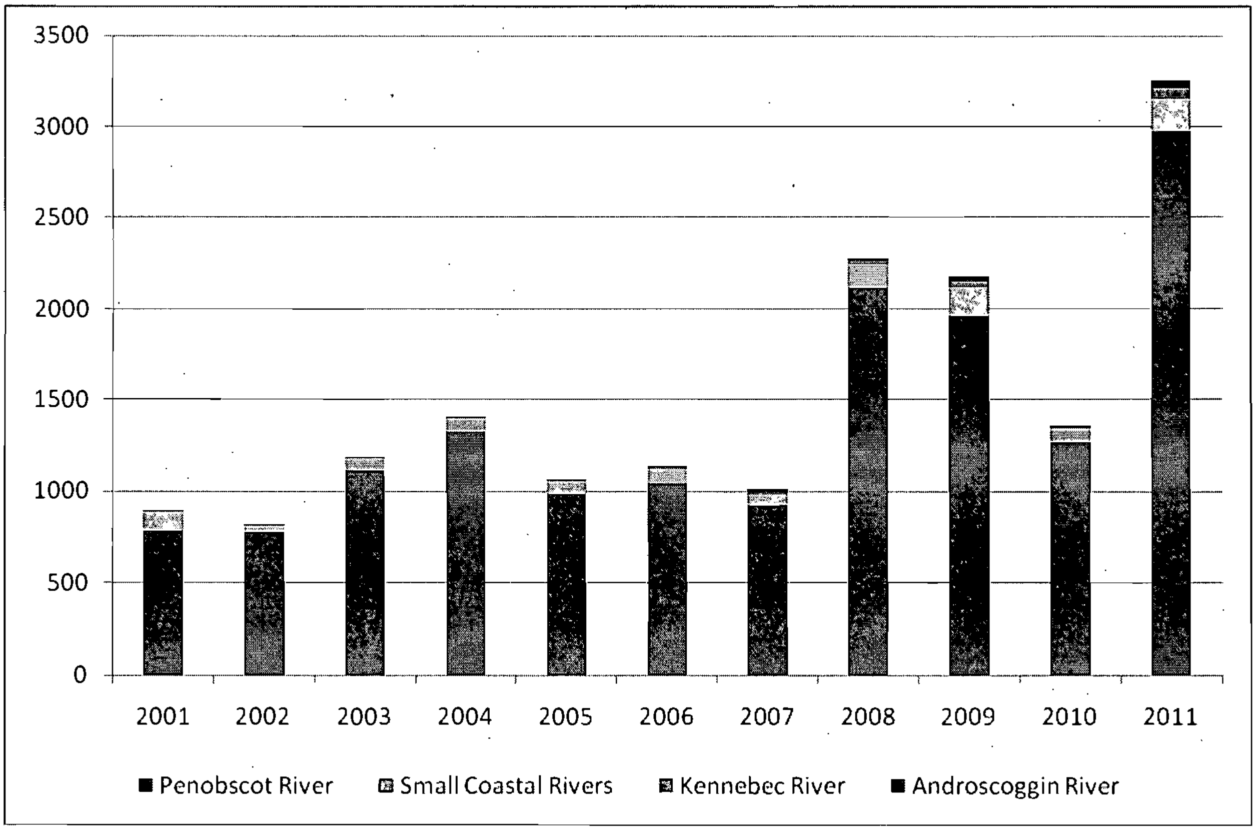

Figure 2. Adult Atlantic salmon returns to the GOM DPS 2001-2011. 2011 data is preliminary as of August 8, 2011.

Low abundances of both hatchery-origin and naturally-reared adult salmon returns to Maine demonstrate continued poor marine survival. Declines in hatchery-origin adult returns are less sharp because of the ongoing effects of hatcheries. In short, hatchery production over this time period has been relatively constant, generally fluctuating around 550,000 smolts per year (USASAC 2008). In contrast, the number of naturally reared smolts emigrating each year is likely to decline following poor returns of adults (three years prior). Thus, wild smolt production would suffer three years after a year with low adult returns, because the progeny of adult returns typically emigrate three years after their parents return. The relatively constant inputs from smolt stocking, coupled with the declining trend of naturally reared adults, result in the apparent stabilization of hatchery-origin salmon and the continuing decline of naturally reared components of the GOM DPS observed over the last two decades.

Adult returns for the GOM DPS remain well below conservation spawning escapement (CSE) goals that are widely used (ICES 2005) to describe the status of individual Atlantic salmon populations. When CSE goals are met, Atlantic salmon populations are generally self-sustaining. When CSE goals are not met (i.e., less than 100 percent), populations are not reaching full potential; and this can be indicative of a population decline. For all GOM DPS rivers in Maine, current Atlantic salmon populations (including hatchery contributions) are well below CSE levels required to sustain themselves (Fay et al. 2006), which is further indication of their poor population status.

In conclusion, 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 very small (approximately 10%) and is continuing to decline. 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.

3.2. Critical Habitat

Coincident with the June 19, 2009 endangered listing, NMFS designated critical habitat for the GOM DPS of Atlantic salmon (74 FR 29300; June 19, 2009) (Figure 3). Designation of critical habitat is focused on the known primary constituent elements (PCEs) within the occupied areas of a listed species that are deemed essential to the conservation of the species. Within the GOM DPS, the PCEs for Atlantic salmon are 1) sites for spawning and rearing and 2) sites for migration (excluding marine migration[1]). NMFS chose not to separate spawning and rearing habitat into distinct PCEs, although each habitat does have distinct features, because of the GIS-based habitat prediction model approach that was used to designate critical habitat (74 FR 29300; June 19, 2009). This model cannot consistently distinguish between spawning and rearing habitat across the entire range of the GOM DPS.

The physical and biological features of the two PCEs for Atlantic salmon critical habitat are as follows:

Physical and Biological Features of the Spawning and Rearing PCE

A1. Deep, oxygenated pools and cover (e.g., boulders, woody debris, vegetation, etc.), near freshwater spawning sites, necessary to support adult migrants during the summer while they await spawning in the fall.

A2. Freshwater spawning sites that contain clean, permeable gravel and cobble substrate with oxygenated water and cool water temperatures to support spawning activity, egg incubation, and larval development.

A3. Freshwater spawning and rearing sites with clean, permeable gravel and cobble substrate with oxygenated water and cool water temperatures to support emergence, territorial development and feeding activities of Atlantic salmon fry.

A4. Freshwater rearing sites with space to accommodate growth and survival of Atlantic salmon parr.

A5. Freshwater rearing sites with a combination of river, stream, and lake habitats that accommodate parr's ability to occupy many niches and maximize parr production.

A6. Freshwater rearing sites with cool, oxygenated water to support growth and survival of Atlantic salmon parr.

A7. Freshwater rearing sites with diverse food resources to support growth and survival of Atlantic salmon parr.

Physical and Biological Features of the Migration PCE

1 Although successful marine migration is essential to Atlantic salmon, NMFS was not able to identify the essential features of marine migration and feeding habitat or their specific locations at the time critical habitat was designated.

B1. 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.
B2. Freshwater and estuary migration sites with pool, lake, and instream habitat that provide cool, oxygenated water and cover items (e.g., boulders, woody debris, and vegetation) to serve as temporary holding and resting areas during upstream migration of adult salmon.
B3. Freshwater and estuary migration sites with abundant, diverse native fish communities to serve as a protective buffer against predation.
B4. Freshwater and estuary migration sites free from physical and biological barriers that delay or prevent emigration of smolts to the marine environment.
B5. Freshwater and estuary migration sites with sufficiently cool water temperatures and water flows that coincide with diurnal cues to stimulate smolt migration
B6. Freshwater migration sites with water chemistry needed to support sea water adaptation of smolts.

Habitat areas designated as critical habitat must contain one or more PCEs within the acceptable range of values required to support the biological processes for which the species uses that habitat. Critical habitat has only been designated in areas considered currently occupied by the species. Critical habitat includes the stream channels within the designated stream reach and includes a lateral extent as defined by the ordinary high-water line or the bankfull elevation in the absence of a defined high-water line. In estuaries, critical habitat is defined by the perimeter of the water body as displayed on standard 1:24,000 scale topographic maps or the elevation of extreme high water, whichever is greater.

For an area containing PCEs to meet the definition of critical habitat, the ESA also requires that the physical and biological features essential to the conservation of Atlantic salmon in that area "may require special management considerations or protections." Activities within the GOM DPS that were identified as potentially affecting the physical and biological features and therefore requiring special management considerations or protections include agriculture, forestry, changing land-use and development, hatcheries and stocking, roads and road crossings, mining, dams, dredging, and aquaculture.

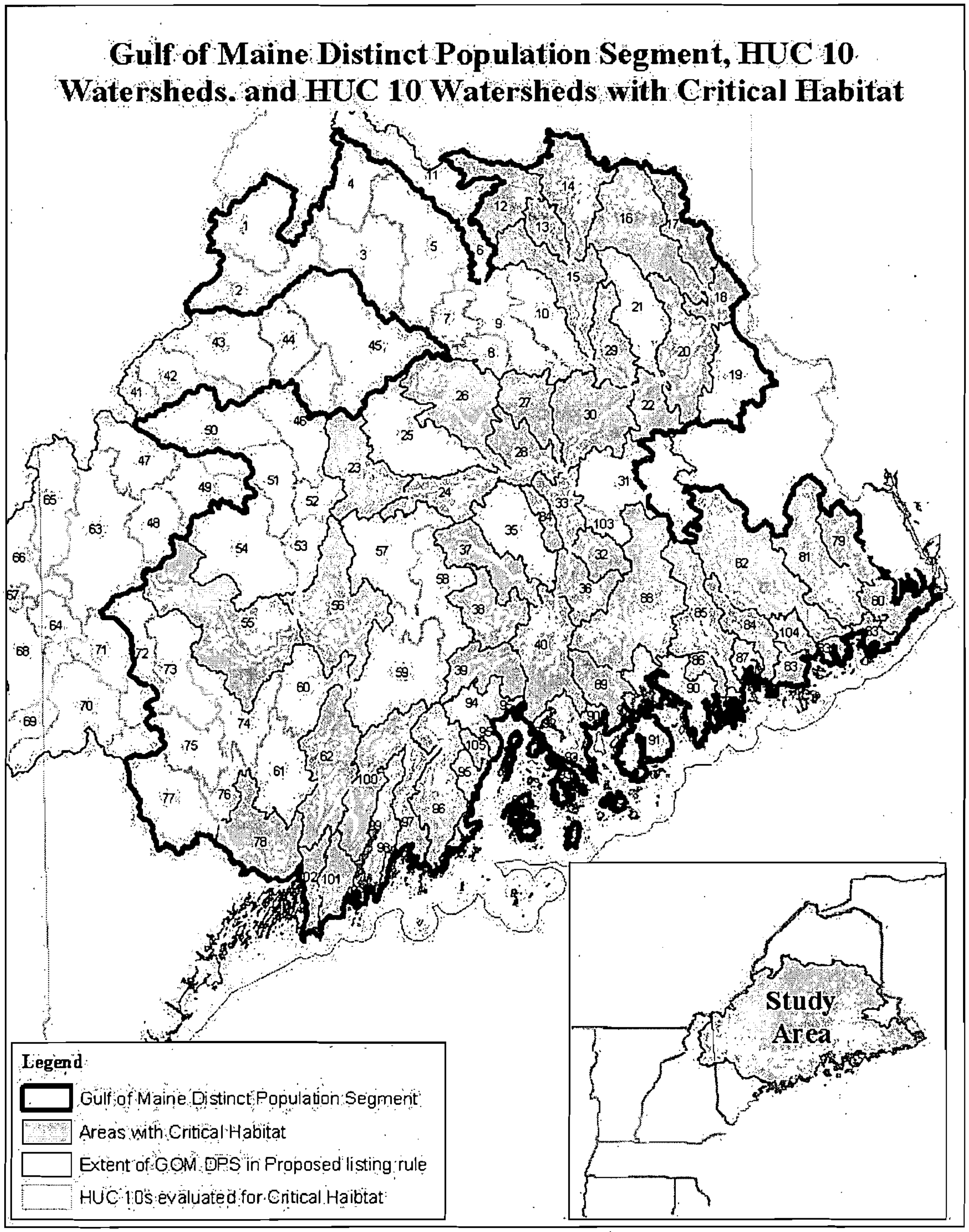

Figure 3. HUC 10 watersheds designated as Atlantic salmon critical habitat within the GOM DPS.

Salmon Habitat Recovery Units within Critical Habitat for the GOM DPS

In describing critical habitat for the Gulf of Maine DPS, NMFS divided the GOM DPS into three Salmon Habitat Recovery Units or SHRUs. The three SHRUs are the Downeast Coastal, Penobscot Bay, and Merrymeeting Bay. The SHRU delineations were designed by NMFS to ensure that a recovered Atlantic salmon population has widespread geographic distribution to help maintain genetic variability and, therefore, a greater probability of population sustainability in the future. Areas designated as critical habitat within each SHRU are described in terms of habitat units. One habitat unit represents 100 m^2 of suitable salmon habitat (which could be spawning and rearing habitat or migration habitat). Habitat units within the GOM DPS were estimated through the use of a GIS-based salmon habitat model (Wright et al. 2008). Additionally, NMFS discounted the functional capacity of modeled habitat units in areas where habitat degradation has affected the PCEs. For each SHRU, NMFS determined that 30,000 fully functional units of habitat are needed in order to achieve recovery objectives for Atlantic salmon. Brief historical descriptions for each SHRU, as well as contemporary critical habitat designations and special management considerations, are provided below.

Merrymeeting Bay SHRU

In the Merrymeeting Bay SHRU, there are approximately 372,600 units of historically accessible spawning and rearing habitat for Atlantic salmon located among approximately 5,950 km of historically accessible rivers, lakes and streams. Of the 372,600 units of spawning and rearing habitat, approximately 136,000 units of habitat are considered to be currently occupied. Of the 136,000 occupied units within the Merrymeeting Bay SHRU, NMFS calculated these units to be the equivalent of nearly 40,000 functional units or approximately 11 percent of the historical functional potential. This estimate is based on the configuration of dams within the Merrymeeting Bay SHRU that limit migration and other activities that cause degradation of physical and biological features from land use activities which reduce the productivity of habitat within each HUC 10. The combined quality and quantities of habitat available to Atlantic salmon within the currently occupied areas within the Merrymeeting Bay SHRU meet the objective of 30,000 fully functional units of habitat available to Atlantic salmon.

In conclusion, the June 19, 2009 final critical habitat designation for the GOM DPS includes 45 specific areas occupied by Atlantic salmon that comprise approximately 19,571 km of perennial river, stream, and estuary habitat and 799 square km of lake habitat within the range of the GOM DPS and on which are found those physical and biological features essential to the conservation of the species which may require special management consideration. Within the occupied range of the GOM DPS, approximately 1,256 km of river, stream, and estuary habitat and 100 square km of lake habitat have been excluded from critical habitat pursuant to section 4(b)(2) of the ESA.

3.3. Summary of Factors Affecting Recovery of Atlantic Salmon

The recovery plan for the previously designated GOM DPS (NMFS and USFWS 2005) and the most recent status review (Fay et al. 2006) as well as the 2009 listing rule, provide a comprehensive assessment of the many factors, including both threats and conservation actions, currently impacting listed Atlantic salmon.

Efforts to Protect the GOM DPS and its Critical Habitat

Efforts aimed at protecting Atlantic salmon and their habitats in Maine have been underway for well over one hundred years. These efforts are supported by a number of federal, state, and local government agencies, as well as many private conservation organizations. The 2005 recovery plan for the originally-listed GOM DPS (NMFS and USFWS 2005) presented a strategy for recovering Atlantic salmon that focused on reducing the most severe threats to the species and immediately halting the decline of the species to prevent extinction. The 2005 recovery plan included the following elements:

1. Protect and restore freshwater and estuarine habitats;
2. Minimize potential for take in freshwater, estuarine, and marine fisheries;
3. Reduce predation and competition for all life-stages of Atlantic salmon;
4. Reduce risks from commercial aquaculture operations;
5. Supplement wild populations with hatchery-reared DPS salmon;
6. Conserve the genetic integrity of the DPS;
7. Assess stock status of key life stages;
8. Promote salmon recovery through increased public and government awareness; and
9. Assess effectiveness of recovery actions and revise as appropriate.

A wide variety of activities have focused on protecting Atlantic salmon and restoring the GOM DPS, including (but not limited to) hatchery supplementation; removing dams or providing fish passage; improving road crossings that block passage or degrade stream habitat; protecting riparian corridors along rivers; reducing the impact of irrigation water withdrawals; limiting effects of recreational and commercial fishing; reducing the effects of finfish aquaculture; outreach and education activities; and research focused on better understanding the threats to Atlantic salmon and developing effective restoration strategies. In light of the 2009 GOM DPS listing and designation of critical habitat, the Services will produce a new recovery plan for the GOM DPS of Atlantic salmon.

Threats to Atlantic Salmon Recovery

A threats assessment performed as part of the 2005 recovery plan resulted in the following list of high priority threats requiring action to reverse the decline of GOM DPS salmon populations:

- Acidified water and associated aluminum toxicity, which decrease juvenile survival
- Aquaculture practices, which pose ecological and genetic risks
- Avian predation
- Changing land use patterns (e.g., development, agriculture, forestry)
- Climate change
- Depleted diadromous fish communities
- Incidental capture of adults and parr by recreational anglers
- Introduced fish species that compete or prey on Atlantic salmon
- Low marine survival

- Poaching of adults in DPS rivers
- Recovery hatchery program (potential for artificial selection/domestication)
- Sedimentation of spawning and rearing habitat
- Water extraction

It is important to note that this analysis was conducted for the species as listed in 2000 and therefore did not include the Atlantic salmon population throughout the Androscoggin, Kennebec and Penobscot Rivers.

Fay et al. (2006) examined each of the five statutory ESA listing factors and determined that each of the five listing factors is at least partly responsible for the present low abundance of the GOM DPS. The information presented in Fay et al. (2006) is reflected in and supplemented by the final listing rule for the new GOM DPS (74 FR 29344; June 19, 2009). The following gives a brief overview of the five listing factors as related to the GOM DPS.

1. **Present or threatened destruction, modification, or curtailment of its habitat or range** – Historically and, to a lesser extent currently, dams have adversely impacted Atlantic salmon by obstructing fish passage and degrading riverine habitat. Dams are considered to be one of the primary causes of both historic declines and the contemporary low abundance of the GOM DPS. Land use practices, including forestry and agriculture, have reduced habitat complexity (e.g., removal of large woody debris from rivers) and habitat connectivity (e.g., poorly designed road crossings) for Atlantic salmon. Water withdrawals, elevated sediment levels, and acid rain also degrade Atlantic salmon habitat.

2. **Overutilization for commercial, recreational, scientific, or educational purposes** – While most directed commercial fisheries for Atlantic salmon have ceased, the impacts from past fisheries are still important in explaining the present low abundance of the GOM DPS. Both poaching and by-catch in recreational and commercial fisheries for other species remain of concern, given critically low numbers of salmon.

3. **Predation and disease** – Natural predator-prey relationships in aquatic ecosystems in the GOM DPS have been substantially altered by introduction of non-native fishes (e.g., chain pickerel, smallmouth bass, and northern pike), declines of other native diadromous fishes, and alteration of habitat by impounding free-flowing rivers and removing instream structure (such as removal of boulders and woody debris during the log-driving era). The threat of predation on the GOM DPS is noteworthy because of the imbalance between the very low numbers of returning adults and the recent increase in populations of some native predators (e.g., double-crested cormorant), as well as non-native predators. Atlantic salmon are susceptible to a number of diseases and parasites, but mortality is primarily documented at conservation hatcheries and aquaculture facilities.

4. **Inadequacy of existing regulatory mechanisms** – The ineffectiveness of current federal and state regulations at requiring fish passage and minimizing or mitigating the aquatic habitat impacts of dams is a significant threat to the GOM DPS today. Furthermore, most dams in the GOM DPS do not require state or federal permits. Although the State of Maine has made substantial progress in regulating water withdrawals for agricultural use,

threats still remain within the GOM DPS, including those from the effects of irrigation wells on salmon streams.

5. **Other natural or manmade factors** – Poor marine survival rates of Atlantic salmon are a significant threat, although the causes of these decreases are unknown. The role of ecosystem function among the freshwater, estuarine, and marine components of the Atlantic salmon's life history, including the relationship of other diadromous fish species in Maine (e.g., American shad, alewife, sea lamprey), is receiving increased scrutiny in its contribution to the current status of the GOM DPS and its role in recovery of the Atlantic salmon. While current state and federal regulations pertaining to finfish aquaculture have reduced the risks to the GOM DPS (including eliminating the use of non-North American Atlantic salmon and improving containment protocols), risks from the spread of diseases or parasites and from farmed salmon escapees interbreeding with wild salmon still exist.

Threats to Critical Habitat within the GOM DPS

The final rule designating critical habitat for the GOM DPS identifies a number of activities that have and will likely continue to impact the biological and physical features of spawning, rearing, and migration habitat for Atlantic salmon. These include agriculture, forestry, changing land-use and development, hatcheries and stocking, roads and road-crossings and other instream activities (such as alternative energy development), mining, dams, dredging, and aquaculture. Most of these activities have or still do occur, at least to some extent, in each of the three SHRUs.

The Penobscot SHRU once contained high quality Atlantic salmon habitat in quantities sufficient to support robust Atlantic salmon populations. The mainstem Penobscot has the highest biological value to the Penobscot SHRU because it provides a central migratory corridor crucial for the entire Penobscot SHRU. Dams, along with degraded substrate and cover, water quality, water temperature, and biological communities, have reduced the quality and quantity of habitat available to Atlantic salmon populations within the Penobscot SHRU. A combined total of twenty FERC-licensed hydropower dams in the Penobscot SHRU significantly impede the migration of Atlantic salmon and other diadromous fish to nearly 300,000 units of historically accessible spawning and rearing habitat. Agriculture and urban development largely affect the lower third of the Penobscot SHRU below the Piscataquis River sub-basin by reducing substrate and cover, reducing water quality, and elevating water temperatures. Introductions of smallmouth bass and other non-indigenous species significantly degrade habitat quality throughout the mainstem Penobscot and portions of the Mattawamkeag, Piscataquis, and lower Penobscot sub-basins by altering predator/prey relationships. Similar to smallmouth bass, recent Northern pike introductions threaten habitat in the lower Penobscot River below the Great Works Dam.

Today, dams are the greatest impediment, outside of marine survival, to the recovery of salmon in the Penobscot, Kennebec and Androscoggin river basins (Fay et al. 2006). Hydropower dams in the Merrymeeting Bay SHRU significantly impede the migration of Atlantic salmon and other diadromous fish and either reduce or eliminate access to roughly 352,000 units of historically accessible spawning and rearing habitat. In addition to hydropower dams, agriculture and urban development largely affect the lower third of the Merrymeeting Bay SHRU by reducing substrate and cover, reducing water quality, and elevating water temperatures. Additionally, smallmouth bass and brown trout introductions, along with other non-indigenous species, significantly degrade habitat quality throughout the Merrymeeting Bay SHRU by altering natural predator/prey relationships.

Impacts to substrate and cover, water quality, water temperature, biological communities, and migratory corridors, among a host of other factors, have impacted the quality and quantity of habitat available to Atlantic salmon populations within the Downeast Coastal SHRU. Two hydropower dams on the Union river, and to a lesser extent the small ice dam on the lower Narraguagus River, limit access to roughly 18,500 units of spawning and rearing habitat within these two watersheds. In the Union River, which contains over 12,000 units of spawning and rearing habitat, physical and biological features have been most notably limited by high water temperatures and abundant smallmouth bass populations associated with impoundments. In the Pleasant River and Tunk Stream, which collectively contain over 4,300 units of spawning and rearing habitat, pH has been identified as possibly being the predominate limiting factor. The Machias, Narraguagus, and East Machias rivers contain the highest quality habitat relative to other HUC 10's in the Downeast Coastal SHRU and collectively account for approximately 40 percent of the spawning and rearing habitat in the Downeast Coastal SHRU.

4. 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 the 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). The environmental baseline for this biological opinion includes the effects of several activities that may affect the survival and recovery of the endangered species in the action area. The activities that shape the environmental baseline in the action area of this consultation generally include: water quality impacts, scientific research, recreational fisheries, and recovery activities associated with reducing those impacts. In addition, in 2011 the Greater Augusta Utility District (GAUD) will conduct a sewer line upgrade that involves five crossings of Bond Brook and its tributaries. The three crossings of Bond Brook associated with this upgrade are proximate to the former MGP site.

4.1. Status of the Gulf of Maine DPS and Critical Habitat in the Action Area

A summary of the status of the species rangewide and designated critical habitat in its entirety was provided above. This section will focus on the status of Atlantic salmon and designated critical habitat in the action area. Due to the fact that the project is located in the tidal portion of Bond Brook, it is reasonable to assume that only migratory life stages (e.g. smolt and adults) of Atlantic salmon would be present in the vicinity of this project.

Status and Trends of Atlantic salmon in the Action Area

At the time the GOM DPS was listed, the Services determined that the Kennebec River supported a population of naturally reproducing Atlantic salmon. Bond Brook flows into the Kennebec River just downstream of the former Edwards dam site. There is mapped spawning and rearing habitat approximately 2,000 feet upstream of the proposed project in Bond Brook. The lower tidal portion of the stream, however, is primarily suitable as migratory habitat.

Counts for Atlantic salmon in the Kennebec River are available since 2006 when a fishlift was installed at the first dam on the river (Lockwood Dam)(NMFS and USFWS 2009), 20 miles upriver of Bond Brook in Waterville. Between 2006 and 2010, the number of Atlantic salmon counted at the Lockwood Dam was 15, 16, 22, 33 and 5, respectively. Preliminary counts for 2011 indicate that 62 adult salmon had been passed at Lockwood Dam as of August 8, 2011.

The Edwards Dam was constructed in Augusta in the 1830s a quarter mile upriver from the confluence of the Kennebec River with Bond Brook. In 1999, the dam was removed opening up approximately 20 miles of habitat to Atlantic salmon. During the approximately 170 years when passage was blocked in the mainstem, adult salmon used the lower tributaries of the Kennebec (Bond Brook and Togus Stream) for spawning, rearing and, in the case of Bond Brook, thermal refuge in the warm summer months. Prior to 1999, as many as 100 adult Atlantic salmon could be observed resting in the deep pool adjacent to the Water Street Bridge when the water temperatures in the river were high. Since the dam's removal, however, no fish have been observed using this pool as thermal refuge; presumably because they have located other refugia upstream of the former dam site. Similarly, the removal of the dam marked a turning point in salmon usage of Bond Brook and Togus Stream. The surveys conducted since the dam removal in 1999 by the MDMR indicate that spawning has all but ceased in Bond Brook (only 1 redd found over 10 years of observation).

MDMR has conducted annual baseline monitoring of Atlantic salmon populations in Bond Brook for the last 10 years. The surveys focus on spawning and rearing habitat in the upper portion of the Brook. Between 2000 and 2009 only one redd was found, and that was discovered in 2000. Parr surveys have been conducted annually over the same time period and no salmon have been identified. However, in spring 2010, due to an increase in spawning in the Sheepscot River, the MDMR stocked Bond Brook with 30,000 Atlantic salmon fry (Paul Christman, MDMR, pers. comm.). In the fall of 2010, 0+ parr were found throughout the system. In 2012, when construction is anticipated to occur, these parr would be age 2. Parr are quite mobile and given the number of fry stocked, it is possible they could occur in lower Bond Brook at certain times of year. Parr are known to take up residency in tidal areas in the winter prior to their movement out of a river system as smolts the following spring. Any parr in the tidal portion of Bond Brook in the summer would likely be transient and would not take up full-time summer residency (Norm Dube, MDMR, pers. comm.). The June 1-October 1 work window is protective of smolts, as well as any pre-smolt parr residing in the tidal portion of the stream in the winter in preparation for outmigration as these life stages are unlikely to be present in the action area during the work window. Therefore, the only salmon that are anticipated to be affected by this project are adults.

Status and Trends of Critical Habitat in the Action Area

The environmental baseline of this Opinion describes the status of salmonid habitat, which is important for two reasons: a) because it affects the viability of the listed species within the action area at the time of the consultation; and b) because those habitat areas designated "critical" provide primary constituent elements (PCEs) essential for the conservation (i.e., recovery) of the species. The environmental baseline also describes the status of critical habitat over the duration of the proposed action because it includes the persistent effects of past actions and the future effects of Federal actions that have not taken place but have already undergone Section 7 consultation.

The complex life cycles exhibited by Atlantic salmon give rise to complex habitat needs, particularly during the freshwater phase (Fay et al. 2006). Spawning gravels must be a certain size and free of sediment to allow successful incubation of the eggs. Eggs also require cool, clean, and well-oxygenated waters for proper development. Juveniles need abundant food sources, including insects, crustaceans, and other small fish. They need places to hide from predators (mostly birds and bigger fish), such as under logs, root wads, and boulders in the stream, as well as beneath overhanging vegetation. They also need places to seek refuge from periodic high flows (side channels and off-channel areas) and from warm summer water temperatures (coldwater springs and deep pools). Returning adults generally do not feed in fresh water but instead rely on limited energy stores to migrate, mature, and spawn. Like juveniles, they also require cool water and places to rest and hide from predators. During all life stages, Atlantic salmon require cool water that is free of contaminants. They also need migratory corridors with adequate passage conditions (timing, water quality, and water quantity) to allow access to the various habitats required to complete their life cycle.

As discussed in Section 3.2, critical habitat for Atlantic salmon has been designated in Bond Brook. Both PCEs for Atlantic salmon (sites for spawning and rearing and sites for migration) are present in the action area of this consultation. PCEs consist of the physical and biological elements identified as essential to the conservation of the species in the documents designating critical habitat. These PCEs include sites essential to support one or more life stages of Atlantic salmon (sites for spawning, rearing, and migration) and contain physical or biological features essential to the conservation of the species, for example, spawning gravels, water quality and quantity, unobstructed passage, and forage.

The spawning and rearing PCE occurs upstream of the project area and is therefore not expected to be directly affected by this project. The project will cause a temporary delay in migration for Atlantic salmon moving upstream to spawning habitat during the summer months. This temporary reduction in the habitat suitability is not anticipated to extend beyond the conclusion of construction.

Effects of Federal Actions that have Undergone Formal Section 7 Consultation

Greater Augusta Utility District CSO Abatement Project

NMFS issued a Biological Opinion for the Greater Augusta Utility District's (GAUD) proposed CSO abatement project on February 22, 2011. Bond Brook currently receives CSO discharges at four locations; three in the tidal portion of the Brook and one into freshwater. The Kennebec River currently receives discharge from a single location. The sewer system upgrade project will eliminate all four of the CSO discharges into Bond Brook and will minimize discharge at the Kennebec River location by installing a storage conduit that will be able to contain overflow from a 1-year, 2-hour event. Excess flow during storms larger than a 1-year, 2-hour event will discharge into the tidally influenced waters of the Kennebec River. As part of the consultation, NMFS authorized non-lethal take of two adult Atlantic salmon. There will be excavation for three sewer line crossings within 400 feet of CMP's proposed project. The construction of the sewer upgrade is scheduled to occur between June 1 and October 1 in 2011, and therefore will not occur concurrently with CMP's project, which is scheduled for 2012.

Other Factors Affecting Atlantic Salmon in the Action Area

Non-Federally Regulated Fishery Operations

Unauthorized take of Atlantic salmon is prohibited by the ESA. However, if present, Atlantic salmon juveniles may be taken incidentally in brook trout fisheries by recreational anglers. Bond Brook falls under general regulations for Maine Department of Inland Fish and Wildlife fishing regulations. Due to a lack of reporting, no information on the number of Atlantic salmon caught and released or killed in recreational fisheries in Bond Brook is available.

Contaminants and Water Quality

Point source and non-point source discharges (i.e., wastewater, agricultural or erosion) could potentially contribute to diminished water quality and sedimentation that impacts Atlantic salmon habitat in Bond Brook. Four combined sewer overflow (CSO) discharges occur in lower Bond Brook, which will be eliminated by the GAUD project discussed above. Loss of riparian habitat in the stream from private and commercial development is also likely degrading water quality and habitat in Bond Brook through sedimentation and thermal warming.

Habitat Fragmentation

Improperly designed or maintained road crossings fragment habitat used by Atlantic salmon. Habitat fragmentation prevents Atlantic salmon from accessing necessary habitat for various life stages of the species. While the extent of habitat fragmentation by road crossings in Bond Brook is presently unknown, road crossing surveys conducted in a similar watershed (Kenduskeag Stream) indicate the problem may be significant (Fay et al. 2006).

Scientific Studies

MDMR has conducted periodic monitoring of Atlantic salmon populations in Bond Brook since the 1990's (MDMR unpublished data). MDMR was authorized in 200l to sample listed Atlantic salmon in the GOM DPS under the USFWS' endangered species blanket permit (No. 697823) issued pursuant to Section l0(a)(1)(A) of the ESA. Under USFWS permit No. 697823, MDMR is authorized to take (typically meaning capture) up to 2% of any given lifestage of Atlantic salmon during scientific research and recovery efforts (except for adults of which less than 1% can be taken). Lethal take of salmon in Bond Brook during MDMR sampling is expected to be less than 2% consistent with take estimates for other Maine streams where such records are maintained by MDMR.

Climate Change

There is a large and growing body of literature on past, present, and future impacts of global climate change induced by human activities -frequently referred to in layman's terms as "global warming." Some of the likely effects commonly mentioned are sea level rise, increased frequency of severe weather events, and change in air and water temperatures. The EPA's climate change webpage provides basic background information on these and other measured or anticipated effects (see www. epa.gov/climatechange/index.html). Activities in the action area that may have contributed to global warming include the combustion of fossil fuels by vessels.

The impact of climate change on Atlantic salmon is likely to be related to ocean acidification, changes in water temperatures, potential changes to salinity in rivers, and the potential decline of forage. These changes may affect the distribution of species and the fitness of individuals and populations due to the potential loss of foraging opportunities, displacement from ideal habitats and potential increase in susceptibility to disease (Elliot and Simmonds 2007). A decline in reproductive fitness as a result of global climate change could have profound effects on the abundance and distribution of Atlantic salmon in the action area, and throughout their range.

As described above, global climate change is likely to negatively affect Atlantic salmon by affecting the distribution of prey, water temperature and water quality. Any activities occurring within and outside the action area that contribute to global climate change are also expected to negatively affect Atlantic salmon in the action area. However, given the timeframe of the proposed action, which is expected to be complete by October 2012, it is unlikely that any new effects of climate change will be experienced by Atlantic salmon in the action area during this time period.

Conservation and Recovery Actions

In November 2005, NMFS and the USFWS issued the Final Recovery Plan for the Gulf of Maine Distinct Population Segment of Atlantic salmon (NMFS and USFWS 2005). The major areas of action in the recovery plan are designed to stop and reverse the downward population trends of Atlantic salmon populations and minimize the potential for human activities to result in the degradation or destruction of Atlantic salmon habitat essential to survival and recovery. The new recovery plan for the GOM DPS is expected to be issued in 2011.

4.2. Summary and Synthesis of the Status of the GOM DPS

The Status of the Species, Environmental Baseline, and Cumulative Effects Sections, taken together, establish a "baseline" against which the effects of the proposed action are analyzed to determine whether the action is likely to jeopardize the continued existence of the species or result in the destruction or adverse modification of designated critical habitat. To the extent available information allows, this "baseline" (which does not include the future effects of the proposed action) would be compared to the backdrop plus the effects of the proposed action. The difference in the two trajectories would be reviewed to determine whether the proposed action is likely to jeopardize the continued existence of the species. This section synthesizes the Status of the Species, the Environmental Baseline, and Cumulative Effects sections.

Adult returns for the GOM DPS remain well below conservation spawning escapement (CSE). For all GOM DPS rivers in Maine, current Atlantic salmon populations (including hatchery contributions) are well below CSE levels required to sustain themselves (Fay et al. 2006), which is further indication of their poor population status. 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 very small (approximately 10%) and is continuing to decline. 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.

A number of activities within the GOM DPS including Bond Brook will likely continue to impact the biological and physical features of spawning, rearing, and migration habitat for Atlantic salmon. These include agriculture, forestry, changing land-use and development, hatcheries and stocking, roads and road-crossings and other instream activities (such as alternative energy development), mining, dams, dredging, and aquaculture. Dams, along with degraded substrate and cover, water quality, water temperature, and biological communities, have reduced the quality and quantity of habitat available to Atlantic salmon populations within the GOM DPS.

Impacts from actions occurring in the Environmental Baseline have the potential to impact Atlantic salmon. Despite improvements in water quality and the elimination of directed fishing for these species, Atlantic salmon still face threats in Bond Brook. The number of listed GOM DPS Atlantic salmon in Bond Brook is very small. Data collected by the MDMR indicates that few if any listed adult Atlantic salmon are returning to Bond Brook. In addition, very few juvenile Atlantic salmon or spawning redds have been documented in the stream since 2000.

5. EFFECTS OF THE ACTION

This section of a biological opinion assesses the direct and indirect effects of the proposed action on threatened or endangered species or critical habitat, together with the effects of other activities that are interrelated or interdependent (50 CFR 402.02). Indirect effects are those that are caused 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. This biological opinion examines the likely effects (direct and indirect) of the proposed action on the GOM DPS of Atlantic salmon and its designated critical habitat within the context of the species' current status and the environmental baseline.

5.1. Effects to GOM DPS of Atlantic salmon

During construction the proposed action is likely to expose Atlantic salmon to increases in sediment, construction noise, riparian vegetation removal, and temporary alterations in fish passage conditions. Additionally, fish may be disturbed during the construction and removal of cofferdams and bypass structures and during the associated fish evacuation procedures. These temporary project related effects could potentially lead to avoidance behavior, which could in turn cause a delay in migration to upstream spawning habitat. As described in Section 3.1, adult salmon begin ascending the rivers within the GOM DPS beginning in the spring; although spawning does not occur until fall. Early migration is an adaptive trait that ensures adults have sufficient time to effectively reach spawning areas despite the occurrence of temporarily unfavorable conditions that naturally occur within rivers (Bjornn and Reiser 1991). Consequently, a delay in migration could potentially prevent adult Atlantic salmon from reaching suitable spawning habitat in time to spawn.

Cofferdam Construction Effects

Atlantic salmon may be killed or more likely temporarily disturbed, displaced, or injured by instream work activities. Isolation of a stream work area within a cofferdam is a conservation measure intended to minimize the overall adverse effects of construction activities on Atlantic salmon and their habitat. Isolating the work area within a cofferdam, however, could lead to negative impacts on fish if any individuals are trapped within the isolated work area. To minimize the probability of entrapping an adult Atlantic salmon within the work area, a daily visual survey will be conducted by qualified personnel to verify that there are no Atlantic salmon within the project area during the installation and removal of any in-water bypass structure, including cofferdams. If any Atlantic salmon are observed within the enclosed cofferdam, all in-water work will cease and the NMFS Maine Field Office will be contacted to coordinate removal of the fish.

Salmon present during the installation of the cofferdam or turbidity curtain may either be temporarily disturbed or displaced so that they move away from the instream work area while a cofferdam or bypass structure is being installed. As discussed above, this could cause a delay in migration to spawning habitat upstream of the project area.

Given the recent adult returns to GOM DPS rivers, the likelihood of an adult being present at any given project site is very small. Given the level of instream activity associated with setting up the cofferdams and other construction-related activities along the stream banks, any adult salmon present in the project area would very likely be disturbed and move away from the work zone.

The stream bypass structures proposed by CMP will allow continual flow of water through the project site for the duration of the project. This will minimize the probability that any part of the downstream channel will "dry" out, which could potentially strand adult salmon in downstream pools. In the eventuality that pumps will be required to pump water around the cofferdam, or to dewater an enclosed cofferdam, the intake hose has the potential to adversely affect fish through impingement and entrainment. Approach velocities across the screen that are faster than a fish's swimming capability can draw and hold fish against the screen surface (*i.e.*, impingement), resulting in suffocation or physical damage to the fish (NMFS 2008). Impingement and entrainment can be avoided by putting a properly designed fish screen on the end of the intake hose. According to NMFS guidance, the installation of a ¼ inch mesh screen on the end of an intake hose will protect fish 2.36 inches and longer from entrainment and impingement. With the implementation of this protective measure, diversion pumps should have minimal, if any, effects on Atlantic salmon, or the Bond Brook fish community as a whole.

Effects of Exposure to Increases in Sediment

Construction activities that involve work in a stream or near the banks of the stream are likely to result in some level of sediment being discharged into the stream as a result of disturbance to either land-based soils or stream substrates. The amount of sediment entering streams in association with this project, however, is expected to be relatively minor given the measures proposed to minimize erosion and sedimentation. The project covered by this opinion will have all instream work limited to the period from June 1 to October 1 when stream flows are relatively low, consequently limiting the potential for stream flows to generate erosion and carry sediment downstream. Furthermore, precipitation is usually fairly low during the summer in Maine, limiting the potential for rain and subsequent construction-site runoff to cause erosion and carry sediment into a stream. The project will be constructed using erosion and sedimentation controls. The erosion and sedimentation control plan will be approved and fully enforced by CMP.

Salmon eggs and newly emerged fry, which are generally considered the most sensitive life stages to the effects of increased suspended sediments, will not be present in the action area during the summer instream work window (Robertson et al. 2007) and therefore will not be exposed to any increases in suspended sediment associated with the proposed action.

Limiting most instream work to a dewatered section of stream within a cofferdam will minimize the amount of sediment mobilized and distributed downstream. Turbid water from within a cofferdam will be pumped into the "dirty water" treatment system to minimize sedimentation impacts to the stream when the diverted water is returned downstream.

The installation and removal of the bypass (either a cofferdam or pipe diversion) can result in some amount of sediment being dispersed in the stream. Because most of the sediment in the project area is composed of sand and gravel, there is an opportunity for sediment to be mobilized and carried downstream by construction activities. To minimize sediment release, turbidity curtains will be placed up and downstream of the project during installation and removal of the bypass. Construction-related disturbances in riparian areas near the stream will also have the potential to result in erosion and sediment entering the stream, particularly if there are rainstorms during periods when there are disturbed soils on the construction site. Strict adherence to the erosion and sedimentation control plan (Appendix F of the BA), as well as the surface water monitoring plan (Appendix H), and vigilant monitoring by CMP staff should minimize this source of erosion and subsequent sediment reaching the stream, as well.

Atlantic salmon are adapted to natural fluctuations in water turbidity, such as during high water events from spring runoff; a variety of anthropogenic activities, however, can result in short-term increases in suspended sediments and unnatural increases in stream turbidity (Robertson et al. 2007). Potential adverse effects of these increases in stream turbidity on Atlantic salmon could include the following (Robertson et al. 2006; Newcombe 1994): 1) reduction in feeding rates; 2) increased mortality; 3) physiological stress, including changes in cardiac output, ventilation rate, and blood sugar level; 4) behavioral avoidance of the work area; 5) physical injury (e.g., gill abrasion); 6) reduction in macroinvertebrates as a prey source, and 7) a reduction in territorial behavior. An increase in stream turbidity may provide temporary enhancement of cover conditions, which could result in less susceptibility to predation (Danie et al. 1984).

In a review of the effects of sediment loads and turbidity on fish, Newcombe and Jensen (1996) concluded that more than 6 days exposure to total suspended solids (TSS) greater than 10 mg/l is a moderate stress for juvenile and adult salmonids. A single day exposure to TSS in excess of 50 mg/l is also a moderate stress to salmonids. Robertson et al. (2007) found adverse effects to juvenile Atlantic salmon from short-term increases in suspended sediment at sediment levels as low as 15 nephelometric turbidity units (NTU) in a laboratory setting. Effects on fish from short-term turbidity increases (hours or days) are generally temporary and are reversed when turbidity levels return to background levels (Robertson et al. 2006).

In a study conducted by Foltz et al. (2008) on eleven culvert removals (2 to 5 foot diameter) on logging roads in Idaho and Washington; it was observed that turbidity measurements exceeded Idaho water quality standards (50 NTU above background) 300 feet downstream of the project location. However, when a sedimentation barrier was placed downstream of the project the sediment yield was reduced by 98%. Since the project proposed by CMP will occur within dewatered cofferdams using appropriate erosion and sedimentation control BMPs, it is unlikely that the sedimentation effects will approach the levels detected by Foltz et al.

Based on our knowledge of instream construction activities of a similar nature to the project discussed here, we would not expect construction-related TSS levels to reach those described by Newcomb and Jensen. The sediment and erosion control measures that will be employed for this project should keep sediment effects on Atlantic salmon to a minimal level on a temporary basis. Although the turbidity-related effects described above are expected to be minor and short-term, it is possible that they could cause avoidance behavior in adult Atlantic salmon that could contribute to a delay in migration to spawning habitat upstream of the project.

Effects on the Riparian Zone

Vegetation will be removed from the stream banks to allow for construction access and to provide placement for the RCM and Reno mattresses. The proposed project will disturb 0.28 acres (12,200 sf) of riparian habitat; 0.13 acres (5,700 sf) permanently. The remaining 0.15 acres (6,500 sf) will be replanted post-construction and monitored for success for 1 year. Of the 0.13 acres permanently impacted by the RCM mats, 0.05 acres (2,100 sf) are comprised of un-vegetated eroded bank. The remaining 0.08 acres (3,600 sf) are vegetated, and cannot be replanted since the Reno mattresses would not allow for sufficient depth. It is not anticipated that the permanent removal of 0.08 acres of vegetation will significantly alter the temperature in Bond Brook. Furthermore, vegetation removal will be kept to the minimum necessary to accomplish the project, and should not result in any input of sediment into the streams, as long as appropriate erosion control BMPs, such as silt fence, are employed.

Effects of Exposure to Coal Tar Contamination

Petroleum-based materials, such as diesel fuel and oil, contain polycyclic aromatic hydrocarbons (PAHs). PAHs are also produced as a byproduct of the coal gasification process and are found in the substrates of Bond Brook as a result of the old MGP on Mount Vernon Avenue. 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).

Contaminants, including PAHs, can have substantial deleterious effects on aquatic life including production of acute lesions, growth retardation, and reproductive impairment (Cooper 1989; Sindermann 1994). Ultimately, toxins introduced to the water column become associated with the benthos and can be particularly harmful to benthic organisms (Varanasi 1992). Available data suggest that early life stages of fish are more susceptible to environmental and pollutant stress than older life stages (Rosenthal and Alderdice 1976).

In the Connecticut River, coal tar leachate was suspected of impairing shortnose sturgeon reproductive success. Kocan et al. (1996) conducted a laboratory study to investigate the survival of sturgeon eggs and larvae exposed to PAHs. Only 5% of sturgeon embryos and larvae survived after 18 days of exposure to Connecticut River coal tar contaminated sand in a flow-through laboratory system. This study demonstrated that coal tar contaminated sediment is toxic to the embryos and larvae of certain fish species under laboratory exposure conditions (Kocan et al. 1996).

Much of the research on the effects of PAHs on salmonids has been conducted on pink salmon (*Oncorhynchus gorbuscha*) exposed to oil off the coast of Alaska in 1989 due to the *Exxon Valdez* oil spill. For the four years after the spill, it was found that the survival rates of embryonic salmon in streams that had been oiled were significantly less than in streams that had not been affected (Bue et al. 1998). It was also found that the offspring of the salmon that had been exposed to oil during larval development had lower survival rates than the offspring of normal pink salmon. It is hypothesized that this is due to impaired reproductive development in the fish due to their exposure to PAHs and other contaminants. Heintz et al. (2000) found that marine survival of juvenile pink salmon that had been exposed to high PAH concentrations during development was 15% lower than marine survival in salmon that had not been exposed to high PAH levels.

Although there are sediments within Bond Brook with elevated PAH concentrations, they are stable and currently are not leaching into the top layer of sediment or into the water column. The proposed brook remedy will not involve excavation, which minimizes the probability that there will be an increase in PAH in the stream during construction. However, the placement of the RCM and Reno mattresses will involve the excavation of a trench (up to 2 feet deep) at, or just below the MLW line. This excavation will occur within a dewatered cofferdam and any contaminated water will be removed and treated prior to the removal of the cofferdam. Oil booms will be placed up and downstream of the project to contain any potential release of PAH contaminated material. Overall, this project is anticipated to minimize the probability of further seepage from soils in the bank, as well as further stabilize the tar mats under the stream bed itself. No Atlantic salmon are expected to be exposed to an increase in coal tar contaminants during the proposed action. Over the long term, this coal tar remediation project is expected to improve water quality in the action area. Post-construction monitoring will be conducted to ensure that no sheen or odor is detectable after the remedies have been applied.

As a component of the erosion and sedimentation control plan for this project, CMP or their contractor will develop and implement a Spill Prevention Control and Countermeasure Plan (SPCCP) designed to avoid any impacts to rivers and streams 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 SPCCP and in a manner which avoids chemicals or other hazardous materials getting into the stream.

Effects on Fish Passage

Effects to fish passage through lower Bond Brook could occur due to the temporary placement of a bypass structure or by the placement of 6 inches of substrate material over 0.4 acres of stream channel. To assess the effects of the project on fish passage, CMP used the ACOE's Hydrologic Engineering Centers River Analysis System (HEC-RAS) to model existing conditions and compare them to what is anticipated during and post-construction.

Bypass Options

The HEC-RAS model indicates that passage for adult Atlantic salmon through the bypass structure is feasible at high tide, regardless of whether an open bypass or a pipe bypass is utilized. However, from the model results, it appears that velocities though the pipe bypass at low tide may preclude Atlantic salmon passage. In addition, the bottom of the pipes will be placed 6-inches above mean low water, which suggests that for part of the tide cycle, the culverts will be hanging at the outlets, and that there will be an additional time during the tide cycle where there will be insufficient depth for an adult Atlantic salmon to swim into the pipes.

The 90% design plans indicate that the two 5-foot diameter, 500-foot long smoothbore culverts will be placed at an approximately 0.2% slope. The final design will be up to the contractor. Although the pipes are anticipated to contain sufficient depth and velocity of water for the majority of the tide cycle, a slight change in slope or in flow conditions would likely make the bypass impassable. According to the fish passage software Fish Xing (USDA-FS 2010), increasing the slope from 0.2% to 0.3% would make the pipes largely impassable to adult Atlantic salmon due to the formation of a depth barrier at the inlet. Likewise, flows in excess of the estimated flow could create a velocity barrier throughout the pipe that would be problematic for migrating salmon. At the median tide level, Fish Xing indicates that flow rates in excess of 35 cfs and below 22 cfs (normal flow is estimated at 30 cfs based on watersheds of similar size) would create a barrier to large Atlantic salmon. Given the narrow margin of error, as well as the imprecision inherent in modeling and construction, it is possible that passage through these structures would be at least partially, if not totally, obstructed by the culvert bypass option.

It is unknown whether or not adult Atlantic salmon in the action area would successfully migrate upstream through the bypass culverts when the velocities and depths are within suitable ranges.

It is assumed that the disturbance from construction activities within the stream, on the streambanks and within the cofferdam could lead to some avoidance behavior. In addition, the presence of siltation curtains across the stream during work on the cofferdam, as well as a oil containment boom that will be in place for the duration of the project, are also anticipated to create additional obstructions to fish passage. Therefore, it is assumed that even when passage conditions within the pipes are appropriate for migrating Atlantic salmon, there is the potential that project activities could lead to avoidance behavior that would lead to a delay in upstream migration. The extent of that delay cannot be known precisely, but it can be assumed that it would last for no more than the duration of construction activities, which will be limited to daylight hours.

The culvert bypass option is anticipated to block upstream migration during low tide and could potentially obstruct it for longer if the flow rates and culvert slopes vary from what is proposed and has been described in the BA. It is also possible that Atlantic salmon may exhibit avoidance behavior in response to construction activities during the daylight hours and may hold in habitat just downstream of the project. Therefore, it is anticipated that upstream migration through the project area could be partially to entirely blocked by the presence of the pipe bypass for the approximately 2.5 to 3 months that it would be in place.

If an open bypass is utilized, it is assumed that passage barriers due to low water and avoidance behavior could still lead to delays in migration. However, since the stream gradient would not be altered by the bypass and the design would not incorporate a six inch drop at the outlet, it is anticipated that delays caused by this bypass option would be relatively minor and of short duration.

Brook Remedy

The addition of 6 inches of material to 0.4 acres of stream channel could affect the hydrology of lower Bond Brook, and possibly hinder passage of fish at low tide. The HEC-RAS analysis indicated that passage for adult salmon, both prior to and post construction, is possible at all but the lowest tides. In addition, the average velocities through the project area post-construction are not expected to increase at low tide due to the brook remedy. However, a minor increase in average velocity is anticipated (0.3 to 0.4 feet/second) at high tide. This slight increase in velocity is not expected to affect adult Atlantic salmon migration through lower Bond Brook.

It is anticipated that there will be some movement of the new rock material over time due to high flows. The HEC-RAS analysis presented by CMP indicates that this movement will be minor and that overall the material will be stable. It is possible, however, that due to extreme high flows and ice scour, that the material could move downstream. To ensure that material does not create a barrier to fish passage, the ACOE and CMP should conduct post-construction monitoring of fish passage conditions. If an unanticipated barrier is formed by the placement or movement of the material, corrective action should be taken, in coordination with NMFS, to ensure that passage is restored for Atlantic salmon.

Fish Evacuation

This project will involve a significant amount of in-stream work due to the installation and removal of the cofferdam, as well as the placement of fill in 0.4 acres of stream habitat. During these activities adult Atlantic salmon may be temporarily disturbed or displaced. Isolation of the stream work area with a cofferdam is a measure intended to minimize the overall adverse effects of construction activities on Atlantic salmon and their habitat by minimizing the potential for exposure of individuals. As proposed in CMP's fish evacuation plan, qualified fisheries biologists will survey the area prior to the commencement of any in-stream work and will use nets and seines to herd all fish out of the area. Once the site has been cleared of fish, siltation curtains will be installed and construction of the cofferdam will commence. Although it is unlikely that salmon will be able to get back into the work zone through the curtains, the area will be periodically monitored during construction to ensure that salmon have not reentered the area. If salmon are observed within the area during the installation and removal of the cofferdam, work will cease until the biologists have safely herded the fish out. It is unlikely that any adult Atlantic salmon would be captured within the cofferdam as it is being constructed due to presence of siltation curtains, as well as the general disturbance associated with construction. The likelihood is further reduced by the presence of trained fisheries biologists that will monitor for fish presence and herd any salmon away, if necessary. However, if a salmon is detected within the enclosed cofferdam, the dam will be breached and, if possible, the salmon will be herded out. If this is not possible, the biologists will use nets and seines to attempt to capture and remove the fish safely. Electrofishing will be used only where other means of fish capture are not feasible or effective. If the cofferdams are overtopped due to a high flow event during construction, the area will be resurveyed and any Atlantic salmon will be safely moved upstream of the project.

The dewatering of the stream inside the cofferdam would have a lethal effect on any fish left inside the cofferdam, but given the evacuation plan proposed by CMP, it is anticipated that any salmon in the work area will be successfully transported to a safe location; thus, no effects to Atlantic salmon from dewatering the cofferdams are anticipated . If any Atlantic salmon are detected and captured they will be released upstream of the project site so that they can continue their migration to spawning habitat.

Adverse effects could result from the herding, capturing and handling of these fish. Studies have shown that all aspects of fish handling, such as dipnetting, time out of water, and data collection like measuring the length, are stressful and can lead to immediate or delayed mortality (Murphy and Willis 1996). Direct mortality may occur when fish are handled roughly, not properly restrained, sedated during handling, or kept out of the water for extended periods. To minimize any injury or stress to Atlantic salmon captured during construction of the cofferdam, only qualified fisheries biologists will be allowed to handle fish and all personnel involved with electrofishing will have appropriate experience with salmonids. Risk of injury will be further minimized by: 1) ensuring minimal handling time (no data will be collected from individual Atlantic salmon other than to record the number of salmon captured); 2) ensuring minimal time that fish are held out of water and the stream; and 3) using transfer containers with aerated stream water of ambient temperature. With the incorporation of these measures it is not anticipated that any Atlantic salmon will be injured or killed due to handling and their relocation upstream of the project area.

Affected Atlantic salmon in Bond Brook

Atlantic salmon data collected in the stream since 2000 can be used to estimate the number of fish likely to be affected by the coal tar remediation project. However, it is extremely difficult to predict the number of GOM DPS Atlantic salmon that are likely to occur inside the work area, or to be forced to delay migration due to noise, vibration, sedimentation, or barrier effects.

Based on certain assumptions outlined below, it is possible to develop an estimate of the number of GOM DPS Atlantic salmon reasonably likely to be affected through entrapment in the work area and delay of migration. It is not anticipated that smolts will be in the action area during the summer (June 1 to October 1) when construction will occur; therefore, only Atlantic salmon adults are reasonably likely to be vulnerable to entrapment within the project area, or a delay in migration.

Since 2000, between 0 and 1 Atlantic salmon redds have been documented in the stream annually. The single redd was found upstream of the project area. As there is not anticipated to be an increase in available habitat or in the abundance of adults returning to the Kennebec River system, it is reasonable to assume that this range of spawning effort will continue in the stream in 2012. Although it is possible that the single redd could represent the presence of a female and several males, it is assumed that due to the small number of salmon in the Kennebec in any given year, and the lack of detections in Bond Brook despite annual surveys, that the single redd most likely represents the presence of just two adult Atlantic salmon. As such, NMFS does not expect any more than one pair of adult Atlantic salmon to be present in Bond Brook between June 1 and October 1. As noted above, NMFS recognizes that this estimate is based on several assumptions, including that (1) spawning activity in 2012 will be within the range of spawning activity documented between 2000 and 2011; and (2) the presence of one redd indicates that no more than 2 adults were present in the action area that year. In light of these assumptions, NMFS believes it is a reasonable estimate of the number of Atlantic salmon that could become entrapped in the work area or delayed in migration due to the in-water work associated with this coal tar remediation project. It is possible that adult salmon might use Bond Brook as thermal refuge in the summer months; however, such refugia have historically been available downstream of the coal tar deposits and the project will not affect the suitability of that habitat. NMFS does not anticipate that adult Atlantic salmon seeking thermal refugia will migrate through the work area.

5.2. Effects to Atlantic salmon Critical Habitat

The proposed action was evaluated to determine which of the critical habitat PCEs (and their associated physical and biological features) are present within the action area. The action area, defined as the entirety of Bond Brook, contains both the spawning and rearing and migration PCEs. However, the spawning and rearing PCE will not be directly affected as it is upstream of the project area. The habitat in the vicinity of the project contains habitat suitable for smolt and adult migration.

The discussion that follows lists each PCE and then discusses how the proposed coal tar remediation project may affect it.

5.2.1 Effects to the Spawning and Rearing Primary Constituent Element and its Seven Physical and Biological Features

The spawning and rearing PCE exists upstream of the project in Bond Brook. It is not anticipated that any of the physical and biological features will be affected directly by this project. The only effect to the upstream environment will be a temporary disruption of access to adult salmon migrating to spawning habitat.

5.2.2 Effects to the Migration Primary Constituent Element and its Six Physical and Biological Features

The coal tar remediation project could potentially result in a blockage of both upstream and downstream fish movements for approximately 10-14 weeks (8-12 weeks for the bank remedy, 2 weeks for the brook remedy). The proposed project will be constructed between June 1 and October 1 during the early portion of the upstream migration period for adult Atlantic salmon in the Kennebec River. Since the work window occurs after the downstream migration of Atlantic salmon smolts; these stream blockages will not affect smolt migration. Most adult Atlantic salmon ascend the Kennebec River beginning in the spring, with numbers peaking in June and July; hold in the vicinity of their natal streams until the fall, and spawn from late October to November. Of the Atlantic salmon passed between 2007 and 2010 at the Lockwood Dam in Waterville, 80% passed in June and July. No spawning has been documented in Bond Brook itself, despite its available habitat, since 2000.

Given the recent adult returns to the Kennebec River, in general, and Bond Brook specifically, the likelihood of an adult being present in the action area is very small. However, the habitat upstream of the project in Bond Brook is suitable for spawning and rearing and has been used as such in the past. Therefore, it is possible that a small number of adult salmon could be in the action area at the time of construction.

Adult salmon may be affected by the project by impacting the migratory corridor in such a manner as to delay or prevent their movement upstream. This effect could occur from an incidence of high turbidity that may cause the fish to hold or seek refuge; creation of a temporary impediment to passage through a stream bypass structure; or delay or injury from loud noise. CMP is addressing these effects by avoidance or minimization measures:

1. The effect of turbidity will be minimized by using cofferdams and turbidity curtains to isolate the excavation areas from Bond Brook, as well as by monitoring turbidity levels regularly and addressing elevated levels as soon as they occur according to CMP's approved Surface Water Monitoring Plan;
2. To ensure that adult Atlantic salmon are not within the project area, qualified CMP personnel, or a qualified consultant, will conduct regular surveys according to CMP's approved Fish Evacuation Plan (as revised March 30, 2011). This will minimize the probability that there will be any physical harm caused to an adult;
3. CMP will be in the water for as short duration as possible to minimize the extent of the effect.

NMFS has analyzed the potential impacts of this permitting action on designated critical habitat in the action area and has determined that given the above avoidance and minimization efforts the potential adverse effects to critical habitat will be insignificant because:

1. The project will not result in a permanent migration barrier;
2. The project will not increase the risk of predation;
3. Due to the proposed erosion and sedimentation control BMP's, is not anticipated that this project will significantly affect water quality;
4. The project will not significantly affect the forage of juvenile or adult Atlantic salmon because of the timing and location; and,
5. Any effects to the natural structure of the nearshore habitat are not expected to appreciably diminish the capacity of substrate, food resources, and natural cover to meet the conservation needs of listed Atlantic salmon.

6. CUMULATIVE EFFECTS

Cumulative effects are defined in 50 CFR §402.02 as those effects of future state or private activities, not involving Federal activities, that are reasonably certain to occur within the action area of the Federal action subject to consultation. 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.

Future state and private activities in the action area that are reasonably certain to occur during project operations are recreational fisheries, pollutants, and development and/or construction activities resulting in excessive water turbidity and habitat degradation. Atlantic salmon are also vulnerable to direct and indirect effects from these types of activities.

Impacts to Atlantic salmon from non-federal activities are largely unknown in Bond Brook. In December 1999, the State of Maine adopted regulations prohibiting all angling for sea-run salmon statewide. Although there have been no documented takes in the action area in recent years, it is possible that occasional recreational fishing for other fish species may result in incidental takes when fisheries operate in the presence of Atlantic salmon.

Despite strict state and federal regulations, both juvenile and adult Atlantic salmon remain vulnerable to injury and mortality due to incidental capture by recreational anglers and as bycatch in commercial fisheries. The best available information indicates that Atlantic salmon are still incidentally caught by recreational anglers. Evidence suggests that Atlantic salmon are also targeted by poachers (NMFS 2005). No estimate of the numbers of Atlantic salmon caught incidentally in recreational or commercial fisheries exists.

Atlantic salmon are also vulnerable to impacts from pollution and are likely to continue to be impacted by water quality impairments.

7. INTEGRATION AND SYNTHESIS OF EFFECTS

7.1. GOM DPS

Based upon the best available scientific information, NMFS has determined that the proposed study will result in disturbance and potential delay in migration of up to 2 adult Atlantic salmon. Based upon assumptions outlined in this Opinion, no incidental mortality of Atlantic salmon is likely to occur during the project.

In the discussion below, NMFS considers whether the effects of the proposed action reasonably would be expected, directly or indirectly, to reduce appreciably the likelihood of both the survival and recovery of the listed species in the wild by reducing the reproduction, numbers, or distribution of the GOM DPS of Atlantic salmon. The purpose of this analysis is to determine whether the proposed action would jeopardize the continued existence of Atlantic salmon. In the NMFS/USFWS Section 7 Handbook, for the purposes of determining jeopardy, survival is defined as, "the species' persistence as listed or as a recovery unit, beyond the conditions leading to its endangerment, with sufficient resilience to allow for the potential recovery from endangerment. Said in another way, survival is the condition in which a species continues to exist into the future while retaining the potential for recovery. This condition is characterized by a species with a sufficient population, represented by all necessary age classes, genetic heterogeneity, and number of sexually mature individuals producing viable offspring, which exists in an environment providing all requirements for completion of the species' entire life cycle, including reproduction, sustenance, and shelter." Recovery is defined as, "Improvement in the status of listed species to the point at which listing is no longer appropriate under the criteria set out in Section 4(a)(1) of the Act." Below, for each of the listed species that may be affected by the proposed action, NMFS summarizes the status of the species and considers whether the proposed action will result in reductions in reproduction, numbers or distribution of that species and then considers whether any reductions in reproduction, numbers or distribution resulting from the proposed action would reduce appreciably the likelihood of both the survival and recovery of that species.

Atlantic salmon in the GOM DPS currently exhibit critically low spawner abundance, poor marine survival, and are still confronted with a variety of threats. Numbers of endangered adult Atlantic salmon returning to the GOM DPS are extremely low.

In the NMFS/USFWS Section 7 Handbook, for the purposes of determining jeopardy, survival is defined as, "the species' persistence as listed or as a recovery unit, beyond the conditions leading to its endangerment, with sufficient resilience to allow for the potential recovery from endangerment. Said in another way, survival is the condition in which a species continues to exist into the future while retaining the potential for recovery. This condition is characterized by a species with a sufficient population, represented by all necessary age classes, genetic heterogeneity, and number of sexually mature individuals producing viable offspring, which exists in an environment providing all requirements for completion of the species' entire life cycle, including reproduction, sustenance, and shelter." Recovery is defined as, "Improvement in the status of listed species to the point at which listing is no longer appropriate under the criteria

set out in Section 4(a)(1) of the Act."

Because the proposed action will not result in the mortality of any Atlantic salmon, the proposed action will not reduce the numbers of Atlantic salmon in Bond Brook or in the GOM DPS as a whole. The proposed action is not likely to reduce distribution because the action will only temporarily impede Atlantic salmon from accessing spawning habitat upstream of the project area. The proposed action will not reduce distribution of Atlantic salmon throughout the GOM DPS. The action will not directly affect suitable spawning or rearing habitat. While the action may result in a delay in upstream spawning migrations by individual Atlantic salmon, this delay is not likely to be lengthy enough to prevent these individuals from spawning or result in any reduction in the number of eggs laid or other measurable indicator of reproductive fitness. As such, any temporary delay to spawning migrations will not result in any reduction in reproduction and there would be no reduction in future year classes due to the prevention of adults from reaching the spawning grounds upstream of the project site.

In certain instances, an action that does not appreciably reduce the likelihood of a species' survival might still affect its likelihood of recovery or the rate at which recovery is expected to occur. As explained above, NMFS has determined that the proposed action will not appreciably reduce the likelihood that Atlantic salmon will survive in the wild. Here, NMFS considers the potential for the action to reduce the likelihood of recovery. As noted above, recovery is defined as the improvement in status such that listing is no longer appropriate. Section 4(a)(1) of the ESA requires listing of a species if it is in danger of extinction throughout all or a significant portion of its range (i.e., "endangered"), or likely to become in danger of extinction throughout all or a significant portion of its range in the foreseeable future (i.e., "threatened") because of any of the following five listing factors: (1) the present or threatened destruction, modification, or curtailment of its habitat or range, (2) overutilization for commercial, recreational, scientific, or educational purposes, (3) disease or predation, (4) the inadequacy of existing regulatory mechanisms, (5) other natural or manmade factors affecting its continued existence.

The proposed action is not expected to modify, curtail or destroy the range of the species since it will not result in any reduction in the number of Atlantic salmon and since it will not affect the overall distribution of Atlantic salmon other than to cause minor temporary adjustments in movements in the action area. The proposed action will not utilize Atlantic salmon for recreational, scientific or commercial purposes or affect the adequacy of existing regulatory mechanisms to protect this species. As the proposed action is not likely to result in the mortality of any Atlantic salmon; there is not expected to be any effect on the persistence of the GOM DPS of Atlantic salmon and no change in the status or trend of the GOM DPS. As the proposed action will not result in any reduction in numbers or future reproduction, the action will not result in an appreciable reduction in the likelihood of improvement in the status of the GOM DPS. The effects of the proposed action will not hasten the extinction timeline or otherwise increase the danger of extinction since the action will not result in any mortality. The effects of the proposed action will also not reduce the likelihood that the status of the species can improve to the point where it is recovered and could be delisted.

As there is not likely to be any reduction in the reproduction, numbers or distribution of Atlantic salmon, there is not likely to be an appreciable reduction in the likelihood of survival and recovery of the GOM DPS of Atlantic salmon in the wild of lower Kennebec River populations or the species as a whole.

7.2. Critical Habitat

The complex life cycles exhibited by Atlantic salmon give rise to complex habitat needs, particularly during the freshwater phase (Fay et al. 2006). For example, in order for Atlantic salmon to persist in the freshwater environment, spawning gravels must be a certain size and free of sediment to allow successful incubation of the eggs and juveniles need diverse habitats that provide abundant food sources, including insects, crustaceans, and other small fish, places to hide from predators, and areas that act as refuge from changing environment conditions. Returning adults generally do not feed in fresh water but instead rely on limited energy stores to migrate, mature, and spawn. Like juveniles, they also require cool water and places to rest and hide from predators. During all life stages, Atlantic salmon require cool water that is free of contaminants. They also need migratory corridors with adequate passage conditions (timing, water quality, and water quantity) to allow access to the various habitats required to complete their life cycle.

As discussed in Section 3.2, critical habitat for Atlantic salmon has been designated for the GOM DPS and includes Bond Brook. The physical and biological elements of the spawning and rearing PCE as identified as essential to the conservation of the species are present in the action area of this consultation. However, the habitat is present upstream of the project and will not be directly affected by the proposed coal tar remediation project. The only effect to the upstream habitat will be a temporary disruption of adult salmon migrating to spawning habitat.

The physical and biological elements of the migration PCE as identified as essential to the conservation of the species are present in the action area of this consultation. Migration through the stream will be obstructed for approximately 12-14 weeks. Once the cofferdams and bypass structures are removed, the migration habitat will be restored to its original condition and there will be minimal permanent effect to the habitat. There will be permanent stream impact associated with the 6 inches of sediment cover placed over 18,000 sf below the high water line (Table 1). An additional 2,200 sf will be permanently affected by the placement of the RCM mats. This effect is not anticipated to significantly affect the migratory function of the habitat.

The spawning and rearing PCE, as well as the migratory PCE, are present in the mainstem Kennebec River 300 to 400 feet downstream of the project. It is possible that a small amount of sediment will be transported to the river but it is expected to be diluted quickly, and will not affect the functioning of the habitat. No part of this project will affect the suitability of the habitat at the outlet of Bond Brook that has been historically used as thermal refuge for adult salmon when the temperatures in the mainstem increase during the summer months.

PAHs and other toxic compounds degrade Atlantic salmon critical habitat by putting pathogens, solids, and toxic pollutants directly to the receiving waters. Bond Brook currently contains coal tar residuals from the former Augusta manufactured gas plant, and receives some seepage from the adjacent stream banks. This project is anticipated to minimize the probability of further seepage from soils in the bank, as well as further stabilize the tar mats under the stream bed itself. Therefore, this coal tar remediation project will improve water quality and, thus, benefit the critical habitat within Bond Brook.

NMFS has analyzed the potential impacts of this permitting action on designated critical habitat in the action area and has determined that the potential adverse effects to critical habitat will be insignificant.

8. CONCLUSION

After reviewing the best available information on the status of endangered and threatened species under NMFS jurisdiction, the environmental baseline for the action area, the effects of the action, and the cumulative effects, it is NMFS' biological opinion that the proposed action may adversely affect but is not likely to jeopardize the continued existence of the GOM DPS of Atlantic salmon. Critical habitat has been designated for the GOM DPS however, NMFS has determined that the potential adverse effects to critical habitat will not appreciably diminish the value of the primary constituent elements and; therefore, it is NMFS' biological opinion that the proposed action is not likely to result in the destruction or adverse modification of critical habitat designated for the GOM DPS of Atlantic salmon.

9. INCIDENTAL TAKE STATEMENT

Section 9 of the ESA prohibits the take of endangered species. The statutory definition of "take" includes "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 NMFS to include any act which actually kills or injures fish or wildlife (50 CFR §222.12). Such an act may include significant habitat modification or degradation that actually kills or injures fish or wildlife by significantly impairing essential behavioral patterns including breeding, spawning, rearing, migrating, feeding, or sheltering. Incidental take is defined as take that is incidental to, and not the purpose of, the carrying out of an otherwise lawful activity. The term "harass" has not been defined by NMFS; however, it is commonly understood to mean to annoy or bother. In addition, legislative history helps elucidate Congress' intent that harassment would occur where annoyance adversely affects the ability of individuals of the species to carry out biological functions or behaviors: "[take] includes harassment, whether intentional or not. This would allow, for example, the Secretary to regulate or prohibit the activities of birdwatchers where the effect of those activities might disturb the birds and make it difficult for them to hatch or raise their young" (HR Rep. 93-412, 1973). 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 under the ESA provided that such taking is in compliance with the terms and conditions of this Incidental Take Statement.

Amount or Extent of Incidental Take

The proposed construction of a coal tar remediation project in Bond Brook in Augusta, Maine has the potential to directly affect Atlantic salmon by delaying adult migration to spawning grounds upstream of the project area. NMFS considers such a disruption in migration harassment, and not harm, since it could potentially lead to a delay of normal spawning behavior, but is not likely to lead to injury to individuals. The early migration to spawning habitat by adult Atlantic salmon ensures that they have sufficient time to effectively reach spawning habitat. A potential 2.5 to 3.5 month delay due to the proposed project could significantly disrupt this migration, but is not likely to result in a failure to spawn or any reduction in individual fitness or reduction in size of future year classes due to a decrease in eggs laid or similar measure of reproductive output. In addition, any adult Atlantic salmon in the project area will be subject to disturbance by the fisheries biologists that will be conducting evacuation activities within the work area during the installation and removal of cofferdams and bypass structures. As part of these activities, any Atlantic salmon in the immediate vicinity of the project could be herded or captured in order to safely remove them prior to in-water work. Captured fish will only be held for the minimum time required to transport them immediately upstream of the project area. As no injury is anticipated, NMFS also categorizes this capture as harassment and not harm. Based upon Atlantic salmon abundance data collected by the MDMR in Bond Brook since 2000, the known quantities of salmon stocked by MDMR, and the assumptions outlined in the Effects of the Action (Section 5), NMFS anticipates that no juvenile Atlantic salmon and no more than 2 adult Atlantic salmon are likely to be affected during construction of this project. No lethal take of adult Atlantic salmon is anticipated or exempted and no take of any juvenile Atlantic salmon is anticipated or exempted.

Qualified CMP personnel, or a qualified consultant, will conduct daily visual surveys within the work area during the installation and removal of cofferdams and bypass structures. Additional surveys will be conducted on a weekly basis while the in-water structures are in place to document whether Atlantic salmon are being delayed (i.e. harassed) by the blockage of the stream channel. These monitoring surveys will provide a mechanism for documenting incidental take associated with the proposed project.

NMFS believes that this level of incidental take is reasonable given the seasonal distribution and abundance of Atlantic salmon in the action area. In the accompanying biological opinion, NMFS determined that this level of anticipated take is not likely to result in jeopardy to the species or destruction or adverse modification of critical habitat.

Reasonable and Prudent Measures

The measures described below are non-discretionary, and must be undertaken by ACOE so that they become binding conditions for the exemption in section 7(o)(2) to apply. ACOE has a continuing duty to regulate the activity covered by this Incidental Take Statement. If ACOE (1) fails to assume and implement the terms and conditions or (2) fails to require the applicant, to adhere to the terms and conditions of the Incidental Take Statement, the protective coverage of section 7(o)(2) may lapse. In order to monitor the impact of incidental take, ACOE or the applicant must report the progress of the action and its impact on the species to the NMFS as specified in the Incidental Take Statement [50 CFR §402.14(i)(3)] (See U.S. Fish and Wildlife Service and National Marine Fisheries Service's Joint Endangered Species Act Section 7 Consultation Handbook (1998) at 4-49).

NMFS believes the following reasonable and prudent measures (RPM) are necessary and appropriate to monitor and minimize the impacts of incidental take of Atlantic salmon:

1. Minimize the adverse effects to Atlantic salmon in Bond Brook by employing construction techniques that avoid or minimize adverse effects to water quality, aquatic or riparian habitats, and aquatic organisms.
2. Ensure completion of a monitoring, evaluation, and reporting program to confirm that the project is effective in avoiding and minimizing incidental take from permitted activities.
3. Minimize adverse effects to and incidental take of Atlantic salmon in Bond Brook by ensuring that fish passage and habitat connectivity through the project area is either maintained in its current condition or is improved.

To implement these reasonable and prudent measures, Terms and Conditions outlining monitoring and reporting requirements are given below. The RPMs, with their implementing terms and conditions, are designed to minimize and monitor incidental take resulting from the coal tar remediation project. NMFS believes that adherence to these conditions will reduce the potential for interactions with Atlantic salmon.

Terms and Conditions

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

1. The ACOE must ensure that CMP 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. The ACOE shall notify NMFS 48 hours prior to commencement of in-water construction. NMFS Point of Contact is Dan Tierney at 207-866-3755 or by email at Dan.Tierney@noaa.gov.

3. The ACOE must ensure that the contractor minimize the potential for impacts to Atlantic salmon and their habitat by conducting all construction activities for this project in accordance with an erosion and sedimentation control plan approved by CMP and ACOE.

4. The ACOE must ensure that the contractor develops a spill prevention and control plan for review and approval by ACOE and CMP before any construction begins. The plan must require all refueling or adding of other fluids to be done in an appropriate location at least 100 feet away from Bond Brook.

5. The ACOE must require that, to minimize the effects of entrainment and impingement from diversion pumps, CMP and their contractors use a screen on all intake hoses with a maximum mesh size of 0.25 inches. Furthermore, CMP shall insure that the approach velocity to the intake hose does not exceed 0.4 ft/sec.

6. The ACOE must require that CMP carefully monitor the actions described in this Opinion and document the level of incidental take. Documentation of all interactions with Atlantic salmon will be recorded during daily visual surveys during the installation and removal of in-water structures; as well as during weekly surveys when work is occurring within cofferdams. Within 30 days of the project's completion ACOE will submit a final report to NMFS that details how each of the Terms and Conditions were met, and any take of Atlantic salmon. Any interactions with Atlantic salmon must be reported to NMFS' Maine Field Office within 24 hours.

7. The ACOE must require that CMP evaluate fish passage conditions within the project limits according to a NMFS approved evaluation plan, in the first, third and fifth year post-construction. A post-construction monitoring plan shall be submitted to NMFS at least two weeks prior to the commencement of construction. The evaluation shall include stream flow measurements and photos of the stream channel. Photos shall be taken during the inspection to document characteristics of the brook remedy, and the stream upstream and downstream from the project area. CMP staff shall note any channel condition changes, including scour and bedload deposition in the project area. Velocities and depths should be compared to pre-construction conditions and to the known swimming capabilities of Atlantic salmon.

8. The ACOE and NMFS shall be provided with a summary of findings that provides information regarding depths and velocities within the reconstructed stream segment. These monitoring reports will be submitted in a timely fashion that will allow for the planning and implementation of any necessary instream construction work to correct identified fish passage problems during the following July 15 to September 30 work window (unless another work window is approved by NMFS). After the fifth year monitoring report is evaluated, the NMFS will determine the need for any further monitoring or corrective measures.

The reasonable and prudent measures, with their implementing terms and conditions, are designed to minimize the impact of incidental take that might otherwise result from the proposed action. If, during the course of the action, the level of incidental take is exceeded, reinitiation of consultation and review of the reasonable and prudent measures are required. ACOE must immediately provide an explanation of the causes of the taking and review with NMFS the need for possible modification of the reasonable and prudent measures.

The ACOE, as well as the applicants, have reviewed the RPMs and Terms and Conditions outlined above and all parties have agreed to implement all of these measures as described herein. The discussion below explains why these RPMs and each of the Terms and Conditions are necessary and appropriate to minimize or monitor the level of incidental take associated with the proposed action and how they represent only a minor change to the action as proposed by

CMP and ACOE.

RPM #1, as well as Terms and Conditions #1-5, are necessary and appropriate as they will require that CMP and their contractors use best management practices and best available technology for the stream crossings. This will ensure that take of listed Atlantic salmon is minimized to the extent practical. These procedures represent only a minor change to the proposed action as following these procedures should not increase the cost of the project or result in any delays or reduction of efficiency of the project.

RPM #2, as well as Term and Condition #6, are necessary and appropriate to ensure the proper documentation of any interactions with listed species as well as requiring that these interactions are reported to NMFS in a timely manner with all the necessary information. This is essential for monitoring the level of incidental take associated with the proposed action. This RPM and the Term and Condition represent only a minor change as compliance will not result in a significant increase in cost, delay of the project or decrease in the efficiency of the project.

RPM #3, as well and Term and Condition #7, are necessary and appropriate to ensure that the project does not create a physical barrier to adult migrating Atlantic salmon or to outmigrating smolts. This will ensure that there are no long-term effects to the species due to the placement of the brook remedy.

10. 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. NMFS has determined that the construction to be permitted by ACOE for the coal tar remediation project around Bond Brook in Augusta, Maine is not likely to jeopardize the GOM DPS of Atlantic Salmon or adversely modify or destroy critical habitat for listed Atlantic salmon. NMFS recommends that the following conservation recommendation be implemented:

- If any lethal take occurs, contaminant analysis of the specimen should be conducted. If this recommendation is to be implemented, the fish should be immediately frozen and NMFS should be contacted within 24 hours to provide instructions on shipping and preparation.

11. REINITIATION NOTICE

This concludes formal consultation on construction to be permitted by ACOE for the coal tar remediation project around Bond Brook in Augusta, Maine. As provided in 50 CFR §402.16, reinitiation of formal consultation is required where 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 taking specified in the incidental take statement is exceeded; (2) new information reveals effects of the action that may not have been previously considered; (3) the identified action is subsequently modified in a manner that causes an effect to listed species; or (4) a new species is listed or critical habitat designated that may be affected by the identified action. In instances where the amount or extent of incidental take is exceeded, Section 7 consultation must be reinitiated immediately.

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