ENDANGERED SPECIES ACT SECTION 7 CONSULTATION

BATCHED BIOLOGICAL OPINION

Agency: Department of the Army, Corps of Engineers, New England District

Activity: Proposed maintenance, rehabilitation, removal, or replacement of multiple bridges and culverts on many streams throughout the State of Maine (Corps of Engineers file number: NAE-2009-00514)

Conducted by: U.S. Fish and Wildlife Service, Maine Field Office [53411-2008-F-0402]

Date Issued: June 19, 2009

Approved by:

for Steve E. [signature]

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

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INTRODUCTION

This constitutes the biological opinion (opinion) of the U.S. Fish and Wildlife Service (USFWS) on the proposed maintenance, rehabilitation, replacement, or removal of twenty-three deteriorated bridges and culverts (associated with twenty different "projects") on many different rivers and streams throughout the State of Maine by the Maine Department of Transportation (MEDOT). Two of these projects (Farmington PIN 12693 and Norridgewock PIN 6900.01) have already received permits from the Army Corps of Engineers (ACOE) under Section 404 of the Clean Water Act (CWA) but are included here because they are located within areas encompassed by a recent rule listing a new Gulf of Maine Distinct Population Segment (GOM DPS) of Atlantic salmon (*Salmo* salar) as endangered and another recent rule designating critical habitat for the new GOM DPS (ACOE permit NAE-2008-01434, Farmington and NAE-2007-2062, Norridgewock). A third project, Meddybemps (no PIN), has already undergone formal Section 7 consultation for effects on endangered Atlantic salmon but is included here because of the recent designation of critical habitat for salmon in the project area. The ACOE has not yet issued a permit for Meddybemps (NAE-2007-2229).

For the other seventeen projects, the ACOE is considering authorization under Section 404 of the CWA or Section 10 of the Rivers and Harbors Act (RHA). The ACOE's request for formal Section 7 consultation and conference[1] was received on March 25, 2009.

This opinion is based on the following: 1) information provided in the ACOE's March 25, 2009 initiation letter and attachments in support of formal consultation under the Endangered Species Act (ESA); 2) the February 17, 2009 MEDOT permit application to the ACOE under Section 404 of the CWA and Section 10 of the RHA; 3) Final Endangered Status for a Distinct Population Segment of Anadromous Atlantic Salmon (*Salmo salar*) in the Gulf of Maine (65 FR 69459; Nov. 17, 2000); 4) Status Review for Anadromous Atlantic Salmon (*Salmo salar*) in the United States (Fay *et al.* 2006); 5) Determination of Endangered Status for the Gulf of Maine Distinct Population Segment of Atlantic salmon; Final Rule (74 FR 29345; June 19, 2009); 6) Designation of Critical Habitat for Atlantic salmon Gulf of Maine Distinct Population Segment (74 FR 29300; June 19, 2009); 7) field investigations; 8) numerous meetings; and 9) other sources of information. A complete administrative record of this consultation will be maintained by the USFWS Maine Field Office in Old Town, Maine. The USFWS log number is 53411-2008-F-0402.

CONSULTATION HISTORY

July 8, 2008 – At their monthly interagency meeting, MEDOT introduced state and federal regulatory and resource agencies (including Wende Mahaney, USFWS) to a new program to perform a variety of maintenance, replacement, and removal projects on over 300 culverts and bridges spread throughout the entire state. "An Act To Keep Bridges Safe and Roads Passable" requires the MEDOT to allocate 160 million dollars of taxpayer funded bonds within four years

[1] At the time USFWS received ACOE's request, the new GOM DPS and critical habitat rules were still proposed (and thus ACOE's request for consultation *and* conference). These rules have since been finalized (74 FR 29344; June 19, 2009 and 74 FR 29300; June 19, 2009), so this biological opinion does **not** include a conference opinion.

of June 2009. At this meeting, it was recognized that ESA Section 7 consultation for federally listed species would likely be required for at least some of the projects, particularly for Atlantic salmon.

August 12, 2008 – At their monthly interagency meeting, MEDOT provided an update on the four year bridge program to state and federal agencies (Wende Mahaney, USFWS).

September 9, 2008 – At their monthly interagency meeting, MEDOT provided an update on the four year bridge program to state and federal agencies (Wende Mahaney, USFWS).

October 14, 2008 - At their monthly interagency meeting, MEDOT provided an update on the four year bridge program to state and federal agencies (Wende Mahaney, USFWS). In addition, MEDOT and fisheries agencies reviewed an early list of potential projects to identify site-specific fisheries concerns. USFWS and NMFS identified those projects that might have effects on listed Atlantic salmon and designated critical habitat. At this time, the new GOM DPS and critical habitat were still proposed.

November 17, 2008 – At their monthly interagency meeting, MEDOT provided an update on the four year bridge program to state and federal agencies (Wende Mahaney, USFWS).

December 3, 2008 – Wende Mahaney (USFWS), Jeff Murphy (NMFS), Norm Dube (Maine Department of Marine Resources [MEDMR]), Jay Clement (ACOE), Dan Tierney (MEDOT), and John Perry (MEDOT) met to review the current list of bridge project that may affect Atlantic salmon and to conduct a site visit at Bangor (PIN 15090). At the site visit, staff discussed concerns related to 1) adult Atlantic salmon that congregate at the mouth of this brook during the summer when water temperatures are elevated in the Penobscot River, 2) fish passage at this structure and downstream, and 3) realignment of the brook. Agencies agree that ACOE should have the federal lead for all Section 7 consultations on Atlantic salmon (some projects will have funding from the Federal Highway Administration [FHWA] as well as requiring an ACOE permit). Furthermore, it is decided to “batch” all of the projects warranting informal consultation, with NMFS as the lead, and all projects warranting formal consultation, with USFWS as the lead.

December 9, 2008 - At their monthly interagency meeting, MEDOT provided an update on the four year bridge program to state and federal agencies (Wende Mahaney, USFWS). MEDOT indicates they plan to submit their permit applications in January 2009.

January 13, 2009 - At their monthly interagency meeting, MEDOT provided an update on the four year bridge program to state and federal agencies (Wende Mahaney, USFWS). By this time, MEDOT has decided to split the four year bridge program into two more-manageable groups of projects, Phase 1 (2010-2011) and Phase 2 (2012-2013). MEDOT announces that John Perry will be the lead for the informal batch consultation with NMFS and Dan Tierney will be the lead for the formal consultation batch with USFWS.

January 23, 2009 – Wende Mahaney (USFWS), Norm Dube (MEDMR), John Perry (MEDOT), and Dan Tierney (MEDOT) meet to review the latest list of projects for the informal and formal batched consultations and conferences.

January 30, 2009 – Wende Mahaney (USFWS), Jeff Murphy, Dan Kircheis, and Trent Liebach (all NMFS), Dan Tierney (MEDOT), and John Perry (MEDOT) meet to discuss topics related to the proposed designation of critical habitat for Atlantic salmon. Review of potential bridge and culvert projects continues.

February 10, 2009 - At their monthly interagency meeting, MEDOT provided an update on Phase 1 of the four year bridge program to state and federal agencies (Wende Mahaney, USFWS). MEDOT indicated that they intend to submit their permit application to the ACOE during the week of February 16, 2009. MEDOT also provided a copy of draft consultation initiation packages for the informal and formal batches and requested comments back by February 20, 2008.

February 18, 2009 – Wende Mahaney (USFWS) calls John Perry (MEDOT) to arrange a meeting to discuss USFWS and NMFS comments on the draft initiation packages.

February 24, 2009 – Wende Mahaney (USFWS), Jeff Murphy (NMFS), Trent Liebach (NMFS) Dan Tierney (MEDOT), and John Perry (MEDOT) meet to discuss comments on draft initiation packages. Also, MEDOT submits their permit application to the ACOE for the Phase 1 bridge projects.

February 27, 2009 – Wende Mahaney (USFWS) and Jeff Murphy (NMFS) participate in conference call with John Perry (MEDOT), Dan Tierney (MEDOT), and Jay Clement (ACOE) to finish discussion of comments on draft initiation packages. Norm Dube (MEDMR) joins conference call to discuss instream work window and scope of work for the Bangor project on Meadow Brook (PIN 15090).

March 5, 2009 – Dan Tierney (MEDOT) provides second draft of formal consultation initiation package with updated list of projects to Wende Mahaney (USFWS) and Jay Clement (ACOE) for review. Also, ACOE submits request for informal Section 7 consultation and conference to NMFS for twenty-one bridge and culvert projects.

March 10, 2009 - At their monthly interagency meeting, MEDOT provided an update on Phase 1 of the four year bridge program to state and federal agencies (Wende Mahaney, USFWS). A detailed discussion is had on the Bangor project (PIN 15090) to develop a conceptual construction plan that might allow construction to begin during the summer of 2009 but still provide adequate protection for Atlantic salmon that use Meadow Brook as high value cold water refuge habitat.

March 16, 2009 – Dan Tierney (MEDOT) and Wende Mahaney (USFWS) meet to discuss comments on the second draft of the formal initiation package.

March 18, 2009 – USFWS staff, MEDOT staff, and FHWA staff meet to discuss progress of Section 7 consultation and the relationship of FHWA's National Environmental Policy Act compliance to completion of Section 7 consultation.

March 25, 2009 - USFWS receives March 25, 2009 letter and biological assessment (BA) from ACOE requesting initiation of formal Section 7 consultation and conference for twenty bridge and culvert projects throughout the State of Maine.

March 25, 2009 - Wende Mahaney (USFWS) and Dan Tierney (MEDOT) meet to work on determining the "action area" and extent of effects for each project and compiling information into a tabular format.

March 27, 2009 – Letter from USFWS to ACOE acknowledging initiation of formal Section 7 consultation and conference. USFWS's biological opinion is due to the ACOE by August 7, 2009.

March 30, 2009 - Wende Mahaney (USFWS) and Dan Tierney (MEDOT) meet to continue working on determining the "action area" for each project and compiling into a tabular format.

April 1, 2009 – Wende Mahaney (USFWS) and Dan Tierney and John Perry (MEDOT) conduct site visit in Ebeemee Township at the Route 11 culvert on Stinking Brook.

June 11, 12, 15, and 16, 2009 – Wende Mahaney (USFWS) and Dan Tierney (MEDOT) meet to review and work on the draft opinion, particularly the Effects of the Action section.

June 19, 2009 – NMFS and USFWS publish a final rule to list a new, expanded GOM DPS of Atlantic salmon as an endangered species.

June 19, 2009- NMFS publishes a final rule to designate critical habitat for the GOM DPS of Atlantic salmon.

The consultation history for this action also includes numerous other telephone conversations and electronic mail exchanges between staff of the USFWS, NMFS, MEDOT, and ACOE to share additional information or make relatively minor changes to the scopes of individual projects. Because of the relatively short timeframes associated with planning for some of these projects, the scopes of several projects were evolving during the course of the Section 7 consultation and while this opinion was being written. Certain project-specific details simply were not available at the time the BA was submitted to the USFWS by the ACOE, in an effort to accommodate the MEDOT's timeframes for project implementation.

BIOLOGICAL OPINION

I. DESCRIPTION OF THE PROPOSED ACTION

The ACOE is either proposing to permit or has already permitted the replacement, rehabilitation or removal of twenty-three bridges or culverts (associated with twenty distinct projects) on many different rivers and streams throughout the State of Maine from Cumberland County in the south to Aroostook County in northern Maine. These projects would all be carried out by the MEDOT, although the actual construction work will often be done by hired contractors under the oversight of MEDOT staff. These twenty projects are listed and briefly described below in Table 1 (modified from the March 2009 BA to reflect more recent changes to some projects and the elimination of one project that was determined to not need a permit from the ACOE). Appendix A of this opinion contains a more detailed description for each of the twenty project locations and the anticipated scopes of work, with an emphasis on construction activities that could affect federally-listed species and designated critical habitat or candidate species.

1.1 General Project Scope Descriptions

In order to facilitate the review of the twenty projects in this batch consultation (particularly in light of the lack of specific details for some projects), the projects have been grouped into separate categories based on general scope of work. The five categories of project scopes are 1) Rehabilitation Projects, 2) Replacement Projects, 3) Bridge Abutments Projects, 4) Bridge Pier Projects, and 5) Linear Projects with Multiple Crossings. A basic description of each category is given below, with more details to follow in section **1.2 More Detailed Project Scope Descriptions** (beginning on page 7).

1.1.1 Replacement Projects

The structures in this group have been proposed to be replaced. For purposes of this consultation, the structures in this group are considered to be either culverts (including corrugated metal pipes [CMPs) and reinforced concrete pipes [RCPs] of varying diameters), concrete boxes (with closed bottoms), or three-sided concrete boxes with open or natural bottoms. The new structures may be the same size as the existing one or have different dimensions, depending on site-specific needs (e.g., a longer culvert may be needed to accommodate a safer, expanded road shoulder with new guard rail).

1.1.2 Rehabilitation Projects

The structures in this group have been proposed to be rehabilitated to extend their useful lives. For purposes of this consultation, the structures in this group are considered to be either culverts (including CMPs and RCPs of varying diameters) or concrete boxes with closed bottoms (i.e., a four-sided box). Rehabilitation of these structures includes 1) invert lining (with or without the addition of weirs for fish passage); 2) slip lining (with or without the addition of weirs for fish passage); 3) culvert end repairs including resetting, extensions, replacements, or repairs (inlet, outlet, or both); and 4) other structure repairs, such as patching concrete.

Table 1. Projects being considered under the 2009 MEDOT bridge and culvert batched section 7 consultation.

			Atlantic Salmon					
No.	**Project**	**PIN**	***DPS***	***CH***	**Stream/River**	**Watershed**	**Scope**	**Instream Work Window**
	Rehabilitation (with/without external weirs)							
1	Farmington	15640	X	X	Abbott Brook	Sandy River	Slipline	July 15-Sept 30
2	Farmington	12693	X	X	Cascade Str.	Sandy River	Invert Line	July 15-Sept 30
3	Ebeemee		X	X	Stinking Brook	WB Pleasant	Slipline	July 15-Sept 30
4	Sebec	11487	X	X	Piscataquis	Repair	July 15-Sept 30	
	Replacement (culverts and boxes)							
5	Prentiss Twp	16742	X	X	Mud Brook	Mattawamkeag	Bridge Replacement	July 15-Sept 30
6	Meddybemps	No Pin	X	X	Unnamed Trib	Dennys River	Culvert Replacement	July 15-Sept 30
7	Weston	15968	X		Trout Brook	Mattawamkeag	Strut Replacement	July 15-Sept 30
	Bridge abutment work on stream banks (no in-channel piers)							
8	Winterport	16763	X	X	Marsh Stream	Penobscot	Bridge Replacement	July 15-Sept 30
9	New Sharon	16721	X	X	Fillibrown Brook	Sandy River	Bridge Replacement	July 15-Sept 30
	Bridge Pier(s) work with/without associated abutment work							
10	Whitneyville	16762	X	X	Machias River	Machias River	Pier Rehab	July 15-Sept 30
11	Bradley	16687	X	X	Great Works St	Penobscot	Bridge Replacement	July 15-Sept 30
12	Island Falls	15097	X	X	WB Mattawam	Mattawamkeag	Bridge Replacement	July 15-Sept 30
13	Bangor	15090	X	X	Meadow Brook	Penobscot	Bridge Replacement	Sept 1-May 1
14	Howland	15635	X	X	Piscataquis	Piscataquis	Bridge Replacement	Open
15	Oakfield	15630	X	X	Mattawamkeag	Mattawamkeag	Bridge Replacement	July 15-Sept 30
16	Norridgewock	6900.01	X	X	Kennebec	Kennebec	Bridge Replacement	Open
	Bridge Removal							
17	New Sharon	16719	X	X	Muddy Brook	Sandy River	Bridge Removal	July 15-Sept 30
	Linear Projects with Multiple Stream Crossings							
18	Sherman to Houlton	16819	X	X	Tributaries	Mattawamkeag	I-95 Reconstruction	July 15-Sept 30
19	T2R9-Veazie	15954	X	X	Unnamed Trib	Penobscot	I-95 Reconstruction	July 15-Sept 30
	New England Cottontail Project							
20	Falmouth	15094	New England Cottontail		Presumpscot R	Presumpscot R	Bridge Replacement	

1.1.3 Bridge Abutment Projects

The structures in this group consist of bridges, single or multiple spans, but whose scope of instream work consists only of work on or immediately around the existing abutments and adjacent shoreline. A typical scope of work for a project in this group consists of instream work limited to the placement of a coffer dam around the abutment, or each abutment, to repair or replace the abutment; however, no mid-channel work away from the immediate shoreline will occur for projects in this group (i.e. no pier work).

1.1.4 Bridge Pier Projects

The structures in this group consist of multiple span bridges that involve mid-channel work on pier(s), generally the construction of new piers associated with a replacement bridge. Projects in this group may also involve in-stream work on or immediately around the existing abutments and adjacent shorelines.

1.1.5 Linear Projects with Multiple Crossings

Linear projects involve a variety of highway reconstruction activities that can include multiple stream crossings. These projects generally involve the removal of the existing roadbed and its reconstruction. These projects often involve work to replace or rehabilitate stream crossing structures (e.g., culvert replacements or rehabilitations). There are two linear projects, both associated with Interstate 95, in this batch consultation (Sherman to Houlton and Veazie to T2R9; their specific scopes are discussed in more detail in Appendix A.

1.2 More Detailed Project Scope Descriptions

The five categories of project scopes are Replacement Projects, Rehabilitation Projects, Bridge Abutment Projects, Bridge Pier Projects, and Linear Projects with Multiple Crossings. Specific details for all twenty projects (and the twenty-three associated stream crossing structures) included in this consultation are provided in Appendix A**.**

General descriptions of the work scopes that will be used in association with the twenty projects are described below. While individual details may vary, including timing, duration, materials, and extent of stream and riparian impacts, these descriptions generally apply to all MEDOT projects involving instream work. Any modifications will still meet the requirements of the MEDOT Best Management Practices for Erosion and Sediment Control (BMP manual) (2008a) and will minimize impacts to aquatic resources.

1.2.1 Coffer Dam Descriptions

While the projects in this batch consultation vary by scope, the same conceptual construction guidelines for the installation of cofferdams will be employed whenever cofferdams are used. Individual details will vary by project.

The initial step in culvert and box Replacement Projects is to dewater the work area so that all instream work is conducted in the dry. This will be done by 1) setting up cofferdams both upstream and downstream to prevent water from leaking into the work area, 2) dewatering the work area, and 3) diverting the existing stream flow out of the banks and then returning the flow to the stream downstream of the work area.

Cofferdam Placement

Cofferdams constructed of various materials (e.g. sheetpile, sandbag, industrial sandbag, inflatable dam) will be placed to keep water out of the work area by blocking flow both upstream and downstream. This isolation technique has the added benefit of keeping all sediment released by instream construction in the dry work area, where it can be removed before stream flow is restored.

For sandbag cofferdams:

a. The upstream cofferdam will be installed first. 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 then the current level of the stream, working from the stream bank to the center.
b. 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.
c. 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 is placed within the work area to catch accumulating water, which is then pumped into the "Dirty Water" Treatment System (described below on page 10).

For sheetpile cofferdams:

a. The upstream portion of the dam will be installed first, followed by the downstream dam if it is deemed necessary to keep the work area dry. If the substrate is conducive to driving sheets (i.e. substrate without ledge and/or boulders), then the dam would be installed by vibrating the interlocking sheets into the substrate. If the substrate has ledge or boulders, then pre-excavation may be required to install the sheets. This would consist of a small amount of dredging with a clam-shell bucket.
b. If the cofferdam is being established around a culvert structure, the sheets will be driven deep enough into the stream substrate so that they are self supporting. If there is any concern about the bottom of the sheets "kicking out", then large sand bags or rip-rap will be placed along the bottom on the inside of the sheets.
c. If the cofferdam is being established around a new pier location, then a concrete seal will be placed on the floor of the dam. This seal provides a concrete pad on which to construct the new pier footing and ensures that the cofferdam is sealed tightly. If placing a seal, the substrate within the dam will be excavated with a

clam-shell bucket prior to pouring the concrete seal. Once the seal is placed on the stream bottom and the cofferdam is braced, the work area can be dewatered.

d. If a concrete seal has been placed, dewatering will take place after the underwater concrete has cured, which generally takes seven days. Sediment is allowed to settle on top of the seal. Most of the water inside the cofferdam is discharged overboard (i.e., directly into the stream) as the water in the upper elevations of the cofferdam has not been in contact with the concrete or accumulated sediments. At the first sign of sediment stirring in the cofferdam, the pump is stopped and an outlet hose is attached so that sediment laden (high pH) water can be captured and properly treated in the “Dirty Water” Treatment System. A representative of the MEDOT Surface Water Quality Unit will periodically monitor pH and determine what water is sufficiently clean to be pumped directly back into the river or what water needs to be treated first. Once dewatered, the seal can be cleaned of sediment to accommodate construction work. After the seal is cleaned, the cofferdam can be maintained in a “dry” condition by pumping to facilitate construction of the new structure.

For inflatable cofferdams:

a. Inflatable dams require a relatively even and stable substrate for successful installation. Relatively narrow spots in the stream are chosen both upstream and downstream. The coffers are laid across the channel, either by hand or by boat.
b. The inflatable coffers are pumped full of water and installed around the structure. The weight of the water creates a seal with the stream substrate.
c. Prior to dewatering, upstream diversion pumps are started and flow is pumped around the work area while the area between the cofferdams would remain flooded. During dewatering, a representative of the MEDOT Surface Water Quality Unit will determine what water is sufficiently clean to be pumped directly back into the river or what water needs to be treated first. As the area between the coffers is dewatered, either overboard into the stream if clean or into a sediment basin if the installation has disturbed the sediment, the hydraulic pressure on the outside of the inflatable dam becomes greater than that inside the cofferdams. When this happens, the cofferdams have a tendency to roll toward the dewatered side. The contractor will generally support the cofferdam on the inside using sandbags, clean stone, or Jersey barriers. Once the cofferdam is stabilized, it can be maintained in a “dry” condition by pumping to facilitate construction of the new structure.

<u>Stream Diversion after Cofferdam Installation</u>

Stream diversion is generally not a consideration when cofferdams are established around instream piers or abutments along the stream bank. When cofferdams block the entire channel, however, the stream will need to be continually diverted around the work area. If there is a large volume of water in the stream, a culvert may be placed adjacent to the existing structure to carry the stream flow during construction. Generally, however, stream flow is diverted around the work area using the following procedure, which applies to all types of cofferdams:

a. 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 approach is to run the hose over the road and block up around it with wood to protect it from vehicle traffic.
b. 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 and/or the stream bottom will be lined with geotextile fabric. A screen 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 6.35 mm (¼ inch) in the narrow direction (example: 6-14 mesh) (NMFS 1995). 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 ¼ 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 0.24 m/sec (0.8 ft/second) to avoid impingement of Atlantic salmon parr (NMFS 1995).
c. The gasoline diversion pump(s) will then be placed as far away from the stream as possible. The number and size of pumps used varies depending on the stream flows present when the work is being conducted.
d. The downstream discharge point within the stream channel will be protected from scour caused by high-velocity water by discharging onto ledge, large boulders, or non-woven geotextile fabric laid along the streambed.

Install "Dirty Water" Treatment System

After the cofferdams are in place and water diversion pumps have diverted the stream around the work area, it will be necessary to dewater the work area itself. The water from inside the cofferdam will be pumped into a sediment basin for filtration, as the water typically contains some amount of sediment. When dewatering cofferdams around mid-river piers, dirty water may be pumped onto a barge outfitted with a sediment treatment basin. A representative of the MEDOT Surface Water Quality Unit will determine what water is sufficiently clean to be pumped directly back into the river (if any) and what water needs to be run through a filtration system first for further treatment.

a. The system will be installed according to the MEDOT BMP Manual (2008a).
b. The "dirty water" treatment system will either be comprised of a hay bale basin or a "dirt bag". Erosion control fabric is draped over the hay bales and sometimes placed underneath to assist in trapping sediments. These sediments will be disposed of away from the stream in a manner that they cannot erode back into the stream.
c. The sedimentation basin will be located close to the work location, with adequate vegetation between it and the stream to act as a sediment filter.

d. Pumping

i. Hoses will be laid between the treatment basin and the downstream scour pool within the work area.
ii. The "dirty water" pump(s) will then be started in the downstream scour pool.
iii. Before dewatering of the area inside the cofferdam is started, MEDOT staff will generally electrofish the pool to remove Atlantic salmon and other aquatic organisms. As the pool is dewatering, any stranded aquatic organisms (including Atlantic salmon) will be caught and transferred to the downstream channel by a MEDOT biologist (See Appendix B for the fish evacuation plan). Electrofishing within cofferdams on "big river" projects (like the Norridgewock bridge replacement on the Kennebec River) may not be feasible due to the depth of the water.

e. The work area will then be pumped dry, with this water going to the "dirty water" treatment system.
f. If there is leakage around the cofferdam, or upwelling in the work area through the stream substrate, this water will be pumped into the "dirty water" system for treatment prior to its release back into the stream. In some situations, it is necessary to excavate a pocket within the cofferdam to allow such pumping.

Closeout Procedures

After all construction work within the cofferdams has been completed, the cofferdams can be removed and stream flow restored through or around the crossing structure. The same basic closeout procedure is followed for all cofferdam types, with some slight variations in the removal techniques.

a. The upstream "dirty water" pump will be stopped and removed.
b. The diversion pump system will be stopped and the upstream coffer dam will slowly be breached. The first flush of dirty water from the restored stream flow will be captured by the downstream "dirty water" pump, which will then pump the water into the sediment treatment system.
c. When the water behind the remaining downstream cofferdam is clean, that dam will be breached as well.
d. The remainder of the upstream cofferdam and the diversion pump system will then be removed.
e. All disturbed areas will be stabilized and permanent erosion and/or sediment control BMPs will be installed as appropriate.

Sandbag cofferdams will either be removed by hand for small bags or by an excavator or crane working from the stream bank for large, industrial-sized sandbags.

Sheetpile cofferdams will be removed by vibrating or pulling the sheets out with an excavator or other equipment. Sometimes sheetpiles are cut off at the bottom and left in place below the river bottom. If a concrete seal is used, it will be left in place (generally having been incorporated into a new bridge pier).

Inflatable cofferdams will be removed by slowly opening the dam so that the water can drain into the dam at a steady rate. The inflatable “bags” are heavy and are generally removed from the stream with an excavator or other equipment.

1.2.2 Culvert Replacement Projects

a. Once the pumps are running and the work area is dewatered, the culvert 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, dams, and the sediment basin are monitored closely and maintained throughout construction.
b. The old culvert will be removed and the new one replaced in the dry.
c. When the culvert and rip-rap installation is complete, all headwalls, disturbed areas, and permanent drainage ditches are stabilized with final treatments (to include seeding), utilizing temporary erosion control BMPs as necessary (MEDOT, 2008a).

1.2.3 Culvert Rehabilitation Projects—Pipe End Reset, Invert Line or Slip Line

<u>*Culvert Extensions and Resetting Culvert Ends*</u>

Once cofferdams are installed, pumps are running and the work area is dewatered, the culvert extension or culvert end resetting process can commence. At this point, the crews are working in the dry and there is no sediment release into the stream. All pumps, hoses, dams, and the sediment basins are monitored closely and maintained throughout construction.

The fill over the culvert end(s) is excavated so that the existing end(s) can be temporarily removed to allow final grade work around the pipe to allow the end to be reset back in its original location or to allow placement of a new pipe end or pipe extension. This typically includes adding gravel bedding that the pipe end can sit on. To prevent scour at the outlet, a rip-rap apron is placed below the water line under the pipe invert. This apron may extend downstream beyond the end of the pipe. The installation of gravel bedding or rip-rap will not affect fish passage through the culvert. Once final grading is complete, the pipe end will be placed back onto the culvert. The site is then backfilled and slopes rip-rapped. Finally, the cofferdams are removed and normal stream flow is restored.

<u>*Slip Liner*</u>

Slip liner projects occur within cofferdams that have been dewatered. Appendix C provides additional information from MEDOT on their approach to fish passage when culverts are slip lined.

Rehabilitation of CMP culverts by slip lining entails inserting (or “slipping”) a new, slightly smaller diameter pipe through the existing pipe. The liner pipe is usually made of plastic. The annular space between the old and new pipe is filled with grout. Typical wall thickness of the new pipe is about 5.08 cm the grout annulus is 7.62 – 12.7 cm thick. This directly raises the culvert invert by 12.7 to 17.78 cm and may therefore reduce the flow depth to the point where fish cannot pass. If the culvert outlet is already perched, lining has the effect of further raising the perch by another 12.7 to 17.78 cm.

Generally, when water in the original pipe is at least 30.5 to 38.1 cm deep on the outlet invert and through the pipe (40.6 to 48.3 cm for passage of adult salmon, which require deeper water), no extra measures are required to provide fish passage. When this minimum depth condition is not met, some type of grade control is typically required, often a combination of both external and internal weirs. The need for internal weirs is driven primarily by the pipe slope and raised invert; the need for external weirs is driven by the perch and water depth at the new outlet. Appendix C provides additional information on how MEDOT determines if a slip lined culvert can pass Atlantic salmon and what structure modifications may be necessary to facilitate fish passage.

Invert Liner

Invert liner projects occur within cofferdams that have been dewatered. Appendix C provides information on the approach to fish passage when culverts are invert lined.

Rehabilitation of culverts by lining the invert involves pouring a 12.7 cm-thick (5 in) concrete liner along the bottom one-third to one-half of the culvert (approximately). This directly raises the culvert invert by 12.7 cm and may therefore reduce the flow depth in the culvert and create a 12.7 cm jump at the outlet to the point where, in non-ponded situations, fish cannot pass. If the culvert outlet is already perched, lining has the effect of further raising the hydrologic drop by another 12.7 cm.

Generally, when water is at least 30.5 cm deep (12 in) on the outlet invert and through the pipe (40.6 cm or 16 in for passage of adult salmon), no extra measures are required to provide fish passage. When this minimum depth condition is not met, some type of grade control is typically required, often a combination of external and internal weirs. The need for internal weirs is driven primarily by the pipe slope; the need for external weirs is driven by the perch and water depth at the new inlet.

From a hydraulics perspective, fish passage challenges posed by concrete invert liners and plastic slip liners are nearly identical. They both result in a smooth bore (nominal Manning's n = 0.012) and can pose grade problems. Without mitigating factors, this may create problems of shallow depth and higher flow velocity that impair fish passage through the structure.

Weir Construction

External weirs may be required if the existing or new outlet drop is excessive and the outlet flow depth is inadequate. True external weirs can be built beyond the pipe outlet (i.e., downstream) in order to back water into the culvert. They can be constructed of natural materials, such as logs or rocks, or engineered materials, such as Jersey barriers. As an alternative to constructing weirs in the case of small drops, the outlet push bar - an underwater gravel berm located where the outlet pool constricts on the downstream side - can be raised to achieve the same effect.

Right-of-way restrictions or natural stream configuration may prevent the use of external weirs in some situations. In that case, weirs can be built in the pipe outlet (typically, in the open portion of a mitered outlet) by cutting out the pipe bottom. The fish can then be "stepped up" into the pipe through a sequence of closely spaced weirs.

Current MEDOT practice is to build the weirs in two phases. As part of liner construction, a concrete weir is built with an oversized, full depth notch. The size of the weir depends on the hydraulics of the pipe. A notched, plastic weir plate is bolted on the upstream face of the concrete weir. The notch is sized in the field by MEDOT staff, at appropriate flow conditions, to facilitate fish passage by providing proper water depth and flow velocity.

1.2.4 Bridge Abutment and Bridge Pier Replacement and Rehabilitation Projects

The following section describes the step-by-step process that will be undertaken to construct the new bridges. The following equipment, typical of most construction activities, may be utilized during the construction of the temporary (if necessary) and new bridges: large excavator (backhoe), crane, barge (as a working platform in the river), dump trucks, excavator with hoe ram attachment, sheet pile drivers, jack hammers and rock drills, air compressors, welders and cutting torches. Other construction equipment may also be used as necessary.

Removal of the Existing Bridges

A work trestle adjacent to the existing bridge and false-work underneath the bridge may need to be constructed to facilitate removal of the existing bridge deck. The work trestle provides a surface from which heavy equipment can access the bridge during demolition. The false-work under the bridge is used to catch demolition debris generated by removal of the deck. Roughly four piles (H or pipe) will be required for every twenty-five feet of bridge length for both of these temporary structures. Each pile impacts approximately 0.0929 square m (one square foot) of stream substrate. Some piles are driven straight down into the river bottom, whereas others are driven at an angle. The piles are connected at the top to form a pile bent and the ends of the bridge rest on these bents. Some excavation with a clam-shell bucket may be necessary prior to driving the piles in order to create an even surface. All piles are removed when demolition is complete.

The existing superstructure of the bridges will be removed using cranes and cutting tools for concrete and steel. Depending on the location of the project and the depth of water, a barge may be used for removing superstructure bridge components. A hoe ram (a jackhammer-type device attached to an excavator arm) may be necessary to pulverize concrete piers, and a large excavator or possibly a clam-shell on a crane will likely be used for the removal of the debris from the stream bed. The removal of existing piers may be done within a cofferdam, depending on site conditions and on whether they will be removed with a hoe ram or blasting. Cofferdams are not generally used when blasting, since the explosion will destroy the dams.

Blasting to remove piers or abutments would be done by a qualified blasting subcontractor during the specified instream work window. A blasting plan demonstrating that the resulting overpressure will be under 100 kPa[2] would need to be approved by USFWS prior to blasting. A drill rig would drill holes for the blast charges into the pier or abutment. Following placement of low order charges and blasting mats, the confined charges would be detonated. The mats and as much debris as practicable would be removed from the stream. Pier removal by blasting is anticipated to take about one-half of the time required for removal with a hoe ram.

Construction of the New Bridge Structures and Road Approaches

Prior to construction of any new bridge abutments or piers, the contractor will install cofferdams or water diversions, as necessary. Within the cofferdam, ledge or other substrate is typically cleaned and prepared by an excavator or crane with a clam-shell bucket and with hand tools and high pressure water contained and filtered through a sediment detention basin before going back into the waterbody. The concrete will then be placed inside cofferdams and forms. Abutments and piers will be constructed up to grade. Reinforcing steel will be placed and forms will be built. Where the concrete trucks cannot get close enough to place the concrete directly from the road or stream bank, concrete will be placed using a concrete bucket attached to a crane.

While the abutments and piers are being built, any wing walls and retaining walls will also be constructed. These will be built using the cofferdams or by doing work in the dry at low water when possible. In some areas the construction of the retaining wall will start on ledge, while in other areas they will start on fill.

If precast walls are utilized, they will be set by crane and backfilled with gravel. The gravel will then be compacted by a walk-behind vibratory compactor and brought up to grade. Typically, some rip-rap will be placed in front of the retaining structures in the stream as scour protection.

1.2.5 Linear Projects with Multiple Crossings

Most of the activities that occur as part of a "linear" road reconstruction or resurfacing project do not affect Atlantic salmon or their habitat, since they do not occur in or near streams or rivers. In general, linear reconstruction projects involve removing the road materials and then rebuilding. This is accomplished by removing the pavement to subgrade or below, as necessary. Gravel base material is then placed and compacted to the required density using dump trucks, backhoes, bulldozers and graders. New pavement is then installed along the roadway.

Many of these projects require the replacement of stream culverts or the resetting of culvert ends as part of the road reconstruction process. The scope for these activities can be found above in sections 1.2.1 through 1.2.3 of the opinion.

1.3 Best Management Practices for Erosion and Sedimentation Control

All MEDOT construction project contracts, including those covered by this batch consultation, are required to be in accordance with the most recent version of the MEDOT BMP manual (MEDOT 2008a). These BMPs require that contractors prepare and submit a Soil Erosion and Water Pollution Control Plan (SEWPCP) that is approved by the MEDOT and fully enforced as

[2] kPa or kilopascal is a measure of force per unit area or pressure.

a contractual agreement. This SEWPCP is prepared and performed in accordance with the BMP manual. Section IID, *Guidance for Sensitive Water Bodies*, of the BMP manual 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, proximity of the project to the water body, etc. All projects considered under this consultation are considered sensitive due the presence of endangered Atlantic salmon or their 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 to protect the waterbody and its aquatic life.

1.4 MEDOT Wildlife and Water Crossing Policy and Design Guide

All of the projects in this batch consultation have been reviewed in accordance with and will be constructed following the 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, while protecting important aquatic and surface water resources.

All projects in this consultation are designed to pass the appropriate life stages of Atlantic salmon. Monitoring of fish passage at road crossing structures will be done according to the MEDOT crossing policy, ACOE permit conditions, and the terms and conditions of the Incidental Take Statement in this opinion.

1.5 Proposed Instream Work Windows

Due to the number and nature of the projects in this batch consultation and the limited number of contractors in Maine qualified to work on these projects, MEDOT is proposing three distinct work windows (depending on the location of the project and the specific circumstances related to Atlantic salmon) in order to complete these projects in a timely fashion and not jeopardize critical funding. All of the projects in this batch consultation occur within the GOM DPS of Atlantic salmon, which some projects are also located within designated critical habitat. Since Atlantic salmon could potentially be present in the vicinity of these projects, most will adhere to a restricted work window.

The three work windows being proposed are detailed below:

Standard Instream Work Window

MEDOT is proposing a restricted low flow instream work window for most of the projects in this batch due to the possible year-round presence of Atlantic salmon within or near the action areas. Since all of these projects are in fresh water habitats, the work window will be the standard Atlantic salmon summer-time work window of July 15 to September 30 of any given year.

Modified Instream Work Window

MEDOT is proposing an expanded instream work window from September 1 to May 1 for one project, Bangor (PIN 15090). Atlantic salmon are most likely to be present at the mouth of Meadow Brook during the summer when water temperatures in the Penobscot River reach 22° C or higher (typically July and August) and salmon become stressed. This modified work window was determined in consultation with USFWS, NMFS, and MEDMR.

Open Instream Work Window

MEDOT is proposing an open, year-round instream work window for two bridge projects (Norridgewock and Howland) that occur over and in major rivers. Although Atlantic salmon occur in these rivers year-round, their presence in the vicinity of the bridges is largely associated with seasonal migrations both upstream and downstream. Spawning or rearing habitat are not known to occur at either project locations. At both project locations, the wide channel width allows for salmon passage during construction, as long as work is only conducted in a small percentage of the channel at any one time.

1.6 Fish Passage Monitoring

In order to ensure compliance with state and federal permits and to minimize adverse effects on Atlantic salmon, MEDOT will monitor several structures to determine efficacy of replacement culverts and installed fish passage measures (see Appendix D for the complete MEDOT monitoring plan). Most of these structures were designed to pass juvenile salmonids, mainly federally-listed Atlantic salmon and wild brook trout; although some structures have been designed to pass other diadromous fish species.

MEDOT proposes to directly monitor the ability of fish to pass through their structures by installing block nets above and below the structure, electrofishing the stream reach between the nets (including inside the structure if possible), and relocating a subset of the captured fish to the stream reach immediately upstream of the downstream-most block net. The site will be revisited the subsequent day and electrofished again to determine fish movement through the structure.

Indirect monitoring will consist of measuring water depth and water velocity inside the crossing structure, calculating flows, and comparing these results to known swimming capabilities of fish that might inhabit this reach of the stream including Atlantic salmon. In addition, stream substrate deposited in the pipe, including type and size, depth, and relative amounts, as well as use by aquatic organisms, will be assessed.

1.7 Summary of MEDOT Data Collection for this Consultation

All of the project locations in this batch consultation have been assessed by qualified MEDOT biologists with experience in Atlantic salmon life history requirements and aquatic habitat determination and who are familiar with MEDOT construction practices. In addition, throughout the data collection process for this batch consultation, MEDOT biologists have been in multiple discussions with Norm Dube, Atlantic salmon Biologist with the Bureau of Sea-Run Fisheries and Habitat at the MEDMR, who has been instrumental in providing historical and current information on Atlantic salmon studies in Maine.

1.8 Action Area

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

The twenty bridge and culvert projects included in this opinion occur throughout a large portion of the State of Maine, from Cumberland County in the south to Aroostook County in northern Maine (Figure 1). The bridge replacement project (PIN 15094) in Falmouth, Maine (Cumberland County) is not included in the following action area description because it does not involve effects to Atlantic salmon or its critical habitat. The Falmouth bridge project may affect the New England cottontail (*Sylvilagus transitionalis*), which is a federal candidate species.

The nineteen bridge and culvert projects that affect Atlantic salmon are spread throughout the 45,980 km^2 of the GOM DPS, as well as specific areas within the geographic range of the GOM DPS that are designated as critical habitat. These projects occur in all three of the Salmon Habitat Recovery Units (SHRU) in Maine, which represent the geographic framework within which critical habitat has been designated. The projects occur within 15 different 10-digit HUC[3] watersheds throughout the three SHRUs (Table 2). These nineteen projects are only located within the freshwater portion of the GOM DPS.

Given the aggressive nature of the funding sources associated with these projects, the MEDOT does not yet have detailed construction plans available for many of the projects. Consequently, it is difficult to determine with precision the action area for each project that would affect Atlantic salmon or its critical habitat. However, based on a construction overview provided by MEDOT for each project, combined with previous experience from similar bridge and culvert replacement or rehabilitation projects, Table 3 provides a reasonable estimate of the likely action area for each project. The manner in which this action area table was developed is supported by two previous biological opinions written by the USFWS for MEDOT bridge and culvert replacement projects (USFWS 2005 and USFWS 2008).

In general, the action area related to a bridge or culvert replacement or rehabilitation project may include some or all of the following:

1) An area or areas of stream that is temporarily isolated and dewatered within a cofferdam so that construction work can proceed in the dry;

2) An area downstream of the cofferdam that would experience a temporary increase in sediment from construction activities, particularly during removal of the cofferdam(s);

3) An area of riparian land along the stream bank where vegetation is removed to facilitate

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[3] HUC = hydrologic unit code as defined by the U.S. Geological Survey

construction, including access of equipment to the stream;

4) An area of stream bank and/or stream bottom that is rip-rapped to stabilize the inlet and outlet of the culvert or a bridge abutment;

5) An area of stream around an existing bridge pier that will be removed without isolation inside a cofferdam;

6) An area of upstream habitat that is affected by a change in fish passage at the culvert (e.g., a hanging culvert that prevents upstream fish passage is replaced by a properly sized and embedded culvert that allows for upstream fish passage); and

7) An area of stream downstream of a rehabilitated culvert (e.g., a slip-lined culvert) that may experience an adjustment in response to altered hydraulic characteristics of the culvert.

Figure 1. Location map of the MEDOT bridge and culvert projects. Projects in red (faded) are in critical habitat for Atlantic salmon.

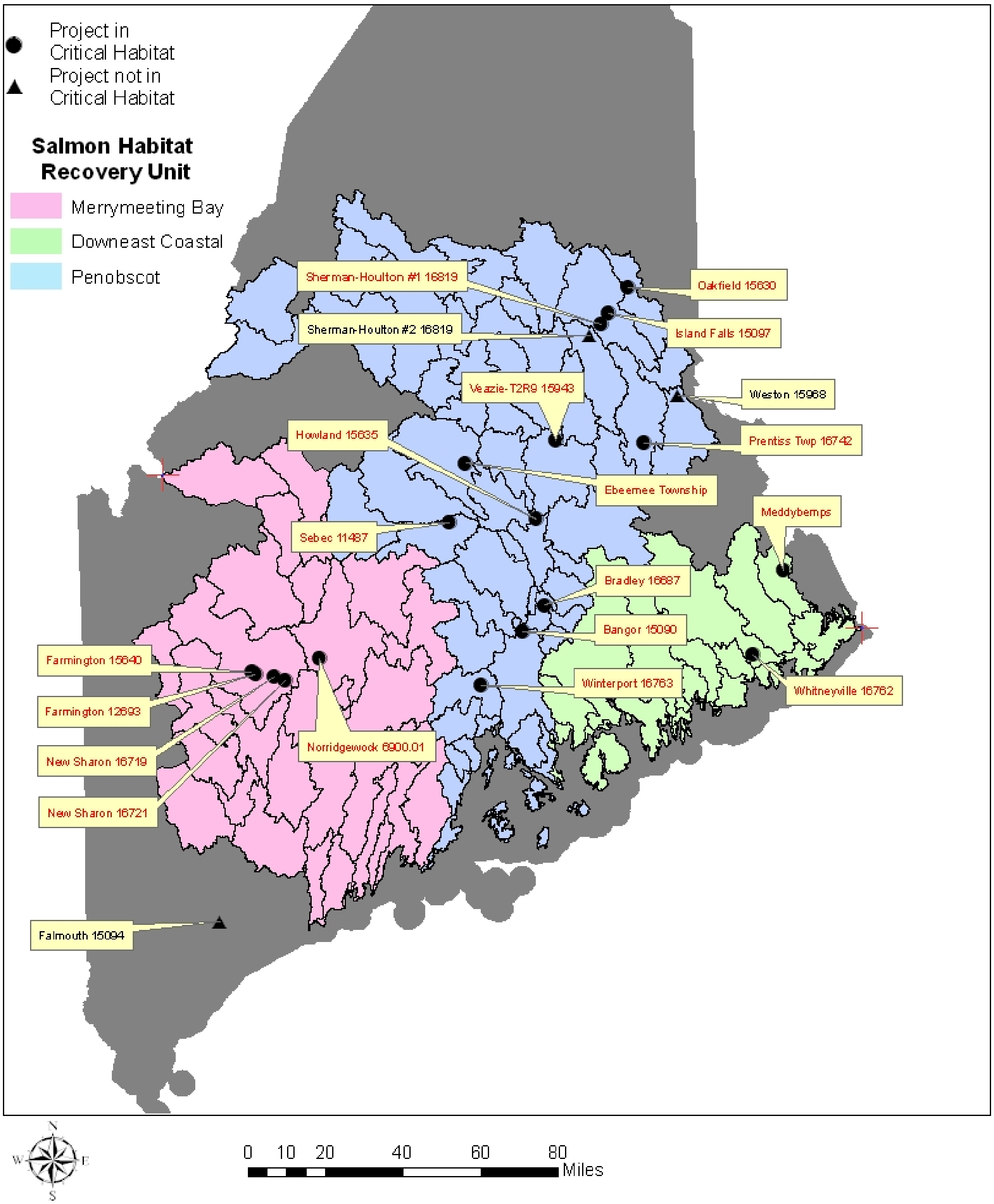

Table 2. List of the Salmon Habitat Recovery Units (SHRUs) and HUC 10 watersheds that contain the MEDOT projects being considered under this consultation.

SHRU	*HUC 10 Watersheds*	*Habitat Units*	*Biological Score*	*# of Projects*
Downeast Coastal		**61,395**		**2**
	Dennys River	1, 717	Suitable	1
	Machias River	14,964	Highly Suitable	1
Merrymeeting Bay		**372,639**		**5**
	Kennebec River at Waterville Dam	40,133	Highly Suitable	1
	Sandy River	43,137	Highly Suitable	4
Penobscot		**323,740**		**12**
	Marsh River	6,018	Suitable	1
	Penobscot (6)	10,826	Highly Suitable	1
	Penobscot (4) at Veazie Dam	7,550	Highly Suitable	1
	Piscataquis River (4)	9,669	Highly Suitable	1
	Piscataquis River (3)	8,165	Highly Suitable	2
	Pleasant River	22, 346	Highly Suitable	1
	Mattawamkeag River (2)	10, 042	Highly Suitable	1
	West Branch of the Mattawamkeag	11, 290	Highly Suitable	2
	East Branch of the Mattawamkeag	3, 973	Suitable	1
	Molunkus Stream	4,517	Marginally Suitable	1

Table 3. Estimates of Project-Specific Action Areas (impacts in square meters unless otherwise noted).

Culvert Rehabilitation			Cofferdam				Stream Impact	
	PIN	Stream	Weirs*	Dewatered	Downstream	Upstream	Total	Riparian
Farmington	15640	Abbot Brook	3.34	345.59	111.48	0.00	457.07	130.06
Farmington	12693	Cascade Stream	0.00	291.33	65.03	0.00	356.36	603.85
Ebeemee Twp	17088	Stinking Brook	9.75	144.92	111.48	0.00	256.40	130.06
Sebec	11487	Meadow Stream	0.00	132.85	102.19	0.00	235.04	37.16

Culvert Replacement						Stream Impact	
	PIN	Stream	Cofferdam	Downstream	Upstream**	Total	Riparian
Prentiss Twp	16742	Mud Brook	220.73	167.22	0.00	387.95	74.32
Meddybemps	No Pin	Unnamed Trib	42.36	167.22	0.00	209.58	18.58
Weston	15968	Trout Brook	260.12	185.80	7.24 km	0.00	0.00

Bridge abutment work on stream banks--no in-channel piers							Stream Impact	
	PIN	Stream	Cofferdam	Downstream	Inlet/Outlet	Upstream**	Total	Riparian
Winterport	16763	Marsh Stream	148.80	465.00	83.70	0.00	697.50	74.40
New Sharon	16721	Fillibrown Brook	18.60	325.50	3.53	0.00	344.10	37.20

Bridge Pier(s) work with/without in water									Stream Impact	
	PIN	Stream	Cofferdam	Pier Demo°	Piers (net)	Riprap	Downstream	Upstream	Total	Riparian
Whitneyville	16762	Machias River	111.60	0.00	0.00	0.00	697.50	0.00	809.10	0.00
Bradley	16687	Great Works St	1302***	0.00	0.00	46.50	465.00	0.00	1767.00	186.00
Island Falls	15097	WB Mattawam	254.45	312.48[C]	-9.30	137.64	953.25	0.00	1207.70	316.20
Bangor	15090	Meadow Brook	209.25	0.00	0.00	53.94	223.20	0.00	432.45	37.20
Howland	15635	Piscataquis	3189.90	212.04	548.70	744.00	3720.00	0.00	6909.90	46.50
Oakfield	15630	Mattawamkeag	27.90	100.44[C]	-11.16	41.85	558.00	0.00	585.90	122.30
Norridgewock	6900.01	Kennebec	416.64	660.30	13.58	51.06	1860.00	0.00	2276.64	412.08
New Sharon	16719	Muddy Brook	0.00	83.7[C]	-9.30	0.00	267.38	267.38	534.75	37.20

Linear Projects with Multiple Stream Crossings								Stream Impact	
	PIN	Stream	Cofferdam	Piers (net)	Riprap	Downstream	Upstream	Total	Riparian
Sherm-Houlton	16819	Tributaries	371.91	0.00	11.16	292.95	0.00	664.86	37.20
T2R9-Veazie	15954	Tributaries	44.92	0.00	1.40	55.80	0.00	100.72	37.20

* Included in cofferdam impact
** Mile of stream habitat made available to salmon
*** Half of the channel at a time and includes h-piles for temporary bridge
**** Includes vegetation clearing and riprap area on slopes
[C] Piers could be removed within the confines of a cofferdam
° Area within 3 meters of the pier being demolished

II. STATUS OF THE SPECIES AND CRITICAL HABITAT

This section presents biological information relevant to formulating this opinion and documents the effects of all past human and natural activities that have led to the current status of the species throughout its range, including those areas designated as critical habitat.

In addition to the endangered Atlantics salmon and the candidate NEC, other federally-listed species under the jurisdiction of USFWS that are known to occur in areas of Maine where these twenty projects are proposed include the threatened Canada lynx (*Lynx canadensis*) and its critical habitat, the threatened small whorled pagonia (*Isotrea medeoloides*), and the threatened Eastern prairie fringed orchid (*Plantanthera leucopehaea*). Neither of the two listed plant species is known to occur at any of the project locations, and therefore, will not be considered further in this consultation.

Although the Canada lynx could occur in the general vicinity of some of the proposed projects (e.g., Sherman-Houlton PIN 16819, Oakfield PIN 15630), the proposed culvert and bridge rehabilitation activities in and near a stream channel would not be expected to affect lynx or its critical habitat according to the Section 7 Programmatic Agreement between MEDOT, USFWS, and FHWA (signed December 16, 2008). Therefore, the Canada lynx and its critical habitat will not be considered further in this consultation.

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 basin of the North Atlantic Ocean, from the Arctic Circle to Portugal in the eastern Atlantic, from Iceland and southern Greenland, and from the Ungava region of northern Quebec south to the Connecticut River (Scott and Crossman 1973). In the United States, Atlantic salmon historically ranged from Maine south to Long Island Sound. However, the Central New England DPS and Long Island Sound DPS have both been extirpated (65 FR 69459; Nov. 17, 2000).

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

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

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

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. 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 5 months in the river before spawning, often seeking cool water refuge (e.g., deep pools, springs, and mouths of smaller tributaries) during the summer months.

In the fall, female Atlantic salmon select sites for spawning. Spawning sites are positioned within flowing water, particularly where upwelling of groundwater occurs, allowing for percolation of water through the gravel (Danie et al. 1984). These sites are most often positioned at the head of a riffle (Beland et al. 1982); the tail of a pool; or the upstream edge of a gravel bar where water depth is decreasing, water velocity is increasing (McLaughlin and Knight 1987; White 1942), and hydraulic head allows for permeation of water through the redd (a gravel depression where eggs are deposited). Female salmon use their caudal fin to scour or dig redds. The digging behavior also serves to clean the substrate of fine sediments that can embed the cobble/gravel substrate needed for spawning and consequently reduce egg survival (Gibson 1993). As the female deposits eggs in the redd, one or more males fertilize the eggs (Jordan and Beland 1981). The female then continues digging upstream of the last deposition site, burying the fertilized eggs with clean gravel.

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

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

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

First year parr are often characterized as being small parr or 0+ parr (4 to 7 cm long), whereas second and third year parr are characterized as large parr (greater than 7 cm long) (Haines 1992). Parr growth is a function of water temperature (Elliott 1991); parr density (Randall 1982); photoperiod (Lundqvist 1980); interaction with other fish, birds, and mammals (Bjornn and

Resier 1991); and food supply (Swansburg et al. 2002). Parr movement may be quite limited in the winter (Cunjak 1988; Heggenes 1990); however, movement in the winter does occur (Hiscock et al. 2002) and is often necessary, as ice formation reduces total habitat availability (Whalen et al.1999). Parr have been documented using riverine, lake, and estuarine habitats; incorporating opportunistic and active feeding strategies; defending territories from competitors including other parr; and working together in small schools to actively pursue prey (Gibson 1993; Marschall et al.1998; Pepper 1976; Pepper et al. 1984; Hutchings 1986; Erkinaro et al. 1998; Halvorsen and Svenning 2000; Hutchings 1986; 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 freshwater for 2 years (90 percent or more) with the balance remaining for either 1 or 3 years (USASAC 2005). In order for parr to undergo smoltification, they must reach a critical size of 10 cm total length at the end of the previous growing season (Hoar 1988). During the smoltification process, parr markings fade and the body becomes streamlined and silvery with a pronounced fork in the tail. Naturally reared smolts in Maine range in size from 13 to 17 cm, and most smolts enter the sea during May to begin their first ocean migration (USASAC 2004). During this migration, smolts must contend with changes in salinity, water temperature, pH, dissolved oxygen, pollution levels, and predator assemblages. The physiological changes that occur during smoltification prepare the fish for the dramatic change in osmoregulatory needs that come with the transition from a fresh to a salt water habitat (Ruggles 1980; Bley 1987; McCormick and Saunders 1987; McCormick et al. 1998). The transition of smolts into seawater is usually gradual as they pass through a zone of fresh and saltwater mixing that typically occurs in a river's estuary. Given that smolts undergo smoltification while they are still in the river, they are pre-adapted to make a direct entry into seawater with minimal acclimation (McCormick et al. 1998). This pre-adaptation to seawater is necessary under some circumstances where there is very little transition zone between freshwater and the marine environment.

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

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

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

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, Fay *et al.* (2006) present a comprehensive time series of adult returns to the GOM DPS dating back to 1967. It is important to note that contemporary abundance levels of Atlantic salmon within the GOM DPS are several orders of magnitude lower than historical abundance estimates. For example, Foster and Atkins (1869) estimated that roughly 100,000 adult salmon returned to the Penobscot River alone before the river was dammed, whereas contemporary estimates of abundance for the entire GOM DPS have rarely exceeded 5,000 individuals in any given year since 1967 (Fay *et al.* 2006).

Contemporary abundance estimates are informative in considering the conservation status of the GOM DPS today. After a period of population growth in the 1970s, adult returns of salmon in the GOM DPS have been steadily declining since the early 1980s and appear to have stabilized at very low levels since 2000 (Figure 2). The population growth observed in the 1970s is likely attributable to favorable marine survival and increases in hatchery capacity, particularly from GLNFH that was constructed in 1974. Marine survival remained relatively high throughout the 1980s, and salmon populations in the GOM DPS remained relatively stable until the early 1990s. In the early 1990s marine survival rates decreased, leading to the declining trend in adult abundance observed throughout 1990s. Poor marine survival persists in the GOM DPS to date.

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

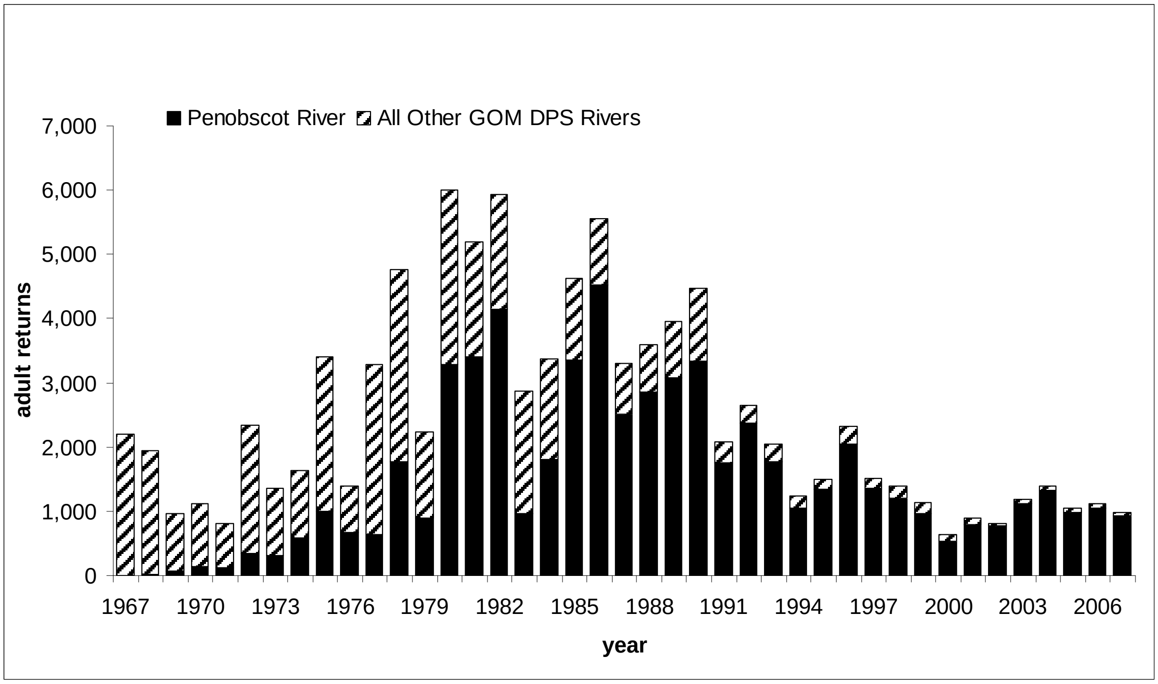

Figure 2. Adult returns to the GOM DPS 1967-2007.

DPS in 2007. Of the 1044 adult returns to the Penobscot in 2006, 996 of these were the result of smolt stocking and only the remaining 48 were naturally-reared. The term naturally-reared includes fish originating from natural spawning and from hatchery fry (USASAC 2008). Hatchery fry are included as naturally-reared because hatchery fry are not marked; therefore, they cannot be distinguished from fish produced through natural spawning. Because of the extensive amount of fry stocking that takes place in an effort to recover the GOM DPS, it is possible that a substantial number of fish counted as naturally-reared were actually 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 hatcheries. In short, hatchery production over this time period has been relatively constant, generally fluctuating around 550,000 smolts per year (USASAC 2008). In contrast, the number of naturally reared smolts emigrating each year is likely to decline following poor returns of adults (three years prior). Although it is impossible to distinguish truly wild salmon from those stocked as fry, it is likely that some portion of naturally reared adults are in fact wild. Thus, wild smolt production would suffer three years after a year with low adult returns, because the progeny of adult returns typically emigrate three years after their parents return. The relatively constant inputs from smolt stocking, coupled with the declining trend of naturally reared adults, result in the apparent stabilization of hatchery-origin salmon and the continuing decline of naturally reared components of the GOM DPS observed over the last two decades.

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

In conclusion, the abundance of Atlantic salmon in the GOM DPS has been low and either stable or declining over the past several decades. The proportion of fish that are of natural origin is very small (approximately 10%) and is continuing to decline. The conservation hatchery program has assisted in slowing the decline and helping to stabilize populations at low levels, but has not contributed to an increase in the overall abundance of salmon and has not been able to halt the decline of the naturally reared component of the GOM DPS.

2.2. Critical Habitat for Atlantic Salmon in the GOM DPS

Coincident with the June 19, 2009 endangered listing, NMFS designated critical habitat for the GOM DPS of Atlantic salmon (74 FR 29300; June 19, 2009) (Figure 3).

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 that are deemed essential to the conservation of the species. Within the GOM DPS, the PCEs for Atlantic salmon are 1) sites for spawning and rearing and 2) sites for migration (excluding marine migration[4]). NMFS chose not to separate spawning and rearing habitat into distinct PCEs, although each habitat does have distinct features, because of the GIS-based habitat prediction model approach that was used to designate critical habitat (74 FR 29300; June 19, 2009). This model cannot consistently distinguish between spawning and rearing habitat across the entire range of the GOM DPS.

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

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

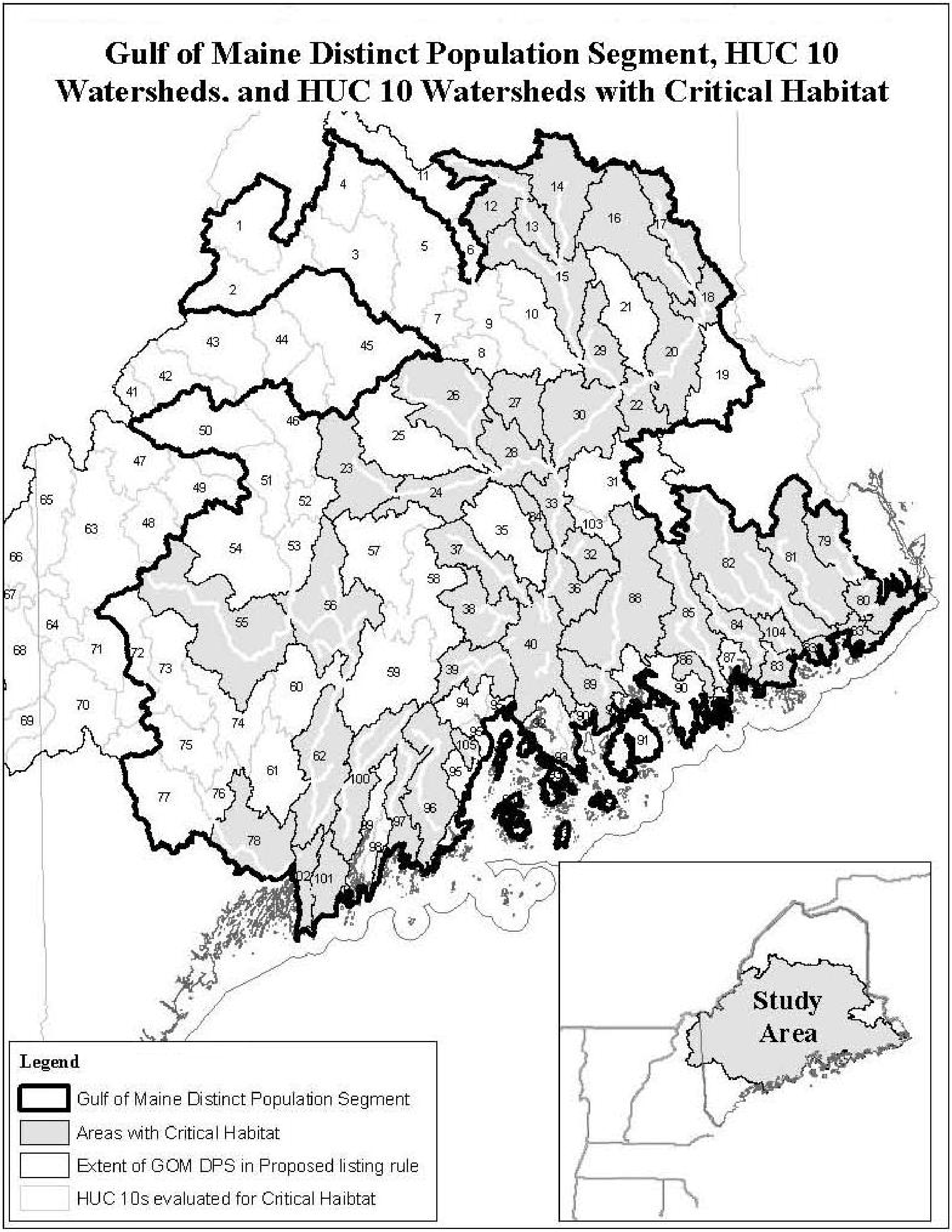

Figure 3. HUC 10 watersheds designated as Atlantic salmon critical habitat within the GOM DPS.

Physical and Biological Features of the Spawning and Rearing PCE[5]

A1. Deep, oxygenated pools and cover (e.g., boulders, woody debris, vegetation, etc.), near freshwater spawning sites, necessary to support adult migrants during the summer while they await spawning in the fall.
A2. Freshwater spawning sites that contain clean, permeable gravel and cobble substrate with oxygenated water and cool water temperatures to support spawning activity, egg incubation, and larval development.
A3. Freshwater spawning and rearing sites with clean, permeable gravel and cobble substrate with oxygenated water and cool water temperatures to support emergence, territorial development and feeding activities of Atlantic salmon fry.
A4. Freshwater rearing sites with space to accommodate growth and survival of Atlantic salmon parr.
A5. Freshwater rearing sites with a combination of river, stream, and lake habitats that accommodate parr's ability to occupy many niches and maximize parr production.
A6. Freshwater rearing sites with cool, oxygenated water to support growth and survival of Atlantic salmon parr.
A7. Freshwater rearing sites with diverse food resources to support growth and survival of Atlantic salmon parr.

Physical and Biological Features of the Migration PCE[6]

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

Habitat areas designated as critical habitat must contain one or more PCEs within the acceptable range of values required to support the biological processes for which the species uses that habitat. Critical habitat includes all perennial rivers, streams, and estuaries and lakes connected

[5] Appendix A designates the seven physical and biological features of the spawning and rearing PCE as A1 – A7. That convention will be used throughout this opinion.
[6] Appendix A designates the six physical and biological features of the migration PCE as B1-B6. That convention will be used throughout this opinion.

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 considered currently occupied by the species. Critical habitat includes the stream channels within the designated stream reach and includes a lateral extent as defined by the ordinary high-water line or the bankfull elevation in the absence of a defined high-water line. In estuaries, critical habitat is defined by the perimeter of the water body as displayed on standard 1:24,000 scale topographic maps or the elevation of extreme high water, whichever is greater.

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

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

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

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 61,400 units of historical spawning and rearing habitat for Atlantic salmon among approximately 6,039 km of rivers, lakes and streams. Of the 61,400 units of historical spawning and rearing habitat, approximately 53,400 units of habitat in eleven HUC 10 watersheds are considered to be currently occupied. Of the 53,400 occupied units within the Downeast Coastal SHRU, NMFS calculated these units to be the equivalent of roughly 29,111 functional units of habitat or approximately 47 percent of the estimated historical functional potential. This estimate is based on the configuration of dams within the SHRU that limit migration and the degradation of physical and biological features from land use activities which reduce the productivity of habitat within each HUC 10. Though the Downeast SHRU does not currently meet the objective of 30,000 fully functional units of habitat available to Atlantic salmon, there is enough habitat 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 323,700 units of historically accessible spawning and rearing habitat for Atlantic salmon among approximately 17,440 km of rivers, lakes and streams. Of the 323,700 units of spawning and rearing habitat (within 46 HUC 10 watersheds), approximately 211,000 units of habitat are considered to be currently occupied (within 28 HUC 10 watersheds). Of the 211,000 occupied units within the Penobscot SHRU, NMFS calculated these units to be the equivalent of nearly 66,300 functional units or approximately 20 percent of the historical functional potential. This estimate is based on the configuration of dams within the SHRU that limit migration and the degradation of physical and biological features from land use activities which reduce the productivity of habitat within each HUC 10. The combined qualities and quantities of habitats available to Atlantic salmon within the currently occupied areas in the Penobscot Bay SHRU currently meet the objective of 30,000 fully functional units of habitat available to Atlantic salmon. 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, although the Penobscot Nation specifically requested that their lands be included as critical habitat.

Merrymeeting Bay SHRU

The Merrymeeting Bay SHRU drains approximately 2,691,814 hectares of land (6,651,620 acres) and contains approximately 372,600 units of historically accessible spawning and rearing habitat for Atlantic salmon located among approximately 5,950 km of historically accessible rivers, lakes and streams. Of the 372,600 units of spawning and rearing habitat, approximately 136,000 units of habitat are considered to be currently occupied. There are forty-five HUC 10 watersheds in this SHRU, but only nine are considered currently occupied. Of the 136,000 occupied units within the Merrymeeting Bay SHRU, NMFS calculated these units to be the equivalent of nearly 40,000 functional units or approximately 11 percent of the historical functional potential. This estimate is based on the configuration of dams within the Merrymeeting Bay SHRU that limit migration and other land use activities that cause degradation of physical and biological features and which reduce the productivity of habitat within each HUC 10. The combined qualities and quantities of habitat available to Atlantic salmon within the currently occupied areas within the Merrymeeting Bay SHRU meet the objective of 30,000 fully functional units of habitat available to Atlantic salmon. 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 includes 45 specific areas occupied by Atlantic salmon that comprise approximately 19,571 km of perennial river, stream, and estuary habitat and 799 square km of lake habitat within the range of the GOM DPS and on which are found those physical and biological features essential to the conservation of the species. Within the occupied range of the GOM DPS, approximately 1,256 km of river, stream, and estuary habitat and 100 square km of lake habitat have been excluded from critical habitat pursuant to section 4(b)(2) of the ESA.

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 GOM DPS (NMFS and USFWS 2005) and the most recent status review (Fay *et al.* 2006) provide a comprehensive assessment of the many factors, including both threats and conservation actions, currently impacting listed Atlantic salmon. A threats assessment done as part of the recovery plan resulted in the following list of high priority threats requiring action to reverse the decline of GOM DPS salmon populations:

- Acidified water and associated aluminum toxicity, which decrease juvenile survival
- Aquaculture practices, which pose ecological and genetic risks
- Avian predation
- Changing land use patterns (e.g., development, agriculture, forestry)
- Climate change
- Depleted diadromous fish communities
- Incidental capture of adults and parr by recreational anglers
- Introduced fish species that compete or prey on Atlantic salmon
- Low marine survival
- Poaching of adults in DPS rivers
- Recovery hatchery program (potential for artificial selection/domestication)
- Sedimentation of spawning and rearing habitat
- Water extraction

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

1. **Present or threatened destruction, modification, or curtailment of its habitat or range –** Historically and, to a lesser extent currently, dams have adversely impacted Atlantic salmon by obstructing fish passage and degrading riverine habitat. Dams are

considered to be one of the primary causes of both historic declines and the contemporary low abundance of the GOM DPS. Land use practices, including forestry and agriculture, have reduced habitat complexity (e.g., removal of large woody debris from rivers) and habitat connectivity (e.g., poorly designed road crossings) for Atlantic salmon. Water withdrawals, elevated sediment levels, and acid rain also degrade Atlantic salmon habitat.

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

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

4. **Inadequacy of existing regulatory mechanisms –** The ineffectiveness of current federal and state regulations at requiring fish passage and minimizing or mitigating the aquatic habitat impacts of dams is one of the significant threats to the GOM DPS today. Furthermore, most dams in the GOM DPS do not require state or federal permits. Although the State of Maine has made substantial progress in regulating water withdrawals for agricultural use, threats still remain within the GOM DPS, including those from the effects of irrigation wells on salmon streams;

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

2.3.2. Threats to Critical Habitat within the GOM DPS

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

Downeast Coastal SHRU

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

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 FERC-licensed hydropower dams in the Penobscot SHRU significantly impede the migration of Atlantic salmon and other diadromous fish to nearly 300,000 units of historically accessible spawning and rearing habitat. Agriculture and urban development largely affect the lower third of the Penobscot SHRU below the Piscataquis River sub-basin by reducing substrate and cover, reducing water quality, and elevating water temperatures. Introductions of smallmouth bass and other non-indigenous species significantly degrade habitat quality throughout the mainstem Penobscot and portions of the Mattawamkeag, Piscataquis, and lower Penobscot sub-basins by altering predator/prey relationships. Similar to smallmouth bass, recent Northern pike introductions threaten habitat in the lower Penobscot River below the Great Works Dam.

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. 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 spawning and rearing habitat. In addition to hydropower dams, agriculture and urban development largely affect the lower third of the Merrymeeting Bay SHRU by reducing substrate and cover, reducing water quality, and elevating water temperatures. Additionally, smallmouth bass and brown trout introductions, along with other non-indigenous species, significantly degrade habitat quality throughout the Merrymeeting Bay SHRU by altering natural predator/prey relationships.

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, and local government agencies, as well as many private conservation organizations. The 2005 recovery plan for the originally-listed GOM DPS (NMFS and USFWS 2005) presented a strategy for recovering Atlantic salmon that focused on reducing the 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 DPS salmon;
6. Conserve the genetic integrity of the DPS;
7. Assess stock status of key life stages;
8. Promote salmon recovery through increased public and government awareness; and
9. Assess effectiveness of recovery actions and revise as appropriate.

A wide variety of activities have focused on protecting Atlantic salmon and restoring the GOM DPS, including (but not limited to) hatchery supplementation; removing dams or providing fish passage; improving road crossings that block passage or degrade stream habitat; protecting riparian corridors along rivers; reducing the impact of irrigation water withdrawals; limiting effects of recreational and commercial fishing; reducing the effects of finfish aquaculture; outreach and education activities; and research focused on better understanding the threats to

Atlantic salmon and developing effective restoration strategies. In light of the 2009 GOM DPS listing and designation of critical habitat, the Services expect to produce a new recovery plan for Atlantic salmon.

2.4. The New England Cottontail – a Federal Candidate Species

The USFWS recognizes the New England cottontail as a high priority candidate for listing under the ESA (71 FR 53756; Sept. 12, 2006). The New England cottontail is dependent on early-successional habitats, specifically the dense, woody understory cover found in shrub thickets and young, regenerating forests. Historically, the New England cottontail occurred in southern Maine (primarily York and Cumberland Counties), where it still persists today although with much-reduced distribution and densities (present at 58 out of 406 surveyed habitat patches in the early 2000s). Population declines throughout its range (including outside of Maine) are attributed to the following: 1) habitat loss and fragmentation from development; 2) the increased risk of predation due to degraded habitat conditions (including from domestic dogs and cats); and 3) competition for food and habitat from the introduction of the non-native eastern cottontail (except in Maine, where the eastern cottontail is not known to occur). The New England cottontail is listed by the State of Maine as an endangered species.

III. ENVIRONMENTAL BASELINE

The Environmental Baseline provides a snapshot of the health or status at a given time of the species and its habitat, 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).

The action areas for these projects involve work in 23 different rivers and streams scattered throughout the range of the GOM DPS and all three of the SHRUs with designated critical habitat. Projects occur in 14 different HUC 10 watersheds, with 10 of these in the Penobscot Bay SHRU and two each in the Downeast Coastal and Merrymeeting Bay SHRUs.

The Environmental Baseline is typically a more narrowly focused subset of the Status of the Species and Critical Habitat evaluation. For example, an opinion discussing a bridge replacement project on the East Machias River would have an environmental baseline that discusses the status of the salmon population and critical habitat in the East Machias River basin and the project-specific action area on the East Machias River. However, in this opinion, the action area of the proposed agency action encompasses a considerable portion of the freshwater range of the entire Atlantic salmon GOM DPS and its critical habitat. As such, the environmental baseline for the species and its critical habitat in the action area is basically the same as the current status of the species and its critical habitat as a whole, as discussed above in Section II. Status of the Species and Critical Habitat (pages 23-38). Based on the best available scientific information, there is nothing noticeably different about the 23 proposed project locations (i.e., streams or rivers) when compared to the entire GOM DPS and its critical habitat.

The Environmental Baseline for this proposed action includes the effects of the proposed MEDOT culvert replacement on Route 191 in Meddybemps on an unnamed tributary of the Dennys River. A biological opinion submitted by the USFWS to the ACOE on August 11, 2008 analyzed the effects of this project on the GOM DPS of Atlantic salmon (as listed at the time) and concluded that the project would not jeopardize the continued existence of the species. Furthermore, the opinion authorized the take of up to four juvenile Atlantic salmon. Since the scope of this project or its effects on the GOM DPS has not changed, this opinion will not re-consider the effects on the species. This opinion will, however, consider the project's effects on critical habitat, which was not designated at the time of the August 2008 opinion.

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). 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.

Because the projects included in this opinion will, by and large, have similar effects on the GOM DPS and its critical habitat, this section will generally not include a project-specific analysis of effects. Instead, this section will focus on a general discussion of effects as they apply to most, if not all, of the projects under consideration. For example, many of these projects will involve the temporary isolation of an instream work area by cofferdams and the potential need to capture and relocate Atlantic salmon downstream to a safe location during construction within the cofferdam. A generic discussion of the effects to Atlantic salmon from capture and relocation, following a proposed standard protocol, would then apply to all of the proposed projects. The discussion of effects to critical habitat will pertain to all of the projects except the Weston (PIN 15968) culvert replacement on Trout Brook.

The New England cottontail is a candidate species and accordingly is not currently provided any protection under the federal ESA. However, its candidate status defines this small mammal as a species in decline that the USFWS believes needs to be listed under the ESA. Such listing is currently precluded by other priorities of the USFWS. In light of its candidate status and its listing by the State of Maine as endangered, the ACOE and MEDOT have chosen to evaluate the potential impacts of the Falmouth (PIN 15094) bridge replacement project on the New England cottontail and its habitat.

4.1. Effects to Atlantic Salmon from Specific Construction and Monitoring Activities

4.1.1 Cofferdams, Dewatering, and Fish Relocation

Atlantic salmon may be killed or more likely temporarily disturbed, displaced, or injured by instream work activities. Isolation of a stream work area with a cofferdam is a conservation measure intended to minimize the overall adverse effects of construction activities on Atlantic salmon and their habitat. Dewatering of a stream inside a cofferdam, however, would have a lethal effect on any fish left inside the cofferdam. Some salmon may either be temporarily disturbed or displaced so that they move away from the instream work area while a cofferdam is being installed. Atlantic salmon that don't move away and are subsequently captured inside the cofferdam will be temporarily removed from the stream, before or while the cofferdam is being dewatered, and then released downstream, outside of the action area according to a fish evacuation plan (Appendix B). Atlantic salmon and other fish will generally be removed from the cofferdam area by electrofishing but dip nets or other techniques may also be used. Because small juvenile Atlantic salmon can hide within coarse stream substrate, electrofishing is generally considered to be the most efficient method for removing all fish from inside a cofferdam (Scott Craig, USFWS, pers. comm.).

For the culvert rehabilitation and repair projects, the entire stream channel will generally be spanned by an upstream and a downstream cofferdam (i.e., above and below the culvert) to completely isolate the construction area. While the cofferdams are in place and dewatered, Atlantic salmon will be prohibited from occupying or moving through the work area. Although temporary in nature, cofferdams will disrupt normal Atlantic salmon behavior of both juveniles and adults for a period of as little as one day to several weeks. For most projects, this disruption of behavior would occur during the normal instream work window from July 15 to September 30.

Atlantic salmon parr are highly territorial and actively defend their feeding territory to maximize their opportunity to capture prey items. 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 more stress while looking for another suitable, unoccupied area of stream in which to establish a new territory.

To avoid the death of fish caught inside a cofferdam as a result of dewatering, MEDOT will capture and remove all Atlantic salmon and other fish species. Capturing and handling salmon causes 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 dipnetting, time out of water, and data collection like measuring the length, are stressful and can lead to immediate or delayed mortality (Murphy and Willis 1996). Direct mortality may occur when fish are handled roughly or kept out of the water for extended periods. Delayed mortality is often associated with a disease epizootic which typically 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 sedated during handling. It is common for fish to jump out of the worker's hand and fall onto a hard surface, resulting in internal injuries.

To minimize any injury or stress to Atlantic salmon captured during construction and dewatering of the cofferdam, only certain MEDOT Environmental Office staff will be allowed to handle fish and all personnel involved with electrofishing will have appropriate experience with salmonids in Maine (see Appendix B for a list of specific staff names). Handling stress and risk of injury 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, other MEDOT staff, its consultants, or its contractors may not handle any Atlantic salmon during the course of these construction projects.

Despite efforts to avoid mortality while electrofishing, some mortality is inevitable. The MEDMR annually reports to the USFWS juvenile salmon mortality associated with electrofishing activities in GOM DPS waters[7]. While the MEDMR usually handles a few thousand juvenile salmon each year during electrofishing, mortalities are usually less than two percent of total fish captured (Table 4).

Table 4. Mortality of juvenile Atlantic salmon during MEDMR electrofishing activities within GOM DPS rivers.

Life Stage	**2005**	**2006**	**2007**	**2008**
Young of theYear (0+)	2.46%	1.43%	2.28%	1.83%
Parr	1.24%	0.24%	0.26%	0.20%
Total Number of Fish Handled	6243	5592	7869	5427
Total Number of Mortalities	121	50	132	75
Total Habitat Units Sampled (1 unit = 100 m^2)	992	1137	739	301

For the period 2005-2008, MEDMR averaged 0.12 juvenile mortalities/100 m² or a 1.50% mortality rate during electrofishing activities throughout the GOM DPS[8]. MEDOT fish removal activities are not expected to result in a higher level of Atlantic salmon mortality. Even though most Atlantic salmon are not expected to be injured or killed by capture and relocation activities, these fish will be temporarily disrupted from their normal behaviors (e.g., territorial behavior of parr, which includes foraging on aquatic invertebrates).

[7] The MEDMR is authorized by the USFWS 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.

[8] This mortality figure does not include "catch per unit effort" sampling or random "poke" sampling because the size of the stream area sampled is not know in these instances. The data above, however, captures the majority of MEDMR's electrofishing effort for Atlantic salmon and is thought to be representative of overall mortality rates.

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 (formerly the Atlantic Sea Run Salmon Commission). While electrofishing for juvenile Atlantic salmon population estimates (for both young-of-the-year [YOY] and parr) and collection of parr for use as broodstock at the USFWS's Craig Brook National Fish Hatchery, the MEDMR collected a GOM DPS average of 6.29 salmon/100 m^2 in 2005; 4.92 salmon/100 m^2 in 2006; 10.65 salmon/100 m^2 in 2007; and 8.03/100 m^2 in 2008. The four-year GOM DPS average for juvenile Atlantic salmon density is then 7.93 salmon/100 m^2. These data are from electrofishing efforts in many streams located in watersheds throughout the new GOM DPS (as defined in June 2009) and represent the best available scientific information to assist in determining the number of juvenile Atlantic salmon that are likely to be displaced or collected and relocated when a portion of a stream is dewatered within a cofferdam.

All projects that will use cofferdams to isolate instream work areas are expected to capture some juvenile Atlantic salmon within the cofferdam areas. The total cofferdam area for all projects, excluding Howland and Norridgewock (where the capture of juvenile salmon is not reasonably likely to occur in the large, mainstem rivers) is 3,675.72 m^2 or 36.8 units of salmon habitat. While some of the projects included in this total area do not contain juvenile habitat at the project site, there is juvenile rearing habitat upstream and/or downstream of the project; so it is possible that salmon could be moving through the project area during construction. Therefore, it is reasonable that as many as 292 juvenile Atlantic salmon (7.93 parr/100 m^2 x 36.8 habitat units = 291.82 salmon) could be displaced from or captured inside cofferdams. Because some of the habitat within the cofferdams is currently inside of an existing culvert and may not be as suitable as habitat outside of the structure for Atlantic salmon, we are reducing the number of salmon expected to be caught by electrofishing by 25%. As a result, it is reasonable that as many as 219 (292 x 0.75 = 219) juvenile Atlantic salmon could be displaced or captured inside cofferdams and subsequently relocated downstream of the action area. This total does not include the 4 juvenile salmon that were authorized as incidental take for the Meddybemps culvert project (USFWS 2008).

From 2005-2008, MEDMR averaged 1.50% electrofishing mortality for YOY and parr combined. Given that MEDOT staff (and possibly consultants) who will be electrofishing are experienced with handling salmonids in Maine, we expect a similar level of mortality during electrofishing efforts. Therefore, USFWS expects that no more than four (4) juvenile Atlantic salmon will be killed as a result of electrofishing activities to relocate fish outside of cofferdam work areas (219 salmon captured x 1.50% mortality rate = 3.29 salmon mortalities; round up to 4 salmon mortalities).

Adult Atlantic salmon are not expected to be affected by MEDOT electrofishing activities. Given the recent adult returns to GOM DPS rivers, the likelihood of an adult being present at any given project site is very small. Given the level of instream activity associated with setting up the cofferdams and other construction-related activities along the stream banks, any adult salmon present in the project areas would very likely be disturbed and move away from the work zone. It is highly unlikely that an adult would be captured within a cofferdam; and, therefore, the USFWS does not believe that take of an adult salmon is reasonably likely to occur.

In order to keep the stream flows diverted around the cofferdam (in situations where the entire stream channel is blocked off) 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 Atlantic salmon, through impingement and entrainment. Effects from entrainment into the pump can be avoided by putting a properly sized screen on the end of the intake hose. Approach velocities across the screen, however, can draw and hold fish against the screen surface (i.e., impingement), resulting in suffocation or physical damage to the fish (ADFG 1998).

To prevent entrainment of Atlantic salmon parr, MEDOT proposes to use a screen on the end of all intake hoses with a screen opening not to exceed 6.35 mm (¼ inch) (NMFS 1995). This mesh size is appropriate for pumping when the smallest salmon expected in the area are YOY (Jeff Murphy, NMFS, pers. comm.). In order to minimize the occurrence of impingement of salmon on the screened intake hoses, MEDOT will also employ additional barriers that serve to slow the approach velocity to the hose. MEDOT may place the hose within a five-gallon plastic bucket or create a barrier with a ¼ knotless block seine around the perimeter of the intake. Other barriers, including sandbags, plastic sheeting, or other suitable materials, may be used depending on the site conditions. With the use of these barriers, MEDOT proposes to keep the approach velocity below 0.24 m/sec (0.8 ft/sec) to avoid impingement of Atlantic salmon on the hose screens (NMFS1 997).

With the implementation of these protective measures, diversion pumps should have minimal, if any, effects on Atlantic salmon. In order for these protective measures to be effective, they must be carefully planned to suit the project site conditions and monitored throughout the period of pumping.

When a sheetpile cofferdam will have a concrete seal placed on the stream bottom (generally when a new bridge pier is being constructed), there is the possibility of Atlantic salmon being exposed to very high pH water (sometimes as high as pH 12) while the concrete is curing. High pH water can kill fish; cause damage to or burn outer surfaces including gills, eyes, and skin; and impair a fish's ability to dispose of metabolic wastes. MEDOT intends to remove Atlantic salmon captured inside of a sheetpile cofferdam before a concrete seal is poured underwater, thus avoiding any effects to salmon from high pH water. For the large bridge construction projects in deeper water (e.g., Howland), however, it may not be feasible to electrofish or otherwise remove fish from inside a sheetpile cofferdam constructed in deep water. Based on experience, MEDOT believes it is relatively rare for fish to be trapped within a sheetpile cofferdam, given the general construction-related activity associated with the installation. In addition, the relatively low numbers of Atlantic salmon in these rivers further reduces the likelihood that a salmon would be captured inside a sheetpile cofferdam.

Based on monitoring of pH levels inside a cofferdam during dewatering, MEDOT has determined that higher pH water is limited to area in proximity to the concrete seal. MEDOT has observed brook trout swimming inside a cofferdam while concrete is curing, apparently unaffected the by high pH water near the bottom of the cofferdam (Mike Clark, MEDOT, pers. comm.).

4.1.2 Effects from Fish Passage Monitoring

Following construction of replaced or rehabilitated culverts, MEDOT will monitor these projects for the efficacy of fish passage through these road crossing structures (Farmington PIN 15640, Farmington PIN 12693, Ebeemee PIN 17088, Prentiss PIN 16742, Meddybemps, Weston PIN 15968, and Bradley PIN 16687). Monitoring will involve the use of block nets and electrofishing to determine the ability of fish to move through the structure. Only indirect monitoring is necessary at the Prentiss project since the replacement of bottomless arch structure is unlikely to affect fish passage. If any Atlantic salmon are present in these project areas, most likely juvenile salmon, they could be subjected to physiological stress, injury, or death, as discussed above, related to electrofishing, netting, and relocation. The effects from fish passage monitoring activities are expected to be very similar to those related to the installation and dewatering of cofferdams. Other monitoring activities, to include measuring water depths and velocities and assessing the occurrence of stream substrates inside the culvert, are not expected to have any effects on Atlantic salmon.

For the six projects that will be monitored with electrofishing, the total number of juvenile Atlantic salmon expected to be captured is based on the expected occurrence of fish within the same amount of habitat as was isolated by a cofferdam during construction. Consequently, it is reasonable that as many as 143 Atlantic salmon could be captured by electrofishing and then released back into the stream (24 habitat units x 7.93 parr/unit x 0.75 = 142.74; rounded up to 143 fish). Fish passage monitoring is proposed to occur over three separate years, so as many as 429 salmon could be captured during electrofishing over the course of the monitoring program. Total electrofishing mortality is expected to be about seven (7) salmon (429 x 1.5% = 6.435; rounded up to 7 fish).

The MEDOT monitoring protocol uses a second day of electrofishing to determine the ability of fish to pass through the structure after being placed below the structure near the downstream block net. Consequently, some of the fish captured on day one may be captured again on the second day of monitoring. Based on previous monitoring experience, MEDOT does not anticipate an increase in mortality rates from electrofishing on the second day (John Perry, MEDOT, pers. comm.). New fish are not expected to be caught on the second day due to the presence of block nets in the stream both upstream and downstream of the culvert.

4.1.3 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. The amount of sediment entering streams in association with these projects, however, is expected to be relatively minor given the measures proposed by MEDOT to minimize erosion and sedimentation. Sixteen of the projects covered by this opinion will have all instream work limited to the period from July 15 to September 30 when stream flows are relatively low, consequently limiting the potential for stream flows to generate erosion and carry sediment downstream. Furthermore, precipitation is usually fairly low during the summer in Maine, limiting the potential for rain and subsequent construction-site runoff to cause erosion and carry sediment into a stream.

Salmon eggs and newly emerged fry, which are generally considered the most sensitive life stages to the effects of increased suspended sediments, will not be present in streams during the summer instream work window (Robertson *et al.* 2007). The Bangor, Howland, and Norridgewock projects have either open or modified instream work windows that allow for winter and spring work when eggs or fry could be present. There is, however, no spawning habitat located within the action areas of these projects, so eggs and newly emerged fry would not be affected by these construction activities.

All projects will be constructed in accordance with the MEDOT BMP manual for sediment and erosion control (MEDOT 2008a). Each project will have an individual Soil Erosion and Water Pollution Control Plan (SEWPCP) that is approved and fully enforced by MEDOT. Because these projects are all located in habitat for an endangered species, the BMP manual designates each project as “sensitive” and requires that a combination of BMPs will be used to protect the resource, including that one of the BMPs must be an erosion control BMP versus a sedimentation control BMP. A higher level of inspection and compliance assurance is required by MEDOT for all projects where endangered species are present (MEDOT 2008a).

Limiting most instream work to a dewatered section of stream within a cofferdam will minimize the amount of sediment mobilized and distributed downstream. Turbid water from within a cofferdam will be pumped into the “dirty water” treatment system to minimize sedimentation impacts to the stream when the diverted water is returned downstream. However, the installation and removal of these cofferdams, installation and removal of pipe-piles and H-piles, removal of piers, and the diversion of streamflow around the construction site can result in some amount of sediment being dispersed in the stream. Because most of these projects are located in sections of streams with coarser substrates (generally ledge, boulder, cobble, and gravel and rarely sand), the opportunity for sediment to be mobilized and carried downstream by construction activities will be minimal. Construction-related disturbances in riparian areas near the stream will also have the potential to result in erosion and sediment entering the stream, particularly if there are rainstorms during periods when there are disturbed soils on the construction site. Strict adherence to the SEWPCP plan and vigilant monitoring by MEDOT staff should minimize this source of erosion and subsequent sediment reaching the stream, as well.

A clamshell bucket will be used, most likely in association with bridge projects, to remove debris from a stream or river channel during and after demolition of bridge decks, piers, and abutments. Clamshell buckets are also used to create a level surface on the river bottom for the placement of a pile or the concrete seal used in association with a sheetpile cofferdam; relatively small amounts of streambed materials are excavated for these purposes. The majority of piles used for the projects in this consultation will be less than 61 cm. (24 in.) in diameter and will require minimal removal of sediment. If the stream substrate is soft, it is possible that no excavation will be necessary. Cobble or boulder substrates will require the removal of some rock to access substrate through which a pile can be driven. The amount of sediment expected to be released into the stream by this use of a clamshell bucket is expected to be relatively minor and short-term in nature. Removal of demolition debris that has fallen into the stream channel will not involve excavation of the substrate and should consequently result in little, if any, sediment being suspended in the stream.

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

In a review of the effects of sediment loads and turbidity on fish, Newcomb and Jensen (1996) concluded that more than 6 days exposure to total suspended solids (TSS) greater than 10 mg/l is a moderate stress for juvenile and adult salmonids. A single day exposure to TSS in excess of 50 mg/l is also a moderate stress to salmonids. Robertson *et al.* (2007) found adverse effects to juvenile Atlantic salmon from short-term increases in suspended sediment at sediment levels as low as 15 nephelometric turbidity units (NTU) in a laboratory setting. These effects, however, were observed during the fall and winter seasons, a time period when most of the MEDOT projects will not be engaged in instream work activities that are most likely to cause increases in stream sediment levels. 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 USFWS does not have sufficient information to compare the conclusions of Newcomb and Jensen (1996) with TSS levels that might be expected for the projects and various construction activities covered by this opinion. In 2006 MEDOT monitored extraction of H-piles in the Sheepscot River in association with a bridge replacement project. During the 2-hour monitoring process, turbidity about 22.9-30.5 m downstream from the work area yielded an average of 6.8 NTU and a high of 10.58 NTU compared to a background level of 5.8 NTU. Correlation between turbidity and TSS was calculated and 50 mg/l TSS correlated to 23.28 NTU for this section of the Sheepscot River. Therefore, it did not appear as though the sedimentation associated with removing the H-piles would have affected Atlantic salmon.

However, based on our knowledge of instream construction activities in Maine of a similar nature to the projects discussed here, we would not expect construction-related TSS levels to reach those described by Newcomb and Jensen. The sediment and erosion control measures that will be employed for each project, including construction in the dry in most situations, should keep sediment effects on Atlantic salmon to a minimal level on a temporary basis. Because of the minor amount of construction-related sediment expected to reach these streams and because of the relatively small number of salmon expected to be in the action areas, turbidity-related effects are expected to be minor and short-term. Atlantic salmon displaced from the action area would be expected to return once sediment levels return to background levels and normal behaviors would be resumed (e.g., foraging, defending territory). Such effects would not be expected to harm salmon by significantly impairing essential behavioral patterns including breeding, feeding, and sheltering. Therefore, effects of sedimentation are not expected to result in any take of Atlantic salmon.

4.1.4 *Pier and Ledge Removal Effects*

Bridge rehabilitation, replacement, and removal projects can require the removal of old bridge piers, typically either by mechanical equipment, such as a hoe ram, or by blasting. Specific pier demolition plans have not yet been developed for these projects, so the effects on Atlantic salmon from the most likely demolition and removal scenarios will be evaluated. Piers may be removed entirely with a hoe ram, entirely by blasting, or by using a combination of a hoe ram and blasting. A hoe ram may be used to remove the pier above the water line, with blasting then used to remove the remainder of the pier below the water.

Ledge may need to be removed in association with some projects, particularly bridge projects that will involve construction of piers in a new location. Ledge may need to be removed from the river bottom, either with a hoe ram or by blasting, primarily to provide a level surface for the placement of a new bridge pier. Although ledge removal is not anticipated for any of these projects at this time, this activity might become necessary as more specific project plans are developed and river substrate conditions are evaluated.

<u>Blasting Effects</u>

The use of explosives in or near water produces a post-detonation compression shock wave with a rapid rise to a peak pressure followed by a rapid decay to below ambient hydrostatic pressure (Wright and Hopky 1998). This final pressure deficit causes most of the known adverse effects to fish from blasting by damaging the swim bladder, kidney, liver, spleen, and circulatory system (sinus venous). Any of these organs may rupture or hemorrhage as a result of blasting, with the swim bladder being the most sensitive. The effects on fish are variable and relate to the type of explosive; size and pattern of charges; method of detonation; distance from the point of detonation; water depth; and species, size and life stage of fish. Small fish, including juvenile salmon, are more likely to be injured by an explosion than large fish (ADFG 1991). Wright (1982) demonstrates that effects on fish from blasting occur when the overpressure exceeds 100 kPa (kilopascals), or 14.5 pounds per square inch. Shock waves generated by in-water explosions generally have more adverse effects on fish than underground explosions, in part because some energy is reflected and lost at the ground-water interface. Underwater explosions that are contained (e.g., explosive placed within a pier for demolition by drilling and covering), however, reduce the capacity of the water-borne shock wave to cause fish mortality when compared to an unconfined underwater explosion (Keevin 1998).

Because a precise blasting plan (e.g., the total of amount of explosives needed, location(s) of charges, etc.) for pier or ledge removal is not available for any of the projects in this consultation at this time, it is not possible to determine the effects of such blasting on Atlantic salmon. However, because small fish with swim bladders (e.g., juvenile Atlantic salmon) are known to be particularly susceptible to injuries and death from blasting activities, MaineDOT will need to develop a project-specific blasting plan that limits the overpressure in the surrounding waters to 100 kPa. This pressure limit is derived from guidelines developed by the Canadian Department of Fisheries and Oceans to protect fishery resources from explosions in or near water bodies (Wright and Hopky 1998). Adult salmon, which could be present at some of the project sites, are also susceptible to injuries or death from blasting.

If this pressure guideline cannot be met, then a hoe ram will be used for pier or ledge removal activities. If, in order to meet the required pressure guidelines, MEDOT or its contractor introduces effects to Atlantic salmon not previously consulted on, reinitiation of ESA Section 7 consultation may be necessary to analyze these new effects. Because MEDOT has never proposed a blasting plan for work in waters where endangered Atlantic salmon occur and, therefore, USFWS has never had to review such a plan; ACOE and MEDOT should anticipate adequate time to complete such a review if blasting is proposed for any of these projects.

If a hoe ram is used to remove a pier, abutment, or ledge, possible effects to Atlantic salmon would be from sedimentation in the water or from noise. The effects of sedimentation have already been discussed above in Section 4.1.3. Effects from noise will be discussed below.

4.1.5 Construction-Related Sound Effects

Fish are sensitive to the effects of intense sound waves. These extreme changes in pressure can be especially damaging to species that have swim bladders, such as the salmonids, and can cause severe injury or mortality, either instantaneously or over the course of a few days, in individuals exposed for any length of time (NMFS 2003). NMFS noted that severe effects generally occur when sound intensity exceeds 190 dB. Non-fatal injuries, such as permanent hearing damage and stress, frequently occur when levels exceed 180 dB. NMFS further noted that behavioral modification, such as avoidance and startle responses, are often observed in many species of fish when sound levels exceed 150 dB at a frequency above the hearing threshold of the species. These are general thresholds for all fish, but due to differences in the hearing mechanism, some species are more sensitive than others to moderately intense (less than 180 dB) noise levels. Pile driving is known to cause mortality of fish, although the circumstances of such mortality are highly variable and not particularly well understood (Hastings and Popper 2005; NMFS 2003, WSDOT 2008).

Atlantic salmon are hearing non-specialists (or generalists), meaning they only hear noises in a narrow range of frequencies (Amoser and Friedrich 2005) (Figure 4). They lack a Weberian apparatus that connects the inner ear and the swim bladder making them less sensitive to the impacts of noise than species that have this mechanism. Consequently, Atlantic salmon are functionally deaf above 380 Hz; furthermore, they can’t detect noise, even at the optimal frequency (around 160 Hz), until levels exceed 90 dB (Hawkins and Johnstone 1978).

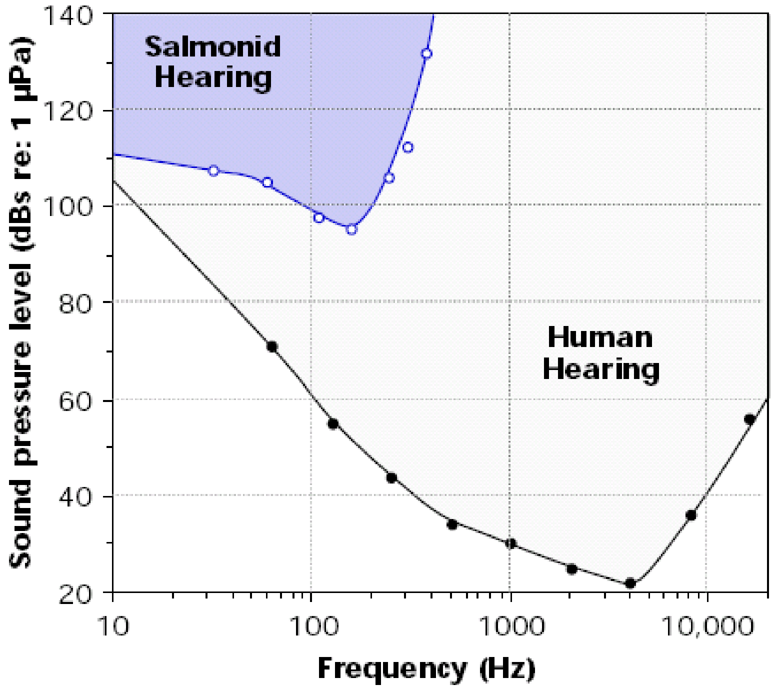

Figure 4. The hearing range of salmonids compared to the range detected by humans (from Feist *et al.* 1996).

Popper and Carlson (1998) found that fish can suffer from hearing damage from sounds that exceed 60 dB higher than their hearing threshold. In the case of Atlantic salmon, that would occur at values ranging between 150 and 200 dB, depending on the frequency of the noise (based on information in Figure 4 from Feist et al. 1996). However, as indicated previously, most research indicates that physical injuries from construction noise do not occur until the noise exceeds the 180 dB threshold (Hastings and Popper 2005; WADOT 2008a; Dolat 1997). Additionally, no behavioral response is expected in most fish species below the 150 dB level. FWS and NOAA-Fisheries have previously used the 150 dB level as a threshold when making effect determinations when dealing with Pacific salmon. These thresholds cannot necessarily be applied to Atlantic salmon, although their hearing mechanism is similar (i.e. no Weberian apparatus).

Pile Driving

The driving of piles is necessary to provide support for temporary detour bridges, work trestles, and falsework. In general, these piles are expected to be less than 61 cm (24 inches). Prior to placement of the pile, a clamshell bucket is used to excavate and create a flat, even surface on the stream bottom in the location where the pile will be set. It is likely that the work with the clamshell and the lowering of the pile into the water would scare any salmon in the work area away prior to the driving of the pile. American Association of State Highway and Transportation Officials (AASHTO 2009) provide guidance on scaring fish out of the impact area prior to blasting, and the same principle could be used prior to initiating pile driving or hoe ramming. Because Atlantic salmon are assumed to be present in the project areas (as well as other fish species), the operator of the hammer will conduct a few light taps on the pile prior to driving, to presumably scare fish away from the area immediately around the pile.

An interagency work group (including USFWS and NMFS), primarily addressing effects to west coast ESA-listed fish, has provided **interim** criteria for what level of noise caused by pile driving will cause direct physical injury to fish (i.e., "harm" in terms of the ESA) (Fisheries Hydroacoustic Working Group 2008). This group has not yet provided criteria for sound levels that would affect the behavior of fish and, therefore, might be considered to "harass" fish in terms of the ESA. The workgroup established a dual sound criteria for injury, measured 10 meters away from the pile, of 206 dB_{Peak}[9] and 187 dB SEL[10] (the second criteria applies only to fish weighing 2 grams or more). When evaluating potential injury impacts to fish, peak sound pressure (dB_{peak}) is often used (WSDOT 2008).

The amount of noise produced by pile driving is affected by the type and size of the pile **(**Table 5**).** The noise produced by driving wood, concrete, and steel piles under 61 cm (24-inches) in diameter is below the assumed threshold of direct physical injury for Atlantic salmon (based on Table 5 and the FHWG 2008 interim criteria). As discussed above, noises above 150 dB can cause a startle response in fish, but are not thought to cause injury. As long as the piles being used for the MEDOT projects are below the upper threshold described in the Fisheries Hydroacoustic Working Group guidance, it does not appear that there will be a direct physical effect to salmon in the action area, either by injury or mortality. If a project requires a larger pile, the noise level can be reduced below the effect threshold by using a bubble curtain or other noise attenuation technique.

Table 5. Sound levels produced by the driving piles of different types and sizes (from WSDOT, 2008)

Pile Type	Sound Level (Single Strike)		
Wood piles:	180 dB_{peak}	170 dB_{RMS}	160 dB SEL
Concrete piles:	192 dB_{peak}	176 dB_{RMS}	174 dB SEL
Steel H-piles:	190 dB_{peak}	175 dB_{RMS}	155 dB SEL
12-inch steel piles:	208 dBpeak	191 dBRMS	175 dB SEL
14-inch steel piles:	195 dB_{peak} @ 30m	180 dB_{RMS} @ 30m	
16-inch steel piles:	200 dB_{peak}@ 9 m	187 dB_{RMS} @ 9m	
24-inch steel piles:	212 dB_{peak}	189 dB_{RMS}	181 dB SEL
30-inch steel piles:	212 dB_{peak}	195 dB_{RMS}	186 dB SEL
36-inch steel piles:	214 dB_{peak}	201 dB_{RMS}	186 dB SEL
60-inch dia. steel piles:	210 dB_{peak}	195 dB_{RMS}	185 dB SEL

[9] (dB_{peak}) is instantaneous peak sound pressure level

[10] Sound exposure level (SEL) – The constant sound level acting for one second, which has the same amount of acoustic energy, as indicated by the square of the sound pressure, as the original sound. It is the time-integrated, sound-pressure-squared level. SEL is typically used to compare transient sound events having different time durations, pressure levels, and temporal characteristics (Hastings and Popper 2005).

The driving of sheet piles was not specifically addressed by the hydroacoustic working group. Data exist from California, however, that allow for the comparison between the noise produced by driving sheet piles and the dual threshold criteria. The California Department of Transportation (CADOT) determined that the noise produced by driving a sheet pile with an impact hammer was more intense (205 dB_{Peak}, 190 dB_{RMS}, and 180 dB_{SEL} 10 meters away from the source) than a sheet driven with a vibratory hammer (175 dB_{Peak}, 160 dB_{RMS}, and 160 dB_{SEL}) (CADOT 2007). Overall, data collected on in-water noise produced by vibratory hammers versus impact hammers demonstrate that vibratory hammers produce lower sound levels. In general, MEDOT uses vibratory hammers to install and extract sheetpiles. In either case, the noise produced from driving sheetpiles or piles less than 61 cm (24 inches) is unlikely to exceed the thresholds described by the hydroacoustic working group in 2008 and is therefore not likely to cause physical injury or mortality to any salmon in the project area.

Hoe Ramming

Reports on the amount of noise produced from hoe ramming vary between 150 dB at 15.24 m (50-feet) from the source (FHWA 2008) and 190 dB at 30.48 m (100-feet) away from the source (Dolat 1997). NMFS (2004), in a biological opinion for a bridge replacement project that involved pier demolition with a hoe ram in California, noted that there is a ten-fold decrease in the driving energy delivered by a hoe ram as compared to a pile-driving hammer.

During demolition of concrete piers in the Connecticut River, Dolat (1997) measured sound in the water from use of a hoe ram. Sound measurements at 30.48 m from the demolition of a pier without a cofferdam was 190 dB and for a pier with a cofferdam (apparently not dewatered) was 181 dB (peak Sound Pressure Level or SPL). Another set of sound measurements on either side of the cofferdam showed 187 dB inside and 180 dB outside of the cofferdam. The use of a sheetpile cofferdam, even without dewatering, reduced sound levels in the nearby water column. Dolat (1997) concluded that hoe ramming a pier without a cofferdam as an attenuation measure could cause physical damage to fish within 30.48 m of the pier. This conclusion, however, is likely based on "rules of thumb", as discussed above, that pre-date the 2008 FHWG interim criteria.

Summary of Effects from Noise

Both juvenile and adult Atlantic salmon could be present in the action areas during pile driving, pier demolition, or ledge removal where the use of various construction equipment, such as a hoe ram, impact hammer, or vibratory hammer, would produce noise in the water column. Hydro-acoustic effects from construction activities can kill, injure, or affect the behavior of fish, including Atlantic salmon.

Based on the best available information presented above (including the FHWG 2008 interim criteria), it appears that driving piles less than 61 cm diameter and sheet piles should not cause mortality or injury to Atlantic salmon. Noise in the water column may, however, still affect the behavior of salmon. For example, driving sheet piles may cause a startle response in fish that causes an individual to move to another location in the river. Such short-term responses, however, are not expected to significantly disrupt normal behavior patterns (such as feeding or migration) of salmon. Therefore, driving sheet piles or piles less than 61 cm is not expected to result in the take of any Atlantic salmon.

If MEDOT needs to drive piles larger than 61 cm, USFWS assumes, for purposes of this effects analysis, that appropriate noise attenuation techniques will be employed to meet the 2008 interim noise criteria and, therefore, avoid physical injury. Noise attenuation techniques include (but are not limited to) 1) confined and unconfined air bubble curtains; 2) work inside a dewatered cofferdam; and 3) work inside a larger casing that isolates the pile. A properly installed bubble curtain is a commonly used method for noise attenuation and can achieve noise reductions ranging from 5 dB to 30 dB peak SPLs (WSDOT 2008).

There are five bridge replacement projects that may use a hoe ram to demolish existing piers. The Island Falls, Oakfield, and New Sharon projects will use a hoe ram within a dewatered cofferdam (likely sandbags). The cofferdam will be constructed prior to any pier demolition work, including the portion of the pier above the water. Use of the cofferdam as an attenuation technique should keep noise effects in the adjacent water column below the dual criteria established to avoid physical injury or death of fish. Short-term effects to fish behavior, such as a startle response, are not expected to significantly disrupt normal behavior patterns. Therefore, hoe ramming within a dewatered cofferdam is not expected to result in the take of Atlantic salmon.

The Norridgewock and Howland bridge replacement projects require removal of existing piers in large river settings. Typically, MEDOT would remove such piers using a hoe ram above the water level to break apart the concrete and blasting below the water, both without the use of cofferdams. Cofferdams are generally not used because of the expense of installing sheet pile dams in relatively deep water where sandbags are not practicable. The use of a hoe ram in pier demolition will cause some noise in the water column that could affect Atlantic salmon. MEDOT estimates that typical pier removal work would take from five to seven days of effort.

The FHWG generally considers the use of a hoe ram to demolish concrete piers as a similar activity to driving concrete piles (Emily Teachout; USFWS; pers. comm.). CADOT (2007) summarizes noise information measured at various projects where concrete piles were installed without the use of noise attenuation measures. The highest noise measured at 10 m, 192 dB_{PEAK} and 174 dB SEL, was associated with driving a 61 cm octagonal concrete pile at the water's edge. The lowest noise measured at 10 m, 184 dB_{PEAK} and 165 dB SEL, was associated with driving a 61 cm octagonal concrete pile in 8 m of water.

The sound data associated with driving concrete piles indicates that using a hoe ram to demolish a concrete pier should not cause physical injury or mortality to Atlantic salmon. Use of a noise attenuation technique, such as a cofferdam to isolate the pier, would further reduce the potential noise effects to salmon. While the expected noise in the water column could produce a behavioral response in salmon, such as an individual being startled and moving to another part of the river channel, these effects are expected to be relatively short-term and minor and not result in take of any fish (i.e., harass). Work to demolish piers at both Howland and Norridgewock will only involve a portion of the river channel at any given time, allowing salmon to use and move through some portion of the river that is unaffected by noise.

4.1.6 Effects from Hazardous Materials Associated with Construction

As a component of the SEWPCP for each project, MEDOT or their contractor will develop and implement a Spill Prevention Control and Countermeasure Plan (SPCCP) designed to avoid any impacts to rivers and streams from hazardous chemicals associated with construction, such as diesel fuel, oil, lubricants, and other hazardous materials. All refueling or other construction equipment maintenance will be done at a location consistent with the SPCCP and in a manner which avoids chemicals or other hazardous materials getting into the stream. 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 the overall SEWPCP, should make it highly unlikely that Atlantic salmon would be exposed to harmful chemicals during a construction project.

4.1.7 Effects on the Riparian Zone

At all project locations some vegetation, including trees, shrubs, or the herbaceous layer, will be removed from the stream banks to allow for construction access, placement of larger crossing structures, or other construction-related activities. Vegetation removal will be kept to minimum necessary to accomplish each project. Some projects will use rip-rap to stabilize stream slopes or protect structures from scour. Although riprap along stream banks can increase stream water temperatures due to solar radiation, the generally small amounts of riprap proposed for these projects should not have a measurable effect on water temperature. Furthermore, the minor vegetation removal at each project should not result in any input of sediment into the streams, as long as appropriate erosion control BMPs, such as silt fence, are employed. All disturbed areas will be mulched and stabilized following construction (MEDOT 2008a).

4.1.8. Effects on Fish Passage through the Structures Post-Construction

Road crossing structures, particularly culverts, can have adverse effects on fish passage, particularly upstream movements of fish. As stated in their BA, MEDOT intends to provide passage of all appropriate life stages of Atlantic salmon through each crossing structure covered by this opinion. A more extensive discussion of fish passage through these bridges and culverts is provided below in the Section *4.2.2.*, which discusses effects of these projects on critical habitat and the migration PCE.

The Weston culvert replacement project (PIN 15968) does not contain designated critical habitat for salmon, so it will be discussed further here. MEDOT notes that there is juvenile rearing habitat in Trout Brook both upstream and downstream of the road crossing. The existing culverts have hanging outlets and do not allow for upstream passage of salmon. As such, approximately 7.24 km of upstream habitat is currently unavailable to Atlantic salmon and other fish species. MEDOT proposes to replace the existing structure with twin reinforced concrete pipes. One pipe will be embedded 30.5 cm below the existing stream elevation to provide for fish passage, while the other pipe will be placed at the existing stream elevation. If the new structure is properly installed and does result in improved fish passage, Atlantic salmon will potentially have restored access to 7.24 km of juvenile rearing habitat in Trout Brook. This would result in a beneficial effect for Atlantic salmon.

The Interstate-95 rehabilitation project from Veazie to T2R9 involves removing and resetting the end of an existing culvert on an unnamed tributary to the East Branch Medunkeunk Stream, which does contain critical habitat. The culvert is undersized (compared to the stream width upstream and downstream) and its outlet hangs about 0.6 m above the stream bed, making the structure currently impassable to Atlantic salmon and other fish species. MEDOT notes that this stream contains juvenile rearing habitat for salmon. Since the proposed work only on the end of the culvert will not address the current lack of fish passage, MEDOT proposes to leave this stream crossing as a structure that is not passable for Atlantic salmon. Consequently, salmon habitat upstream of the culvert will continue to be unavailable for Atlantic salmon; and this project will have no net effect on the ability of salmon to move through this structure.

4.2. Effects to Atlantic Salmon Critical Habitat

Each project covered by this consultation (except Falmouth PIN 15094) was evaluated by an MEDOT biologist familiar with Atlantic salmon habitat requirements to determine which of the critical habitat PCEs (and their associated physical and biological features) are present within each project-specific action area. Twelve projects contain both the spawning and rearing and migration PCEs and six projects contain only the migration PCE. One project, Weston (PIN 15968), does not occur within designated critical habitat. Appendix A provides a description of the salmon habitat at each project site and a list of the PCEs and specific habitat features present at each location.

The discussion that follows lists each PCE and its associated biological and physical features and then discusses how the proposed bridge and culvert projects may affect the PCE and their associated features.

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

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

Only two projects – the Winterport bridge repair on Marsh Stream and the Bradley twin-culvert replacement on Great Works Stream – have been identified as having PCE A1 present. Deep pools that could support adults during the summer are presumably present either upstream or downstream of all twenty projects, somewhere in their respective watersheds.

Based on the information available, these two projects will not result in the loss of any deep pools and cover that provide summer holding habitat for adults. Other projects, however, could affect use of deep pools and cover located either upstream or downstream of the road crossing. Several of the projects in this batch, which involve replacing or rehabilitating culverts, will necessitate blocking off the entire stream channel to temporarily divert stream flows around the work site. During this time, access to upstream or downstream pools for adults will be temporarily disrupted. This disruption could last for as little as one day for smaller culverts that only need an end reset to as much 63 days, which is the full extent of the typical July 15 to September 30 instream work window. Following the completion of instream construction work and the removal of cofferdams, salmon access to upstream and downstream pools should be fully restored at all project locations.

All of these projects have the potential to generate some amount of instream sediment. Given the various BMPs that will be employed to minimize the amount of sediment, particularly the use of cofferdams so that instream excavation work can be done in the dry, the amount of sediment that could affect deep pools is relatively minor and would not be expected to degrade or eliminate their use by adults as summer holding habitat.

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

Only two projects – the Winterport bridge repair on Marsh Stream and the Bradley twin-culvert replacement on Great Works Stream – have been identified as having PCE A2 present. Spawning habitat for Atlantic salmon may be present either upstream or downstream of all 18 projects with designated critical habitat. Because instream work for both Winterport and Bradley will be conducted from July 15 to September 30, spawning habitat will not be affected at a time when spawning, egg incubation, or larval development is occurring.

The Winterport bridge replacement project should not result in the loss of any spawning habitat. The new bridge will not have any in-water piers and the new abutments will be constructed behind the existing abutments and out of the stream channel. Installation and removal of the cofferdams used to isolate the work area during the removal of the existing abutments will generate some sediment that could settle out in nearby spawning habitat. However, given the predominance of bedrock, boulder, and cobble substrate in the action area and the minor amount of stream disturbance associated with installing and removing cofferdams, the amount of finer sediments likely to be mobilized and moved downstream is very minor and will not result in any spawning habitat being degraded. Some shrubs and small trees will have to be removed from the riparian area on both banks to allow access and construction of the new abutments. Because the stream channel is about 100 feet wide, the existing forest canopy is not closed and does not shade the entire stream channel. Loss of a few shrubs and small trees will not increase water temperature in the project area.

The Bradley bridge replacement project involves the replacement of twin 5.18 m by 21.34 m multiplate pipes on Great Works Stream, likely with somewhat larger twin pipes. MEDOT anticipates that the larger pipes would displace about 158 m^2 of stream substrate. Additionally, about 19 m^2 of stream bottom would be displaced by new rip-rap, above the water, used to stabilize the inlets and outlets of the new pipes. These two habitat impacts would likely result in a permanent loss of spawning habitat because salmon are unlikely to spawn inside the new pipes. This loss, however, would have a very minor effect on Atlantic salmon critical habitat as the Penobscot Bay SHRU currently has more than enough functional habitat to support the 2000 adult spawners deemed necessary for the conservation of the species (74 FR 29300; June 19, 2009). While some trees and shrubs will be removed from the riparian zone to allow construction of the approaches for a detour bridge, this minor vegetation removal should not increase stream water temperature in the short-term because the forest canopy is not closed over this section of stream. In the long-term, all removed vegetation will be allowed to grow back once construction is complete.

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

MEDOT has identified eleven project sites that have PCE A3 in the project vicinity. Following emergence from the redd, fry tend to move to shallower, lower velocity riffle habitats, often near stream margins.

Some of these projects would involve temporary dewatering of a portion of the stream within cofferdams to allow for inwater work to occur with a minimal amount of sediment entering the stream. All of these projects that could dewater fry habitat would do so from July 15 to September 30, after the time when fry would have entered the parr stage. Consequently, temporary dewatering would not affect fry habitat at a time when it is being used by fry.

Two projects – Farmington (PIN 15640) and Ebeemee Township (PIN 17088) – will involve rehabilitating the existing culverts by inserting a slipliner into the existing structure and filling the space in between with concrete. Internal and/or external weirs will be installed to facilitate fish passage through the rehabilitated culverts, which will experience higher water velocities and raised culvert outlets. External weirs, which function to back water into the culvert and are often constructed with concrete Jersey barriers, would permanently displace a small amount of fry habitat. Each external weir is expected to displace about 1.67 m^2 of stream bottom for Farmington and 3.25 m^2 for Ebeemee, with two or three weirs likely needed. This loss of fry habitat is relatively minor and will not affect the capacity of the Merrymeeting Bay or Penobscot SHRUs to produce salmon fry.

The installation of a slipliner may increase flow velocity through the pipe structure, due to the smoother pipe surface and reduced flow area. The principal impact of a velocity increase would be increased scour immediately downstream of the pipe and subsequent deposition somewhat farther downstream once the energy has dissipated. However, culvert hydraulic calculations by MEDOT indicate that any effect is likely to be minor and that any adjustment will be a one-time event as the watershed, culvert, and channel establish a new equilibrium. The installation of internal and external weirs will minimize the effect of the reduced flow area through rehabilitated culverts. This expected channel adjustment, therefore, could result in the erosion of a very small amount of fry habitat immediately below the culvert outlet and the subsequent deposition of the eroded material into downstream fry habitat. MEDOT, however, did not quantify the amount of habitat likely to be affected.

These projects will all necessitate the removal of some trees and shrubs to provide construction access to the bridge or culvert. The two projects that require external weir construction will require additional vegetation removal downstream of the culvert for construction access along the stream banks. Area of vegetation removal varies from about 37 m^2 to 130 m^2; in all cases vegetation would be allowed to regrow after construction. Because of the relatively small amounts of vegetation removal and the fact that the entire tree canopy would generally not be removed from a given section of stream, we do not anticipate any increase in stream temperature that would affect fry habitat.

PCE A4-A7 for parr rearing habitat

The four distinct physical and biological elements of freshwater habitats used by Atlantic salmon parr will be considered together because of the similarity of the habitats that support these various features of critical habitat for parr. MEDOT identified that all four physical and biological features of the spawning and rearing PCE important for parr are present at eleven project sites. There are no project locations where fewer than four parr PCEs were noted.

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

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

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

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

Six of these projects will result in the complete dewatering of a section of the stream (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. The area of stream channel, and therefore critical habitat for parr, that would be temporarily dewatered varies from about 45 m^2 to about 220.73 m^2. During the period of dewatering, which could last from one day (for a small culvert end reset) to several weeks (for a large culvert replacement), all parr habitat within the cofferdam area would be unavailable to Atlantic salmon. The maximum time frame during which this parr habitat could be dewatered and displaced by cofferdam materials is 63 days during the standard. summer low-flow work window (July 15 to September 30). Once the project is completed, the cofferdams removed, and normal stream flows are restored, the temporarily impacted parr habitat should be returned to its prior condition. These projects would result in the total, temporary loss of 962.26 m^2 of parr habitat or about 9.6 units of juvenile habitat.

One of these six projects, Bangor (PIN 15090), would dewater about 209 m^2 of parr habitat. However, this bridge, as well as the stream condition at a downstream railroad bridge, is thought to prevent movement of any salmon past the railroad bridge into Meadow Brook from the Penobscot River. Consequently, the parr habitat at the Bangor project is not expected to be occupied by Atlantic salmon. Nevertheless, dewatering of habitat during construction is only a temporary effect. Flow to stream habitat will be restored following construction, although in this case flow will be restored to a new stream channel alignment.

The Bradley (PIN 16687) project consists of the replacement of large, twin culverts. Most likely the pipes would be replaced one at a time, so that only about one-half of the stream is isolated within a cofferdam at any given time while stream flow is maintained through the other culvert. Consequently, about one-half of the stream width and its associated parr habitat would be dewatered for a period of time and then the other side of the stream would be dewatered for a similar length of time. This project would result in the total temporary loss of 1302 m^2 of parr habitat or about 13.02 units of parr habitat.

The other four projects are bridge projects that will require cofferdams around abutments or piers that will isolate and dewater only a portion of the stream channel at the project site. The area of stream channel, and therefore critical habitat for parr, that would be temporarily dewatered varies from about 18.6 m^2 to about 148.80 m^2. Total parr habitat that would be temporarily lost due the placement of cofferdams and stream dewatering is 306.9 m^2 or slightly more than 3 units of parr habitat.

De-watered parr habitat would experience a loss of aquatic invertebrates, which provide food for Atlantic salmon. This loss of food resources would be temporary; however, as aquatic invertebrates should recolonize the stream once flows are re-established. Since the stream habitat 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 cool, oxygenated water but will still lack in food resources until aquatic invertebrates are able to recolonize the stream substrate.

Some projects will require rip-rap to stabilize new or repaired bridge abutments or the inlets and outlets of culverts. Some of this rip-rap will be placed in critical habitat that is used by Atlantic salmon parr. Only some of this rip-rap will result in a permanent loss of habitat because the rock fill will extend above the stream surface (i.e., the rip-rap placed closest to the edge of the stream). As the rip-rap slopes down into the stream from the abutments, some of the placed rock will be under water and would offer rearing habitat for Atlantic salmon parr. Rip-rap impacts are estimated to range from as little as 3.5 m^2 to 232 m^2, which is a relatively minor effect to critical habitat given the amount of salmon habitat available in these streams.

The placement of weirs downstream of the rehabilitated culvert in Ebeemee Township to facilitate fish passage would also result in the loss of a small amount of parr habitat. This loss of habitat is expected to be between 6.5 m^2 and 10 m^2.

The installation of a slipliner may increase flow velocity through the pipe structure, due to the smoother pipe surface and reduced flow area. The principal impact of a velocity increase would be increased scour immediately downstream of the pipe and subsequent deposition somewhat farther downstream once the energy has dissipated. However, culvert hydraulic calculations by MEDOT indicate that any effect is likely to be minor and that any adjustment will be a one-time event as the watershed, culvert, and channel establish a new equilibrium. The installation of internal and external weirs will minimize the effect of the reduced flow area through rehabilitated culverts. This expected channel adjustment, therefore, could result in the erosion of a small amount of parr habitat immediately below the culvert outlet and the subsequent deposition of the eroded material into a small amount of downstream parr habitat. Most of these streams do not have substantial amounts of natural, fine sediments, which are most likely to be eroded and deposited downstream. Streams at road crossings can have finer sediments that have originated from the nearby road, and these finer sediments may be more likely to erode and degrade downstream parr habitat. Such effects, however, are expected to be relatively minor.

Culverts can result in the loss of natural stream bottom inside the culvert, depending on the type of culvert and the site-specific conditions. Some culverts have natural stream bed materials settle out inside the structure while others completely lack any natural stream substrate. Culverts that have a relatively natural stream bottom inside of them may offer habitat for Atlantic salmon parr. It is not known, however, if salmon parr would actually establish a territory inside a culvert. The existing 12.2 m culvert at the Meddybemps project has natural stream substrate on the bottom of the culvert. The new 17.1 m culvert would result in the displacement of 4.9 m of parr habitat by the longer culvert. However, it is anticipated that stream substrate will settle onto the bottom of the new culvert and offer some habitat values for salmon parr. The twin culverts at the Bradley project currently have some natural stream substrate on the bottom of the culverts. The new culverts will be slightly wider and longer, thus covering a small amount of parr habitat. Stream bed materials are expected to settle onto the bottoms of the new culverts and offer some habitat value for parr. The Ebeemee culvert currently has no stream bed materials inside because high water velocities prevent materials from settling out. Insertion of a slip liner into this culvert will likely keep materials from settling out because of the smooth surface and high water velocities. Therefore, there will be no effect on parr habitat inside this culvert.

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

All 18 of the bridge and culvert projects have the migration PCE present at the project site. In general, MEDOT noted that feature B3[11] was absent at most sites due to the overall depleted diadromous fish communities throughout rivers in Maine. However, native diadromous fish are still present in rivers where salmon occur, albeit in reduced numbers, and still provide an alternative prey species for predators of Atlantic salmon. The other five features of the migration PCE are present at all of the project sites except Meddybemps, which is an artificial canal with a dam and fish ladder at its upstream end.

Eight of the projects with the migration PCE present would result in a complete, temporary blockage of both upstream and downstream fish movements through the work site while the cofferdams (which span from one stream bank to the other) are in place. During this time, both juvenile and adult salmon would be prevented from migrating through the work site. This temporary blockage would occur between July 15 and September 30 and could last from as little as one day for a simple culvert end reset to the entire 63 day instream work window for a more complicated culvert replacement projects. Since the summer instream work window occurs after the downstream migration of Atlantic salmon smolts, which is generally during the period from mid-April through mid-June (Baum 1997), these stream blockages will not effect smolt migration. Once the cofferdams are removed, the migration function of the critical habitat would

[11] Feature B3 of the migration PCE: Freshwater and estuary migration sites with abundant, diverse native fish communities to serve as a protective buffer against predation.

be completely restored as the habitat would be returned to its previous condition.

The other projects will use cofferdams that only isolate a portion of the channel during construction (e.g., a cofferdam around a mid-stream pier or around an abutment along the stream bank). Although a portion of the migration habitat will be temporarily obstructed, both juvenile and adult salmon are expected to be able to move through the work sites to access both upstream and downstream spawning and rearing habitat. Once the cofferdams are removed, the migration habitat will be restored to its original condition and there will be no permanent effect to the habitat. These partial stream blockages will generally occur during the July 15 to September 30 work window, although the Norridgewock and Howland bridge replacement projects both have an open instream work window. Having cofferdams in place for more than 63 days is not expected to affect the ability of juvenile and adult salmon to pass around the construction work at either project since an adequate zone of passage will be maintained at all times in the approximately 152.4 m wide river channels.

Culverts and bridges can have adverse effects on the passage of fish, including Atlantic salmon (Benton et al. 2008; Belford and Gould 1989). We do not believe, however, that any of the bridges covered by this consultation are affecting movements of Atlantic salmon past the bridge structure. Road crossings with culverts, either round pipes or square boxes, can affect fish passage by acting as a physical barrier (e.g., a hanging culvert) or by altering stream flows (e.g., increasing water velocity, decreasing water depth), consequently limiting a fish's ability to navigate a stream crossing.

All of the projects covered by this consultation have been designed in accordance with the MEDOT Wildlife and Water Crossing Policy and Design Guide (MEDOT 2008b), which does not necessarily require the passage of native fish species through a given road crossing structure. While MEDOT recognizes the importance of providing aquatic habitat connectivity, they have to balance the design of transportation projects in light of many considerations including project costs and available funding, regulatory requirements, safety, and right-of-way issues. Consequently, fish passage for all species and all life stages may not be provided at every MEDOT stream crossing. In their BA, nevertheless, the ACOE and MEDOT state that all projects covered by this consultation will pass the appropriate life stages of Atlantic salmon.

The three culvert rehabilitation projects that involve either a slip liner or an invert liner have the potential to adversely affect salmon migration by increasing water velocity through the structure and raising the elevation of the outlet. Although final design details may change at the time of construction based on input from MEDOT staff, Farmington PIN 15640 is planned with both internal and external weirs and Ebeemee Township is planned with external weirs to facilitate migration of salmon through these culverts. Farmington PIN 12693, which involves a concrete invert liner, is not proposed to have either internal or external weirs, as MEDOT believes the water depth and velocity will be suitable for upstream passage of juvenile Atlantic salmon without any modifications to the culvert.

Given the design guide parameters in the MEDOT crossing policy (MEDOT 2008b), USFWS expects that the three rehabilitated culverts will pass the appropriate life stages of Atlantic salmon, at least to some unknown degree. The MEDOT design guide is based on the known hydraulic swimming abilities of the fish species that need to move through a structure and the recognition that crossings should mimic as much as possible the natural hydraulic conditions of the stream. MEDOT (2008b), however, has not determined the actual passage efficacies of fish passage structures installed to date. They believe that most of their existing fish passage structures do pass the target fish species, based on indirect evidence (e.g., comparing known swimming speeds versus the water velocity through the structure) or through direct observation of fish using the structure. Monitoring activities through 2004 provide some evidence that fish are passing through structures retrofitted with slip liners or invert liners; however, additional direct evidence of fish passage, such as mark-recapture studies, is needed to demonstrate that these structures can effectively pass both juvenile and adult Atlantic salmon at the various stream flows when salmon would be moving through a stream. At this time, USFWS believes that there is insufficient monitoring data from Maine road crossing structures to draw conclusions about overall effectiveness at providing passage for Atlantic salmon. MEDOT will monitor fish passage efficacy at the three retrofitted culverts following the protocol found in Appendix D.

4.3. Effects on the Candidate Species New England Cottontail

The bridge to be replaced is in the floodplain of the Presumpscot River. Habitat adjacent to the northeast side of the bridge contains semi-open forest with some dense, shrub habitat. The area of suitable habitat for the cottontail is limited to about 4,877 m^2. This area may also serve as a travel corridor along the floodplain of the Presumpscot River for cottontails to access other suitable shrub habitats upstream and downstream of this bridge. Two observations of New England cottontail have been noted about 402.3 m from the bridge in an area between the railroad and the river. Cottontails could also occur in the shrub habitat next to the bridge.

The new bridge will be located about 26 m downstream of the existing bridge. Vegetation will be cleared to provide for the new bridge alignment, as well as between the existing and new bridge locations to allow for construction access. Although there will b a loss of some cottontail habitat associated with the Falmouth bridge project, the existing habitat is of marginal value and the loss will be minor and temporary. To minimize effects on the New England cottontail, the area disturbed by construction should be revegetated with native shrub species that are known to be used by cottontails. This revegetated habitat should still be suitable for cottontails and may continue to function as a travel corridor.

4.4. Potential Effects not Considered in this Biological Opinion

As discussed above, many of these projects do not yet have final designs. Consequently, there are many unknowns about site-specific conditions, project-specific construction techniques, and final amounts of habitat impacts from new or rehabilitated structures. In general, however, MEDOT and USFWS attempted to analyze projects in light of the greatest likely effects to salmon and their habitat. As project plans develop, 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 ACOE to reinitiate Section 7 consultation for that particular project (or projects), 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 of the ESA.

Given that the action area encompasses a substantial amount of the freshwater portion of the GOM DPS and an extensive area of land (45,980 km^2) associated with many rivers, stream, ponds, and lakes, there is potential for a vast array of future state, tribal, local, and private actions to occur. There is very little federal land within the GOM DPS watersheds. In a broad sense, future activities would include (but not be limited to) agriculture, forestry, residential and commercial/industrial development, and recreational fishing. Within each of these broad categories are a variety of actions that could affect Atlantic salmon and their habitat including water withdrawal to irrigate crops, logging roads and stream crossings, non-point source pollution from residential development, and loss of forest and other natural habitats within a stream or lake ecosystem from residential and commercial development. Irrigation of blueberry and cranberry fields from both surface water withdrawals and wells is an ongoing activity, generally with no federal nexus, that is expected to expand, particularly for blueberries, as crop acreages increase. Reduction in stream flows from irrigation practices during the summer is of concern for Atlantic salmon at a time when stream flows are naturally low in most years. The Services continue to work with state regulatory agencies to address impacts to Atlantic salmon from irrigation.

Because many activities that impact streams, ponds, and wetlands require federal permits from the U.S. Army Corps of Engineers under the Clean Water Act and the Rivers and Harbors Act, at least some future actions (whether state, tribal, local, or private in nature) that would affect Atlantic salmon and their critical habitat would be subject to ESA Section 7 consultation. Indeed, even some of the activities mentioned above, such as residential development, could be subject to a federal action if impacts to wetlands or streams would occur.

Maine's total population in 2008 was 1,316,456 people, compared to 1,125,043 people in 1980 (14.6% growth over 28 years). The U.S. Census Bureau projected Maine's population growth from 2000 to 2030 and noted an overall aging of Maine's general population. Maine's population is expected to grow by 10.7% through 2030, indicating a reduced growth rate (USCB 2004). Subsequently, patterns and types of land use and development are not expected to dramatically change compared to trends seen over recent decades. Activities that have affected Atlantic salmon and their habitat in recent years are expected to continue relatively unchanged, although efforts at salmon conservation have and will continue to benefit Atlantic salmon (e.g., dam removals and riparian conservation easements).

MEDOT has recently identified that some of their culvert and bridge maintenance projects (rehabilitation or replacement) will not require a permit from the ACOE or will not involve federal funding. Consequently, there is the possibility that some future projects, which would likely have effects on Atlantic salmon and critical habitat, will not undergo Section 7 consultation. MEDOT and USFWS will be exploring the need to develop a Habitat

Conservation Plan to authorize take of Atlantic salmon associated with this group of future road crossing maintenance projects. It appears that most future MEDOT projects that would affect Atlantic salmon or their critical habitat would involve either a federal permit or federal funding and, therefore, would be evaluated through the Section 7 consultation process.

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 actions, and the potential for future cumulative effects in the action area, it is the USFWS's biological opinion that the proposed project is not likely to jeopardize the continued existence of the GOM DPS of Atlantic salmon throughout all or a significant portion of its range. Furthermore, the proposed actions are not expected to result in the destruction or adverse modification of critical habitat. In reaching these conclusions, the USFWS considered the best available scientific and commercial information regarding Atlantic salmon and the likely effects of the proposed bridge and culvert projects.

Our conclusions regarding the GOM DPS of Atlantic salmon and its critical habitat are based on the following considerations.

- Impacts to Atlantic salmon habitat are largely temporary during various instream construction activities. Most habitat will be returned to its previous condition after construction is completed and will continue to function to support Atlantic salmon, either as spawning and rearing habitat or migration habitat.
- Sediment and erosion control practices are enhanced for each project (in addition to standard MEDOT requirements) due to the presence of an endangered species and should result in very minor amounts of sediment being released into rivers and streams. Sedimentation is not expected to affect the long-term function of any spawning and rearing or migration habitat for salmon.
- Take of Atlantic salmon juveniles is expected to be largely non-lethal and is associated either with capture and removal from cofferdams or with fish passage monitoring. Capturing and relocating salmon during instream construction activities will avoid the more serious effects to salmon from temporarily dewatering habitat inside a cofferdam or not using a cofferdam at all during construction. Take of adult Atlantic salmon is not authorized and any effects to adults are expected to be relatively minor and short-term. Therefore, the current reproductive potential of the GOM DPS will not be affected.
- Fish passage for adult and juvenile salmon will be provided at all projects, except one culvert which is currently not passable and will remain so. One project will restore access to more than 7 km of upstream salmon habitat by replacing a currently impassable (i.e., "hanging") culvert with one that accommodates salmon passage. Overall, these projects will not adversely affect the ability of Atlantic salmon to

access spawning and rearing, except on a short-term basis during certain in-water construction activities. MEDOT will monitor fish passage at culverts to verify that new structures are not fragmenting habitat by blocking fish movements.

- Most instream work is scheduled during the standard summer work window when stream flows and precipitation are typically low, minimizing the likelihood of erosion and sedimentation to effect salmon and their habitat. Furthermore, the summer work window avoids particularly sensitive times of the salmon's life cycle, such as spawning, egg incubation, and downstream smolt migration.
- Permanent losses to salmon habitat from piers, abutments, and rip-rap are relatively minor compared to the total amount of habitat available in each of the three SHRUs. The individual and cumulative losses of habitat will not affect the function of critical habitat as needed to support recovery of the species.

In conclusion, while some limited, short-term adverse effects and limited project-related injury and mortality of juvenile salmon will occur from implementation of these bridge and culvert projects, the overall effects will not jeopardize the long-term survival and recovery of the species and or the function of designated critical habitat as needed for the conservation of Atlantic salmon.

VII. INCIDENTAL TAKE STATEMENT

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

A. Amount or Extent of Take

The USFWS anticipates that juvenile Atlantic salmon will be taken as a result of the proposed actions addressed in this opinion. This take will be the result of instream construction activities, including the placement and dewatering of cofferdams, and post-construction monitoring of fish passage through certain road crossing structures.

The four-year GOM DPS average for juvenile Atlantic salmon density is then 7.93 salmon/100 m^2. These data are from electrofishing efforts in many streams located in watersheds throughout the new GOM DPS (as defined in June 2009) and represent the best available scientific information to assist in determining the number of juvenile Atlantic salmon that are likely to be displaced or collected and relocated when a portion of a stream is dewatered within a cofferdam.

All projects that will use cofferdams to isolate instream work areas are expected to capture some juvenile Atlantic salmon within the cofferdam areas. Any Atlantic salmon captured during cofferdam installation will be properly handled and moved downstream outside of the work area by qualified MEDOT personnel according to their fish evacuation plan (Appendix B).

As discussed above in more detail in the Effects section (see pages 41-42), it is reasonable that as many as 219 juvenile Atlantic salmon could be captured inside various cofferdams and subsequently relocated by MEDOT staff downstream of the action area. This total does not include the 4 juvenile salmon that were authorized as incidental take for the Meddybemps culvert project (USFWS 2008). USFWS expects that no more than four (4) juvenile Atlantic salmon will be killed as a result of electrofishing activities to relocate fish outside of cofferdam work areas (219 salmon captured x 1.50% mortality rate = 3.29 salmon mortalities; round up to 4 salmon mortalities).

For electrofishing activities associated with fish passage monitoring, it is reasonable that as many as 143 juvenile Atlantic salmon could be captured by electrofishing and then released back into the stream (24 habitat units x 7.93 parr/unit x 0.75 = 142.74; rounded up to 143 fish). Fish passage monitoring is proposed to occur over three separate years, so as many as 429 salmon could be captured during electrofishing over the course of the monitoring program. Total electrofishing mortality is expected to be about seven (7) salmon (429 x 1.5% = 6.435; rounded up to 7 fish). These totals represent all projects that require "direct" monitoring of fish passage in accordance with the monitoring plan in Appendix D.

In total, incidental take is expected to be no more than 648 juvenile Atlantic salmon. Furthermore, of these 648 salmon, lethal take of no more than seven fish is expected due to capture, handling, and relocation.

This ITS specifically does **not** authorize the take (lethal or non-lethal) of any adult Atlantic salmon associated with any of the 19 projects covered by this opinion. If take of an adult salmon becomes a concern at any particular project, all activities that might be contributing to this concern should immediately cease and USFWS be contacted to discuss next steps. Reinitiation of Section 7 consultation may be necessary depending on the particular circumstances at hand.

B. Reasonable and Prudent Measures

The measures described below are nondiscretionary and must be implemented by the ACOE (or the MEDOT and their contractors) in order for the exemption in Section 7(o)(2) to apply. The ACOE has a continuing duty to regulate the activities covered by this incidental take statement. The USFWS considers the following reasonable and prudent measures to be necessary and appropriate to minimize take of the Atlantic salmon associated with the 19 culvert and bridge projects:

- Minimize the adverse effects to and incidental take of Atlantic salmon in the rivers and streams where bridge or culvert projects will occur by employing construction techniques that avoid or minimize adverse effects to water quality, aquatic and riparian habitats, and other aquatic organisms.

- Minimize adverse effects to and incidental take of Atlantic salmon by ensuring that fish passage and habitat connectivity at culverts and bridges is either maintained in its current condition or is improved by the replacement or rehabilitated structure.

C. Terms and Conditions

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

1. MEDOT shall hold a pre-construction meeting for each project with appropriate MEDOT Environmental Office staff, other MEDOT staff, and the MEDOT construction crew (as practicable) or the contractor(s), to review all procedures and requirements for avoiding and minimizing impacts to Atlantic salmon and to emphasize the importance of these measures for protecting salmon and their habitat. ACOE staff will attend these meetings as practicable.

2. MEDOT and their contractors will minimize the potential for impacts to Atlantic salmon and their habitat by conducting all instream work (which includes the installation and removal of cofferdams, as well as other activities) according to the work windows specified in Table 1 (page 6) of this opinion.

3. MEDOT and their contractors will minimize the potential for impacts 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.

4. A fish evacuation plan must be implemented by appropriate MEDOT staff during construction and dewatering of all cofferdams to carefully remove juvenile Atlantic salmon from the work area (see Appendix B).

5. All Atlantic salmon mortalities from electrofishing or other activities will be reported to the USFWS (Wende Mahaney at 827-5938, Ext. 20; FAX 827-6099; or wende_mahaney@fws.gov) and NMFS (Jeff Murphy at 866-7379; FAX 866-7342; or jeff.murphy@noaa.gov) within 48 hours of occurrence. Mortalities shall be immediately preserved (refrigerate or freeze) for delivery to the NMFS office in Orono, Maine (contact Jeff Murphy at 866-7379 to arrange for delivery).

6. To minimize the effects of entrainment and impingement from diversion pumps, MEDOT and their contractors shall use a screen on all intake hoses with a maximum mesh size of 6.35 mm. Furthermore, MEDOT shall insure that the approach velocity to the intake hose does not exceed

0.24 m/sec. Intake hoses shall be regularly monitored while pumping to minimize adverse effects to Atlantic salmon.

7. The MEDOT or their contractor will follow a Spill Prevention Control and Countermeasure Plan designed to avoid effects to rivers and streams from hazardous materials associated with construction activities. This plan will be approved by appropriate MEDOT Environmental Office staff prior to the start of construction and then carefully enforced throughout the duration of each construction project.

8. To minimize adverse effects to Atlantic salmon and ensure that salmon and other fish species are able to pass through rehabilitated culverts and that stream habitat is not fragmented, MEDOT will monitor the efficacy of fish passage through all culverts rehabilitated by invert lining or slip lining, regardless of whether or not fish passage structures are installed (e.g., weirs). Monitoring reports shall be submitted to USFWS (Attn: Wende Mahaney, 1168 Main Street, Old Town, ME 04468) with a copy to ACOE (Attn: Jay Clement, Maine Project Office, 675 Western Avenue #3, Manchester, ME 04351).

Monitoring will be completed at the following projects: 1) Farmington PIN 15640, 2) Farmington PIN 12693, and 3) Ebeemee PIN 17088. Monitoring will follow the procedures outlined in Appendix D, except as modified below. Monitoring will be completed during the first, third, and fifth years after construction during appropriate stream flows as discussed in Appendix D. Monitoring reports will be submitted in a timely fashion that will allow for the planning and implementation of any necessary instream construction work to correct identified fish passage problems during the following July 15 to September 30 work window (unless another work window is approved by USFWS). After the fifth year monitoring report is evaluated, the USFWS will determine the need for any further monitoring or corrective measures.

9. To minimize adverse effects to Atlantic salmon and ensure that salmon and other fish species are able to pass through replacement culverts and that stream habitat is not fragmented, MEDOT will monitor the efficacy of fish passage through the following culvert replacement projects: 1) Prentiss Township (PIN 16742); 2) Meddybemps (No PIN); 3) Weston (PIN 15968); and 4) Bradley (PIN 16687). Electro-fishing is not necessary at Prentiss unless indirect monitoring indicates there may be problems with fish passage through the new structure.

Monitoring will follow the procedures outlined in Appendix D, except as modified below. Monitoring will be completed during the first, third, and fifth years after construction during appropriate stream flows. Monitoring reports will be submitted in a timely fashion that will allow for the planning and implementation of any necessary instream construction work to correct identified fish passage problems during the following July 15 to September 30 work window (unless another work window is approved by USFWS). After the fifth year monitoring report is evaluated, the USFWS will determine the need for any further monitoring or corrective measures.

10. 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 life passage is not unnecessarily restricted. If a project is not completed but there will be substantial delays in construction, cofferdams will need to be at least partially removed to allow unobstructed passage of Atlantic salmon until construction resumes.

11. If any project proposes to use blasting, MEDOT will submit a project-specific blasting plan to USFWS for review and approval prior to any blasting activities. This plan must demonstrate that blasting will not produce overpressure in surrounding waters that exceeds 100 kPa. These plans must be submitted at least 30 days before the anticipated blasting activities to allow for adequate review and approval by USFWS.

12. To minimize adverse effects to Atlantic salmon from pile driving, equipment operators shall conduct a few light "taps" on the pile prior to normal pile driving operations in an effort to scare Atlantic salmon and other fish away from the piles.

13. To minimize adverse effects to Atlantic salmon from water column noise produced by demolition of the existing bridge piers (likely with a hoe ram), pier demolition shall be conducted inside a cofferdam at the following projects: 1) Island Falls (PIN 15097), Oakfield (PIN 15630), and New Sharon (PIN 16719). The cofferdam does not need to be dewatered, but dewatering would serve to further reduce the amount of noise in the adjacent water column and minimize effects on Atlantic salmon.

14. To minimize adverse effects to Atlantic salmon, particularly physical injury or mortality, any piles larger than 61 cm (24 in) in diameter will be driven using one or more noise attenuation techniques. Such techniques can include (but are not limited to) an air bubble curtain and isolation of the piles within a cofferdam. Driving of piles with noise attenuation techniques shall meet the interim noise criteria of the FHWG (2008) of 206 dB_{Peak} and 187 dB SEL measured in the water at 10 m from pile.

15. ACOE staff shall carefully monitor the actions described in this opinion and document the level of incidental take to ensure that these projects are minimizing the take of Atlantic salmon. ACOE will provide the USFWS with an annual report summarizing the work done under this opinion and accounting for all cumulative take of Atlantic salmon, until such time as all projects are completed. When all construction projects are completed, the ACOE shall submit a final report to the USFWS summarizing the total amount of incidental take from all projects.

VIII. CONSERVATION RECOMMENDATIONS

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

1. ACOE 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.

2. ACOE and MEDOT should evaluate the Bangor (PIN 15090) project on Meadow Brook (structure replacement with an open bottom box on a new stream alignment) for its ability to provide fish passage and the overall effectiveness of the new stream channel design to provide an ecologically productive stream channel. Although downstream conditions, particularly at the railroad bridge, are thought to prohibit upstream passage of Atlantic salmon and other fish species from the Penobscot River to the new structure, the proposed design is anticipated to offer fish passage at some stream flows.

3. ACOE 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 this data will be useful for future Section 7 consultations regarding MEDOT projects, when assessing the effects of construction projects on Atlantic salmon habitat and their habitat.

4. ACOE and MEDOT should collaborate to conduct monitoring of in-water noise associated with pile driving, hoe ramming, and other loud construction activities that could adversely affect Atlantic salmon. Collecting this data will be useful for future Section 7 consultation regarding MEDOT projects, when assessing the effects of construction projects on Atlantic salmon and their habitat. Collecting noise data related to the use of a hoe ram to demolish concrete piers or abutments would be particularly useful.

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

IX. REINITIATION NOTICE

This concludes formal consultation for the ACOE's proposed permitting of nineteen bridge and culvert rehabilitation or replacement projects to be carried out by the MEDOT on several rivers and streams throughout 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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