United States Department of the Interior

FISH AND WILDLIFE SERVICE

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Ms. Cheryl Martin, Assistant Division Administrator
Federal Highway Administration
Maine Division
40 Western Avenue, Room 614
Augusta, ME 04330

November 21, 2012

Re: Formal Section 7 Consultation (Log No. 53411-2011-F-0349)

Dear Ms. Martin:

The enclosed document contains a biological opinion (Opinion) prepared by the U.S. Fish and Wildlife Service (Service) pursuant to section 7(a)(2) of the Endangered Species Act (ESA) on the effects of the Federal Highway Administration's (FHWA) proposed funding of a bridge replacement project on Route 1 at Orient, Maine. The subject bridge is located on Skagrock Brook. This project would be carried out by the Maine Department of Transportation (MEDOT) with funding provided by the FHWA. In this Opinion, the Service concludes that the action, as proposed, is not likely to jeopardize the continued existence of Atlantic salmon or result in the destruction or adverse modification of designated critical habitat for Atlantic salmon.

As required by section 7 of the ESA, the Service is providing an incidental take statement with this Opinion. The incidental take statement describes reasonable and prudent measures that the Service considers necessary or appropriate to minimize incidental take associated with this action. The incidental take statement sets forth nondiscretionary terms and conditions, including reporting requirements, that the Federal agency, and any person involved with this project, must comply with to carry out the reasonable and prudent measures. Incidental take from activities that meet these terms and conditions will be exempt from the ESA take prohibition. To ensure that this consultation remains valid, the Service requests that the action agency keeps us informed of any proposed changes to their funded activity and gets clearance from us before implementing such changes.

We appreciate your cooperation on this consultation and look forward to continued coordination regarding this project. If you have any questions about this consultation, please contact Wende Mahaney (Ext.118).

Sincerely,

Laury A. Zicari,
Field Supervisor
Maine Field Office

Enclosure

cc: Dan Tierney, NMFS – Orono, ME
Jay Clement, ACOE – Manchester, ME
Judy Gates, MEDOT – Augusta, ME

ENDANGERED SPECIES ACT SECTION 7 CONSULTATION

BIOLOGICAL OPINION

Lead Action Agency:	U.S. Department of Transportation, Federal Highway Administration
Activity:	Proposed funding of a bridge replacement project in Orient, Maine
Consultation Conducted By:	U.S. Fish and Wildlife Service, Maine Field Office [53411-2011-F-0349]

Approved By: 11-21-2012

Laury A. Zicari,
Field Supervisor

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INTRODUCTION

This constitutes the biological opinion (Opinion) of the U.S. Fish and Wildlife Service (Service) for a bridge replacement project that is proposed for funding by the Federal Highway Administration (FHWA) on behalf of the Maine Department of Transportation (MEDOT). The project is as follows: replacement of an existing bridge on Route 1 over Skagrock Brook at Orient, Maine. This project is located within the geographic range of the endangered Gulf of Maine Distinct Population Segment (GOM DPS) of Atlantic salmon (*Salmo salar*) and within designated critical habitat for salmon. This Opinion and incidental take statement were prepared by the Service in accordance with section 7(b) of the Endangered Species Act (ESA) of 1973, as amended (16 U.S.C. 1531, *et seq*.), and implementing regulations at 50 CFR 402. With respect to designated critical habitat, the following analysis relied only on the statutory provisions of the ESA, and not on the regulatory definition of "destruction or adverse modification" at 50 CFR 402.02.

The Orient project also needs to receive a permit from the U.S. Army Corps of Engineers (Corps) pursuant to section 404 of the Clean Water Act for the placement of fill materials in waters of the United States. While there are two Federal action agencies associated with the Orient project, the FHWA has agreed to serve as the lead Federal agency for purposes of ESA section 7 consultation with the Service.

Background and Consultation History

September 6, 2011 – Wende Mahaney meets with Eric Ham and Jeni Menendez (MEDOT) to review preliminary plans for the Orient project[1].

October 21, 2011 – MEDOT uploads a draft Biological Assessment on behalf of the FHWA to the ESA Web tool "online file cabinet" for this section 7 consultation.

December 1, 2011 – The Service provides comments to MEDOT and FHWA on the draft Biological Assessment.

February 7, 2012 – The Service receives a request for formal section 7 consultation from the FHWA for the Brownville and Orient projects, including a cover letter dated February 6, 2012 and final Biological Assessment.

February 14, 2012 – Jay Clement (Corps) and Mark Hasselmann (FHWA) send emails to Wende Mahaney (Service) confirming that the FHWA will serve as the lead Federal action agency for this section 7 consultation.

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[1] At this time, the Orient project was "batched" together with another proposed stream-crossing project in Brownville, Maine. Most of the events in this consultation history pertain to both projects. The Biological Assessment used for writing this Biological Opinion pertains to both the Orient project and the Brownville project. The Brownville project is currently being revised and a separate section 7 consultation will be completed at a later date.

March 1, 2012 – The Service sends a letter to FHWA acknowledging initiation of formal section 7 consultation. The Service's Opinion is due to FHWA by June 21, 2012.

June 22, 2012 – The Service notifies FHWA that the Opinion could not be finalized by the June 21, 2012 deadline.

August 31, 2012 – The Service sends a copy of the draft "batched" Opinion for both the Orient and Brownville projects to FHWA and the Corps.

October 1, 2012 – FHWA requests that the Orient and Brownville projects be separated for purposes of section 7 consultation because the Brownville project may undergo a design change, which would require additional work on the consultation for this project. The Orient project will remain as proposed, so section 7 consultation can be completed at this time.

October 9, 2012 – The Service requests comments from FHWA and the Corps on the draft Opinion so that a separate Opinion for just the Orient bridge project can be prepared.

October 9, 2012 – Jay Clement from the Corps informs the Service that the Corps has no comments on the draft Opinion.

October 10, 2012 – FHWA provides the Service with comments on the draft Opinion. These comments include those provided to FHWA by MEDOT.

The consultation history for this action also includes numerous other telephone conversations and email exchanges between staff of the Service, MEDOT, FHWA, and the Corps to share additional information or make relatively minor changes to the scope of the project.

This Opinion presents the Service's review of the status of Atlantic salmon, the condition of designated critical habitat, and the environmental baseline for the action area, as well as our analysis of all the effects of the action as proposed and the cumulative effects (50 CFR 402.14(g)). For the jeopardy analysis, the Service analyzes these combined factors to conclude whether the proposed action is likely to appreciably reduce the likelihood of both the survival and recovery of the affected listed species.

This Opinion is based on the following resources: 1) information provided in the FHWA February 6, 2012 initiation letter requesting formal consultation and the accompanying Biological Assessment; 2) Final Endangered Status for a Distinct Population Segment of Anadromous Atlantic Salmon (*Salmo salar*) in the Gulf of Maine (65 FR 69459; November 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 and 74 FR 39903; August 10, 2009 [revision]); 6) various field investigations; 7) numerous meetings and telephone conversations; and 8) other sources of information. A complete administrative record of this consultation will be maintained by the Service's Maine Field Office in Orono, Maine. The Service log number is 53411-2011-F-0349.

BIOLOGICAL OPINION

I. DESCRIPTION OF THE PROPOSED ACTION

For purposes of this consultation, the proposed action is the FHWA's funding of a Federal aid highway stream crossing project in Maine (Table 1). This project will involve work in a perennial stream that is within the geographic range of the endangered GOM DPS of Atlantic salmon and within designated critical habitat (Figures 1 and 2). The project is also located within the Penobscot Bay Salmon Habitat Recovery Unit (SHRU)[2]. This project will be carried out by the MEDOT, although the actual construction work may be done by hired contractors under the oversight of MEDOT staff. The Orient bridge replacement project is briefly described below, along with generic construction details which will apply to the project.

Table 1. Orient Bridge Replacement Project Details.

Project	PIN	Stream/River	HUC- 10 Watershed	Scope	Existing Structure
Orient	17877.00	Skagrock Brook	Mattawamkeag (1)	replacement	4.27 m by 12.19 m bridge (14 ft by 40 ft)

The Route 1 crossing of Skagrock Brook at Orient, Maine currently consists of a 4.27 m wide by 12.19 m long (14-foot wide by 40-foot long) span bridge. This structure is located about 18.5 km (11.5 mi) upstream from the confluence of Skagrock Brook with the Mattawamkeag River in Haynesville, Maine.

MEDOT proposes to replace the existing bridge with a four-sided 4.57 m wide by 2.44 m high (15-foot wide by 8-foot high) concrete box that is 21.33 m (70 feet) long. The concrete box will be embedded 0.61 m (2 feet) below the streambed and have stream substrate materials similar to those naturally occurring in Skagrock Brook placed inside to simulate a natural stream bed. MEDOT has designed the replacement structure as a concrete box instead of a new bridge because of the cost differences between the two structures. More details on this project are available in the FHWA Biological Assessment.

[2]As part of their process for designating critical habitat, the National Marine Fisheries Service established a geographic framework for recovery within the GOM DPS represented by three Salmon Habitat Recovery Units (SHRUs). The three SHRUs reflect the life history characteristics of Atlantic salmon populations in Maine, which show strong homing characteristics among local breeding populations but also some limited straying among populations (NOAA Fisheries Service 2009c).

Figure 1. Location of the MEDOT Orient bridge replacement project on Route 1 within the Gulf of Maine Distinct Population Segment.

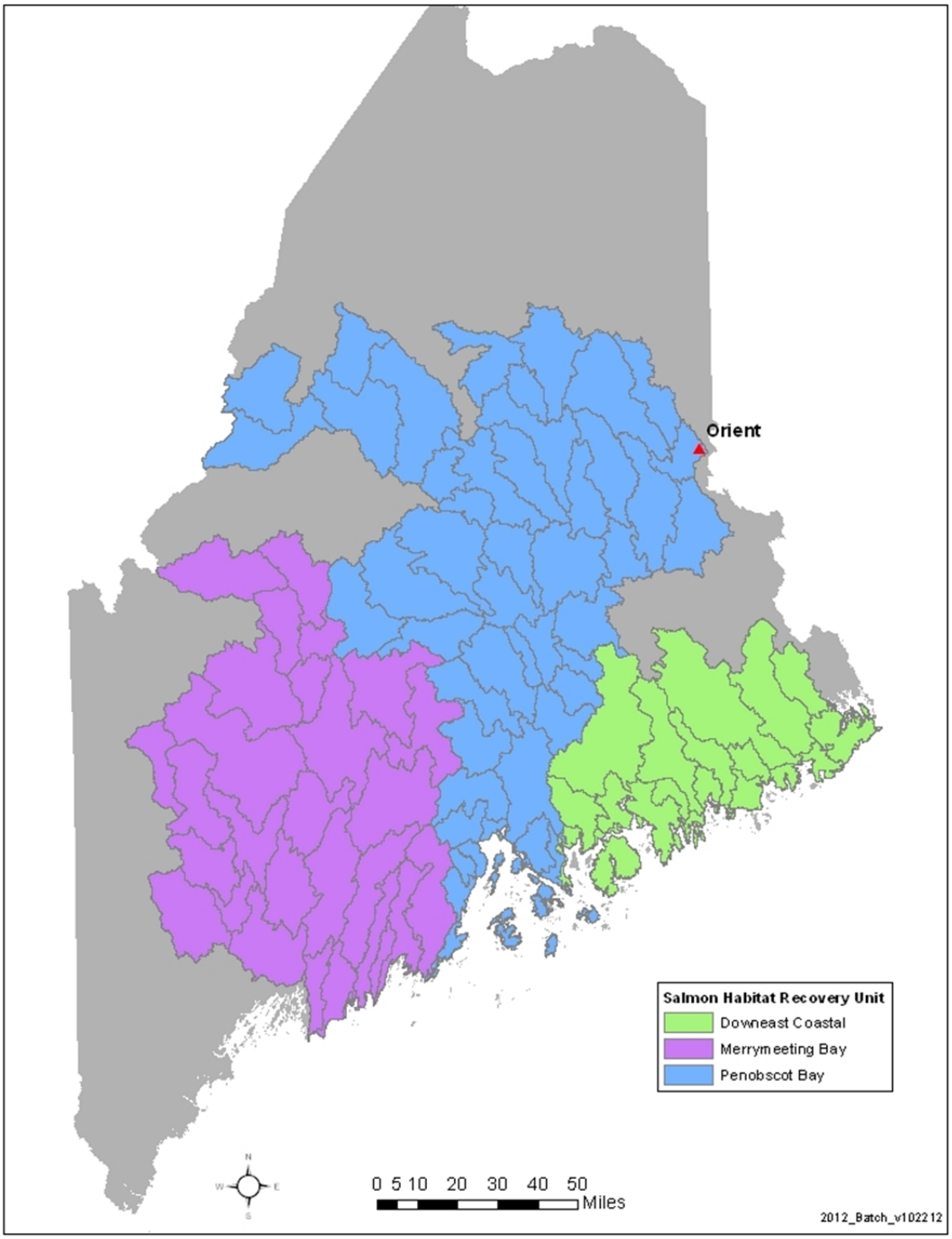
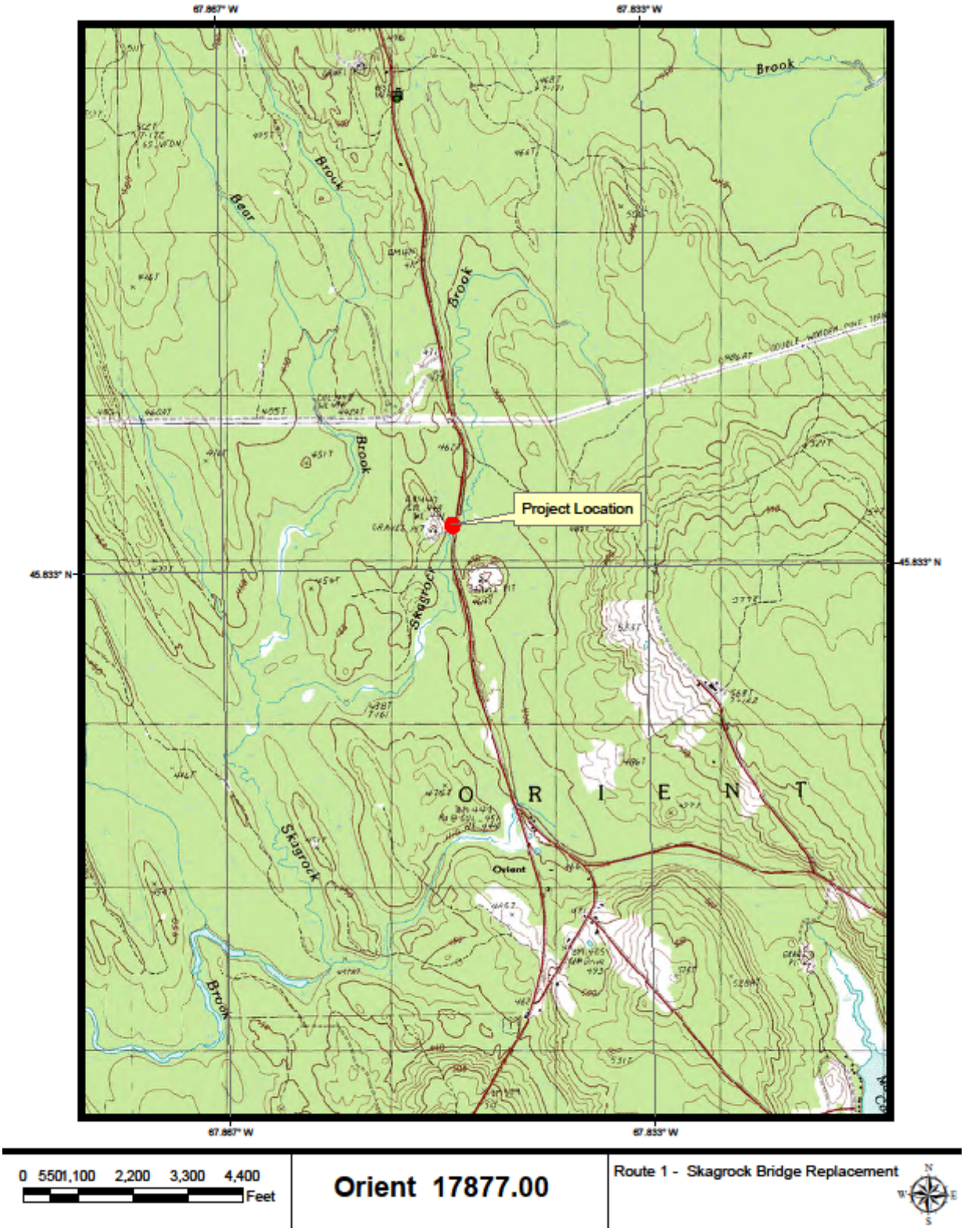


Figure 2. Location of the MEDOT Orient Route 1 bridge replacement project.



General Project Scope Descriptions

General descriptions of the construction process for bridge replacement projects are given below. While individual details may vary for the Orient project, these general scope descriptions apply to this project.

1.3.1 Cofferdam Descriptions

The initial step for instream construction work will be to dewater the work area, in conjunction with the installation of cofferdams, so that all instream construction work can be conducted in isolation from stream flow. In association with the installation of cofferdams, MEDOT will take steps to remove Atlantic salmon and other fish species from the instream work area. The specific approach to fish removal activities can vary from site to site, depending on a variety of factors including stream width, water depth, and substrate type.

Fish Removal Before Cofferdam Placement

1. Prior to the installation of cofferdams, water diversions and block nets, MEDOT biologists will do a survey of the general work area to check for the presence of adult salmon. If adult salmon are witnessed during the survey, MEDOT will contact the Service before proceeding with evacuation of the project work area. If Service staff member is not available to discuss the situation, MEDOT may proceed with evacuation following the procedures described below and in Appendix A (*Maine Department of Transportation Atlantic Salmon Evacuation Plan and Disinfection Procedures*). MEDOT biologists will attempt to herd any adult salmon out of the work area using a variety of net dragging techniques. This will take place prior to cofferdam placement to ensure that salmon have an evacuation route out of the work area. If cofferdams have been installed and an adult salmon is witnessed in the work area, water levels will be lowered to aid in capturing the salmon using methods described in Appendix A. Adult salmon will be relocated downstream of the project area.
2. Block nets, secured to the stream channel bed and banks, will be installed both upstream and downstream of the project site with the intention of keeping fish out of the instream work area.
3. Procedures in the *Maine Department of Transportation Atlantic Salmon Evacuation Plan and Disinfection Procedures* (Appendix A) will be followed to remove as many juvenile Atlantic salmon and other fish from the work area as possible before installation of cofferdams commences within the section of stream contained by the block nets.

Cofferdam Placement

Cofferdams, which can consist of various materials including sheetpile, sand bags, industrial sand bags, or an inflatable dam, will be placed to keep water out of the work area by blocking both upstream and downstream stream flows. Use of cofferdams allows all sediment released by construction activities in the dry work area to be removed before stream flow is restored.

1. The upstream cofferdam will be installed first. At Orient, a sand bag cofferdam is likely to be used but use of other materials is possible. Before installing a sand bag cofferdam, heavy duty plastic sheeting is laid along the width of the stream when practicable. The sand bags are then

placed on the plastic up to a height somewhat higher than the current level of the stream, working from the stream bank to the center.

2. The excess plastic will then be folded over the dam in the upstream direction and another layer of sand bags will be laid on the plastic to help seal the dam from infiltration. The plastic will be extended along the stream bottom as far upstream as practicable.
3. The downstream cofferdam will then be installed. This second dam is a safeguard against a failure of the upstream dam. Most cofferdams leak somewhat, so a pump may be placed within the work area to catch accumulating water, which would then be pumped into the "dirty water" treatment system, described below.

Stream Diversion

Stream flow will be diverted around the work area either by pumping it around through hoses or by diverting flow through a temporary culvert installed next to the stream using sand bags, sheet piles, jersey barriers, or similar materials. The description below outlines the process for using pumps and hoses to divert flow from the upstream side of a project area to an area downstream of the work site.

1. Prior to instream work, a diversion culvert may be placed under the road away from the stream to run a diversion hose. This protects the hose during the construction activities. Another common approach is running the hose over the road and blocking up around it with wood to protect it from vehicle traffic.
2. The intake hose will be placed at the upstream end of the culvert, just upstream of the cofferdam. In order to minimize impact on the streambed, the hose end will be placed in a bucket or the stream bottom will be lined with geotextile fabric. A screen that meets the criteria specified by the National Marine Fisheries Service (NOAA Fisheries Service 2008) will be placed at the intake hose end to prevent injury to fish and other aquatic organisms within the work area. To prevent fish entrainment into the hose, the screen openings shall not exceed 2.38 mm (3/32-inches) in the narrow direction. In order to prevent impingement of Atlantic salmon parr on the screened intake hoses, additional barriers consisting of either placing the intake within a 5-gallon bucket or creating a barrier with a 6.35 mm 1/4 inch) knotless block seine around the perimeter of the intake will be utilized. Other additional barriers, including barriers made of sandbags, plastic sheeting, or other suitable materials may be utilized depending on site conditions. The approach velocity will be kept below 0.06 m/sec (0.2 feet/sec) to avoid impingement of Atlantic salmon juveniles.
3. The gasoline diversion pump(s) will then be setup as far away from the stream as possible. The number and size of pumps used varies depending on the water level present when the work is being conducted.
4. The downstream discharge point within the stream channel will be protected from scour caused by high-velocity water by discharging pump hoses onto ledge, larger boulders, or non-woven geotextile fabric laid along the streambed.

"Dirty Water" Treatment System

After the cofferdams and water diversion pumps have diverted the stream around the work area, it will be necessary to dewater the work area itself. This "dirty water" will be pumped into a sediment basin for filtration before it is returned to the stream.

1. The system will be installed according to MEDOT's sediment and erosion control manual (MEDOT 2008a).
2. The sediment basin will either be comprised of hay bales or "dirt bags". Sometimes erosion control fabric is placed under the hay bale filter to catch sediment. These sediments will be disposed of away from the stream in a manner that they cannot erode back into the stream.
3. The sediment basin will be located close to the project location with adequate vegetation between it and the stream to act as a filter.
4. Pumping:
    a. Hoses will be set up between the treatment basin and the downstream scour pool within the work area.
    b. The "dirty water" pump(s) will then be started in the downstream scour pool.
    c. The pool will be slowly dewatered and any stranded aquatic organisms, including Atlantic salmon, will be caught and transferred out of the project area by a MEDOT biologist (See Appendix A for the Evacuation Plan).
5. The work area will then be pumped dry, with this water going to the "dirty water" treatment system prior to its release back into the stream.
6. If there is leakage around the cofferdam, or upwelling in the work area, pockets will be excavated in the work area to collect the water. This water will then be pumped into the "dirty water" system for treatment, prior to its release back into the stream.

1.3.2 Bridge Replacement

Once flow is diverted and the work area is dewatered, the bridge replacement can commence. At this point, the crews are working in the dry and there is no sediment release into the stream. All pumps, hoses, cofferdams, and sediment basins are monitored closely and maintained throughout construction. The old bridge will be removed and then replaced in the dry. When the structure and rip-rap installation is complete, all headwalls, disturbed areas, and permanent drainage ditches are stabilized with final treatments, utilizing temporary erosion control best management practices (BMPs) as necessary.

Closeout Procedures

1. Once all instream construction work is completed, the upstream "dirty water" pump will be stopped and removed.
2. The diversion pump system will be stopped and the upstream coffer dam will slowly be breached. The first flush of dirty water will be captured by the downstream "dirty water" pump, which will then pump the water into the sediment treatment system.
3. When the water behind the remaining intact cofferdam is clean, that dam will be breached as well.
4. The remainder of the upstream cofferdam and the diversion pump system will then be removed.
5. All disturbed areas will be stabilized, and all permanent erosion control BMPs will be installed.

1.1 Best Management Practices for Erosion and Sediment Control

All MEDOT construction project contracts, including the Orient project, are required to be built in accordance with the most recent version of the MEDOT Standard Specifications (MEDOT 2002). These specifications require that contractors prepare and submit a Soil Erosion and Water Pollution Control Plan (SEWPCP) that is then approved by MEDOT and fully enforced as a contractual agreement. This SEWPCP is prepared and performed in accordance with the most recent version of the MEDOT *Best Management Practices for Erosion and Sedimentation Control* (MEDOT 2008a). Section IID of the BMP manual, *Guidance for Sensitive Water Bodies*, specifies under what conditions a project will be designated as a "sensitive" project. Criteria include State or Federal designation of the water bodies, project scope of work, and proximity of the project to the water body. The project considered under this consultation is considered "sensitive" due to the presence of endangered Atlantic salmon and its critical habitat. A representative of the MEDOT Surface Water Quality Unit is assigned to all construction projects and will evaluate each project and provide a contract Special Provision to specify what additional requirements need to be addressed in the SEWPCP prior to construction to protect the water body and its aquatic life.

1.2 MEDOT Waterway and Wildlife Crossing Policy and Design Guide

The Orient project has been reviewed under and will be constructed following MEDOT's *Waterway and Wildlife Crossing Policy and Design Guide* (MEDOT 2008b). This document has been developed by MEDOT in cooperation with several State and Federal resource and regulatory agencies. Through implementation of this policy and design guide, MEDOT continues to support the goal of developing effective ways to build, repair and maintain the transportation infrastructure of Maine, while protecting important aquatic and surface water resources. As stated in their Biological Assessment, FHWA believes that the Orient project will pass all life stages of Atlantic salmon, expected to be in the action area, during the appropriate times of year.

1.3 Proposed Instream Work Window

The proposed Orient project occurs within the GOM DPS for Atlantic salmon and within designated critical habitat. Since Atlantic salmon could potentially be present in the vicinity of this project during any time of the year, all in-water work will occur during the standard summer work window of July 15 through September 30. This instream work window is a standard conservation measure intended to minimize the effects of construction activities during a time period when stream flows in Maine are typically at their lowest.

1.4 Summary of MEDOT Data Collection

The Orient project location has been assessed by qualified MEDOT biologists with experience in Atlantic salmon life history requirements and aquatic habitat determinations and who are familiar with MEDOT construction practices. In addition, throughout the data collection process for this consultation, MEDOT biologists have had discussions with Norm Dubé (retired as of July 1, 2012), Atlantic salmon Biologist with the Bureau of Sea-Run Fisheries and Habitat at the Maine Department of Marine Resources (MEDMR), who has been instrumental in providing historical information on Atlantic salmon studies in Maine. MEDOT also coordinated with the Service regarding species and habitat in the project area.

The bankfull width for Skagrock Brook in Orient (3.84 m) was estimated using regression equations from the U.S. Geological Survey (Dudley 2004). According to MEDOT, the site conditions at Skagrock Brook are not conducive to field measurements in the vicinity of the structure and would not predict an accurate bankfull width. MEDOT biologists have found that the predictions of such hydraulic analyses are very close to field-measured bankfull widths.

1.5 Action Area

The "action area" means all areas to be affected directly or indirectly by the Federal action and not merely the immediate area involved in the action (50 CFR 402.02). The Orient project occurs within the Penobscot Bay SHRU of the GOM DPS. The Orient project occurs in the Mattawamkeag River (1) HUC-10 watershed (HUC-10 code = 0102000303), which is designated as critical habitat for Atlantic salmon.

The action area for this project includes the following:

- An area of stream that is temporarily isolated and dewatered within a cofferdam so that construction work can proceed in the dry;
- An area downstream of the cofferdam that would experience a temporary increase in suspended sediment from some construction activities, particularly during removal of the cofferdam;
- An area of riparian land along the stream bank where vegetation is removed to facilitate construction, including access of equipment to the stream, and where soils may be disturbed during various construction activities;
- An area of stream bank and stream bottom that is rip-rapped to stabilize the inlet and outlet of the road-stream crossing structure;
- An area of stream channel upstream or downstream of the existing crossing structure that will be affected by the new structure being longer than the existing structure; and
- The stream area upstream of the crossing structure, including any upstream tributaries, which would be affected by the ability of Atlantic salmon and other fish to access upstream habitat.

The action area for Orient contains designated critical habitat for Atlantic salmon. Critical habitat for salmon includes two Primary Constituent Elements (PCEs), 1) spawning and rearing habitat and 2) migration habitat. As noted in the FHWA Biological Assessment, both PCEs are present within the action area of the Orient project.

Based on the construction overview provided by MEDOT for this project, combined with previous experience from similar road-stream crossing projects, Table 2 provides a reasonable estimate of the project's action area. The manner in which this action area table was developed is supported by several previous biological opinions written by the Service for MEDOT road-stream crossing replacement and repair projects.

During construction, cofferdams are anticipated to be placed within 9.14 m (30 feet) both downstream of the structure outlet and upstream of the structure inlet. MEDOT calculates the stream dewatered areas by multiplying the existing crossing structure length plus 9.14 m (8 feet 2.875 inches) at both ends times the bankfull stream width. Based on the expectation of relatively low stream flows during the summer instream work window and MEDOT experience, downstream turbidity effects are expected to be limited to within 30.48 m (100 feet) of the crossing structure.

Table 2. Estimates of the Action Area for the Orient Bridge Replacement Project.

	Stream	Bankfull (m)	Culvert Length (m)	Dewatered (cofferdams[1] + culvert length) (m)	Cofferdam + Dewatered Area (m^2)	Downstream Turbidity Impact[2] (m^2)	Total Stream Impact (m^2)	Riprap Impacts (m^2)	Stream Distance Upstream of Crossing (km)
Bridge Replacement Orient	Skagrock Brook	3.84	21.34	39.62	152.14	117.04	269.18	46.82	3.5

[1]Cofferdam foot print equals 9.14 m upstream of structure + 9.14 m downstream of the structure + culvert/structure length.

[2]The "small stream" potential downstream turbidity impact is assumed to equal 30.48 m (100 feet) based on previous MEDOT experience with similar projects.

II. STATUS OF THE SPECIES AND CRITICAL HABITAT

The ESA establishes a national program to conserve threatened and endangered species of fish, wildlife, plants, and the habitat on which they depend. Section 7(a)(2) of the ESA requires Federal agencies to consult with the Service, National Marine Fisheries Service (NOAA Fisheries Service), or both, to ensure that their actions are not likely to jeopardize the continued existence of endangered or threatened species or adversely modify or destroy their designated critical habitats. Section 7(b)(4) requires the provision of an incidental take statement that specifies the impact of any incidental taking and includes reasonable and prudent measures to minimize such impacts. This Opinion presents the Service's review of the status of each listed species considered in this consultation, the condition of designated critical habitat, and the environmental baseline for the action area.

The only other federally listed species under the jurisdiction of the Service that could occur in the vicinity of the Orient project is the threatened Canada lynx (*Lynx canadensis*). Critical habitat for Canada lynx has been designated in certain portions of northern Maine, however, not at this project location. Although the Canada lynx could occur in the general vicinity of the project, the proposed bridge replacement activities in and near Skagrock Brook would not be expected to affect lynx according to the section 7 Programmatic Agreement between MEDOT, the Service, and FHWA (signed December 16, 2008). Therefore, the Canada lynx will not be considered further in this consultation.

This section defines 1) the biological requirements of each listed species affected by the proposed action and 2) the status of each designated critical habitat relative to those requirements. Listed species facing a high risk of extinction and critical habitats with degraded conservation value are more vulnerable to the aggregation of effects considered under the environmental baseline, the effects of the proposed action, and cumulative effects.

2.1 Gulf of Maine Distinct Population Segment of Atlantic Salmon

2.1.1 Species Description and Listing History of the GOM DPS

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 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; November 17, 2000).

The GOM DPS of anadromous Atlantic salmon was initially listed jointly by the Service and the NOAA Fisheries Service (collectively, the Services) as an endangered species on November 17, 2000 (65 FR 69459). In 2009 the Services finalized an expanded listing of Atlantic salmon as an endangered species (74 FR 29344; June 19, 2009). The decision to expand the 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 consisting of Federal and State agencies and Tribal interests. Fay et al. (2006) conclude that the DPS delineation in the 2000 listing designation was largely appropriate, except in the case of large rivers that were partially or wholly excluded in the 2000 listing determination. Fay et al. (2006) conclude that the salmon currently inhabiting the 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 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) conclude that this group of populations (a "distinct population segment") met both the discreteness and significance criteria of the Services' DPS Policy (61 FR 4722; February 7, 1996) and, therefore, recommend the geographic range included in the new expanded GOM DPS.

The current 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: 1) Rumford Falls in the town of Rumford on the Androscoggin River; 2) Snow Falls in the town of West Paris on the Little Androscoggin River; 3) Grand Falls in Township 3 Range 4 BKP WKR on the Dead River in the Kennebec Basin; 4) 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; 5) Big Niagara Falls on Nesowadnehunk Stream in Township 3 Range 10 WELS in the Penobscot Basin; 6) Grand Pitch on Webster Brook in Trout Brook Township in the Penobscot Basin; and 7) 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 the natural populations; currently, such conservation hatchery populations are maintained at Green Lake National Fish Hatchery and Craig Brook National Fish Hatchery (NFH), both operated by the Service. 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).

2.1.2 Life History of Atlantic Salmon in the GOM DPS

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 sea and migrate to their natal stream to spawn; a small percentage (1 to 2 percent) of returning adults in Maine will stray to a new river. 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 selects sites for spawning in rivers. 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. This digging behavior also serves to clean the substrate of fine sediments that can embed the cobble and gravel substrates needed for spawning and consequently reduce egg survival (Gibson 1993). One or more males fertilize the eggs that the female deposits in the redd (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 fresh water until the following spring before returning to the sea (Fay et al. 2006). From 1996 to 2011, approximately 1.3 percent of the "naturally-reared" adults (fish originating from natural spawning or hatchery fry) in the Penobscot River were repeat spawners (USASAC 2012).

Embryos develop in redds 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 (greater than 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 two to three years before undergoing smoltification, the process in which parr go through physiological changes in order to transition from a freshwater environment to a saltwater marine environment. 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 Reiser 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; Hutchings 1986; Erkinaro et al. 1998a and 1998b; Halvorsen and Svenning 2000; O'Connell and Ash 1993; Erkinaro et al. 1995; Dempson et al. 1996; Halvorsen and Svenning 2000; 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 fresh water 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 various 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). 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, Lacroix and Knox 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) 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 also 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 immature adults located along the coasts of Newfoundland, Labrador, and Greenland, and in the Labrador and Irminger Sea in the later summer and autumn.

2.1.3 Status and Trends of Atlantic Salmon in the GOM DPS

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, a comprehensive time series of adult returns to the GOM DPS dating back to 1967 exists (Fay *et al.* 2006, USASAC 2001-2012) (Figure 2). 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; USASAC 2010; MASC 2011).

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 declined steadily between the early 1980s and the early 2000s but have been

increasing again over the last few years. The population growth observed in the 1970s is likely attributable to favorable marine survival and increases in hatchery capacity, particularly from the construction of Green Lake National Fish Hatchery 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 and early 2000s. The increase in the abundance of returning adult salmon observed between 2008 and 2011 may be an indication of improving marine survival.

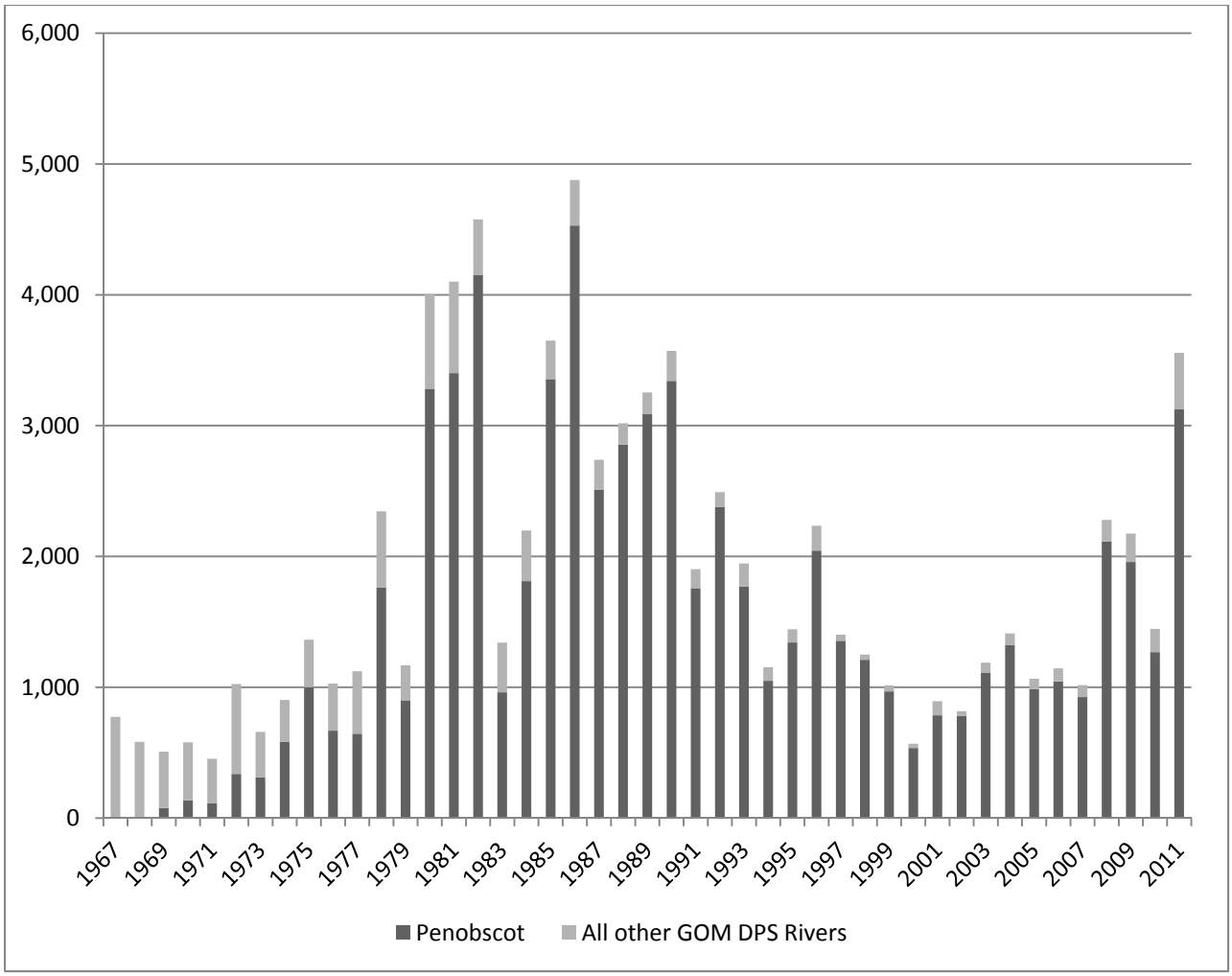


Figure 2. Adult returns to the GOM DPS Rivers between 1967 and 2011(Fay *et al.* 2006 and USASAC 2001-2012).

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 91 percent of all adult returns to the GOM DPS between 2000 and 2011. Of the 3,125 adult returns to the Penobscot in 2011, the vast majority are the result of smolt stocking; and only a small portion were naturally-reared. The

term naturally-reared includes fish originating from both natural spawning and from stocked hatchery fry (USASAC 2012). Hatchery fry are included as naturally-reared because hatchery fry are not marked and, therefore, 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 hatchery fry.

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 consistent hatchery supplementation of smolts. In the GOM DPS, nearly all of the hatchery-reared smolts are released into the Penobscot River - 554,000 smolts in 2011 (USASAC 2012). In contrast, the number of returning naturally-reared adults continues at low levels due to poor marine survival.

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 6 percent over the last 10 years) but appears stable. The conservation hatchery program has assisted in slowing the decline and helping to stabilize populations at low levels. However, stocking of hatchery products has not contributed to an increase in the overall abundance of salmon and as yet has not been able to increase the naturally-reared component of the GOM DPS. Continued reliance on the conservation hatchery program could help to prevent extinction but will not allow recovery of the GOM DPS, which must be accomplished through increases in naturally-reared salmon.

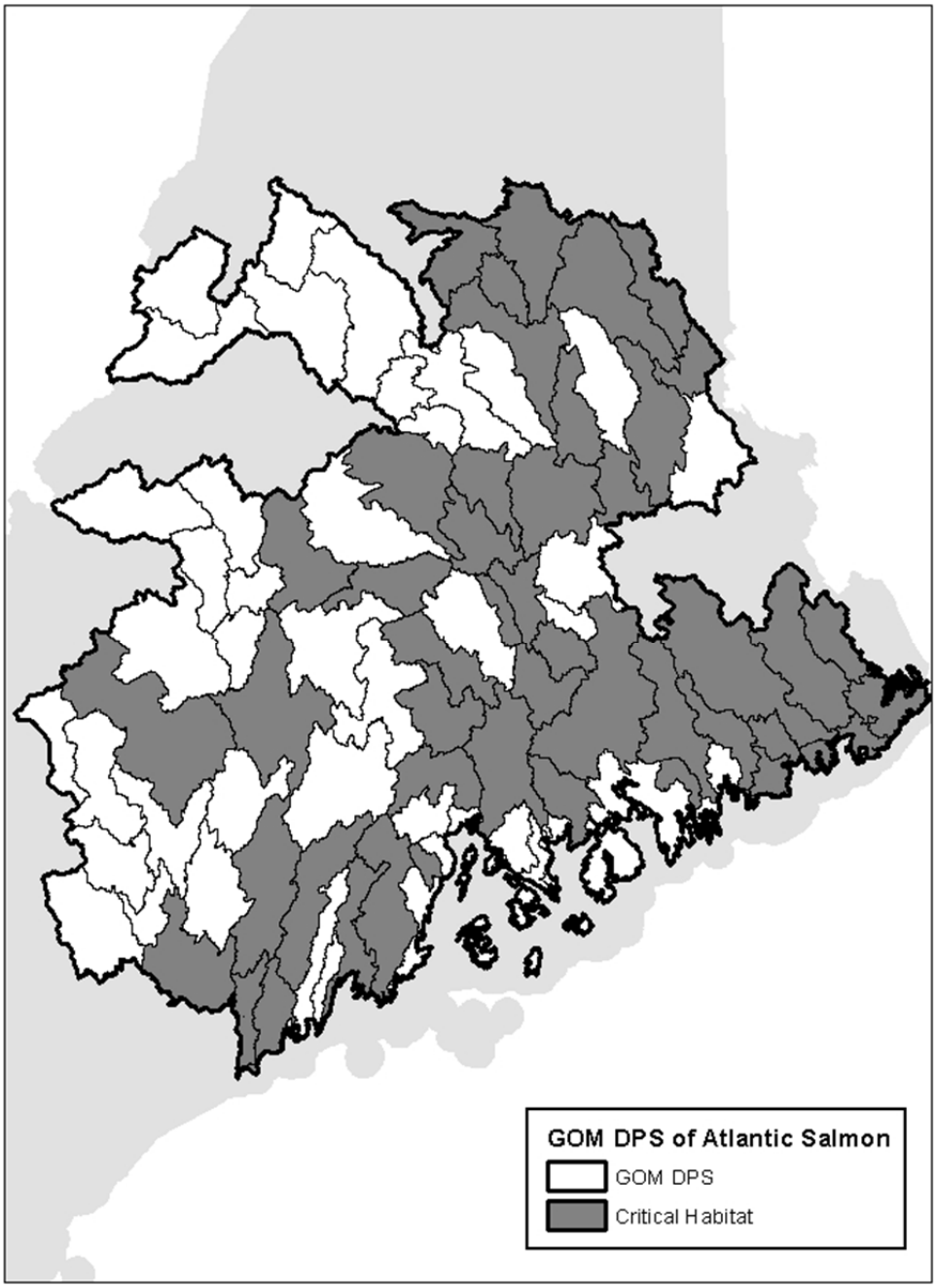
2.2 Critical Habitat for Atlantic Salmon in the GOM DPS

Coincident with the June 19, 2009 endangered listing, the NOAA Fisheries Service designated critical habitat for the GOM DPS of Atlantic salmon (74 FR 29300; June 19, 2009) (Figure 3). The final rule was revised on August 10, 2009 (74 FR 39003; August 10, 2009). In this revision, designated critical habitat for the expanded GOM DPS of Atlantic salmon was reduced to exclude trust and fee holdings of the Penobscot Indian Nation and a table was corrected.

2.2.1. Primary Constituent Elements of Atlantic Salmon Critical Habitat

Designation of critical habitat is focused on the known primary constituent elements (PCEs), within the occupied areas of a listed species which 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). The NOAA Fisheries Service 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.

Figure 3. HUC-10 Watersheds Designated as Atlantic Salmon Critical Habitat within 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

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

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

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

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

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

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

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

Physical and Biological Features of the Migration PCE

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

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

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

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

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

6. Freshwater migration sites with water chemistry needed to support 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 includes all perennial rivers, streams, and estuaries and lakes connected to the marine environment within the range of the GOM DPS, except for those areas that have been specifically excluded as critical habitat. Critical habitat has only been designated in areas (HUC-10 watersheds) 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 mark 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 of salmon habitat and, therefore, requiring special management considerations or protections include agriculture, forestry, changing land-use and development, hatcheries and stocking, roads and road-stream crossings, mining, dams, dredging, and aquaculture.

2.2.2. Salmon Habitat Recovery Units within Critical Habitat for the GOM DPS

In describing critical habitat for the GOM DPS, the NOAA Fisheries Service divided the DPS into three Salmon Habitat Recovery Units or SHRUs. The three SHRUs include the Downeast Coastal, Penobscot Bay, and Merrymeeting Bay. The SHRU delineations were designed by the NOAA Fisheries Service 1) to ensure that a recovered Atlantic salmon population has widespread geographic distribution to help maintain genetic variability and 2) to provide protection from demographic and environmental variation. A widespread distribution of salmon across the three SHRUs will provide a greater probability of population sustainability in the future, as will be needed to achieve recovery of the GOM DPS.

Areas designated as critical habitat within each SHRU are described in terms of habitat units. The quantity of habitat units within the GOM DPS was estimated through the use of a GIS-based salmon rearing habitat model (Wright *et al.* 2008). One habitat unit represents 100 m^2 of salmon rearing habitat. For each SHRU, the NOAA Fisheries Service determined that there were sufficient habitat units available within the currently occupied habitat to achieve recovery objectives in the future; therefore, no unoccupied habitat (at the HUC-10 watershed scale) was designated as critical habitat. A brief historical description for each SHRU, as well as contemporary critical habitat designations and special management considerations, are provided below.

Downeast Coastal SHRU

The Downeast Coastal SHRU encompasses fourteen HUC-10 watersheds covering approximately 747,737 hectares (1,847,698 acres) within Washington and Hancock counties. In this SHRU there are approximately 59,066 units of rearing habitat for Atlantic salmon among approximately 6,039 km of rivers, lakes and streams. Of the 59,066 units of rearing habitat, approximately 53,400 units of habitat in eleven HUC-10 watersheds are considered to be currently occupied. The Downeast SHRU has enough habitat units available within the occupied range that, in a restored state (*e.g.* improved fish passage or improved habitat quality), the Downeast SHRU could satisfy recovery objectives as described in the final rule for critical habitat (74 FR 29300; June 19, 2009). Certain Tribal and military lands within the Downeast Coastal SHRU are excluded from critical habitat designation.

Penobscot Bay SHRU

The Penobscot Bay SHRU, which drains approximately 22,234,522 hectares (54,942,705 acres), contains approximately 315,574 units of rearing habitat for Atlantic salmon among approximately 17,440 km of rivers, lakes and streams. Of the 315,574 units of rearing habitat (within 46 HUC-10 watersheds), approximately 211,000 units of habitat are considered to be currently occupied (within 28 HUC-10 watersheds). Three HUC-10 watersheds - Molunkus Stream, Passadumkeag River, and Belfast Bay - are excluded from critical habitat designation due to economic impact. Certain Tribal lands within the Penobscot Bay SHRU are also excluded from critical habitat designation.

Merrymeeting Bay SHRU

The Merrymeeting Bay SHRU drains approximately 2,691,814 hectares of land (6,651,620 acres) and contains approximately 339,182 units of rearing habitat for Atlantic salmon located among approximately 5,950 km of historically accessible rivers, lakes and streams. Of the 339,182 units of rearing habitat, approximately 136,000 units of habitat are considered to be currently occupied. There are forty-five HUC-10 watersheds in this SHRU, but only nine are considered currently occupied. Lands controlled by the Department of Defense within the Little Androscoggin HUC-10 and the Sandy River HUC-10 are excluded as critical habitat.

In conclusion, the June 19, 2009 final critical habitat designation for the GOM DPS (as revised on August 10, 2009) includes 45 specific areas occupied by Atlantic salmon that comprise approximately 19,571 km of perennial river, stream, and estuary habitat and 799 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. Within the occupied range of the GOM DPS, approximately 1,256 km of river, stream, and estuary habitat and 100 $km^2$of lake habitat have been excluded from critical habitat pursuant to section 4(b)(2) of the ESA.

2.3 Summary of Factors Affecting Recovery within the GOM DPS

There are a wide variety of factors that have and continue to affect the current status of the GOM DPS and its critical habitat. The potential interactions among these factors are not well

understood, nor are the reasons for the seemingly poor response of salmon populations to the many ongoing conservation efforts for this species.

2.3.1. Threats to the Species

The recovery plan for the previously designated GOM DPS (NOAA Fisheries and Service 2005), the latest Status Review (Fay *et al.* 2006), and the 2009 listing rule all provide a comprehensive assessment of the many factors, including both threats and conservation actions, that are currently affecting the status and recovery of listed Atlantic salmon. The Services are writing a new recovery plan that will include the current, expanded GOM DPS and its designated critical habitat. The new recovery plan will provide the most up-to-date list of significant threats affecting the GOM DPS. These are the following:

- Dams
- Inadequacy of existing regulatory mechanisms for dams
- Continued low marine survival rates for U.S. stocks of Atlantic salmon
- Lack of access to spawning and rearing habitat due to dams without fish passage facilities and poorly designed road-stream crossings

In addition to these significant threats there are a number of lesser stressors. These are the following:

- Degraded water quality
- Aquaculture practices, which pose ecological and genetic risks
- Climate change
- Depleted diadromous fish communities
- Incidental capture of adults and parr by recreational anglers
- Introduced fish species that compete with or prey on Atlantic salmon
- Poaching of adults in GOM DPS rivers
- Recovery hatchery program (potential for artificial selection/domestication)
- Sedimentation of spawning and rearing habitat
- Water extraction

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. Conversely, road-stream crossings that impede upstream passage are a more recent threat. Dams are considered to be one of the primary causes of both the historic declines and 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 [LWD] and boulders from rivers) and habitat connectivity (*e.g.*, poorly designed road-stream 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 today.
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 one of the significant threats to the GOM DPS today. Furthermore, most existing dams in the GOM DPS did 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 this poor survival 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.

2.3.2. Threats to Critical Habitat

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 and

rearing habitat and migration habitat for Atlantic salmon. These include agriculture, forestry, changing land-use and development, hatcheries and stocking, roads and road-stream crossings, 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.

Downeast Coastal SHRU

The Downeast Coastal SHRU once contained high quality Atlantic salmon habitat in quantities sufficient to support robust Atlantic salmon populations. Throughout the Downeast SHRU, many poorly designed road-stream crossings provide complete or partial barriers to salmon movements and also degrade the quality of spawning and rearing habitat, both upstream and downstream of the crossing. 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 rearing habitat within these two watersheds. In the Union River, which contains over 12,000 units of 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 rearing habitat, pH has been identified as possibly being the predominate limiting factor for Atlantic salmon. 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 rearing habitat in the Downeast Coastal SHRU.

Penobscot Bay SHRU

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 Federal Energy Regulatory Commission-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 habitat. Throughout the Penobscot SHRU, many poorly designed road-stream crossings provide complete or partial barriers to salmon movements and also degrade the quality of spawning and rearing habitat both upstream and downstream of the crossing.

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 (which was removed in 2012).

Merrymeeting Bay SHRU

Habitat throughout the Merrymeeting Bay SHRU was once of high enough quality to support a robust Atlantic salmon population. The mainstem Kennebec River has the highest biological value to the Merrymeeting Bay SHRU because it provides the central migration conduit crucial for much of the currently occupied habitat found in the Sandy River basin. The Sandy River has the greatest biological value for spawning and rearing habitat within the occupied range of the Merrymeeting Bay SHRU but is currently only accessible to adult salmon through a trap and truck program around the four lowermost dams on the Kennebec River. The construction of dams, and to a lesser extent pollution, has degraded habitat quality and accessibility and is likely responsible for the decline of Atlantic salmon populations within the Merrymeeting Bay SHRU. Today, dams are the greatest impediment, outside of marine survival, to the recovery of salmon in the 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 rearing habitat. Throughout the Merrymeeting Bay SHRU, many poorly designed road-stream crossings provide complete or partial barriers to salmon movements and also degrade the quality of spawning and rearing habitat both upstream and downstream of the crossing.

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. Furthermore, 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.

2.3.3. 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, Tribal and local government agencies, as well as many private conservation organizations. The 2005 recovery plan for the originally-listed GOM DPS (NOAA Fisheries Service and Service 2005) presented a strategy for recovering Atlantic salmon that focused on reducing the severest threats to the species and immediately halting the decline of the species to prevent extinction. The 2005 recovery program 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 GOM DPS salmon;

6. Conserve the genetic integrity of the GOM 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-stream crossings that block passage and 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 expanded listing and designation of critical habitat, the Services will produce a new recovery plan for Atlantic salmon. The new plan, which will include the Kennebec, Androscoggin and Penobscot watersheds, will address effects that dams and road-stream crossings have on the waters in the GOM DPS.

III. ENVIRONMENTAL BASELINE

The Environmental Baseline provides a snapshot of a species and its designated critical habitat's health or status at a given time within the action area and is used as a biological basis upon which to analyze the effects of the proposed action. Assessment of the environmental baseline includes an analysis of the past and present impacts of all State, Federal, or private actions and other human activities in the action area, the anticipated impacts of all proposed Federal projects in the action area that have already undergone formal or early section 7 consultation, and the impact of State or private actions that are contemporaneous with the consultation in process (50 CFR 402.02). An environmental baseline that does not meet the biological requirements of a listed species or its designated critical habitat may increase the likelihood that adverse effects of the proposed action will result in jeopardy to a listed species or in destruction or adverse modification of designated critical habitat.

3.1 Status of the Species in the Action Area

The Orient project is located within the Penobscot Bay SHRU of the GOM DPS of endangered Atlantic salmon. The Orient project is on Skagrock Brook, which is a tributary of the Mattawamkeag River. The Mattawamkeag River flows into the Penobscot River at Mattawamkeag, Maine, about 40 km (24.85 miles) upstream of Howland. From the project location on Skagrock Brook downstream to the Penobscot River is approximately 90 km (55.92 miles).

3.1.1. Adult Returns

Portions of the Penobscot River watershed, including the Pleasant and Piscataquis rivers, are intensely managed by State and Federal agencies to assist with recovery of the GOM DPS of

Atlantic salmon. In 2011, 3,125 adult sea-run salmon were caught at the Veazie Dam fishway trap, the first dam on the Penobscot River. A total of 736 salmon were transported to the Craig Brook NFH for use as broodstock at the hatchery, which ultimately produced 2.63 million eggs. The remaining adults were returned to the Penobscot River to spawn in various places throughout the watershed in the fall of 2011. As of October 30, 2012, only 624 adult salmon had been trapped at the Veazie Dam, with most (474) taken to Craig Brook NFH for spawning. Consequently, there are far fewer spawning adults in the Penobscot system in 2012 compared to 2011, and the number of expected redds would also be much lower. Since the year 2000, adult returns at the Veazie Dam have ranged between a low of 534 adults and a high of 3,125 adults.

3.1.2 Redd Surveys

Redd surveys, by foot or canoe, are used in select areas within the Penobscot watershed to assess Atlantic salmon spawning activity. Both test pits (preliminary digs early in the spawning season) and redds are counted, as weather and river conditions permit. High river flows, rain, cloudy weather and other factors can inhibit the ability to observe and count redds. In 2010, 108.4 km (67.10 miles) of stream reaches were surveyed over 11 days throughout the Penobscot watershed; 66 redds and 76 test pits were counted. In 2011, 149.29 km (92.76 miles) of stream reaches were surveyed over the course of 17 days; 327 redds and 226 test pits were counted throughout the Penobscot drainage. These surveys, however, only represent a portion of the total salmon redds in the Penobscot watershed. Salmon redd data for 2012 is currently being collected.

There are no redd surveys done in Skagrock Brook, however. Redd survey efforts in the Mattawamkeag River subdrainage (which includes Skagrock Brook) are generally limited in favor of other areas of particular management interest in the Penobscot watershed, given current agency staff constraints (Dubé et al. 2012). In 2011, one redd survey was conducted on November 9 on the East Branch Mattawamkeag River (upstream of where Skagrock Brook flows into the Mattawamkeag River). Under excellent survey conditions, nine (9) redds and nine (9) test pits were observed (Dubé et al. 2012). In 2008 and 2010 there were no redd surveys done in the Mattawamkeag watershed. In 2009, one reach in the East Branch Mattawamkeag and one reach in the Mattawamkeag River were surveyed. In the East Branch, seven (7) redds and three (3) test pits were counted; no redds or test pits were observed in the Mattawamkeag River.

3.1.3 Stocking

In 2010 a total of 1,822,000 Atlantic salmon juveniles were stocked throughout the Penobscot River watershed in an effort to increase future adult returns. This total includes 996,400 fry; 259,000 0+ parr; and 567,100 smolts. In 2011 more than 1,774,000 Atlantic salmon juveniles were stocked throughout the Penobscot River watershed. This total includes over 953,000 fry; over 267,000 0 plus parr; and over 554,000 smolts. In addition to juvenile salmon stocking, adults trapped at the Veazie Dam and taken to Craig Brook NFH are later returned back to the Penobscot River, either after spawning at the hatchery or in some cases before spawning when these adults are determined to be excess to the needs of the hatchery to produce eggs. Pre-spawn

adults are often stocked into tributaries of the Penobscot River. Typically each year, a few broodstock die at the hatchery, both before and after spawning.

No juvenile salmon have been stocked in Skagrock Brook. However, fry are stocked in the East Branch Mattawamkeag River, upstream of where Skagrock Brook enters the Mattawamkeag River (Table 6). Between 2002 and 2007, fry were also stocked in the West Branch Mattawamkeag River, with numbers ranging between 10,500 and 59,400 fry. The primary objective of fry stocking is to populate high quality rearing habitat that would otherwise be vacant or underutilized because of inadequate natural reproduction by adult salmon at the time of stocking.

Table 6. Fry Stocking in the East Branch Mattawamkeag River, 2006-2011 (Dubé et al. 2012).

Year	**No. Stream Reaches Stocked**	**Total Fry Stocked**
2006	_	42,600
2007	_	201,000
2008	4	252,500
2009	2	177,000
2010	4	210,400
2011	2	157,200

3.1.4 Juvenile Population Assessments

During the late summer, MEDMR biologists conduct electrofishing surveys to determine the presence and abundance of Atlantic salmon juveniles in locations where fry and parr have been stocked and in locations where salmon or known to have spawned. Surveys are done in multiple locations throughout the Penobscot River drainage. Juvenile salmon surveys are not conducted in Skagrock Brook, as this stream has not been the focus of salmon management activities.

The nearest juvenile surveys are done in the Mattawamkeag River subdrainage. No surveys, however, were done in 2011 or 2010. In 2009, relative abundance of juvenile salmon was

determined with one-run[3] electrofishing surveys in the East Branch Mattawamkeag River in eight (8) locations. The mean density for YOY was 11.4/100 m^2 and for parr was 6.3/100 m^2 (Dubé et al. 2010). One-run surveys were also conducted in 2008 in six locations on the East Branch Mattawamkeag River. Mean YOY density was 13.45/100 m^2 and mean parr density was 1.27/100 m^2.

3.2 Status of Critical Habitat in the Action Area

The Penobscot Bay SHRU contains 389,421 units (one unit = 100 m^2) of salmon rearing habitat, of which 250,132 units are designated as critical habitat. While designating critical habitat, the NOAA Fisheries Service developed a suitability rating system for salmon habitat. The Penobscot Bay SHRU contains 268,196 habitat units considered to be "suitable" or "highly suitable" as salmon habitat. Within critical habitat, the Penobscot Bay SHRU contains 158,471 habitat units that are suitable or highly suitable.

As the Services are developing the new recovery plan for the GOM DPS, recovery efforts are focusing on providing proper access for salmon to habitat units that are rated as at least suitable within those watersheds designated as critical habitat. Based on currently existing data for dams and road-stream crossings, the Penobscot Bay SHRU contains approximately 6,280 units of critical habitat that are both accessible to salmon and rated as suitable habitat. To achieve recovery of the GOM DPS, substantial progress will need to be made in the Penobscot SHRU to expand salmon access to suitable areas of critical habitat for juvenile rearing.

Salmon habitat has not been field mapped in Skagrock Brook. The juvenile rearing habitat model (Wright et al. 2008), however, indicates the likely presence of some juvenile habitat in this brook. The brook, from about 1,000 m below the Route 1 Bridge upstream to the perennial extent of the brook, has about 16.7 units of juvenile salmon habitat. Most of this juvenile rearing habitat is within the project action area. Most of Skagrock Brook between the Route 1 Bridge and its confluence with the Mattawamkeag River contains modeled juvenile rearing habitat, although this entire habitat area is rated as "marginally suitable" for Atlantic salmon. Although salmon are known in recent years to occur in the Mattamwamkeag River subdrainage, particularly the East Branch, it is unknown if salmon currently use habitat in Skagrock Brook. There is one known road-stream crossing on Skagrock Brook downstream of the Route 1 bridge in Orient; this crossing site is inaccessible and could not be surveyed to identify if it poses a barrier to upstream fish passage. Therefore, it is not definitively known if Atlantic salmon from the Mattawamkeag River could currently reach the Orient project site. For purposes of this consultation, however, we have assumed that salmon can access the project location.

3.3 Factors Affecting Species Environment within the Action Area

Skagrock Brook occurs in a watershed that is almost entirely forested, with abundant wetlands, streams, and ponds. Residential and commercial development and agricultural activities all

[3] One-run or 1-Run electrofishing surveys are a rapid assessment method used to determine either the relative abundance of salmon juveniles or the presence or absence of juveniles in a targeted area.

occur at a very low density in and around the action area. Logging occurred historically and continues today in some portions of the watershed. A utility right-of-way crosses Skagrock Brook north of the Route 1 road-stream crossing and runs roughly east-west across the watershed. In the year 2009, the town of Orient had a population of 136. There are no active Atlantic salmon restoration activities in the action area or anywhere else in Skagrock Brook. The nearest salmon stocking has occurred in the East Branch Mattawamkeag and West Branch Mattawamkeag rivers, downstream of the action area.

The existing Route 1 Bridge on Skagrock Brook is likely to have only very minor effects on salmon habitat because the bridge abutments span the bankfull width of the stream and there is natural stream substrate underneath the structure. There are no signs of erosion or sedimentation associated with the bridge. The bridge is not likely having any effect on the ability of salmon or other fish species to move either upstream or downstream through the crossing.

Although no specific information is available, salmon in the action area could be affected by recreational fishing for other fish species. It is currently illegal to fish for Atlantic salmon in Maine. Atlantic salmon parr are sometimes accidentally caught by recreational anglers pursuing other species, like brook trout. In some cases, these salmon are not released, as required by Maine law, because of misidentification of the fish. Intentional poaching of Atlantic salmon, particularly adults, does occur in Maine; it is unknown, however, if poaching affects salmon in the action area.

Given the Atlantic salmon's anadromous lifestyle and the long-distance migrations that would be necessary from the project action area through the Penobscot River and out into the ocean, it is likely that a variety of factors outside the action area are strongly influencing the currently very low population of salmon associated with the Mattawamkeag watershed and presumably Skagrock Brook. For example, poor marine survival rates, the cause(s) of which are not understood, are currently having a strong influence on low salmon populations throughout the Penobscot River watershed and throughout the GOM DPS.

IV. EFFECTS OF THE ACTION

This section of the Opinion analyzes the direct and indirect effects of the proposed action on the GOM DPS of Atlantic salmon and its critical habitat, together with the effects of other activities that are interrelated or interdependent (50 CFR 402.02; June 30, 1986). Effects of the action that reduce the ability of a listed species to meet its biological requirements may increase the likelihood that the proposed action will result in jeopardy to that listed species or in destruction or adverse modification of designated critical habitat. Indirect effects are those that are caused by the proposed action, are later in time, but are still reasonably certain to occur. Interrelated actions are those that are part of a larger action and depend upon the larger action for their justification. Interdependent actions are those that have no independent utility apart from the action under consideration.

4.1 Effects to Atlantic Salmon

4.1.1 Worksite Isolation - Cofferdams, Dewatering, and Fish Relocation

Replacement of a road-stream crossing requires instream work that is done in isolation from stream flows, typically through the installation of cofferdams and the use of pumps to divert stream flows around the work site. During this activity, individual Atlantic salmon may be killed, injured or temporarily disturbed or displaced by instream work. Isolation of a stream work area with a cofferdam, however, is an important conservation measure intended to minimize the overall adverse effects of construction activities on Atlantic salmon and their habitat from sedimentation and equipment working in the channel.

Dewatering of a stream inside a cofferdam would have a lethal effect on any fish left inside the cofferdam, but most fish in the work area will be successfully transported to a safe location before dewatering begins. Fish relocation or evacuation is another conservation measure that uses a sequence of actions to exclude fish from the work area. Nevertheless, adverse effects can result from the capture, handling, and relocation of fish from the work area, as well as the stranding of some fish inside the cofferdam.

Prior to worksite isolation and dewatering, specific protocols will be followed as described above in Section *1.3.1* to remove as many fish as possible from the area, including Atlantic salmon. The project area will first be surveyed for the presence of any adults. If adults are visually observed to be present, a variety of net dragging techniques will be used to herd adults out of the work area. Adults will only be handled when necessary to remove them from the work area using a special rubber "sock", as described in Appendix A.

Block nets will be installed both above and below the work area and properly secured to the stream channel, bed, and banks and then maintained throughout the project. These nets will minimize the opportunity for fish to enter the work site. Once procedures have been implemented to remove as many fish as possible from the general work area, cofferdams will be installed to isolate the road-stream crossing work site from flowing water.

Before or while the cofferdam is being dewatered, Atlantic salmon that don't move away and are subsequently captured inside the cofferdam will be relocated outside of the action area to suitable habitat according to the fish evacuation plan in Appendix A. Fish release upstream of the project site is preferred, as subsequent construction-related sedimentation events would not likely affect individuals upstream of the stream crossing (e.g., sediment released during removal of a cofferdam). Adults, however, may be released downstream if there is better access to suitable adult holding habitat.

Gear such as dip nets, minnow traps and seines should be used first, as practicable, to remove fish; electrofishing gear should be used last in an attempt to clear the work area. To minimize temperature-related handling stress to Atlantic salmon, the MEDMR recommends that electrofishing not be conducted in water temperatures above 23°C (MASC 2005). Given the July

15 to September 30 instream work window, during which stream temperatures can be at their highest, MEDOT may encounter stream temperatures above 23°C. Every effort should be made, however, to avoid electrofishing when water temperatures are above 23°C to minimize the risk to Atlantic salmon. Such efforts could include planning for fish evacuation first thing in the morning, when water temperatures are often cooler. If MEDOT finds it necessary to electro-fish when water temperatures are elevated above 23° C (73.4° F), higher salmon mortalities can be expected compared to the mortality rates typically associated with MEDMR electrofishing activities.

To minimize the stranding of fish caught inside a cofferdam as a result of dewatering, MEDOT (or approved consultants) will capture and remove as many Atlantic salmon and other fish species as possible. Capturing and handling salmon causes some physiological stress and can cause physical injury or death, including cardiac or respiratory failure from electrofishing (Snyder 2003). Studies have shown that all aspects of fish handling, such as dip-netting, time out of water, and data collection (e.g., measuring the length), are stressful and can lead to immediate or delayed mortality (Murphy and Willis 1996). Clément and Cunjak (2010) found a low incidence and severity of injuries to juvenile Atlantic salmon from electrofishing in New Brunswick, with injuries becoming more prevalent in larger parr. However, they recommend caution when electrofishing because sublethal effects other than physical injury remain largely unknown.

Direct mortality may occur when fish are handled roughly or kept out of the water for an extended time. Delayed fish mortality is often associated with a disease epizootic, which generally occurs from 24 hours to 14 days after handling. If a fish is injured during handling, disease may develop within a few hours or days. Examples of injuries which can lead to disease problems are loss of mucus, loss of scales, damage to the integument, and internal damage. Internal injuries occur when fish are not properly restrained or not sedated during handling. When proper precautions are not taken, it is common for fish to jump out of a worker's hand and fall onto a hard surface, resulting in internal injuries and mortality.

To minimize any injury, stress, or mortality of Atlantic salmon captured during fish relocation activities, only qualified MEDOT staff or consultants will be allowed to handle fish. All personnel involved with electrofishing will have appropriate experience with salmonids in Maine. Handling stress and risk of injury for salmon will be 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. To minimize adverse effects to Atlantic salmon, unapproved MEDOT staff, unapproved consultants, and contractors may not attempt to capture or handle any Atlantic salmon during the course of this construction project.

The Orient project has the potential to capture juvenile Atlantic salmon within the cofferdam areas. MEDOT estimates that for the Orient project, 152.14 m^2 of stream will be isolated by cofferdams and then dewatered (Table 2). This equates to approximately 1.52 units of juvenile rearing habitat at Orient that will be isolated and dewatered during instream construction work.

Baum (1997) reported that Maine Atlantic salmon rivers support on average between five and ten parr per 100 m^2 of habitat (or one salmon habitat unit), based on data collected by the MEDMR. In 2006, the MEDMR began using an electrofishing CPUE method to assess juvenile Atlantic salmon relative abundance and spatial distribution in the GOM DPS. CPUE is calculated for both parr and YOY as the number of salmon captured per minute of sampling. Although the primary goal of this work is to provide relative abundance information across a wide spatial scale, CPUE data can also be used to estimate juvenile salmon densities at a particular site. The MEDMR has developed regression equations to predict YOY and parr densities from CPUE relative abundance data (MEDMR 2011; 2012).

Juvenile salmon population data are not available for Skagrock Brook in Orient because this portion of the Penboscot Bay SHRU is not being actively managed for Atlantic salmon recovery at this time. The nearest location of juvenile assessment information is from the East Branch Mattawamkeag River, primarily in the townships of Forkstown and T3 R3 WELS, at least 20 river km from the Orient project site on Route 1. MEDMR conducted electrofishing surveys in 2008 and 2009, as reported above in Section 3.1.4. Juvenile densities ranged from a low of 1.27 parr/100 m^2 to a high of 13.45 YOY/100 m^2. Given the distance between these locations on the East Branch Mattawamkeag River, the lack of salmon stocking in any locations closer than the East Branch, and experience with other MEDOT projects in locations remote from active management activities targeted at Atlantic salmon restoration, we except that juvenile Atlantic salmon would currently be quite scarce in the Orient project area. Given this information, it would be reasonable to expect that only one (1) juvenile Atlantic salmon would be displaced from or captured inside the cofferdams at the Orient project. This number of fish is considered to account for any juvenile salmon which might be removed from the work area by other methods used prior to electrofishing, including "herding", dip-netting, seining, and trapping.

Despite precautions, some mortality is inevitable while electrofishing. The MEDMR annually reports to the Service information on juvenile salmon mortality associated with electrofishing activities in GOM DPS waters.[4] While the MEDMR usually handles a few thousand juvenile salmon each year during electrofishing work, known mortalities are generally less than two percent of total fish captured. The vast majority of the mortality is to YOY salmon. Recently, MEDMR staff instituted changes in operating protocols that have reduced electrofishing mortality of YOY salmon from 2.72 percent in 2001 to 0.44 percent in 2011 (Trial 2012). Total electrofishing mortality in 2011 for juvenile salmon was 0.69 percent. From 2007-2011, MEDMR reported a mean mortality of 1.38 percent for both YOY and 1+[5] or older parr combined, with the number of salmon handled ranging between 3,480 and 9,419 on a yearly basis.

[4] The MEDMR is authorized by the Service under section 10(a)(1)(A) of the ESA (Blanket Permit #697823) to conduct various research and recovery activities for GOM DPS Atlantic salmon, some of which may cause take of Atlantic salmon.

[5] 1+ parr refers to juvenile salmon during the period from July 1 to December 31 one year after hatching.

Given that MEDOT Environmental Office staff and consultants who will be electrofishing are experienced with handling salmonids in Maine and will follow protocols similar to those used by MEDMR, we expect a similar level of mortality during electrofishing efforts as that experienced by MEDMR staff. However, if electrofishing occurs during a time when the water temperature of Skagrock Brook is elevated above 23° C (73.4 ° F), when MEDMR staff would not conduct any electrofishing activity, higher than expected salmon mortality could occur. In either case, there is a small probability of mortality associated with electrofishing for the one (1) juvenile salmon expected to be encountered during fish removal activities at Orient.

Entrainment of fish in block nets could be an additional source of mortality associated with worksite isolation procedures. Experience with the use of block nets set around work areas at culvert replacement projects in Maine has not shown that fish from outside the work area become trapped in these nets (John Perry, MEDOT and Steve Koenig, Project SHARE; personal communications). In an Opinion for culvert replacement and removal projects in Idaho, the NOAA Fisheries Service (2006) concluded that the risk of fish mortality from entrainment on block nets was discountable. Therefore, we do not anticipate any additional capture and mortality of Atlantic salmon associated with entrainment on block nets.

Additionally, some mortality may occur if juvenile fish are missed or stranded in substrate interstices during salvage operations and then subsequently left inside a dewatered cofferdam. Highly territorial salmonids, such as Atlantic salmon, that hold station and establish territories to maximize profitability under one flow condition may be more vulnerable to stranding effects owing to their reluctance to abandon territories (Armstrong *et al.* 1998). For ESA-listed Pacific salmon and steelhead, the NOAA Fisheries Service calculates an expected stranding rate of 8 percent (of the total exposed population) for both electrofished and non-electrofished sites (NOAA Fisheries Service 2006). Furthermore, the relatively low voltages typically used in Maine when electrofishing in the GOM DPS, as a conservation measures to minimize injury or death of salmon from electrofishing, makes it possible that some juvenile salmon (especially YOY) could be left in the stream substrate when dewatering begins (N. Dubé, MEDMR and Scott Craig, Service; personal communications).

During dewatering, stranding does not always lead to mortality, as fish can survive for several hours in the substrate after dewatering. However, stranding over a longer time period (which would be typical for culvert replacement projects) or removal of stream substrate for project construction would result in mortality. In a field experiment conducted in cold water (less than 4.5°C), Saltveit *et al.* (2001) found that 60 percent of Atlantic salmon YOY became stranded during dewatering over a period of 42 minutes. After searching the substrate, about 39 percent of the stranded fish could not be found. YOY Atlantic salmon were affected more severely than older juveniles. Only about 10 percent of 1+ Atlantic salmon parr were stranded during daylight in water greater than 9° C. In general, the incidence of Atlantic salmon stranding is much lower during summer, when water temperature is relatively high compared to winter conditions. This is likely attributable to lower fish activity and a substrate-seeking behavior during the cold season. Stranding is also higher during the day, probably because salmon are predominantly active at night and more likely to move out of substrates.

We are not aware of data or literature that quantifies the stranding of juvenile Atlantic salmon in stream substrates after fish removal efforts, including electrofishing. Given the best available scientific information, however, it is assumed that some juvenile salmon will be left stranded inside a cofferdam, particularly in streams with coarse gravel and cobble substrate where small fish can be very difficult to detect and remove. When cofferdams are de-watered and construction activities begin to replace or remove the existing stream crossing (e.g., excavation of the substrate), any fish left stranded in the substrate will be killed. Therefore, the Service anticipates the death of all juvenile Atlantic salmon left stranded within the stream substrate within the footprint of a de-watered cofferdam after all fish removal efforts have been completed. For a given project, this unknown number of salmon is included in the estimated number of juveniles that would be displaced from or captured inside the cofferdams, as discussed above (i.e., one juvenile salmon at Orient).

Even though very few Atlantic salmon are expected to be injured or killed by capture and relocation activities, relocated fish will be temporarily displaced and disrupted from their normal behaviors. Atlantic salmon parr are highly territorial and actively defend their feeding territory to maximize their opportunity to capture prey items, such as aquatic invertebrates. Territory size increases with fish age and size. Atlantic salmon parr temporarily displaced from their territory by construction activities, particularly the de-watering of a section of stream, may be more vulnerable to predators, may be less able to capture prey, and may experience stress while looking for another suitable, unoccupied area of stream in which to establish a new territory. Once construction activities are finished and stream flows are returned, parr will be able to re-occupy juvenile rearing habitat.

The replacement concrete box at Orient will be embedded and backfilled with substrate materials similar to those found naturally in Skagrock Brook. Assuming that these streambed materials remain on the bottom of the concrete box, the replacement structure should provide stream habitat for salmon similar to what currently exists underneath the bridge. Juvenile salmon should be able to use the new road-stream crossing in a manner similar to their use of the existing structure.

In order to keep the stream flows diverted around the cofferdams for the duration of instream work, a pump will be used just upstream of the upper cofferdam. The intake hose has the potential to adversely affect fish, including juvenile Atlantic salmon, 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 (NOAA Fisheries Service 2008). Pump intake hoses without screens or with improper screens can result in fish being drawn into the pump (entrainment) and killed. Effects from impingement and entrainment can be avoided by putting a properly designed fish screen on the end of the pump intake hose.

To prevent impingement and entrainment of Atlantic salmon juveniles, MEDOT will use pump intake screens that are designed and sized to meet NOAA Fisheries Service (2008) criteria. With the implementation of this conservation measure, diversion pumps should have minimal, if any, effects on Atlantic salmon from impingement and entrainment. In order for this conservation

measure to be effective, however, pump details must be carefully planned to suit the project site conditions and then monitored throughout the period of pumping.

Adult Atlantic salmon are not expected in the vicinity of the Orient project during the summer work window, given the distance from the nearest known adult occurrence and recent spawning activity by Atlantic salmon in the East Branch Mattawamkeag River. The overall low numbers of adult spawners in the entire Penobscot River system further contributes to our expectation that adult salmon will not occur near the proposed Orient project. As of October 30, 2012, 624 adult salmon had returned to the Veazie Dam on the Penobscot River, with 474 salmon being taken to Craig Brook NFH and 150 salmon being returned to the river. Given the project location and the current very low numbers of adult salmon in the entire Penobscot River drainage, adult salmon are not expected to be affected due to activities associated with isolating the instream work area in Skagrock Brook.

4.1.2 Sedimentation Effects

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. Juvenile salmon could be present near the proposed stream crossing project, but as many fish as possible will be relocated away from the work areas, as discussed above. Fish removal and subsequent release upstream of the project site is preferred, as sediment impacts would not likely affect individuals upstream of the crossing. MEDOT's fish evacuation protocol calls for fish to be released upstream, when practicable, as a conservation measure to protect Atlantic salmon from construction activities.

The amount of sediment entering streams in association with the Orient project is expected to be relatively minor given 1) the numerous conservation measures proposed by FHWA and MEDOT to minimize erosion and sedimentation and 2) the limited duration of construction work (about 6 weeks). All instream work will be limited to the period of July 15 to September 30. Stream flows are usually lowest during the summer in Maine, consequently reducing the potential for rain and subsequent construction-site runoff to cause erosion and carry sediment into a stream. Generally, the longer the construction period, the greater the need for various erosion control measures to protect a stream from sediment inputs.

Limiting instream construction work to the summer low flow period will avoid all effects from sediment exposure to salmon redds during the period from egg-laying in the fall through post-hatching in the spring when alevins are still within the stream substrate. Salmon adults may be near construction sites during the summer; however, the Service expects that adults would leave any areas of short-term, elevated instream turbidity and therefore avoid any significant impairment in behaviors, such as feeding or respiration. Adult salmon, however, are not expected in the vicinity of the Orient project.

The Orient project will be constructed in accordance with the MEDOT sediment and erosion control manual (MEDOT 2008a). This project will also have an individual Soil Erosion and Water Pollution Control Plan (SEWPCP) that is approved and fully enforced by MEDOT. Because this project is located in habitat for an endangered species, the MEDOT manual designates this project as "sensitive" and requires that a combination of BMPs be used to protect the stream. At least one of the BMPs must be an erosion control BMP in addition to a sedimentation control BMP. A higher level of inspection and compliance assurance is required by MEDOT for all projects where endangered species and habitat are present (MEDOT 2008a).

Restricting instream work to a dewatered section of stream within cofferdams will minimize the amount of sediment mobilized and distributed downstream of the work site. Turbid water from within cofferdams will be pumped into a "dirty water" treatment system to minimize sedimentation impacts to the stream when the diverted water is returned downstream after treatment to remove sediments. The installation and removal of these cofferdams and the diversion of stream flow around the construction site, nevertheless, can result in some amount of sediment being dispersed into the stream. Construction-related disturbances in riparian areas near the stream also have the potential to result in soil erosion and sediment entering streams, particularly if there are rainstorms during periods when there are disturbed soils on construction sites. MEDOT anticipates removal of some riparian vegetation near the existing crossing structure - about 9.3 m^2 for Orient - primarily for construction access purposes. Strict adherence to the SEWPCPs and vigilant monitoring by MEDOT staff should minimize these various sources of erosion and resultant sediments reaching Skagrock Brook.

Atlantic salmon are adapted to natural fluctuations in water turbidity, such as during high water events from spring runoff. However, a variety of anthropogenic activities 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.

In a review of the effects of sediment loads and turbidity on fish, Newcombe and Jensen (1996) concluded that more than six 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. These effects, however, were observed during the fall and winter seasons, a time period when MEDOT will not be engaged in work activities that could release suspended sediment in association with the Orient project. 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).

The Service does not have sufficient information to compare the conclusions of Newcombe and Jensen (1996) with TSS levels that might be expected from the stream crossing replacement project covered by this Opinion. However, based on our knowledge of instream construction activities in Maine of a similar nature to the project discussed here, we would not expect construction-related TSS levels to reach those described by Newcombe and Jensen (1996). The muck, sand, and gravel stream substrates at the Orient project site pose a greater risk of construction activities mobilizing sediment in the water column compared to streams with coarser substrates. However, the sediment and erosion control measures that will be employed, including construction in the dry, should keep sediment effects on Atlantic salmon to a minimal level on a short-term basis (hours versus days or weeks). Based on observations by MEDOT staff at similar culvert replacement projects throughout the GOM DPS, suspended sediment plumes generally do not extend more than 30.48 m (100 feet) downstream of the work site in similar situations. Considering the expected small volume of suspended sediment likely to be introduced into the affected stream, any discharge is likely to quickly dissipate and return to background levels.

The effects of sediment on Atlantic salmon and their habitat will be most pronounced during cofferdam installation and removal, backfilling of road surfaces, and particularly when the diverted stream flow is returned through the dewatered work site following installation of the new concrete box. Suspended sediment pulses are likely to last from a few minutes to several hours. Because of the minor amount of construction-related sediment expected to reach this stream and because of the relatively small number of salmon expected to be in the action area, turbidity-related effects are expected to be minor and short-term. The Service expects any exposed fish to volitionally seek adjacent, less turbid habitats, thus avoiding direct sediment exposure. Once suspended sediment levels return to background levels, Atlantic salmon displaced from the action area would be expected to return and normal behaviors would resume (*e.g.*, foraging, defending territory). Such effects would not be expected to injure or kill salmon. These effects will be further reduced by the practice of preferentially releasing captured juvenile salmon *upstream* of the upper-most cofferdam or block net. These conclusions, however, are contingent on careful implementation of all related conservation measures by FHWA and MEDOT, including that almost all instream work is conducted in isolation from stream flows.

4.1.3 Effects from Hazardous Materials Associated with Construction

As a component of the SEWPCP for the Orient project, MEDOT or their contractor will develop and implement a Spill Prevention Control and Countermeasure Plan (SPCCP) designed to avoid any impacts to streams from hazardous chemicals associated with construction activities, 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 SPCCP and in a manner that avoids chemical or other hazardous materials getting into the stream. Petroleum-based materials, such as diesel fuel and oil, contain polycyclic aromatic hydrocarbons (PAHs). PAHs can be acutely toxic to salmonids and other aquatic organisms at high exposure levels or can cause sublethal effects at lower exposures (Albers 2003). Careful adherence to an approved SPCCP, as part of an overall SEWPCP, should make it highly unlikely that Atlantic salmon would be exposed to harmful chemicals from a spill or accident.

4.1.4 Effects on the Riparian Zone

The Orient project will require that some vegetation, including trees, shrubs, or the herbaceous layer, be removed from the stream banks to allow for construction access and other construction-related activities, including the placement of rip-rap to stabilize the road slopes around the crossing structure. Removal of riparian vegetation will be kept to the minimum necessary to access the site and complete construction, about 9.29 m^2 at Orient. Rip-rap will be used to stabilize the culvert inlet and outlet from scour.

Although rip-rap along stream banks can increase stream water temperatures due to solar radiation, the small amount of rip-rap proposed should not have a measurable effect on water temperature. Furthermore, minor vegetation removal should not result in any input of sediment into the streams, as long as appropriate erosion control BMPs, such as silt fence, are employed before any vegetation is removed. All disturbed areas not covered by rip-rap will be mulched and stabilized following construction (MEDOT 2008a).

4.1.5 Effects on Stream Connectivity and Aquatic Organism Passage

Road-stream crossing structures, particularly culverts, can have adverse effects on the passage of aquatic organisms, including Atlantic salmon. Reduced habitat connectivity was identified as a stressor to the GOM DPS when it was listed as endangered. Reduced connectivity prevents salmon from fully using substantial amounts of freshwater habitat throughout the GOM DPS and changes native fish community structure by preventing or impairing access for other fish species (74 FR 29367; June 19, 2009). The new recovery plan for the GOM DPS will provide updated information regarding habitat connectivity, primarily road-stream crossings, and will elevate the significance of this threat to Atlantic salmon. As such, the Service expects that future recovery efforts for Atlantic salmon will emphasize the replacement or removal of poorly designed road-stream crossing structures to improve freshwater habitat connectivity and quality in the GOM DPS. Such efforts are expected to be crucial to the future recovery of Atlantic salmon.

During construction of the Orient project, the use of cofferdams will temporarily restrict movements of Atlantic salmon and other aquatic organisms. Cofferdams, however, are a standard conservation measure used for instream construction projects to minimize the overall effects on aquatic life and habitat from various construction activities. The benefits of using cofferdams to minimize the effects of sedimentation and to protect aquatic life from damage by construction equipment outweigh the temporary blockage of movements by fish and other organisms. Once cofferdams are removed and normal stream flows are restored to the construction site, aquatic organisms will be able to reoccupy the instream work area that was temporarily made inaccessible due to the presence of cofferdams and the diversion of stream flow.

The proposed bridge replacement project on Skagrock Brook at Orient should not result in any long-term adverse effects on passage of Atlantic salmon or other native fish species through the

structure. Although an existing three-sided box with a natural stream bottom will be replaced by a four-sided concrete box, the new structure with a concrete bottom is not expected to adversely affect the ability of Atlantic salmon to pass through the structure. The new structure is wider (4.57 m) (15.4 ft) than the estimated bankfull width (3.84 m) (12.6 ft) of the brook and will be embedded into the stream bed to allow for the placement of natural stream substrate materials throughout the structure that generally matches the existing stream bed in the vicinity of the structure. Therefore, water velocities and depths through the new structure should be similar to those in the natural stream channel. The existence of natural stream substrate throughout the concrete box will also help to ensure that salmon and other fish movements will be similar to those in the natural stream channel. The gentle stream channel slope at the project site (1 percent both above and below the existing bridge) should facilitate keeping natural stream substrate materials inside the new box over the long-term, although materials will come and go as a result of natural stream processes.

4.2 Effects to Atlantic Salmon Critical Habitat

This critical habitat analysis determines whether the proposed action will destroy or adversely modify designated critical habitat for listed species by examining any change in the conservation value of the essential features of that critical habitat. This analysis relies on statutory provisions of the ESA, including the following: 1) section 3, which define "critical habitat" and "conservation"; 2) section 4, which describes the designation process; and 3) section 7, which sets forth the substantive protections and procedural aspects of consultation.

Designated critical habitat for Atlantic salmon within the GOM DPS consists of two PCEs, as follows: 1) spawning and rearing habitat and 2) migration habitat. Critical habitat for Atlantic salmon includes perennial rivers and streams, estuaries, and lakes. The proposed action will have both direct and indirect effects to salmon critical habitat. Some of these effects will be temporary and limited in both physical extent and duration. Others will be permanent or long-term, lasting for the functional life of the road-stream crossing. The following discusses the effects of the proposed action with reference to the two PCEs of critical habitat for Atlantic salmon and their associated biological and physical features that are identified as essential to the conservation of the GOM DPS (NOAA Fisheries Service 2009a).

In their Biological Assessment, FHWA identified the presence of both PCEs at the Orient project site. However, FHWA only identified the presence of one "biological and physical feature" for each of the PCEs. For the spawning and rearing PCE, FHWA identified the presence of *freshwater rearing sites with diverse food resources to support growth and survival of Atlantic salmon parr*. FHWA noted that the upstream habitat in Skagrock Brook is associated with a scrub-shrub wetland and may not be suitable as salmon habitat due elevated water temperatures and due to the lack of suitable substrate. FHWA further noted that suitable juvenile rearing habitat might be located further upstream (*i.e.,* upstream of the brook section associated with a large scrub-shrub wetland near Route 1).

For the migration PCE, FHWA identified the presence of *freshwater and estuary migration sites free from physical and biological barriers that delay or prevent emigration of smolts to the*

marine environment. FHWA noted that the stream habitat in the vicinity of the project could be used by juvenile salmon for migration.

4.2.1 Effects on the Spawning and Rearing Primary Constituent Element

In their Biological Assessment, FHWA did not identify the presence of Atlantic salmon spawning habitat in the action area for the Orient project, including habitat upstream of the Route 1 crossing. Furthermore, the Service does not have any information to indicate that there is salmon spawning habitat located within the action area. Therefore, the focus of this effects analysis will be on physical and biological features of critical habitat that support rearing of juvenile Atlantic salmon.

Non-spawning tributaries represent an important part of the habitat complex for juvenile Atlantic salmon. This fact is encompassed by several of the physical and biological features of the spawning and rearing PCE, including *freshwater rearing sites with diverse food resources to support growth and survival of Atlantic salmon parr* and *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.*

During construction of the Orient project, a section of stream will be completely dewatered (*i.e.*, the entire channel from one bank to the opposite bank), albeit temporarily, within cofferdams to allow construction work to occur in the dry. MEDOT estimates that the dewatered stream area will be about 152 m^2 for this project. This section of stream would likely be de-watered for as much as six weeks, during which time all juvenile rearing habitat inside the cofferdam would be unavailable and unsuitable for salmon. Given the July 15 to September 30 instream work window, there will be no effects to habitat during the time that salmon are spawning or when eggs and sac-fry are present in a redd. While de-watered and isolated by the cofferdams, juvenile rearing habitat will be unavailable and unsuitable for Atlantic salmon parr. Once the project is completed, the cofferdams removed, and normal stream flows are restored, the temporarily impacted juvenile rearing habitat should return to its prior condition.

De-watered parr habitat at the project site would experience a loss of aquatic invertebrates, which provide food for Atlantic salmon juveniles. This loss of food resources should be temporary; however, as aquatic invertebrates should recolonize the stream once flows are re-established. Since the stream habitat outside the footprint of the proposed box culvert would not be permanently altered in any way, its ability to support aquatic invertebrates after construction activities are completed should not change. There will likely be a period of time following restoration of stream flows where the parr habitat will immediately regain the habitat elements of space and water but will still lack in food resources until aquatic invertebrates are able to recolonize the stream substrate.

The existing and proposed road-stream crossing structures at Orient are both somewhat larger than the estimated bankfull width of Skagrock Brook. As discussed above under effects to the species, the Service does not believe that the bridge replacement project on Skagrock Brook will have an adverse effect on the use of upstream critical habitat by Atlantic salmon or other fish

species. Since the proposed box culvert at Orient is wider than the stream's bankfull width, this structure is only expected to have a very minor effect on the ability of LWD to pass through the structure.

The Orient project will have a rip-rap apron installed on the stream bottom at the inlet and outlet of the new road crossing structure. These aprons will affect approximately 27.87 m^2 of the bottom of Skagrock Brook. The rip-rap aprons will have a relatively minor spatial effect on salmon critical habitat and will replace the natural stream channel substrate with a more uniform rock structure. These rip-rap aprons should still provide some habitat value for juvenile salmon.

4.2.2 Effects on the Migration Primary Constituent Element

It is unknown if there is Atlantic salmon spawning habitat available upstream of the project location, so it is unknown if adult Atlantic salmon are using the project action area as a migration corridor to access spawning habitat. However, given that most of Skagrock Brook upstream of Route 1 is associated with open scrub-shrub wetlands, we would not expect salmon spawning habitat in this area. Juvenile salmon rearing habitat is present in the Skagrock Brook action area, so the migration PCE as it applies to downstream migration of salmon smolts is also present in the action area. The variety of movements made by juvenile Atlantic salmon in freshwater to utilize a wide range of habitats before they become smolts, including the movement of fry from redds, establishment of feeding territories by parr, and movements to and from parr winter habitat are considered an element of the spawning and rearing PCE rather than the migration PCE.

The Orient project would result in a complete, but temporary, barrier to all migration of Atlantic salmon during construction when cofferdams are installed in the brook. Given the proposed instream work window of July 15 to September 30, these barriers will not affect downstream migration of salmon smolts to the ocean, which occurs in the spring (typically April through June). During the summer, adult salmon inhabit temporary resting and holding areas in the vicinity of spawning habitat. It is possible that the cofferdam barriers could temporarily delay migration of an adult salmon through the action area to upstream resting or holding habitat if such habitat were to exist upstream of either project location. Given the very small number of adult salmon residing in the Mattawamkeag River watershed in recent years and the long distance from the nearest known salmon activity, it is unlikely that this project will actually prohibit the migration of an adult salmon to upstream habitat during the extent of instream construction activities.

Upon removal of the temporary cofferdams, the project site would regain its function as migration habitat for Atlantic salmon. Furthermore, the bridge replacement project on Skagrock Brook is not expected to have any long-term adverse effect on the ability of Atlantic salmon smolts or adults to migrate through the new box culvert because it will have a relatively natural stream bottom and water depths and velocities similar to the adjacent stream channel. Therefore, this project will not have an adverse effect on the migration PCE.

4.3 Potential Effects not Considered in this Biological Opinion

The Biological Assessment provided by FHWA did not include any plans for the Orient project. As such, there are some unknowns about site-specific conditions, project-specific construction techniques, final design plans, and final amount of habitat impacts for the proposed replacement road-stream crossing structure. As final project plans are developed by MEDOT, it is possible that these plans will reveal an effect to Atlantic salmon or critical habitat that has not been assessed in this Opinion. If this situation develops, it will be necessary for the FHWA to reinitiate section 7 consultation, as discussed below in section IX.

V. CUMULATIVE EFFECTS

Cumulative effects include the effects of future State, Tribal, local or private actions that are reasonably certain to occur in the action area considered in this Opinion. Future Federal actions that are unrelated to the proposed action are not considered in this section, because they require separate consultation pursuant to section 7 (a)(2) of the ESA.

FHWA and MEDOT did not identify any future development activities in the action area that are reasonably certain to occur and that are likely to affect Atlantic salmon or their critical habitat. Many activities that would affect Atlantic salmon or their habitat would require a Federal permit from the Corps due to impacts to water bodies, thus triggering the need for ESA section 7 consultation between the Corps and the Service.

Recreational fishing for other fish species or poaching in Skagrock Brook could result in cumulative effects to Atlantic salmon. We do not, however, have specific information about recreational fishing use of Skagrock Brook by anglers targeting other fish species and who might incidentally catch an Atlantic salmon. Until such time that salmon numbers increase substantially in the Mattawamkeag River watershed, the likelihood of recreational anglers or poachers encountering an Atlantic salmon in Skagrock Brook is very remote.

Forestry and agricultural activities could occur in the future in the action area. Most forestry and agricultural activities in Maine occur without any Federal agency involvement and, therefore, don't require ESA section 7 consultation. These activities could include new or repaired road-stream crossings, which could have both short-term and long-term effects on Atlantic salmon and their habitat. With the exception of road-stream crossings, timber harvest and other agricultural activities, when done in accordance with current best management practices, are generally thought to have only minor effects on Atlantic salmon and their habitat (Fay et al. 2006). Poorly designed road-stream crossings associated with logging and farm roads do result in a variety of adverse effects to both salmon and their critical habitat, including impairing upstream fish passage and causing erosion and sedimentation into the stream.

VI. CONCLUSION

This Opinion does not rely on the regulatory definition of "destruction or adverse modification" of critical habitat at 50 CFR 402.02. Instead, we have relied upon the statutory provisions of the ESA to complete the following analysis with respect to critical habitat.

After considering the current status of Atlantic salmon and its designated critical habitat, the environmental baseline, the effects of the proposed action, and the potential for future cumulative effects in the action area, it is the Service's biological opinion that the proposed action by FHWA – funding of a road-stream crossing replacement project at Orient, Maine - is not likely to jeopardize the continued existence of the GOM DPS of Atlantic salmon throughout all or a significant portion of its range. Furthermore, the proposed action is not expected to result in the destruction or adverse modification of critical habitat. In reaching these conclusions, the Service considered the best available scientific and commercial information regarding Atlantic salmon and the likely effects of the proposed action on this species and their critical habitat.

The Orient project will result in short-term adverse effects to Atlantic salmon and their habitat during construction activities. These effects are relatively small in spatial and temporal scope and in some cases will be reversed upon completion of construction (e.g., cofferdams will be completely removed from the stream bottom and normal stream flows will be returned to the de-watered work area). Construction activities are only expected to result in adverse effects to one juvenile Atlantic salmon and no adult salmon in Skagrock Brook. Many of the construction-related effects to salmon are not expected to result in mortality of the individual, but rather temporary relocation to another part of the stream or temporary disruption of normal activities, such as feeding. Mortality could result, however, from electrofishing, stranding inside a dewatered cofferdam, or other construction-related activities. These adverse effects on one individual juvenile Atlantic salmon are not expected to influence the overall population status of the Penobscot Bay SHRU or the entire GOM DPS, which at the present time is largely being sustained by conservation hatchery stocking.

Road-stream crossings have a variety of long-term effects on stream habitats, stream processes, and aquatic organisms. The Service believes that critical habitat within the action area of the Orient project on Skagrock Brook, including the upstream habitat of about 3.5 km (2.17 miles), will remain functional and continue to serve the intended conservation and recovery role for Atlantic salmon. Atlantic salmon of all life stages should be able to move through the proposed box culvert in a fashion commensurate with salmon movements in other areas of Skagrock Brook with a natural channel, given that the structure is wider than the stream's bankfull width and that the structure should support a relatively natural stream substrate on top of the embedded concrete bottom.

VII. INCIDENTAL TAKE STATEMENT

Section 9 of the ESA prohibits the take of endangered species without special exemption. The term take is defined to include harass, harm, pursue, hunt, shoot, wound, kill, trap, capture or collect, or to attempt to engage in any such conduct. Harm is further defined by the Service to

include an act that actually kills or injures wildlife. Such acts may include significant habitat modification or degradation that results in death or injury to a listed species by significantly impairing essential behavioral patterns, including breeding, feeding, or sheltering. The term harass is further defined by the Service as intentional or negligent actions that create the likelihood of injury to listed species by annoying it to such an extent as to significantly disrupt normal behavior patterns which include, but are not limited to, breeding, 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. Under the terms of section 7(b)(4) and section 7(o)(2), taking that is incidental to and not intended as part of the agency action is not considered to be prohibited taking under the ESA, provided that such taking is in compliance with the terms and conditions of this Incidental Take Statement (ITS).

7.1 Amount or Extent of Take

The Service anticipates that there will be incidental take of Atlantic salmon as a result of the proposed action. This take will be limited to juvenile Atlantic salmon. Incidental take caused by the adverse effects of the proposed action could include the following: 1) the capture and relocation of juvenile salmon during work area isolation and dewatering; 2) the mortality of juvenile salmon as a result of electrofishing or other capture methods used during fish relocation activities; and 3) the stranding death of juvenile salmon inside de-watered cofferdams.

The following summarizes the anticipated amount of incidental take associated with the Orient project, as derived from the analysis and discussion above in **Section IV EFFECTS OF THE ACTION**:

- One (1) juvenile Atlantic salmon that is either 1) displaced from or captured and temporarily relocated from the instream work area, 2) left stranded inside the cofferdams and subsequently killed in association with stream de-watering, or 3) killed as a result of electrofishing or other capture techniques used during fish relocation activities.
- No take of adult Atlantic salmon is expected or authorized.

7.2 Reasonable and Prudent Measures

Conservation measures designed to avoid and minimize effects on listed species and critical habitat are integral components of the proposed action, and the proposed project in Orient is expected to be completed consistent with these measures. We have completed our effects analysis accordingly. The measures described below are nondiscretionary and must be implemented by the FHWA (or MEDOT and their contractors) in order for the exemption in section 7(o)(2) to apply. The FHWA has a continuing duty to regulate the activities covered by this incidental take statement. The protective coverage of section 7(o)(2) will lapse if the FHWA fails to require adherence to all the terms and conditions of the incidental take statement or fails to exercise that discretion as necessary to retain the oversight to ensure compliance with these

terms and conditions. Further consultation may be required to determine what effect any modified action may have on listed species or designated critical habitats.

The Service considers the full application of conservation measures included as part of the proposed action and the implementation of the following reasonable and prudent measures to be necessary and appropriate to minimize the likelihood of incidental take of the Atlantic salmon associated with the Orient project. Any deviation from the following reasonable and prudent measures will be beyond the scope of this consultation and will not be exempted from the prohibition against take as described in this incidental take statement:

- Minimize the adverse effects to and incidental take of Atlantic salmon by employing construction techniques that avoid or minimize adverse effects to water quality, aquatic and riparian habitats, and all aquatic organisms.
- Minimize the adverse effects to and incidental take of Atlantic salmon related to aquatic habitat connectivity and fish passage by ensuring that the project is built as designed.
- Ensure completion of a monitoring, evaluation, and reporting program to confirm that this project has been effective in minimizing incidental take from the FHWA-funded activity and that the amount of allowable incidental take is not exceeded.

7.3 Terms and Conditions

In order to be exempt from the prohibitions of section 9 of the ESA, the FHWA, MEDOT, and all contractors must comply with the following terms and conditions, which implement the reasonable and prudent measure described above and outline the required monitoring and reporting requirements. These terms and conditions are nondiscretionary.

1. MEDOT shall hold a pre-construction meeting with appropriate MEDOT Environmental Office staff, other MEDOT staff, and the MEDOT construction crew or contractor(s) to review all procedures and requirements for avoiding and minimizing effects to Atlantic salmon and to emphasize the importance of these measures for protecting salmon and their habitat. FHWA, ACOE, and Service staff will attend these meetings as practicable.
2. All Atlantic salmon mortalities from electrofishing or other related activities will be reported to the Service (Tom Davidowicz at: 207/866-3344, Ext. 152; Fax: 207/866-3351; or Thomas_Davidowicz@fws.gov) within 48 hours of occurrence. Salmon mortalities shall be immediately preserved (refrigerate or freeze) for delivery to the Service office in Orono, Maine. If the Service is not available, contact the NOAA Fisheries Service in Orono, Maine (Dan Tierney; 207/866-3755) to arrange for delivery.
3. All instream work (which includes the installation and removal of cofferdams, as well as other activities) will be conducted during low stream flows from July 15 through September 30.
4. MEDOT and their contractors will minimize the potential for effects to Atlantic salmon and their habitat by conducting all construction activities for each project in accordance with the MEDOT-approved Soil Erosion and Water Pollution Control Plan. Instream turbidity will be visually monitored and all erosion controls will be inspected daily to ensure that the measures taken are adequate to protect the stream. If inspection shows that the erosion controls are ineffective, immediate action will be taken to repair, replace, or reinforce controls as necessary.

5. All areas of temporary waterway or wetland fill will be restored to their original contour and character upon completion of the projects.
6. Disturbed areas adjacent to the stream will be stabilized and re-vegetated with a seed mix appropriate for riparian areas in Maine.
7. The fish evacuation plan (Appendix A) must be implemented by appropriate MEDOT staff or consultants during construction and dewatering of all cofferdams to carefully remove fish from the instream work area. Minimize the use of electrofishing for fish removal by first using netting, trapping, or seining techniques to remove as many fish as possible before electrofishing.
8. To prevent entrainment of Atlantic salmon juveniles related to water diversions, MEDOT shall use a screen on each pump intake sufficiently large enough so that the approach velocity does not exceed 6.10 m sec^{-1} (0.20 feet sec^{-1}). Square or round screen face openings are not to exceed 2.38 mm (3/32 inch) on a diagonal. Criteria for slotted face openings must not exceed 1.75 mm (approximately 1/16 inch) in the narrow direction. These screen criteria follow those of the NOAA Fisheries Service (2008). Intake hoses shall be regularly monitored while pumping to minimize adverse effects to Atlantic salmon.
9. All cofferdams shall be removed from the stream immediately following completion of construction, allowing for minor delays due to high stream flows following heavy precipitation, so that fish and other aquatic organism passage is not unnecessarily restricted. If the project is not completed but there will be substantial delays in construction, cofferdams will need to be at least partially removed to allow passage of Atlantic salmon until construction resumes.
10. To minimize the spread of noxious weeds into the riparian zone, all off-road equipment and vehicles (operating off of existing open and maintained roads) must be cleaned prior to entering the construction site to remove all soil, seeds, vegetation, or other debris that could contain seeds or reproductive portions of plans. All equipment will be inspected prior to off-loading to ensure that they are clean.
11. MEDOT and their contractors will follow measures designed to avoid and minimize effects to streams from hazardous materials associated with construction activities. These measures include the following:

    - All vehicle refueling shall occur more than 100 feet from any water course.
    - All vehicles carrying fuel shall have specific equipment and materials needed to contain or clean up any incidental spills at the project site. Equipment and materials would include spill kits appropriately sized for specific quantities of fuel, shovels, absorbent pads, straw bales, containment structures and liners, and/or booms.
    - During use, all pumps and generators shall have appropriate spill containment structures or absorbent pads in place.
    - All equipment used for instream work shall be cleaned of external oil, grease, dirt, and mud. Any leaks or accumulations of these materials would be corrected before entering streams or areas that drain directly to streams or wetlands.

12. FHWA shall carefully monitor the action described in this Opinion and document the level of incidental take to ensure that the project is minimizing the take of Atlantic salmon. Within 90 days of completion of the project, FHWA shall submit a report to the Service summarizing compliance with all the terms and conditions of the ITS and

specifying the amount of incidental take associated with the project. This report should include as-built drawings, photographs, or other means to confirm that the project was built as proposed.

13. To minimize adverse effects to Atlantic salmon, ensure that salmon and other fish species are able to pass through the replacement box culvert. To ensure that stream habitat is not fragmented, MEDOT will monitor and evaluate the design and installation of the replacement structure on Skagrock Brook at Orient following procedures in Appendix B, Maine Department of Transportation Fish Passage Monitoring Plan. Specifically, MEDOT will use the procedures in part II of Appendix B to monitor and evaluate the structure during the first, third, and fifth years after construction. Over this monitoring period, measurements shall be taken 1) during low flows, when depths are more likely to be critical, and 2) during higher flow conditions, when velocities or turbulence are more likely to be critical (i.e., about average annual minimum and average annual), in order to sufficiently evaluate fish passage conditions. Monitoring reports will be submitted in a timely fashion that will allow for the prompt planning and implementation of any corrective measures that require instream construction work. In-water construction for any corrective actions shall be implemented during a July 15 to September 30 work window, unless another work window is approved by the Service. After the fifth year monitoring report is evaluated, the Service will determine the need for any further monitoring or corrective measures. Such monitoring will be used to evaluate MEDOT's existing fish passage design assumptions and to guide and improve the design of future stream crossings.

VIII. CONSERVATION RECOMMENDATIONS

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

- FHWA should fund or otherwise support research on the effects of culvert rehabilitation projects, including invert liners and slip liners, on fish passage, stream geomorphology, habitat connectivity, and other aspects of stream ecology.
- FHWA and MEDOT should collaborate to conduct monitoring of stream turbidity levels associated with various construction activities at several different project locations, preferably representing as much variation in site conditions as possible. Collecting these data will be useful for future section 7 consultations regarding MEDOT projects to assist in the assessing the effects of various construction activities on Atlantic salmon habitat and their habitat.
- MEDOT, FHWA, Corps, NOAA Fisheries Service, and the Service should explore development of standard local operating procedures ("SLOPES") or other programmatic approaches for section 7 consultations for ESA-listed fish species in Maine involving various types of road projects. These programmatic approaches should include

conservation measures that provide a net benefit for and contribute to recovery of listed species, including Atlantic salmon.

- FHWA and MEDOT should work with the Service and NOAA Fisheries Service to develop a strategy for assessing existing road-stream crossings and addressing identified problems on MEDOT-administered roads within watersheds occupied by ESA-listed fish species.

IX. REINITIATION NOTICE

This concludes formal consultation for the FHWA's proposed funding of one bridge replacement project to be carried out by the MEDOT at Orient, Maine. As provided in 50 CFR 402.16, reinitiation of formal consultation is required when discretionary Federal agency involvement or control over the action has been retained (or is authorized by law), and if: (1) the amount or extent of incidental take is exceeded; (2) new information reveals effects of the agency action that may affect listed species or critical habitat in a manner or to an extent not considered in this Opinion; or (3) the agency action is subsequently modified in a manner that causes an effect to the listed species or critical habitat not considered in this Opinion; or (4) a new species is listed or critical habitat designated that may be affected by the action. In instances where the amount or extent of incidental take is exceeded, any operations causing such take must cease, pending reinitiation.

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APPENDIX A: Maine Department of Transportation Atlantic Salmon Evacuation Plan and Disinfection Procedures

Qualified MaineDOT biologists will be capturing, handling, and removing fish from within cofferdams and water diversions prior to dewatering for projects where there is a concern that juvenile salmon might be trapped within the project area. Capturing and handling juvenile Atlantic salmon causes physiological stress and can cause physical injury or mortality; to minimize these effects the following procedures will be followed by MaineDOT during activities associated with projects in the batch consultation should Atlantic salmon be trapped during project activities:

1. An adequate number of MaineDOT Environmental Office staff will be onsite during construction and dewatering of all cofferdams and for fish salvage activities.

2. If it is possible that an adult salmon could be present in the work area, a visual survey of the work area to inspect for the presence of an Adult salmon will be completed. Further precautions for adult salmon will be followed after the visual inspection to ensure that adult salmon are removed from the work area prior to electro fishing.

3. MaineDOT Environmental Office staff will follow the Maine Atlantic Salmon Commission Disinfection Procedures (below).

4. Following installation of the upstream block net, haze fish out of the proposed dewatered sections by walking seines downstream from the upstream block net location to the end of the work site in an attempt to 'herd' fish out of the worksite. A downstream block net would then be installed and efforts to capture remaining fish with dip-nets would follow. Have MaineDOT fisheries biologists experienced with work area isolation, and competent to ensure the safe handling of all ESA-listed fish, conduct or supervise the operation

5. Install a block net or cofferdam downstream of the project site immediately after the sweep to ensure fish will not move back into the project area. The block net will be secured to the stream channel, bed, and banks until fish capture and transport activities are complete. Size and place the block net in the stream in such a way as to exclude ESA-listed juvenile salmonids expected to occur within the project vicinity at the time of work without otherwise impinging these fish on the net. Monitor the block net once a day to ensure that it is properly functioning and free of organic accumulate..

6. Use one or a combination of the following methods to most effectively capture ESA-listed fish and minimize harm (Figure 1). Fish salvage shall proceed from the least invasive method to most invasive.

   a) <u>Hand Netting</u>. Collect fish by hand or dip-nets, as the area is slowly dewatered.
   b) <u>Seining</u>. Seine using a net with mesh of such a size as to ensure entrapment of the residing ESA-listed fish. The bottom or lead line has lead weights strung or crimped onto it to weight the net. The top or float line includes cork, polystyrene foam, or plastic floats to keep the top of the seine near the water surface. The net is attached to wood or metal poles to handle the seine. Two persons hold the seine in a vertical position above the water and perpendicular to the flow at the downstream edge of a riffle. They then thrust the poles and lead line of the seine to the stream bottom. The poles are allowed to slant downstream so that the flow forms a slight pocket in the

seine. This procedure is continued from one shoreline across the width of the channel to the other shoreline so that the entire riffle is sampled. The seine is then lifted out of the water and the fish removed (Bramblett and Fausch 1991).

c) Trapping. Minnow traps (or gee-minnow traps) are net or wire enclosures that trap live fish. Fish swim through the funnel shaped openings and are guided to a narrow opening at the centre of the trap. These traps are best suited for collecting juvenile fish or small adult fish in pool habitat. Traps should be baited and fished overnight. In areas of moderate to high fish densities, maximum catches in minnow traps are approached within one to two hours, with catches dropping sharply when traps are fished longer than 24 hours between checks. For bait, salmon eggs are most widely used, but hamburger, canned cat food, salmon flesh, canned corn, shrimp, and sardines have been used successfully (Magnus et al. 2006).

d) Electrofishing. Before dewatering, electrofishing will be used as the last evacuation measure following the above other means of fish capture and if they are not practical or effective following NMFS (2000) guidelines found at: http://www.nwr.noaa.gov/ESA-Salmon-Regulations-Permits/4d-Rules/upload/electro2000.pdf.

   a. Prior to the start of sampling at a new location, water temperature and conductivity measurements must be taken to evaluate electroshocker settings and adjustments.
   b. Each electrofishing session must start with all settings (voltage, pulse width, and pulse rate) set to the minimums needed to capture fish. These settings should be gradually increased only to the point where fish are immobilized and captured, and generally not allowed to exceed conductivity-based maxima indicated in the NMFS guidelines. Only direct current (DC) or pulsed direct current (PDC) should be used.
   c. Electrofishing will not commence if the presence of an adult Atlantic salmon is suspected.

Figure 1. Examples of fish salvaging methods.

7. Handling of fish:

a) Juvenile Atlantic salmon will be netted (1/4" knotless nylon) and immediately placed in a disinfected 5-gallon bucket filled with aerated stream water of ambient temperature.

b) Adult Atlantic salmon will be crowded into a handling device utilized by Maine Department of Marine Resoruces. The device consists of a rubber tube that is closed on one end and open on the other (Figure 2). Small holes are placed in the closed end to allow some water out but allow all of the water to drain. Any adults salmon

captured this way will be moved immediately outside of the exclusion with the handling device and will not be held.

c) All other fish species will be placed in a disinfected 5-gallon bucket with aerated stream water of ambient temperature and released upstream is possible or downstream of the project if the upstream does not contain suitable habitat under assessment by the on site biologist.
d) Minimize the number of fish stored in each 5-gallon buckets used for handling bucket to prevent overcrowding.
e) Handling time will be minimized. Monitor water temperature in buckets and well-being of captured fish.
f) Release fish from the isolated reach into a pool or area that provides cover and flow refuge after fish have recovered from stress of capture. Fish release upstream of the project site is preferred as sediment impacts would not likely affect individuals upstream of the crossing, but downstream release may be necessary is upstream reach is not suitable habitat for release.

Figure 2- 'Rubber sock' for adult salmon handling

Photo courtesy of Maine DMR

8. If need be, all salmonids will be clearly photo-documented for identification purposes. Photos will not be taken of Adult atlantic salmon to ensure minimal handling time.

9. A report and any photographs of transferred salmon will be submitted to US Fish & Wildlife Service, NOAA Fisheries, the Maine Department of Marine Resources, the Maine Department of Inland Fisheries & Wildlife and the appropriate action agencies (ACOE and FHWA).

Due to variability in construction timing, potential scheduling conflicts, and other potential unforeseen issues, to ensure coverage and eliminate project delays several MaineDOT employees or their designees will be available during construction and dewatering of cofferdams. The list of qualified MaineDOT Environmental staff includes:

1. John Perry
2. Eric Ham
3. Richard Bostwick
4. Amanda Shearin
5. Jared Stanley
6. Ryan Annis
7. Mike Clark

In addition to the staff listed above, other Environmental staff members, including qualified fisheries consultants, may be added pending USFWS approval. Anyone electrofishing will be required to have experience electrofishing salmonids in Maine. MaineDOT may solicit the aid of fisheries biologists from the USFWS, NMFS or MDMR if agency staff are available to assist at the necessary time.

Biosecurity and Disinfection Guidelines for Field Work

Biosecurity guidelines are practical steps that can be taken to minimize the spread of unwanted organisms. The guidelines below are designed to provide direction to MaineDOT biologists working in Maine's lakes, rivers, and streams in order to minimize the potential for spread of aquatic species, particularly invasive species. These guidelines, which were adapted from the Maine Department of Inland Fisheries & Wildlife guidelines and have been written to separate aquatic plants, aquatic animals, and aquatic pathogens.

I. Equipment:

1 large (40+ gallon) trashcan
Portable hand-pump sprayer for field disinfection
Large stiff bristle brush
Spray bottle
Rubbing alcohol
Nolvasan disinfectant

II. Procedures to minimize the spread of aquatic plants

a. Personnel - visual inspection of personal equipment (i.e. boots/waders/gloves) with hand removal of plants before leaving area.
b. Other Equipment- *same as above*
c. Dip nets, trapnets and leads - aquatic plants must be removed from nets before they are moved between waters. Nets should be visually inspected on land with hand removal of plants before leaving the sampling area. After seasonal use, nets will be cleaned, thoroughly dried in direct sun or indoor storage area, and re-inspected to remove any remaining plant material. Ensure all net sections and components are thoroughly dry for a minimum of 3 days. When possible, clean/dry nets and leads should be used between waters.
d. Reporting Requirements - Aquatic plants of unknown species or plants known to be aquatic nuisance species should not be transported unless placed in a sealed container. Small specimens may be transported to the Maine Department of

Environmental Protection for species identification (DEP contact: John McPhedran (207) 287-2813).

e. Waters with Documented Infestations – Biological staff should be extra diligent when working on waters with known infestations to prevent the further spread of invasives. When possible, staff should minimize contact and disturbance of aquatic invasive plant beds to reduce the risks of spreading the plant within the water being sampled and elsewhere. A current list of known plant infestations is available at MDEP's website (www.maine.gov/dep/blwq/topic/invasives/doc.htm).

III. Procedures to minimize the spread of aquatic animals

a. Personnel- personal equipment (i.e. boots/waders/gloves) should be rinsed clean of all visible mud and aquatic debris.
b. Other Equipment - rinsed clean of mud and aquatic debris.
c. Dip nets, trapnets and leads - Remove as much mud and aquatic debris as possible on site. After seasonal use, trapnets should be transported to maintenance camp or other suitable location and cleaned, thoroughly dried in direct sun or indoor storage area, and re-inspected to remove any remaining material. Ensure all net sections and components are thoroughly dry for a minimum of 3 days. When possible, clean/dry nets and leads should be used between waters.
d. Reporting Requirements- Unknown specimens and known aquatic invasive species should be transported in sealed containers for identification. Identification of invasive aquatic species should be reported to Maine Department of Inland Fisheries & Wildlife (MDIF&W contact: John Boland (207) 287-5261.)
e. Waters w/ Documented Infestations – Biological staff should be extra diligent when working on waters with known infestations to prevent the further spread of invasives. In this case, nets should be cleaned, soaked in salt brine (3%) overnight to destroy freshwater aquatic organisms, rinsed, and dried in sunlight between uses.

IV. Procedures to minimize the spread of aquatic pathogens

a. Equipment - Field equipment that comes in constant contact with stream or lake water (i.e. waders, nets, seines, gloves, shocker wand and tail, buckets, measuring boards, etc.) should be cleaned & disinfected before use between waters. Disinfection for most equipment is accomplished with a 2oz. Nolvasan/gallon water solution in the large trashcan. Equipment should be allowed to set in solution for 10 minutes then rinsed thoroughly.

   Equipment should be sprayed with a hand-pump style sprayer and allowed to set during transit to the new water.
   Delicate equipment such as electronic scales, conductivity meters, thermometers, etc., should be sprayed with alcohol and allowed to air dry.

b. Dip nets, trapnets and leads – are too large to be soaked and unlikely to get reasonable disinfection with a spray system. After seasonal use, trapnets should

be transported to the regional headquarters, cleaned, thoroughly dried in direct sun or indoor area, and re-inspected to remove any remaining material. Ensure all net sections and components are thoroughly dry for a minimum of 3 days. When possible, clean/dry nets and leads should be used between waters.

c. Reporting Requirements - Fish encountered with lesions of reportable pathogens, or unknown pathogens should be preserved in 10% buffered formalin for storage or sent for immediate necropsy to the MDIF&W Fish Health Laboratory. Fish with obvious signs of clinical disease should be disposed of on land, rather than returned to the water to spread the pathogen.

d. Waters with Documented Pathogens – Biological staff should be extra diligent with disinfection procedures when working on waters with known pathogen issues to prevent the further spread of the organisms.

Questions regarding proper cleaning and/or disinfection of field equipment should be addressed with the equipments manufacturer.

MAINE STATUTES
The "Invasive Aquatic Plants" provisions are codified in a number of places in Maine Revised Statutes Annotated:
38 MRSA 410-N -- Aquatic nuisance species control
38 MRSA 419-C -- Prevention of the spread of invasive aquatic plants
38 MRSA Chapter 20-A -- Program to prevent infestation of and to control invasive aquatic plants

38 MRSA 20-B -- Invasive aquatic plants and nuisance species control
Amendments from the 2003-2004 legislative session:

Chapter 627. An Act to Amend the Laws Regarding Invasive Aquatic Species (effective July 30, 2004)
Chapter 655. An Act to Revise the Fish and Wildlife Laws to Complement the Recodification of those laws (IN PART) (effective April 22, 2004)

Reference:

Chapter 136. An Act Regarding the Development and Implementation of an Eradication Plan for Invasive Aquatic Plants (effective September 13, 2003).
Chapter 434. An Act to Prevent Infestation of Invasive Aquatic Plants (effective June 20, 2001)
Chapter 722, An Act to Prevent the Spread of Invasive Aquatic Plants (effective April 14, 2000).

The "Chapters" are in the form that a bill is enacted and signed. They contain temporary provisions, such as report and budget provisions, which are not codified into MRSA.

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APPENDIX B: Maine Department of Transportation Fish Passage Monitoring Plan

Background

In order to ensure compliance with state and federal permits, MaineDOT is required to monitor and evaluate various rehabilitated structures to determine efficacy of installed fish passage measures. Most of these structures were designed to pass juvenile salmonids, mainly federally-listed Atlantic salmon and wild brook trout, although some structures were designed to pass other diadromous species. All monitoring operations, particularly fish capture and handling, will be conducted by qualified MaineDOT biologists. To minimize the spread of unwanted organisms, MaineDOT will follow the most recent version of its Biosecurity and Disinfection Guidelines (see below).

Two forms of monitoring and evaluation will be conducted in order to determine fish passage efficacy at MaineDOT's rehabilitated structures: Fish passage testing (Direct Monitoring) and design validation (Indirect Monitoring).

I. Fish Passage Testing/Direct Monitoring

If required, fish passage testing/direct monitoring will occur within a year of completing construction, during the summer through early fall season when salmonids are typically searching out cold water refugia, and will typically consist of:

1. Installing block nets immediately downstream and upstream of the structure;
2. Capturing fish, by electrofishing if necessary;
3. Mildly anesthetizing captured fish;
4. Mark the fish and release overnight; and
5. Recapturing fish to evaluate whether fish passage occurred.

Monitoring will also take place in the third and fifth years following construction unless monitoring results show the project is functioning properly and USFWS and the involved state agencies agree to discontinue (or lessen) the monitoring requirements.

<u>Capture/Recapture</u>

Following installation of the upstream and downstream block nets, one or a combination of the following methods will be used to capture fish and minimize handling stress (Figure 1). If practicable or as site conditions allow, fish capture shall proceed from the least invasive methods to most invasive (electroshocking).

a) <u>Hand Netting</u>. Collect fish by hand or dip-nets.

b) <u>Seining</u>. Seine using a net with mesh of such a size as to ensure entrapment of the residing ESA-listed fish.

c) <u>Trapping</u>. Minnow traps are net or wire enclosures that trap live fish.

d) <u>Electrofishing</u>. Use electrofishing gear will be used as the last only where the above other means of fish capture are not feasible or effective following The Maine Department of Marine Resources Bureau of Sea-run Fisheries and Habitat (MRBSFH, March 2010). Electrofishing in waters will not be conducted if water temperatures are greater than 23°C or less than 6°C where Atlantic salmon may be present (MRBSFH, March 2010).

a. Prior to the start of sampling at a new location, water temperature and conductivity measurements should be taken to evaluate electroshocker settings and adjustments.
b. Each electrofishing session should start with all settings (voltage, pulse width, and pulse rate) set to the minimums needed to capture fish. These settings should be gradually increased only to the point where fish are immobilized and captured, and generally not allowed to exceed conductivity-based maxima indicated in the MRBSFH guidelines. Only direct current (DC) or pulsed direct current (PDC) should be used.

Figure 1. Examples of Sampling methods.

The site will be subsequently revisited and resampled the next day to determine fish movement through the structure. If the target species are not present or captured, passage efficacy will be determined by using other fish species with similar, or less, swimming capabilities as surrogates. If needed, MaineDOT biologists will work with biologists from state and federal fisheries agencies to determine the feasibility of using hatchery fish or fish captured from other drainages.

Fish Handling/Marking

Any Atlantic salmon that are captured will be documented and released immediately. All non-Atlantic salmon salmonids will be measured (total length in mm); handling will be kept to a minimum. In addition, all salmonids will be transported in properly disinfected, aerated containers of ambient water temperature.

Fish may be mildly sedated in buffered MS-222 (tricaine methanesulfonate) to minimize handling stress, identified and measured, and a subset will be marked (e.g., clipped, tagged, etc), allowed to recover fully before release, and relocated to the stream reach immediately upstream of the downstream-most block net. MS-222, which is regarded as a carcinogenic, must not be used on fish that may be caught and used for human consumption within 21 days.

Each time a fish is netted it may lose some scales, so the number of times a fish is netted should be kept to a minimum. Look for signs of stress and refresh water in holding buckets as necessary. Signs of stress may include darkening of color, gasping and crowding towards the surface, and increasing numbers of ‘jumpers’. Keep lids or nets over the buckets that allow air movement, as well as visual monitoring of the fish.

If fish passage test results are inconclusive MaineDOT shall evaluate other means to test the projects. A description the alternative means will be discussed in the annual monitoring report.

PIT Tagging

At certain projects, the use of passive integrated transponders (PIT tags) may be desirable. PIT tagging uses radio frequency identification (RFID), a signal that is transmitted between an electronic device, such as a tag or transponder, and a reading device, such as a reader or transceiver. RFID technology identifies objects remotely through the use of radio frequencies. The RFID devices most widely used in animals are passive. PIT tags have no battery so the microchip remains inactive until read with a scanner. The scanner sends a low frequency signal to the microchip within the tag providing the power needed to send its unique code back to the scanner and positively identify the animal[1]. Passive tags are designed to last the life of the animal providing a reliable, long term identification method. The value of PIT tags has been successfully demonstrated in studies of mark and recapture, survival, movement, behavior and distribution for a variety of fish species.

To summarize, sample fish[2] would be captured within the watershed in the traditional method (i.e. electrofishing with block nets, using minnow traps, etc.) Sample fish would then have PIT tags inserted and are subsequently released. An antenna, typically installed upstream of the structure being monitored, picks up the tagged fish each time they pass through. The data is immediately recorded in the reader.

PIT tagging will typically be used on the more controversial projects. Since these projects will vary by scope and location, details on the number of study fish, species, sizes, and duration of monitoring should be worked out with the appropriate state and federal fisheries agencies.

II. Design Validation/Indirect Monitoring

If required, MaineDOT will monitor and evaluate the design of the completed structures during the first, third and fifth year post-construction to ensure that the culvert does not pose an unintended impediment to fish passage. This monitoring consists of measuring hydraulic characteristic including water depth, water velocity, and stream discharge. If practicable, depths and water velocities will be measured throughout the lengths of the culverts in the deepest water at approximately 5.0-10.0-foot intervals, and in sites where substantial variations in velocities are apparent (i.e. near weirs), or at the inlet and outlet if culvert size limits access. Photos should be taken during the inspection to document characteristics of the culvert inlet, outlet, bed details and the stream upstream and downstream from the road surface. Note any channel condition changes, including scour and bedload deposition in the stream above and below the project area. Velocities and depths will be compared to the results of known swimming capabilities of fish that might inhabit these stream reaches. Additionally, assess the characteristics of the substrate deposited in the structure (including type, size, depth, and relative amounts) and use by aquatic organisms.

Additionally, evaluate whether measures to minimize surface erosion at the site have been effective. Document whether vegetation has become established on disturbed areas associated with the project, which are prone to erosion, and whether corrective actions necessary.

<u>Monitoring Period</u>

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[1] This is the same technology used when a pet is micro-chipped

[2] Sample fish would be brook trout or surrogate species; Atlantic salmon would not be tagged

Monitor the structures when flows are low and later at near normal flow conditions (*e.g.*, about average annual minimum and average annual). M&E will also take place during the fall spawning season, if necessary, depending on the location of the structure within the watershed and available spawning habitat upstream.

Reporting

MaineDOT will submit a report of the monitoring results by March 31st following the monitoring season. Monitoring reports shall provide a record of procedures and results. The report should include a table stating when projects were constructed and inspected.

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