ENDANGERED SPECIES ACT SECTION 7 CONSULTATION

BIOLOGICAL OPINION

Agency:	Natural Resources Conservation Service, Maine State Office
Activity:	Funding of a large scale assessment of brook trout populations and habitats in streams in Maine by the Maine Department of Inland Fisheries and Wildlife
Conducted by:	U.S. Fish and Wildlife Service, Maine Field Office [53411-2008-F-0097]
Date Issued:	April 21, 2008

Approved by:

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INTRODUCTION

This constitutes the biological opinion (opinion) of the U.S. Fish and Wildlife Service (USFWS) on a large-scale investigation by the Maine Department of Inland Fisheries and Wildlife (MEDIFW) of brook trout (*Salvelinus fontinalis*) populations and habitats in streams throughout Maine. Some of these streams occur within the geographic range of the endangered Gulf of Maine (GOM) Distinct Population Segment (DPS) of Atlantic salmon (*Salmo salar*). The Natural Resources Conservation Service (NRCS) has funded this brook trout study through a Fish and Wildlife Conservation Grant administered by NRCS's Agricultural Wildlife Conservation Center. The NRCS's request for formal Section 7 consultation under the Endangered Species Act (ESA) was received on December 11, 2007.

This opinion is based on the following: (1) information provided in the NRCS's December 10, 2007 initiation letter and attachments in support of formal consultation under the ESA; (2) 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); (3) Status Review for Anadromous Atlantic Salmon (*Salmo* salar) in the United States (Fay *et al.* 2006); (4) meetings between the USFWS, the NRCS, the National Marine Fisheries Service (NMFS), the Maine Department of Marine Resources (MEDMR, formerly the Maine Atlantic Salmon Commission), and MEDIFW; (5) field investigations; and (6) 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-0097.

CONSULTATION HISTORY

April 13, 2007 – USFWS, NRCS, MEDIFW, MEDMR, and NMFS meet to discuss MEDIFW brook trout study funded by NRCS that could have impacts to endangered Atlantic salmon. Discussed ESA Section 7 consultation requirements due to federal funding through NRCS. Study is proposed to involve field work in both 2007 and 2008.

April 2007 – MEDIFW, MEDMR, and USFWS review potential stream sampling sites for 2007 field season to develop a list of streams where endangered Atlantic salmon are not expected to occur.

May 4, 2007 – NRCS letter to USFWS requesting concurrence that the list of proposed 2007 sampling sites are all streams where endangered Atlantic salmon are not expected to occur, even though some of the streams are located within the geographic range of the GOM DPS of endangered Atlantic salmon.

May 11, 2007 – USFWS letter to NRCS concluding informal Section 7 consultation for the proposed 2007 stream sample sites. Those 2007 sample sites that are located within the geographic range of the GOM DPS are all streams where endangered salmon are not expected to occur.

May 22, 2007 – USFWS, NMFS, NRCS, MEDMR, and MEDIFW meet to discuss Section 7 consultation needs for 2008 field season when electrofishing would occur in streams where endangered salmon are currently known or might occur.

October 26, 2007 – USFWS, NMFS, NRCS, and MEDIFW meet to review 2007 sampling season and discuss plans for 2008 sampling season, which will include streams where endangered Atlantic salmon are known to occur. Discussed information necessary for NRCS to request initiation of formal Section 7 consultation with USFWS.

December 11, 2007- USFWS receives December 10, 2007 letter from NRCS requesting initiation of formal Section 7 consultation for funding of the MEDIFW brook trout assessment project.

January 4, 2008 – Letter from USFWS to NRCS acknowledging initiation of formal consultation. The USFWS's opinion is due to NRCS by April 24, 2008.

BIOLOGICAL OPINION

I. DESCRIPTION OF THE PROPOSED ACTION

The NRCS has provided funding to the MEDIFW to conduct a large-scale assessment of brook trout populations and habitats in streams throughout the state of Maine. This funding was provided through a Fish and Wildlife Conservation Grant administered by NRCS's Agricultural Wildlife Conservation Center. As part of the National Fish Habitat Action Plan's[1] Eastern Brook Trout Joint Venture (EBTJV), this study will provide important quantitative data that is currently lacking for many brook trout populations in Maine. The study's results will be useful in monitoring success of the EBTJV and its initiatives in the future.

This project began during the 2007 field season. Streams sampled in 2007 were either outside of the geographic range of the GOM DPS or do not currently contain a naturally reproducing population of endangered Atlantic salmon. MEDIFW worked with MEDMR and the USFWS to identify streams where the likelihood of encountering endangered salmon is discountable (i.e., extremely unlikely to occur). On May 14, 2007 the USFWS sent a letter to NRCS concurring that the 2007 sample sites may affect but are not likely to adversely affect endangered Atlantic salmon in the GOM DPS and concluding Section 7 consultation for that portion of the project. That letter also acknowledged that further Section 7 consultation would be needed to address the 2008 field season when sampling would occur in streams with known or possible occurrence of endangered Atlantic salmon.

The goal of this project is to increase our knowledge of Maine's stream fisheries resources and habitats on privately owned land that is managed primarily for agriculture and forestry. The study will be used to 1) create a stream habitat index model for Maine, 2) identify and prioritize sites for wild brook trout habitat restoration projects, and 3) monitor restoration projects for biological responses. Project objectives, as identified by MEDIFW, are as follows:

- Collect adequate contemporary information to assess approximately 200 12-digit HUC[2] sub-watersheds per year for the EBTJV.

- Develop a habitat index model for native species to identify and prioritize streams and stream reaches for land conservation or habitat restoration projects.

- Evaluate riparian land use and condition to assist with aquatic resource conservation planning and habitat restoration where applicable.

[1] The National Fish Habitat Action Plan, which began in 2001, is a partnership of government, tribal, academic, industry, conservation organizations, and individuals focused on fisheries conservation following the successful model of the North American Waterfowl Management Plan.

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

• Provide a series of Geographic Information System data layers of survey efforts, stream and fish community condition, and prioritized sub-watersheds or sites for habitat restoration projects.

Description of Field Surveys

This project would use a sub-set of standardized stream survey methods developed by MEDIFW in their draft stream assessment manual (Gallagher 2007). Surveys would collect information on biological, habitat, and geomorphical characteristics of streams, as outlined below in Table 1.

Table 1. A conceptual framework for MEDIFW stream assessment protocols according to appropriate spatial scale of reference. Reach assessments highlighted in green are conducted at each survey site, while one of the assessments highlighted in yellow is completed per survey site.

Survey	**Level 1** **Low Intensity**	**Level 2** **Moderate Intensity**	**Level 3** **High Intensity**
Biological	Species Composition	Species Relative Abundance(CPUE[3])	Population abundance estimation *Brook Trout Monitoring Protocol*
Habitat	Reach level categorization *Stream Habitat Survey*	Meso-habitat assessment *Meso-scale Stream Habitat Survey*	Micro-habitat assessment *Micro-scale Stream Habitat Survey*
Geomorphic	Rapid Geomorphic Assessment *(RGA)*	Morphological description (Rosgen Level II)	Site analysis by professional geomorphologist or river engineer

For each HUC-12 sub-watershed, approximately seven to ten stream reaches will be surveyed. Two survey reaches are located on the mainstem river, while the remaining survey reaches are located on representative tributaries in the watershed. The majority of the surveys will be conducted by five seasonal two-person crews, supplemented by MEDIFW staff. Seasonal crews will be supervised and trained by MEDIFW staff (either Merry Gallagher, project leader, or Regional Fisheries Biologists). The 2008 field season will commence in May and run through September. Field crew training consists of three classroom days covering fish and crawfish identification; fish handling protocols; biosecurity procedures; principles of fluvial geomorphology; assessment protocols; and electrofishing techniques. The fourth day of training involves field exercises to practice all elements of sampling. Crew members returning from 2007 will receive a shortened refresher training course (probably two days). Inexperienced field crews are accompanied at all times by a MEDIFW fisheries biologist during the first two weeks of sampling.

[3] CPUE = catch per unit effort is the total catch divided by the total amount of effort used to harvest the catch.

The location of stream sample sites is generally predetermined by the availability of access to the stream and is usually associated with road crossings. If the field situation turns out to be unsuitable for sampling due to site or water conditions, the survey crews can abandon a predetermined sample site and chose another predetermined site in the same watershed. Actual stream survey sites are located upstream of and outside the influence of access points (e.g., road culverts). The majority of the survey work will occur in small, wadeable streams where backpack electrofishing is possible. Outside of the GOM DPS, non-wadeable stream reaches are electrofished by raft or boat. Non-wadeable reaches within the GOM DPS are not sampled, in part to eliminate the possibility of encountering an adult salmon while electrofishing but also due to equipment limitations. A chosen HUC-12 watershed may have to be replaced with another HUC-12 watershed on rare occasions if field logistics cannot be suitably arranged to accommodate sampling (e.g., overnight accommodations are not available nearby).

Sample reach lengths are three to five times the wetted-channel width, with a 50 meter (m) minimum and 500 m maximum. Each sample reach is split into two sections, with three transects each for collection of habitat and geomorphic data (Figure 1).

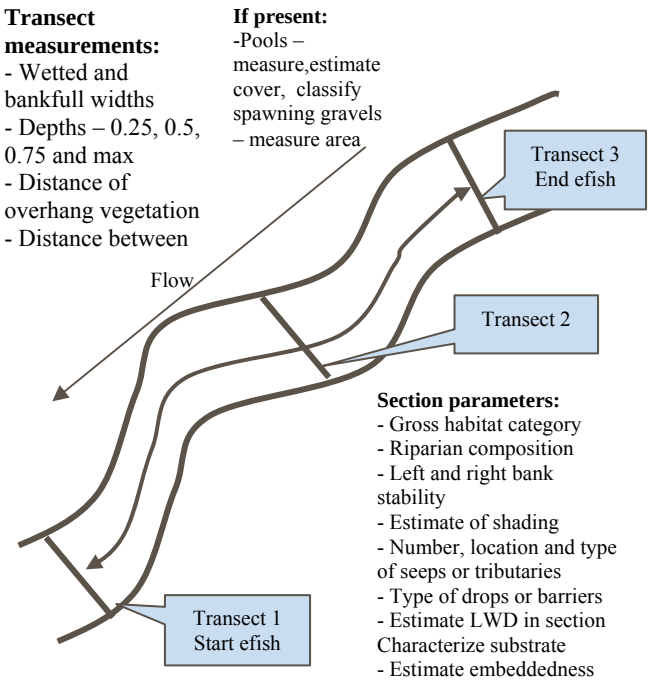


Figure 1. Sample reach transects and variables measured in the transect and in each section.

1. *Biological Surveys*

Fish surveys are conducted by backpack electrofishing to document relative species abundance per reach and survey event. The objective is to collect most, if not all, fish species present in the stream at the time of sampling in numbers proportional to their actual abundance. Within a sample reach, all instream habitat features, such as woody snags, undercut banks, vegetation beds, and large boulders, are sampled. In an attempt to standardize electrofishing efficiency across spatial and temporal scales, consistency in crew size, sampling pattern, unit operator, and unit settings are maintained within a sample area (Reynolds 1996). Water temperature and conductivity are measured prior to electrofishing at all sites. An initial electrofisher setting of ≈ 400 volts and 40 hertz (Hz) with a four millisecond (ms) duty cycle are tested in a small area outside of the survey reach for efficacy at holding fish for netting and minimizing harm. Output voltage and pulse settings, up to six ms, are gradually adjusted until fish are effectively immobilized for capture by a trailing netter.

At all GOM DPS sample sites, water temperature and conductivity are measured prior to electrofishing. If the water temperature exceeds 21.9 degrees Celsius (°C), electrofishing will not occur at that time to avoid harm to Atlantic salmon consistent with MEDMR electrofishing protocol. However, other water quality (e.g., dissolved oxygen, alkalinity, and field pH readings), habitat, and geomorphic surveys will be conducted within that stream reach.

Stream segments are systematically electrofished to sample all areas and habitats within the sample reach using MEDIFW guidelines for effectively and safely sampling a variety of stream types including riffle-pool streams, shallow riffles, rocky riffles, cascades, wadeable torrents, and meandering streams (Gallagher 2007). Netters immediately remove all stunned fish from the stream, and fish are placed in a clean bucket filled with stream water. Crews avoid over-crowding of fish in capture buckets, and large fish are kept separate from prey-sized fish to avoid predation during containment. If captured fish show signs of stress, electrofishing is stopped and fish are recovered following established protocol.

All fish are handled according to American Fisheries Society protocols (Use of Fishes in Research Committee 2004). Prior to handling for measuring, weighing, or taking biological samples, fish are given a general anesthesia of eugenol. An aerator is placed in containment buckets during fish processing and recovery, and water replacement occurs as needed to minimize harm to fish. All fish are identified to species. Brook trout (and other species upon request) are measured on wetted measuring boards, weighed, scales collected, and have adipose fins clipped for future genetics work. In rare cases, additional biosampling may occur upon request, such as blood samples collected from some coastal brook trout for NMFS research led by Dr. Sharon Maclean. Atlantic salmon will be identified as young-of-the-year (YOY), parr, or smolt and immediately released, but biological measurements and samples will not be taken as further handling adds stress and may potentially injure fish. The National Research Council (2004) recommends avoiding intentional electrofishing and subsequent handling of Atlantic salmon whenever possible. All fish are kept under observation until appropriate recovery occurs, and then fish are released in the reach from which they were caught. All mortality during electrofishing and fish processing is documented by species. Mortality of Atlantic salmon will be reported to the Project Leader (Merry Gallagher) the day of occurrence.

All equipment is spot cleaned and disinfected after each survey in the field. Further, all equipment is thoroughly cleaned and disinfected at the field office at the end of each survey day. Most equipment is disinfected with a solution of 2 oz. Nolvasan/gallon water; however, a quaternary ammonia disinfectant may also be used according to label instructions. MEDIFW biosecurity and disinfection guidelines are followed to minimize the spread of aquatic plants, animals, and pathogens (Gallagher 2007).

2. Habitat Surveys

Within each stream survey reach, habitat data is collected as follows:

a. Transect Data: Three transects (see Figure 1) are completed for each sample reach to collect wetted channel width; bankfull width; water depth measurements at points ¼, ½ and ¾ of a transect plus a thalweg water depth; dominant habitat category for the transect site (riffle, pool, run, cascade, deadwater, rapid); the distance of overhanging vegetation toward the center of the stream; and the distance between transects.

b. Section Data: Each stream sample reach will have two sections (see Figure 1) for which the following data are collected: proportion of bare ground, forb, shrub, and tree cover composing the riparian area; reach orientation (e.g., north-south, northeast-southwest); left and right bank stability rating of stable, moderately stable or unstable; percent of overhead shade for the stream channel; number, location, and type of seeps or tributaries; types of potential barriers to aquatic organism passage; presence and cover type of large woody debris; and dominant and subdominant substrate types (e.g., ledge, rubble or rocks, cobble, pea gravel, silt). If potential salmonid spawning gravel patches occur within the survey section, then width, length, and up to three representative depth measurements are recorded. Pools are described, ranked for quality and cover, and length, width, and maximum depths are measured.

3. Geomorphic Surveys

The Level 1 survey approach (low intensity) uses a Rapid Geomorphic Assessment method to 1) screen the gross stability and overall physical condition of a stream reach; 2) identify significant sediment sources from excessive runoff, bank erosion, or slumping; and 3) target reaches for further assessment and restoration planning if appropriate. Visual observation is used to note evidence of stream aggradation, degradation, widening, and planimetric form adjustment. A stability index is then calculated from the resultant qualitative scores.

A Level 2 or Rosgen Level II survey (moderate intensity) (Rosgen 1996) is conducted at approximately 20-30% of sample sites, where both qualitative and quantitative data are collected to represent a mesoscale level of analysis. Information is recorded that 1) estimates fish community structure; 2) classifies stream geomorphology; 3) identifies and quantifies important brook trout habitats for juvenile and adult life stages and spawning; 4) contributes to ranking overall fish habitat; and 5) identifies candidate stream sections for restoration or conservation projects.

At a typical stream cross-section in a sample reach, a surveyor's level is used to measure elevations at the maximum channel depth (thalweg), left and right bankfull points, and 20

equally spaced depth readings across the stream channel, upslope left and right bank extent of the floodplain, and water levels up- and down-stream points 20 bankfull widths apart. A minimum of ten pebble count transects with ten blind touch samples per transect are proportionally distributed among pools and riffles within two stream meander wavelengths. These measurements are used to calculate channel slope, width/depth and entrenchment ratios and to provide a substrate size frequency for the reach.

4. Road-Stream Crossing Data

If a stream survey access point is at a road crossing with a culvert, the road crossing conditions are documented according to the Maine Road-Stream Crossing Survey Manual (Abbott 2007). This protocol collects a variety of observational information as well as some basic measurements to assist in broadly evaluating a crossing's impact on fish and wildlife movements.

In summary, instream activity at each sample site will, at a minimum, require wading upstream to complete electrofishing of the reach and then wading downstream to complete the geomorphic and habitat surveys. In some cases, a reach length may be waded as many as four times. Typically, a two-person survey team conducts all required assessments of a site in about one hour.

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.

This project potentially encompasses most of the state of Maine in watersheds where there is currently a lack of quantitative data on brook trout populations and their habitat. The 2008 field season includes numerous sampling locations throughout the freshwater portion of the GOM DPS (i.e., not including the estuarine or marine components of the GOM DPS) where Atlantic salmon are either known to occur or could occur based on the presence of suitable habitat and knowledge of both historic and current salmon distribution. At this time, 33 HUC-12 sub-watersheds have been identified within the GOM DPS for sampling (Figure 2). These 33 watersheds are scattered throughout the freshwater portion of the GOM DPS. Within each HUC-12 sub-watershed chosen for sampling, approximately seven to ten stream reaches would be sampled. Specific stream locations within each HUC-12 sub-watershed (both on the mainstem river and its tributaries) have been identified for sampling; however, some of these locations might be changed depending on field conditions at the time of sampling. At this time, a total of 329 sample sites have been chosen in streams within the GOM DPS. In essence, the action area for this project encompasses the majority of the freshwater portion of the GOM DPS range. Appendix A provides a complete list of the proposed sample sites within the geographic range of the GOM DPS.

II. STATUS OF THE SPECIES

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

Federally-listed species known to occur in the action area include the threatened Canada lynx (*Lynx canadensis*) and the endangered Atlantic salmon. Although the Canada lynx may occur in the action area, current information on the species' occurrence and the distribution of suitable habitat makes it relatively unlikely that a lynx would occur in the watersheds scheduled for sampling in 2008. Furthermore, given that project activities will take place within stream channels, they would not affect any lynx that might occur in the action area. Therefore, the Canada lynx will not be considered further in this consultation.

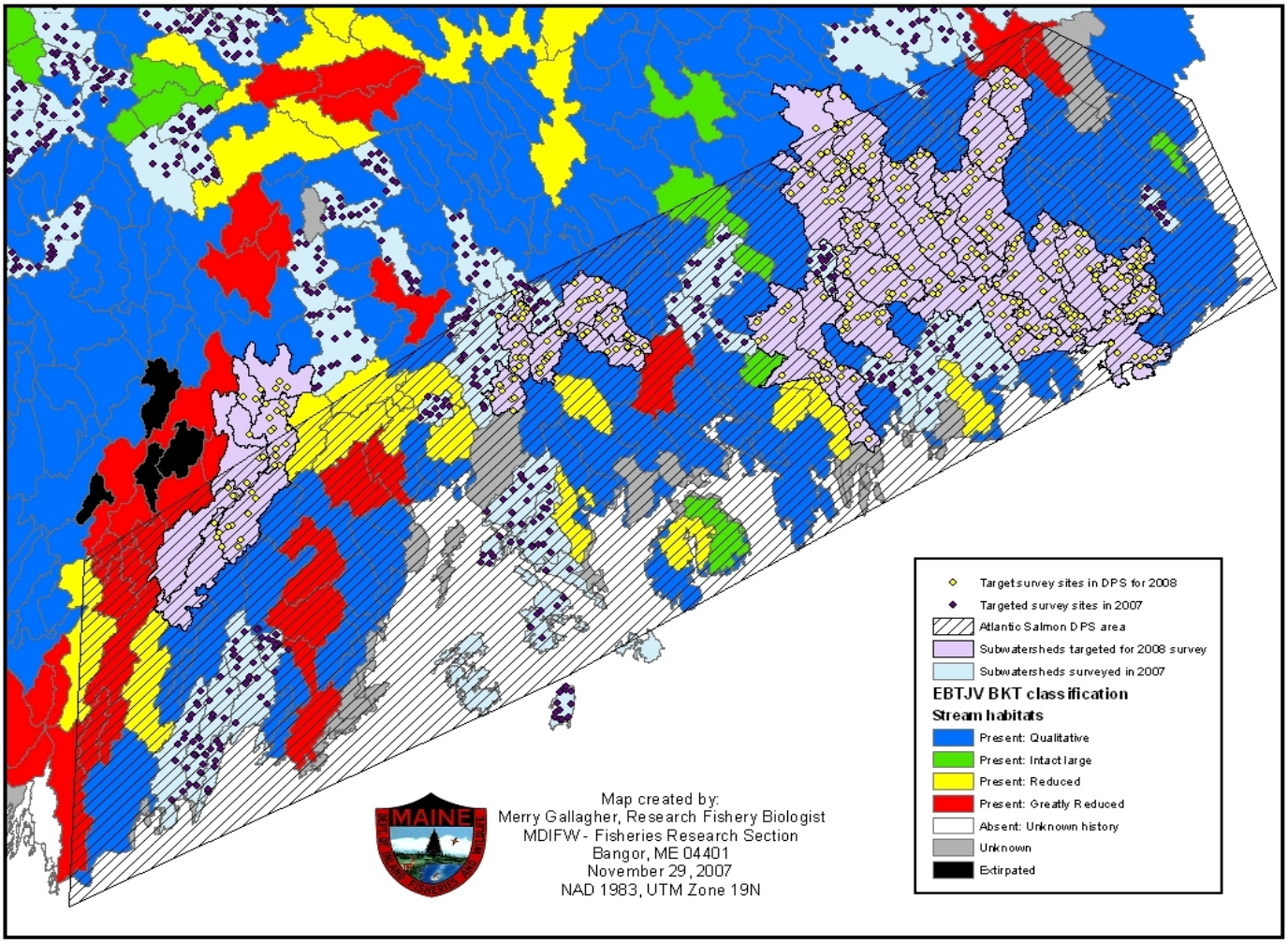


Figure 2. Gulf of Maine distinct population segment of Atlantic salmon and HUC-12 sub-watersheds sampled during 2007 and scheduled for sampling during 2008.

A. Species Description and Listing History

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 listed by the USFWS and NMFS (collectively, the Services) as an endangered species on November 17, 2000 (65 FR 69459). The GOM DPS encompasses all naturally reproducing remnant populations of Atlantic salmon downstream of the former Edwards Dam site on the Kennebec River northward to the mouth of the St. Croix River. This DPS only includes naturally reproducing Atlantic salmon in the Penobscot River downstream of the former Bangor Dam. The USFWS's GOM DPS river-specific hatchery-reared fish are also included as part of the listed entity. To date, the Services have determined that these populations are found in the Dennys, East Machias, Machias, Pleasant, Narraguagus, Ducktrap, and Sheepscot rivers, Kenduskeag Stream, and Cove Brook. Critical habitat has not been designated for this species, but a proposal for critical habitat is currently being developed by the NMFS and must be published by August 31, 2008 under a settlement agreement with the Center for Biological Diversity and the Conservation Law Foundation.

In the final rule listing the GOM DPS of Atlantic salmon, the Services deferred a determination on inclusion of fish that inhabit the main stem and tributaries of the Penobscot River above the site of the former Bangor Dam (65 FR 69464). This deferred decision reflected a need for further analysis of scientific information, including a detailed genetic characterization of the Penobscot population. In June 2006, a new status review of Atlantic salmon populations, including the upper Penobscot River population, was completed by a Biological Review Team (Fay *et al*. 2006). Although the 2000 listing of Atlantic salmon did not include populations in the Penobscot River above the former site of the Bangor Dam, the recently completed status review indicates that the mainstem Penobscot River population of Atlantic salmon (above Bangor Dam) is closely related to the current GOM DPS (Fay *et al.* 2006). The BRT also concluded that Atlantic salmon populations in the Kennebec River upstream of the former Edwards Dam and the Androscoggin River are also closely related to the GOM DPS. NMFS is currently considering the information presented in the new Status Review. A proposed rule concerning additional Atlantic salmon populations and their consideration under the ESA is expected to be published in the summer of 2008.

B. Life History

1. *Freshwater Lifestages*

Adult Atlantic salmon ascend the rivers of New England beginning in the spring and continuing into the fall, with the peak occurring in June. Once an adult salmon enters a river, rising river

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

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

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

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

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

In a parr's second or third spring, when it has grown to 12.5-15 cm in length, physiological, morphological and behavioral changes occur (Schaffer and Elson 1975). This process, called smoltification, prepares the parr for migration to the ocean and life in salt water. In Maine, the majority of parr (80%) remains in fresh water for two years, while the balance remains for three years (Baum 1997). The biochemical and physiological modifications that occur during

smoltification prepare the fish for the dramatic change in osmoregulatory needs that comes with the transition from a freshwater to a saltwater habitat (Bley 1987; Farmer *et al.* 1977; Hoar 1976; USFWS 1989; and Ruggles 1980). As smolts migrate from the rivers between April and June, they tend to travel near the water surface where they must contend with changes in water temperature, pH, dissolved oxygen, pollution levels, and predation. Most smolts in New England rivers enter the sea during May and June to begin their ocean migration. It is estimated that Maine salmon rivers produce 19 fry per unit of habitat, resulting in five to ten parr per unit and ultimately three smolts per unit (Baum 1997).

2. *Marine Lifestages*

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

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

C. Population Dynamics

1. *Historical Abundance*

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

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

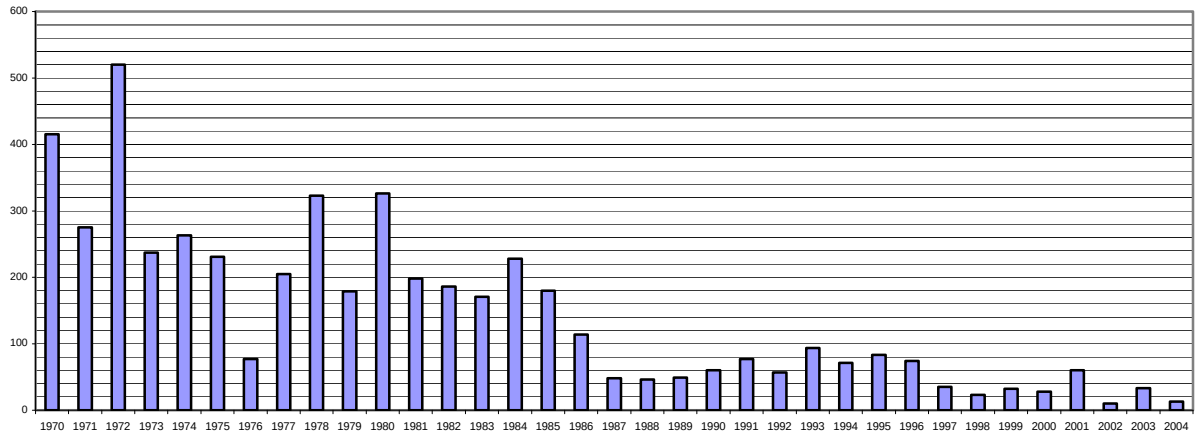
century, three of the five largest salmon populations in New England (in the Connecticut, Merrimack, and Androscoggin rivers) had been eliminated.

2. *Current Abundance*

As with most anadromous species, Atlantic salmon can exhibit temporal changes in abundance. Angler catch and trapping data from 1970 to 2004 provide the best available composite index of recent adult Atlantic salmon population trends within the GOM DPS rivers. These indices indicate that there was a dramatic decline in the mid-1980s, and that populations have remained at low levels ever since. Figure 3 demonstrates this trend in the GOM DPS salmon population.

Total documented (rod and trap caught fish) natural (wild and stocked fry) GOM DPS spawner returns for 1995 through 2006 are as follows: 1995 (85); 1996 (82); 1997 (38); 1998 (23); 1999 (32); 2000 (28); 2001 (60); 2002 (16); 2003 (33); 2004 (13); 2005 (13); 2006 (21) and 2007 (14). These counts (as well as the counts shown in Figure 3) represent minimal estimates of the wild adult returns, because not all GOM DPS rivers have trapping facilities (e.g., weirs) to document spawner returns in all years. The counts of redds conducted annually by the MEDMR demonstrate that salmon do return to those rivers for which no adult counts are possible. Since 2001, scientists have estimated the total number of salmon returning to the GOM DPS with a linear regression model. This estimate is calculated using capture data on GOM DPS rivers with current or historical trapping facilities (Dennys, Pleasant, and Narraguagus rivers), combined with redd count data from the other five GOM DPS rivers. Total return estimates based on these redd counts and trap data are 99 adults in 2001, 33 adults in 2002, 72 adults in 2003, 82 adults in 2004, 71 adults in 2005, 79 adults in 2006, and 53 adults in 2007 (at 90% probability).

Figure 3. Total documented natural (wild and conservation hatchery) spawner returns from USASAC (2005) data for the GOM DPS 1970-2004 (minimal estimates).



Densities of YOY salmon (0+) and parr (1+ and 2+) generally remain low relative to potential carrying capacity. This depressed juvenile abundance is a direct result of low adult returns in recent years. Survival from the parr to the smolt stage has previously been estimated to range from 35-55% (Baum 1997). Research in the Narraguagus River, however, demonstrated at the

99% probability level that survival was less than 30% (Kocik *et al.* 1999). Survival from fry to smolt, based on results from hatchery fry stocking, is reported by Bley and Moring (1988) to range from about 1-12%; and survival from egg to smolt stage is reported by Baum (1997) to be approximately 1.25%.

In summary, naturally-producing Atlantic salmon populations in the GOM DPS are currently at extremely low levels of abundance. This conclusion is based principally on the fact that: 1) spawner abundance is below 10% of the number required to maximize juvenile production; 2) juvenile abundance indices are lower than historical counts; and 3) smolt production is less than one-third of what would be expected based on the amount of habitat available. Counts of adults and redds in all rivers continue to show a downward trend from these already low abundance levels. Given recent estimates of spawner-recruitment dynamics, some researchers suggest that adult populations may not be able to replace themselves, and that populations would be expected to decline further (Beland and Friedland 1997).

D. Status of the Species and Factors Affecting its Environment

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

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

At this time, the Services consider the Atlantic salmon an endangered species that is faced with a variety of threats including Atlantic salmon aquaculture off the coast of Maine, poaching of adults in DPS rivers, incidental capture of adults and parr by recreational anglers, predation, diseases, sedimentation of habitat, passage barriers, and water withdrawals. No single factor can be currently pinpointed as the cause of the continuing decline of the DPS. Rather, all threats that were key factors in the listing determination, in combination with other recently identified threats (e.g., loss of habitat complexity and connectivity, effect of acidified water and aluminum toxicity, depletion of the historical predator assemblage in rivers [Fay *et al.* 2006]) have the potential to adversely affect Atlantic salmon and their habitat. Continued research and assessment is needed to understand the impacts of and interactions among all the threats faced by the DPS. Not all threats are pervasive throughout the DPS rivers, and not all current threats

would be expected to adversely affect the DPS if populations were stable (e.g., predation and competition). Despite many conservation activities already completed or currently in progress by several government agencies and other conservation organizations, the GOM DPS has not shown any recent signs of population recovery.

III. ENVIRONMENTAL BASELINE

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

A. Status of the Species in the Action Area

This project is proposed to have stream sample sites located throughout the GOM DPS, with 33 HUC-12 watersheds and 329 stream reaches currently proposed for sampling. River systems where sampling is proposed and endangered Atlantic salmon are known to occur include the East Machias River, Machias River, Narraguagus River, Pleasant River, Sheepscot River, and the lower Penobscot River (below the site of the Bangor Dam). Other river systems that historically contained Atlantic salmon but are not currently known to have salmon are included in the 2008 sample sites, such as the Orange River.

The Environmental Baseline is typically a more narrowly focused subset of the Status of the Species 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 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 large portion of the freshwater range of the Atlantic salmon GOM DPS. As such, the current status of the species for the action area is basically the same as the current status of the species, as discussed above in Section II. C. 2. Current Abundance and Section II. D. Status of the Species and Factors Affecting the Environment (pages 13-15).

In summary, the GOM DPS has declined to critically low levels. Adult returns, juvenile abundance estimates, and survival rates have continued to decline since listing in December 2000. In 2007, 11 salmon were caught in the trap on the Narraguagus River and 3 salmon at the weir on the Dennys River; in total, 53 adult salmon were estimated to return to the eight core rivers of the GOM DPS in 2007. For the seventh straight year, no spawning activity was documented in Cove Brook. In recent years, most populations in the GOM DPS are below 15% of their conservation spawning escapement goal, a widely used measure to describe the status of individual Atlantic salmon populations (Fey *et al.* 2006)

B. Factors Affecting Atlantic Salmon in the Action Area

A discussion of factors affecting the species in the action area needs to encompass the range of many factors that are affecting the entire Atlantic salmon GOM DPS. The recovery plan for the GOM DPS (NMFS and USFWS 2005) and the most recent status review (Fey *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 decline of the 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 fishermen
- 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
- Water extraction

Fey *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 following gives some brief examples of the five listing factors as relates 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. Water withdrawals for agricultural irrigation affect salmon streams, as does anthropogenic sedimentation from a variety of sources including roads;

2. **Overutilization for commercial, recreational, scientific, or educational purposes –** While most directed fisheries for Atlantic salmon have ceased, the impacts from past fisheries are important in explaining the present low abundance of the GOM DPS. Both poaching and by-catch in the recreational fishery are of concern given critically low numbers of salmon. Fisheries agencies are giving increasing scrutiny to the potential impacts of scientific activities on salmon populations, including electrofishing, in light of the current status of salmon;

3. **Predation, disease, and competition –** 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). Atlantic salmon are susceptible to a number of diseases and parasites but mortality is primarily documented in conservation hatcheries and aquaculture facilities;

4. **Inadequacy of existing regulatory mechanisms –** While current state and federal regulations pertaining to finfish aquaculture have reduced the risks to the GOM DPS, risks from the spread of diseases or parasites and from farmed salmon escapees interbreeding with wild salmon still exist. 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 impacts of irrigation wells on salmon streams;

5. **Other natural or manmade factors –** Although a conservation hatchery program can be effective at maintaining or increasing wild salmon populations, there are genetic risks associated with this practice. Mating strategies used in hatcheries can reduce the genetic variability inherent in natural salmon populations. Decreased marine survival rates of Atlantic salmon are receiving increasing attention recently, although the causes of this decrease 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 increasing scrutiny in its contribution to the current status of the GOM DPS and its role in recovery of the Atlantic salmon.

In summary, there are a very wide variety of factors that have and continue to affect the current status of the GOM DPS throughout the freshwater range of Atlantic salmon. 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.

IV. EFFECTS OF THE ACTION

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

A. Effects from Electrofishing

The biological survey component of this project involves electrofishing, which is the use of electricity to capture or control fish. Backpack electrofishing has been a principal sampling technique for salmonids used by fishery scientists for over half a century. In this study,

backpack electrofishing will be used to capture most, if not all, fish species present at a given sample site and will very likely result in the capture of endangered Atlantic salmon at some of the 329 sample sites. Where Atlantic salmon are present, several individuals could be captured by electrofishing; identified and counted; and then released back into the stream following study protocols to minimize harm to fish. Unlike brook trout, no measurements or biological sampling will be conducted on any Atlantic salmon to keep handling and risk of injury to a minimum. Given that electrofishing will occur from May through September, it is possible that several juvenile salmon lifestages - YOY, parr, and smolt - could be captured. Eggs in redds will not be affected by the project.

Electrofishing and associated handling can cause harm to fish, including physiological stress, physical injury, or mortality from cardiac or respiratory failure (Snyder 2003). This harm will be minimized by using trained electrofishing crews that are following a protocol based on electrofishing procedures successfully used by the MEDMR and USFWS personnel when working in Atlantic salmon streams (Kolz et al. 1998, Stevens and Simpson 2005). These protocols require minimal fish handling, minimal time that fish are held out of water, and use of transfer containers with aerated stream water of ambient temperature. At all GOM DPS sample sites, electrofishing will not occur if the water temperature exceeds 21.9° C to avoid further stress to fish under relatively warm stream conditions. This is a conservative temperature threshold aimed at minimizing harm to endangered Atlantic salmon; MEDMR does not conduct electrofishing or biological sampling of salmon in water temperatures greater than 23° C (Stevens and Simpson, 2005).

The MEDMR annually reports to the USFWS juvenile salmon mortality associated with electrofishing activities in GOM DPS waters[4]. While the MEDMR usually handles a few thousand juvenile salmon each year during electrofishing, mortalities are usually less than two percent of total fish captured (Table 2).

Table 2. Mortality of juvenile Atlantic salmon during MEDMR electrofishing activities within GOM DPS watersheds.

Life Stage	**2005**	**2006**	**2007**
Young of theYear	2.90%	1.55%	2.6%
Parr	1.08%	0.09%	0.28%
Total Number of Fish Handled	6037	6316	7069
Total Number of Mortalities	118	50	126
Total Habitat Units Sampled (1 unit = 100 m^2)	883	1020	703

[4] 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.

Snyder (2003), in a review of the effects of electrofishing, notes that trout, char, and probably salmon (subfamily Salmoninae) are usually more vulnerable to injuries and perhaps mortality than most other fish species. Injuries from electrofishing include spinal injuries (e.g., broken or compressed vertebrae) and muscular hemorrhages. Internal injuries, however, are difficult to detect in the field, particularly when captured fish are released alive. Most electrofishing mortalities appear to result from asphyxiation due to extended tetany[5] or poor handling (Snyder 2003). Furthermore, Snyder (2003) concludes that, except in severe cases, most electrofishing injuries heal and seldom result in immediate or delayed fish mortality when electrofishing is done cautiously. Consequently, electrofishing is unlikely to have a population-level effect if sampling is conducted carefully and the proportion of the population sampled is small.

In a January 14, 2005 letter to the USFWS, the MEDMR concludes that their various electrofishing activities in Atlantic salmon streams have no overall effect on populations within any rivers sampled. Using the Narraguagus River as an example (since it is electrofished most extensively) MEDMR notes that about 300 habitat units are electrofished annually. This is slightly less than five percent of the juvenile rearing habitat in the Narraguagus system. From 2001-2004, large parr mortality during electrofishing in the Narraguagus was less than 0.1% of the basin-wide population estimate. MEDMR believes that this low level of mortality is compensated for by density-dependent population regulation in the months following their late summer sampling and, consequently, not added to natural mortality. Juvenile Atlantic salmon are territorial, so their survival and density are related to physical and hydrologic characteristics that determine space and food availability.

Based on the available information about the effects of electrofishing on Atlantic salmon, it is unlikely that this project would result in population-level impacts on salmon populations in Maine. While a number of Atlantic salmon are expected to be temporarily captured during electrofishing, most of these fish will be released alive back into the stream. With proper training of field crews, mortality rates are expected to be similar to those experienced by the MEDMR during electrofishing.

In 2007 the median sample reach dimensions for this project were a wetted width of 3.7 m and a reach length of 50 m, for a median sample reach size of 185 m^2. In 2008 it is expected that about 329 sites will be sampled; if the median sample reach size from 2007 is used, approximately 60,865 m^2 of stream habitat (or 608.65 stream habitat units) will be sampled in 2008. In 2007, 56% of the sample sites had some amount of riffle habitat while 37% had some amount of run habitat, both habitat types where Atlantic salmon would be expected to occur as opposed to pool, cascade or deadwater habitats. Many of the 2007 sample sites contained both riffle and run habitat. Juvenile Atlantic salmon, however, would occur more often in riffle habitat compared to run habitat.

While electrofishing for juvenile Atlantic salmon population estimates and collection of parr for use as broodstock at the USFWS's Craigbrook National Fish Hatchery, the MEDMR collected an average of 6.84 salmon/100 m^2 in 2005, 6.19 salmon/100 m^2 in 2006, and 10.06 salmon/100 m^2 in 2007 (data for GOM DPS streams only). These data are from electrofishing efforts in many dozens of streams located in watersheds throughout the DPS, from the Dennys River in the

[5] Tetany is a state of electrically induced immobility where muscles are rigid.

east to Bond Brook, a tributary of the lower Kennebec River, in the west. These catch rates are higher than would be expected for the brook trout assessment project, as MEDMR is targeting specific areas of streams where Atlantic salmon juveniles are routinely stocked or salmon are otherwise known to occur. Futhermore, sample sites for the brook trout project are not always located in stream segments with appropriate salmon habitat and are generally higher in the watershed on smaller streams than those electrofished by MEDMR, where Atlantic salmon are more likely to occur.

Assuming that approximately 50% of the 608.65 stream habitat sample units expected to be electrofished in 2008 will have either riffle or run habitat where salmon might be found and that the catch rate of salmon per unit of habitat will be less than that of the MEDMR from 2005 – 2007 (an average of 7.7 salmon/100 m^2), the USFWS anticipates that no more than 609 juvenile Atlantic salmon will be collected during electrofishing (2.0 salmon/100 m^2 x 304.3 units = 608.6 salmon). Because of the lack of knowledge about the occurrence or abundance of salmon in most of the 2008 proposed sample sites within the range of the GOM DPS, the USFWS used the best available scientific data (i.e., MEDMR data from electrofishing within the GOM DPS) to evaluate the likely effects on salmon from electrofishing. We used our best professional judgment to estimate an average of 2.0 salmon captured/100 m^2 of habitat for the brook trout sample sites. While some of the 2008 sample sites are in streams where salmon are known to occur and we expect that salmon catch rates could be similar to those of MEDMR from 2005-2007, overall we expect the catch rate to be considerably less than that of MEDMR during their salmon electrofishing activities. Some of the brook trout project sample sites will be in areas without salmon habitat, while others will have suitable habitat but are expected to have fewer or even no salmon given current low levels of salmon throughout the GOM DPS and our current knowledge of salmon occurrences.

For 2005-2007, MEDMR averaged 1.51% electrofishing mortality for YOY and parr combined. If the prescribed electrofishing protocols are followed and crews are specifically trained in the careful handling of Atlantic salmon, mortality levels are expected to be similar to those of MEDMR electrofishing crews. Therefore, the USFWS expects that no more than 10 juvenile Atlantic salmon will be killed as the result of electrofishing activities (609 salmon captured x 1.51% mortality rate = 9.20 salmon mortalities). This mortality can include YOY, parr, and smolt, although electrofishing mortality rates are typically higher for YOY than parr. The MEDMR does not capture smolts during their electrofishing activities, which are typically later in the summer when smolts have already left the rivers on their way to the ocean, so specific data on mortality of smolts are not available. Our estimate of mortality is assumed to capture effects on all stages of juvenile salmon (YOY, parr, and smolt).

It is possible that adult Atlantic salmon could be present in or near some sample sites. Given recent estimates of adult returns to GOM DPS rivers, however, the number of adults that might be encountered is very small (e.g., only 53 adults are estimated to have returned to the eight core GOM DPS rivers in 2007). Because of their large size and the general activities occurring in a stream during electrofishing, it is highly unlikely that an adult salmon would be approached closely enough to be shocked by the electrofishing equipment. The only impact to adult salmon would be a temporary disturbance as they move away to avoid the area being electrofished. Therefore, no adult Atlantic salmon are likely to be captured or injured during electrofishing.

B. Effects from Other Stream Sampling Activities

To complete all the surveys required by this project, a given stream reach will be waded between two and four times by a two-person crew, typically in about one hour. When the crew enters and wades through the stream, their movements may temporarily cause Atlantic salmon to move away from the disturbance and to possibly temporarily stop feeding while seeking escape cover. These impacts to salmon, however, are expected to be very short term and minor within each sample reach.

While wading in streams, field crews are expected to briefly disturb existing streambed materials and cause some downstream movement of sediments. Crews will be instructed to enter streams from well-vegetated ground on the top of a stream bank to minimize the addition of sediment to a stream. Consequently, surveying activities are expected to contribute very minor amounts of new sediment (if any) to a stream and cause only very minor and short-term suspension of existing streambed materials in a very small area. The median stream sample reach in 2007 was 185 m^2. These very minor sedimentation events are expected to have a negligible impact on Atlantic salmon or other aquatic life.

The proposed field gear disinfection protocol, when carefully followed, should avoid the spread of any pathogens or diseases between sample sites or river systems. Similar disinfection protocols have been used by state and federal fisheries agencies when working in salmon streams from many years. Consequently, it is highly unlikely that sampling in streams associated with this project would result in the spread of pathogens or disease to endangered Atlantic salmon or other aquatic life.

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 basically encompasses the entire freshwater portion of the GOM DPS and an extensive area of land (1,365,847 hectares) associated with many rivers, 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, 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 ecosystem from residential and commercial development. Irrigation of blueberry and cranberry fields from both surface water withdrawals and wells is an ongoing activity 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 and wetlands require federal permits from the U.S. Army Corps of Engineers under the Clean Water Act and the Rivers and Harbors Act, it is likely that many future actions (whether state, tribal, local, or private in nature) that would affect Atlantic salmon and their 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.

VI. CONCLUSION

The proposed action may affect Atlantic salmon in up to 33 HUC-12 watersheds located throughout the freshwater portion of the GOM DPS, although not all of these watersheds are expected to have endangered Atlantic salmon in their streams. These impacts are expected to almost exclusively affect juvenile Atlantic salmon that are residing in the action area. The proposed action will result in the take of listed Atlantic salmon in several streams throughout the GOM DPS through capture by electrofishing (up to 609 juvenile salmon captured). A small number of Atlantic salmon mortalities are also expected as a result of electrofishing (up to 10 juvenile salmon mortalities). Most of the salmon taken during this project (i.e., temporarily collected) will be released alive back into the streams. Despite the overall low population of GOM DPS salmon, this project is not expected to result in a population-level impact to the GOM DPS of Atlantic salmon.

Therefore, after considering the environmental baseline, the effects of the proposed action, and the potential for future cumulative effects in the action area, the USFWS has concluded that the proposed project is not likely to jeopardize the continued existence of the GOM DPS of Atlantic salmon throughout all or a significant portion of its range. As no critical habitat has been designated for the Atlantic salmon pursuant to Section 4 of the ESA, no critical habitat will be adversely modified or destroyed.

VII. INCIDENTAL TAKE STATEMENT

Section 9 of the ESA prohibits the take of endangered species without special exemption. The term “take” is defined to include harass, harm, pursue, hunt, shoot, wound, kill, trap, capture or collect, or to attempt to engage in any such conduct. Harm is further defined by the Services to include an act that actually kills or injures wildlife. Such acts may include significant habitat modification or degradation that results in death or injury to a listed species by significantly impairing essential behavioral patterns, including breeding, feeding, or sheltering. The term “harass” is defined by the USFWS as intentional or negligent actions that create the likelihood of injury to listed species to such an extent as to significantly disrupt normal behavior patterns which include, but are not limited to, breeding, feeding or sheltering. (NMFS has not defined the term “harass” in its ESA regulations.) Incidental take is defined as take that is incidental to, and

not the purpose of, the carrying out of an otherwise lawful activity. Under the terms of Section 7(b)(4) and Section 7(o)(2), taking that is incidental to and not intended as part of the agency action is not considered to be prohibited taking under the ESA, provided that such taking is in compliance with the terms and conditions of this Incidental Take Statement (ITS).

A. Amount or Extent of Take

The USFWS anticipates that numerous juvenile Atlantic salmon will be taken as a result of the proposed actions addressed in this opinion. This take will result from stream sampling activities, specifically electrofishing. While the goal of this project is to assess brook trout populations and habitats in Maine, electrofishing will be used to collect most, if not all, fish species in a sample reach to document species relative abundance at each sample location. All Atlantic salmon collected during electrofishing will be counted and released back into the stream following appropriate handling procedures to minimize adverse impacts on the fish. In their biological assessment, NRCS noted that they could not quantify or estimate the number of Atlantic salmon that would be collected by electrofishing.

As discussed above in Section IV Effects of the Action (pages 17-21), the USFWS has determined that up to 609 juvenile Atlantic salmon may be taken (i.e., captured) by electrofishing activities. Furthermore, no more than 10 juvenile Atlantic salmon will be killed as a result of electrofishing activities. The majority of the 609 salmon captured will be returned to the stream alive. This take can include YOY, parr, and smolts.

This ITS specifically does **not** authorize the take (lethal or non-lethal) of any adult Atlantic salmon. Furthermore, since this project would not effect salmon eggs, no take of eggs is authorized.

B. Reasonable and Prudent Measures

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

- Minimize the adverse effects to Atlantic salmon at all sample sites throughout the GOM DPS by carefully following electrofishing protocols that minimize harm, including injury and mortality, to all fish species, including salmon.

C. Terms and Conditions

In order to be exempt from the prohibitions of Section 9 of the ESA, the NRCS and MEDIFW 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. All field personnel will be instructed in proper electrofishing techniques to minimize harm to all fish, including Atlantic salmon. In addition, all personnel, before beginning field work within the GOM DPS, will be advised of the importance of careful handling of endangered Atlantic salmon, to include an overview of this opinion and its ITS.

2. All 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 should 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).

3. Electrofishing activities will cease in any sample reach where adult Atlantic salmon are observed in the general area (including nearby but outside of the sample reach).

4. Total catch of Atlantic salmon, with catch location identified, will be reported to the USFWS (Wende Mahaney at 827-5938, Ext. 20; FAX 827-6099; or wende_mahaney@fws.gov) every two weeks for the duration of the 2008 sampling season to allow progressive tracking of the amount of incidental take (both lethal and non-lethal take).

5. NRCS staff will carefully monitor the actions described in this opinion and document the level of incidental take, with a final report provided to the USFWS after conclusion of the 2008 field sampling season, to ensure that the project is minimizing the take of Atlantic salmon.

VIII. CONSERVATION RECOMMENDATIONS

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

1. If this project identifies stream restoration projects that would be of benefit to endangered Atlantic salmon, NRCS should work with state and federal agencies and conservation organizations to prioritize and implement these restoration projects.

2. If this project identifies any irrigation projects that are affecting stream habitat for Atlantic salmon, NRCS should work with state and federal fisheries agencies to address this concern and explore opportunities to minimize impacts on stream habitat from agricultural irrigation practices.

3. If this project identifies opportunities for long-term protection of riparian buffers through fee acquisitions, conservation and management agreements, conservation easements, and other appropriate tools, NRCS should assist in efforts to protect these buffer areas.

4. If this project identifies road crossings in the GOM DPS that are impairing Atlantic salmon passage and degrading aquatic habitat, NRCS should provide engineering and design expertise to assist in addressing these problems.

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 NRCS implements of any of these conservation recommendations.

IX. REINITIATION NOTICE

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

Literature Cited

Abbott, A. 2007. Maine Road-Stream Crossing Survey Manual. Gulf of Maine Coastal Program, USFWS, Falmouth, ME. 22pp.

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

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

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

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

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

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

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

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

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

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

Farmer, G.J., D. Ashfield and J.A. Ritter. 1977. Seawater acclimation and parr-smolt transformation of juvenile Atlantic salmon, *Salmo salar*. Freshwater and Anadromous Division, Resourc. Branch, Fish. Mar. Serv., Tech. Rep. Serv. MAR/T-77-3

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

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

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

Gallagher, M. 2007. Stream Assessment: Protocols for MDIFW stream data collection efforts (draft). Maine Department of Inland Fisheries and Wildlife. Bangor, ME.

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

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

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

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

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

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

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

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

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

Kolz, A.L., Reynolds, J.B., Boardman, J., Temple, A., and Lam, D. 1998 (et seq.). Principles and techniques of electrofishing (course manual), Branch of Aquatic Resources Training, U.S. Fish and Wildlife Service National Conservation Training Center, Shepherdstown, West Virginia.

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

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

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

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

National Research Council. 2004. Atlantic salmon in Maine. National Academy of Science,The National Academies Press, Washington, DC. 275 pp.

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

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

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

Reynolds, J.B. 1996. Electrofishing. Pages 221-253 *in* Murphy, B. R. and D. W. Willis (Editors). Fisheries Techniques (Second Edition). American Fisheries Society, Bethesda, MD. 732 pp.

Rosgen, Dave. 1996. Applied River Morphology. Printed Media Companies. Minneapolis, MN.

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

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

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

Snyder, D.E. 2003. Electrofishing and its harmful effects on fish. Information and Technology Report USGS/BRD/ITR-2003-0002. U.S. Government Printing Office, Denver, CO. 149 pp.

Stevens, J. and M. Simpson. 2005. Maine Atlantic Salmon Commission standard operating procedure for juvenile Atlantic salmon sampling by electrofishing in wadeable streams. Maine Atlantic Salmon Commission, Bangor, ME.

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

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

Use of Fishes in Research Committee. 2004. Guidelines for the use of fishes in research. American fisheries Society, Bethesda, MD. 57 pp.

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

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