UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
PROGRAM PLANNING AND INTEGRATION
Silver Spring, Maryland 20910

To All Interested Government Agencies and Public Groups:

Under the National Environmental Policy Act, an environmental review has been performed on the following action.

TITLE: Atlantic Salmon Freshwater Assessment and Research
NOAA award # NA11NMF4720235

LOCATION: Maine

SUMMARY: The Maine Department of Marine Resources (DMR) and National Marine Fisheries Service (NMFS) initiated a series of Cooperative Agreements in 1990, to research issues of mutual concern relative to the Atlantic salmon populations in Maine. In the current agreement, the investigators will concentrate on smolt emigration, adult salmon returns and spawning sites and will also identify preferred habitat.

RESPONSIBLE OFFICIAL: Harold C. Mears, Assistant Regional Administrator,
DOC/NOAA, National Marine Fisheries Service
Operations and Budget Division
55 Great Republic Drive
Gloucester, MA 01930
978-281-9327

The environmental review process led us to conclude that this action will not have a significant effect on the human environment. Therefore, an environmental impact statement will not be prepared. A copy of the finding of no significant impact including the supporting environmental assessment is enclosed for your information. Please submit any written comments to the responsible official named above. Also, please send one copy of your comments to my staff at NOAA Program Planning and Integration (PPI), SSMC3, Room 15603, 1315 East-West Highway, Silver Spring , MD 20910.

Sincerely,

Paul N. Doremus, PH.D.
NOAA NEPA Coordinator

Enclosure

ENVIRONMENTAL ASSESSMENT
AND
FINDING OF NO SIGNIFICANT IMPACT
NOAA Award NA10NMF4720235

Maine Department of Marine Resources

Proposed Activities for July 1, 2011 to June 30, 2016

I. INTRODUCTION

Guided by the Atlantic Salmon Recovery Framework (NMFS, MDMR, USFWS, PIN 2010), state and Federal fisheries agencies work cooperatively to restore and manage depleted and federally endangered Atlantic salmon populations in Maine rivers. The Maine Department of Marine Resources, Bureau of Sea Run Fisheries and Habitat (BSRFH) has management responsibilities for Atlantic salmon in Maine waters. The US Fish and Wildlife Service (USFWS) and the National Marine Fisheries Service (NMFS) share management responsibilities for the endangered Gulf of Maine Distinct Population Segment (GOM DPS) of Atlantic salmon, which was listed in 2009. The geographic range of the GOM DPS extends from the Androscoggin River watershed northward to the Dennys River watershed.

The Maine Department of Marine Resources (DMR) was established by State Statute (Title 12 Parts 4, 9) to conserve and develop marine and estuarine resources; to conduct and sponsor scientific research; to promote and develop the Maine coastal fishing industries; to advise and cooperate with local, state and Federal officials concerning activities in coastal waters; and to implement, administer and enforce the laws and regulations necessary for these enumerated purposes. Within DMR, the Bureau of Sea Run Fisheries and Habitat (BSRFH) has responsibility for diadromous species management. Assessment personnel from the Atlantic Salmon Commission were integrated with DMR in 2007, and in 2010 the Atlantic Salmon Commission Board was eliminated by the legislature, shifting management of Atlantic salmon to DMR.

Atlantic salmon returns and angling catches in wild run rivers in Maine declined severely in the late 1980s and early 1990s and have not recovered significantly as of 2010. Atlantic salmon have a complex anadromous life history, which includes two or three years of riverine life, followed by one or two years at sea. Because there were both freshwater and marine causes for the decline in salmon abundance, NMFS and the State of Maine (initially the Atlantic Salmon Commission) initiated a series of Cooperative Agreements starting in 1990. The agreements focused on documenting the capture of Atlantic salmon from Maine rivers by commercial fisheries in Canada and Greenland. Once this was established, the agreement expanded to include assessing adult and juvenile populations in selected rivers and conducting research of mutual interest to understand freshwater constraints on population recovery. BSRFH prepares semi-annual reports summarizing assessment and research activities funded by NMFS and co-authors Maine sections of annual US Atlantic Salmon Assessment Committee (USASAC) Reports with NMFS and USFWS.

BSRFH requests funding from NMFS to continue assessment and research activities for the period July 1, 2011, to June 30, 2016, with the overall objectives to:

1) Assess adult and juvenile Atlantic salmon populations and progress toward recovery of the GOM DPS.
2) Identify spatial variability of freshwater production of juvenile Atlantic salmon within the GOM DPS.
3) Increase the distribution and abundance of Atlantic salmon within the GOM DPS.
4) Increase the proportion of salmon produced from natural spawning within the GOM DPS.
5) Restore abiotic and biotic ecosystem services that contribute to Atlantic salmon growth and survival.

II. PURPOSE AND NEED FOR FUNDING THE PROPOSED STUDIES

The purposes of this project are to monitor and assess Atlantic salmon populations in Maine rivers. The project is needed to provide data essential to monitoring the recovery of Atlantic salmon populations in Maine and is a continuation of previous agreements. The work is guided by the Atlantic Salmon Recovery Framework (NMFS, MDMR, USFWS, PIN 2010), in which state and Federal fisheries agencies identified data and research needed to monitor, restore, and manage depleted and federally endangered Atlantic salmon populations in Maine rivers. The work was also identified by the National Research Council of the National Academies (NRC 2004), the Final Recovery Plan for the Gulf of Maine Distinct Population Segment of Atlantic Salmon (NMFS/USFWS 2005), and the Hatchery Review (SEI 2007) as essential to understanding the status and trends of populations of wild Atlantic salmon in Maine and the effects and effectiveness of management actions directed at recovering endangered Atlantic salmon in Maine.

The proposed July 1, 2011, to June 30, 2016, Atlantic Salmon Freshwater Assessment and Research Project focuses on data collection and analyses in freshwater and includes the following categories: A) assessing adult and juvenile salmon populations; B) assessing the movement of anadromous fishes in the Penobscot River watershed; C) assessing the roles of native anadromous fishes in salmon recovery; D) monitoring freshwater salmon habitat quality and quantity; and E) providing support for hatchery production of Atlantic salmon and for evaluating the contribution of hatchery products to recovery. As funds become available, it also is intended to develop, in collaboration with the University of Maine, analyses of Atlantic salmon spatial ecology and ecosystem function to identify practical activities that will help recover the GOM DPS.

A) Assess adult and juvenile salmon populations

Atlantic salmon population assessment data, products of the Cooperative Agreement, will be gathered and integrated into the US Atlantic Salmon Assessment Committee annual reports and those of the International Council for the Exploration of the Sea Working Group on North Atlantic Salmon (WGNAS) assessments. The core assessments are: annual returns and spawners, estimates of marine survival (requires estimates of smolt and adult returns over time on individual rivers), biological characteristics of juvenile and adult salmon (e.g. size at age, age at smolt emigration, age at maturity, fecundity), and trends in freshwater resident and smolt population abundance. Adult assessment includes two methods for collecting data on adult abundance, intercepting and counting adults at traps, and counting redds. Traps provide a census of the population and for rivers without traps, redd counts are an index of adult abundance.

The adult assessments have the following objectives: 1) enumerate adult Atlantic salmon returns to Maine rivers with salmon trapping facilities; 2) collect or coordinate collecting scales and biological data from a statistically determined sample of the returns; 3) determine age and origin of that sample to statistically assign age and origin to all returns; 4) conduct autumn redd counts on rivers included in the Gulf of Maine Distinct Population Segment (GOM DPS); and 5) maintain, update, and distribute adult returns and redd count databases.

Activities to assess the freshwater production include an index of large parr abundance based on electrofishing and estimates of smolt production in selected rivers based on captures in rotary screw smolt traps operated from late April through early June. Both were identified by the Freshwater Action Team as key metrics within the Atlantic Salmon Recovery Framework (NMFS, MDMR, USFWS, PIN 2010). The work proposed follows the sample size recommendations for selected HUC 10 watersheds to provide an 80% chance of detecting an increasing trend with a 0.10 rate of change per year over a 10 year period (Stock Assessment Action Team Recovery Framework appendix 2010). In addition, Maine parr and smolt data will be used to develop range wide abundance indices for U.S. Atlantic Salmon Assessment Committee status of stock reporting.

Juvenile assessments have the following objectives: 1) assess late summer abundance of stream resident juvenile Atlantic salmon throughout the GOM DPS using a stratified design within each Salmon Habitat Recovery Unit (SHRU) that includes one stratum based on likely origin of juvenile salmon (hatchery or natural reproduction); 2) Collect scales and biological data for individual salmon and fish community data for sites sampled on rivers within the geographic range of the GOM DPS; 3) maintain and update electronic databases of stream resident juvenile salmon abundance that include biological data for sites and individual salmon for rivers within the geographic range of the GOM DPS; 4) assess smolt emigration from the Narraguagus and Sheepscot watersheds, Hobart Stream, and a portion of at least one watershed (e.g. a Penobscot basin tributary, Old Stream) from mid-April through the end of the smolt run; 5) collect scales and biological data for individual salmon smolts and fish community data for sites sampled on rivers within the geographic range of the GOM DPS; and 6) provide fully audited electronic staging data from smolt assessment work undertaken by BSRFH to NMFS.

Adult Trapping Activities

The BSRFH plans to operate trapping facilities to intercept, count, and collect biological data from migrating adult Atlantic salmon on the Narraguagus, Dennys, Pleasant, Kennebec, Androscoggin, and Penobscot rivers. Data from fishway traps on the Sebasticook, Saco, St. Croix, East Branch Penobscot, and Union rivers will also be compiled and reported over the agreement period.

The Cherryfield fishway trap, located at a low head ice control dam on the Narraguagus River, was built in 1991, and has been operated from early May through mid-November each year. The Dennys weir was redesigned in the summer of 2005 and deployed for the late autumn of that year, and from spring through late fall each year from 2006 to 2010. The primary purpose of the Dennys River Weir is to exclude aquaculture escapes from the river. BSRFH will install an adult counting facility at the Saco Falls Fishway on the Pleasant River to provide a third adult census in the Downeast Salmon Habitat Recovery Unit (SHRU). Annual concurrent adult census and redd counts will be used to revise the regression predicting returns for rivers where only redds are counted (See Redds section below).

The Veazie fishway trap, located at the Veazie hydroelectric dam, the lowermost salmon migration barrier in the Penobscot River, has been operated since 1978. All Atlantic salmon are captured and examined as they migrate upstream. During the first years of this agreement, the Veazie Dam will be removed as part of the Penobscot River

Restoration Project. A new fish lift in the Milford Dam will become the counting location for adult Atlantic salmon returns to the Penobscot River. While the new lift is being tested there will be a period when both facilities will be in operation (either over two years or in one year). For this period adult Atlantic salmon returns will be counted, and biological data and broodstock collected at Veazie with fish being released upstream to assess the Milford fish lift and trap and sorting facility. In either mid-summer 2012 or May 2013, trapping operations will have been transferred entirely to Milford.

Continuing to census adult Atlantic salmon returns under this proposed research will provide data used in regional and international stock assessments and to assess the effects and effectiveness of management actions directed at recovering endangered Atlantic salmon in Maine.

Redd Counts

Spawning ground redd counts are conducted between early November and ice-in, with the timing and portions of rivers where counts are made varying annually depending on weather and flow. Redd counts will be made on the small coastal rivers within the geographic range of the GOM DPS, and on selected habitat segments in other drainages. Redd counts provide data on the distribution of spawning that are used to delineate strata for juvenile assessments and manage juvenile stocking to avoid suppressing natural reproduction.

Currently, a regression model is used to estimate returns to small coastal rivers within the geographic range of GOM DPS from redd survey count data. The regression model was developed using concurrent annual data on returns and redds in from one to three rivers (Narraguagus, Dennys, and Pleasant). The model is updated every five years, requiring at a minimum data from two rivers each year for the period. The redd/return regression was updated at the 2010 USASAC meeting [ln (returns) = 0.559 ln (redd count) + 1.289]. Based on recent data collecting experiences, the Stock Assessment Action Team recommended in a Recovery Framework appendix that concurrent trap and redd counts be made in three rivers in the GOM DPS to ensure that data from at least two rivers are available annually for the next update in 2015. The counting facility being installed at the Saco Falls Fishway on the Pleasant River fulfills this recommendation for four of the five years.

Continuing to conduct redd surveys under this proposed research will provide the data used in regional and international stock assessments and to assess the effects and effectiveness of management actions directed at recovering endangered Atlantic salmon in Maine.

Adult Salmon Databases

Maintaining and analyzing adult salmon return and redd count directly serves GOM DPS, U.S., and International management of Atlantic salmon stocks. BSRFH manages adult salmon return and redd count data for all Maine rivers and reports that data to U.S.

Atlantic Salmon Assessment Committee, North Atlantic Salmon Conservation Organization, and ICES WGNAS. To enhance data management capabilities, BSRFH, NMFS, and USFWS adopted common database protocols, and designed databases that integrate with a Geographic Information System (GIS)-compatible library of place names and codes called MaineSalmon. Returns and redd count data are referenced to a river kilometer network and archived in a digital database. For the term of this project updated redd count and adult return databases will be provided to NMFS annually.

Stream Resident Juvenile Abundance Surveys

Over the years, BSRFH has conducted electrofishing surveys to monitor abundance of Atlantic salmon juveniles using two sampling approaches. The first is estimating density at index sites on each river that document a spatial and temporal record of juvenile abundance. The second is a catch per unit effort (CPUE) method based on standardized wand sweeping protocols for a specified time period, typically 300 seconds of wand time. Fish total abundance is presented as fish/unit, where one unit equals 100 m^2, and relative abundance (CPUE) is presented in fish/minute and, if the area sampled is measured, in fish/unit. Written protocols for conducting electrofishing surveys and collecting biological data and tissue samples from juvenile salmon are reviewed annually and revised as needed (BSRFH 2010).

BSRFH has developed a set of index sites distributed across occupied salmon rivers that have been used to track annual populations of parr. The percentage of available habitat sampled annually within a watershed is between 0.01 and 7.25%. The sites established in the 1950s and 1960s were easy to access because the electrofishing equipment used a generator, which was both heavy and cumbersome. Further, sites known to have good salmon habitat and/or populations were selected because the number of sites that could be sampled was limited by equipment and staff available. As forest road systems were built in the 1970s and 1980s new sites were selected with the same general criteria or for a specific research project. This legacy of sites means that, although much effort has been expended electrofishing, any index of abundance (watershed or SHRU) calculated using these data would likely be biased. Unbiased single basin juvenile salmon population estimate have been calculated based on the Basin-wide Geographic and Ecologic Stratification Technique (BGEST). Abundance data for juvenile Atlantic salmon on the Narraguagus River were collected based on sites in strata defined in a BGEST for the watershed from 1990 to 2010, with whole basin estimates produced for 1991 to 2007. BSRFH scientists also estimated basin large parr populations for the Dennys River (2001-2005), and the Sheepscot River (2003 - 2006).

For the period of this agreement BSRFH is proposing a change in sampling strategy where there will be no fixed sites. We propose to survey approximately the 350 sites annually using the CPUE method, distributing them more evenly among the SHRU based on the proportions of functional habitat (NOAA 2008), and numbers of eggs and juveniles stocked, and spawners. These allocations will change annually, as the reaches selected for more intensive sampling shift among the SHRU and the amount of habitat changes within management strata. As a result each year there will be a new set of random sites selected to produce the GOM DPS index of juvenile abundance. Annually up to 10% of these sites will be identified where depletion and CPUE estimates will be made to maintain a record of catchability for gear and methods and to calibrate CPUE data among years.

BSRFH will create a generalized random-tessellation stratified sampling design for the GOM DPS using the spsurvey package for R, developed by the US Environmental Protection Agency Environmental Monitoring. Strata for stream width and management (natural reproduction, life stage stocked, unknown/unoccupied) will be nested within watershed and thus within SHRU. Samples will initially be allocated in proportion to linear extent of each strata for occupied habitat and unoccupied habitat will be sampled at a much lower intensity. After the first year or two, the data will be used to optimize sampling effort based on the variance among strata (e.g. some strata might have less among site variation than others thus requiring fewer samples).

Accurate data on juvenile abundances throughout the GOM DPS are the best measure for assessing the effects and effectiveness of management actions in freshwater directed at recovering endangered Atlantic salmon in Maine. This project will provide much-needed information on population trends and vital rates necessary for the actively managing Atlantic salmon stocks in Maine.

Assessing Smolt Production

Rotary screw smolt traps are operated from late April through early June to capture smolts as they migrate into marine waters. Since 1997, mark-recapture estimates of smolt abundance and migration timing data have been obtained on the Narraguagus River and population estimates derived using a stratified mark-recapture design. The recapture marking strata consist of alternating marks every four days throughout the trapping season to identify mark groups. Estimates based on marking and moving smolts upstream of traps have been calculated for the Upper Piscataquis River in Abbot (2009 & 2010), the Sheepscot River at Head-of Tide (2001), and in the upper portion of the Narraguagus River (2005 to 2010).

For the term of this cooperative agreement BSRFH will assume responsibility for smolt trapping operations throughout the GOM DPS including: the Narraguagus and Sheepscot watersheds, Hobart Stream, and a portion of at least one other watershed from mid-April through the end of the smolt run. Annual smolt trap operations and protocols will be coordinated with NMFS staff, with NMFS responsible for maintaining the Rotary Screw Trap Operations Protocol document.

Juvenile Salmon Databases

During the 1980s, DMR staff began making electronic juvenile electrofishing databases. The results of these efforts were neither relational nor spatially referenced. More recently DMR, NMFS, and USFWS developed a GIS-compatible data system integrating multiple databases. BSRFH has an electrofishing database that is compatible with the system that is updated annually with current data and contains historic electrofishing trip data on Maine rivers. Annually, electrofishing data will be transferred to NMFS and the database steward to be integrated with USASAC databases. BSRFH will annually provide fully audited electronic staging data from smolt assessment work to NMFS.

B) Assess movement of anadromous fishes in the Penobscot River watershed

BSRFH will work with the USGS Cooperative Research Unit to maintain a PIT data collection system at dams on the mainstem and major tributaries in the Penobscot River watershed. This array will be used to assess the movements of PIT tagged anadromous fishes in the Penobscot River. The objectives of these movement studies are: 1) in cooperation with USGS Cooperative Research Unit, maintain PIT data collection system at dams on the mainstem and major tributaries in the Penobscot River watershed, assist in developing, and provide long-term stewardship for an archive database of available PIT tag data; 2) document the movements of adult diadromous fish, including Atlantic salmon, within the Penobscot River watershed based on PIT detections; and 3) relate movements of PIT tagged individuals within the Penobscot River watershed to fish age and origin, month, river hydrology, and dam status (e.g. removed, increased head, additional turbines).

In 2010, USGS Co-operative Fisheries and Wildlife reinitiate PIT technology monitoring of the mainstem fishways on the Penobscot River, with funding to continue the work through June 2011. PIT antennas have been installed at the entrance and exit of fish ways on the Penobscot River and its larger tributaries allowing data to be collected on the numbers of salmon reaching upper watershed habitat that is comparable to Gorsky (2005) and Gorsky et al. (2009). BSRFH will work with the USGS Cooperative Research Unit to maintain PIT data collection system at dams on the mainstem and major tributaries in the Penobscot River watershed. System operations will be primary responsibility of USGS in 2011 and 2012 and will transfer to DMR in 2013, if USGS does not find support for the infrastructure. BSRFH will tag adult Atlantic salmon, initially at the Veazie trap and later at the Milford lift, with PIT tags before they are released to the river. In addition other species that are captured will also be tagged and included in the monitoring. In collaboration with USGS, we will operate PIT detection equipment at other sites in the Penobscot River watershed that will provide data of mutual interest to BSRFH and NMFS. These sites will be focused on the other species tagged.

BSRFH will collaborate with USGS to use the antenna system database to evaluate movements of PIT tagged individuals within the Penobscot River watershed. The current Co-op Unit student will focus his data analysis on timing and efficiency of upstream Atlantic salmon passage at these major facilities prior to dam de-construction and bypass construction, as well as movement speed between facilities, and path choice between the Piscataquis (Howland) and the mainstem (West Enfield). BSRFH will collaborate on these analyses and focus on analyzing the movements of PIT tagged individuals with sufficient numbers tagged (probably alewife/blueback herring) related to fish age and origin, month, river hydrology, and dam status (e.g. removed, increased head, additional turbines).

PIT Tag Data Management

A system for storing and reducing acquired data into a database will be developed and maintained by the Maine Cooperative Fish and Wildlife Research Unit and shared with DMR and NMFS. BSRFH will serve as steward for an archive database that contains summary data from current studies and previous PIT work conducted from 2002-2004 and 2009.

Habitat connectivity has been identified as a major threat to the Endangered GOM DPS Atlantic salmon. Documenting the effects of the Penobscot Restoration Project on the distribution of spawners within the watershed is critical to understanding how increased connectivity for the largest stock component of the GOM DPS of Atlantic salmon will affect recovery.

C) Assess the roles of native anadromous fishes in salmon recovery

Fay et al. (2006) and Saunders et al. (2006) present arguments that healthy populations of other diadromous fishes are key to Atlantic salmon recovery and identify a number of likely interactions among members of the diadromous fish community of the GOM DPS. Foremost of these is that native anadromous fishes, particularly river herring, are important as prey buffers for emigrating smolts. Mather (1998) noted that a number of studies on smolts identified predation as demographically important. Mackey (2009), based on retrospective analyses, noted that alewife abundance seemed to be related to Atlantic salmon marine survival for Penobscot River hatchery smolt, cautioning that the relationship did not necessarily identify cause and effect and could suggest that alewife spawning population and salmon marine survival may be synchronous due processes in the Gulf of Maine. The objectives of the work to assess the roles anadromous fishes have in restoring salmon are: 1) provide *fisheries independent* estimates of spawning escapement and run timing for alewife and blueback herring for watersheds in the geographic range of the GOM DPS annually; 2) relate the annual timing (start, peak, end) of alewife and blueback herring returns to environmental conditions in Maine rivers draining to the GOM where daily river herring count data exist (historic and collected as part of the agreement); and 3) examine assumptions and hypotheses related to the ecosystem benefits of diadromous fishes in Atlantic salmon freshwater habitat.

The hypothesis that native anadromous fishes, particularly river herring, are important as prey buffers for emigrating smolts will be addressed first. River herring spawning escapement and run timing data from fishways where adult Atlantic salmon are counted and on two tributaries to the Penobscot estuary will be used to model the temporal and likely spatial overlap of smolts and river herring spawners.

Testing hypotheses and underlying assumptions related to the roles of co-evolved anadromous fishes in Atlantic salmon recovery is needed to advance ecosystem management of Atlantic salmon.

D) Assess freshwater salmon habitat quality and quantity

The State of Maine has mapped Atlantic salmon habitat since the 1940s (Baum 1997). BSRFH maintains and updates Atlantic salmon habitat inventory databases for Maine rivers in the geographic range of the GOM DPS. Under this proposed research, the BSRFH will continue to conduct habitat assessments, focusing on collecting data on measures of habitat quality (i.e. wood loading, embeddedness, detailed substrate characteristics, channel geomorphology, thermal conditions) for selected stream reaches. Data on thermal conditions are extremely important, providing insight into influences of climate and land use on juvenile and adult salmon behavior and survival. Habitat mapping, (location and units of meso-habitat types) will be limited to habitat surveys on streams or stream segments where connectivity or management has changed. The objectives of habitat assessment are to: 1) maintain and update Atlantic salmon habitat and MaineSalmon databases for Maine rivers in the Gulf of Maine DPS area with: a) BSRFH habitat surveys of streams where connectivity or management has changed; b) habitat surveys from researchers and other resource agencies; and c) additional parameters that enhance our ability to assess habitat quality., and 2) manage Dennys River flows below Meddybemps Lake Dam to ensure low flows maintain near optimal juvenile Atlantic salmon habitat throughout the summer.

Habitat quantity and quality data are required to conduct juvenile assessment and track population recovery. Habitat data are the basis of the sample design for juvenile population assessment, estimates of conservation spawning escapement (CSE), and are used to identify high priority connectivity projects.

E) Provide support for hatchery production of Atlantic salmon and assess the contribution of hatchery products to recovery

The geographic range of the Gulf of Maine Distinct Population Segment (GOM DPS) extends from the Androscoggin River watershed to the Dennys River watershed. Atlantic salmon populations in the GOM DPS are dependant on river specific hatchery stocks maintained by the USFWS. Understanding the role of these hatchery fish is critical to ensuring that the products are helping effect population recovery. Marking and ensuring spatial and temporal segregation of life stage and other stocking strategies are needed to assess the contribution of hatchery products to recovery. The objectives of supporting hatchery production and distribution are to: 1) adaptively manage stocking throughout Maine based on integrated analyses of adult, juvenile, and habitat assessments; 2) provide coordination, technical and operational assistance, and logistical support for Atlantic salmon marking programs for Maine rivers; 3) coordinate the collection, marking, and transport of sea run salmon brood fish from the Penobscot River to USFWS hatcheries; 4) collect Atlantic salmon juveniles for captive rearing as river-specific broodstocks at USFWS hatcheries from the Narraguagus, Dennys, Sheepscot, Machias, East Machias, and Pleasant rivers; 5) Conduct directed studies on the juvenile production of translocated adults in the Piscataquis River and adult returns from smolt stocking in the Pleasant River, Washington County; and 6) stock USFWS hatchery products into rivers of origin.

Adaptive management is the cornerstone of the Atlantic Salmon Recovery Framework (NMFS, MDMR, USFWS, PIN 2010). Over the period of this agreement BSRFH is proposing to implement adaptive management of GOM DPS Atlantic salmon hatchery stocks. Adaptive management of GOM DPS stocks requires adult and juvenile assessment data, stocking data, and analyses that focus on the advantages and disadvantages of life stages stocked and change based on the results. Short term adaptive management is based on the ability of life stage stocking to produce juveniles and returning adults. While long-term adaptive management addresses how the offspring of these products contribute to successive populations (lifetime fitness of returning adults). Marked older hatchery juveniles (parr and smolt) improve the accuracy of assigning adult returns to the appropriate smolt cohort and improve the accuracy of estimates of marine survival. Collecting adult salmon at the Veazie Dam and parr in small coastal rivers for hatchery broodstock and stocking their progeny are vital to restoration efforts on rivers in the geographic range of the GOM DPS.

III PROPOSED FUNDING ACTIVITIES AND ALTERNATIVES

A. Proposed Funded Activities

A1. Field Activities

Field activities are directed at sampling different life stages of Atlantic salmon and spawning alewife either where they reside (freshwater streams) or as they migrate into freshwater. A variety of sampling methods are included in the proposal, attempting to optimize the efficiency and effectiveness of the gear at each sample site, while minimizing mortality to all species captured. Sampling locations are distributed throughout the geographic range of the GOM DPS Atlantic salmon to ensure that assessments are comprehensive. BSRFH has an overall biosecurity plan that addresses basic disinfection protocols (reference) and individual sampling protocols (references) includes biosecurity measures specific to that field activity.

Activities in the proposed July 1, 2011, to June 30, 2016 Atlantic Salmon Freshwater Assessment and Research Project are covered by USFWS Federal Fish and Wildlife Endangered/Threatened Species Permit (number TE 697823 –2 with effective dates 6/13/2008 – 6/13/2013).

Adult Trap Operations

Under this proposed research, BSRFH will operate trapping facilities from 2011 to 2016 to intercept, count, and collect biological data from migrating adult Atlantic salmon on the Narraguagus, Dennys, Pleasant, Kennebec, Androscoggin, and Penobscot rivers. In addition, if alewife, blueback herring, and/or shad use the facility, *fisheries independent* estimates of spawning escapement will be developed and data on run timing collected. Each of these traps has site specific operating protocols used by BSRFH (BSRFH 2010). All adult salmon handled in the fish traps will be marked (usually with an adipose fin punch) prior to release back into the river. This identifies salmon as having been previously captured and avoids double-counting of salmon recaptured during the same year. Salmon captured with an existing adipose fin punch will receive a second punch in the upper lobe of the caudal fin. Suspected aquaculture escapees will be killed and sampled for the following purposes: fish health surveys, genetic characterization, sexual maturity assessment, and food habits studies.

<u>Descriptions of Trapping Facilities:</u>
The Cherryfield fishway trap, located at a low head ice control dam on the Narraguagus River, was built in 1991, and has been operated from early May through mid-November each year. The trap consists of an aluminum grate cage structure designed to intercept adult Atlantic salmon at the top of the fishway. The trap is connected to a winch system that raises the trap to allow fish processing. Barrier weirs and fish traps were installed seasonally on the Pleasant and Dennys rivers starting in 1999. Both weirs deteriorated and the Pleasant River Weir operations were discontinued in 2005. The Dennys weir was redesigned in the summer of 2005 and has been deployed from spring through late fall each year from 2006 to 2010. The weir and trap are constructed of aluminum grated panels (3.81 cm clear spacing). The weir spans the width of the river and is angled upstream from each bank, with the trap box located at the apex. The weir is anchored to the stream bottom by a timber cribwork covered by wooden planks with mounting "boots" attached. The supports for the weir (A-frames) fit into the boots to secure them to the bottom. Aluminum grates slide into channels mounted on the A-frames. The trap cage has a narrow opening that allows salmon and other species to enter, but larger fish, such as salmon, find it difficult to leave. The opening is also fitted with flexible plastic fingers that allow fish to enter, but make it difficult to leave.

For this agreement, BSRFH will install and operate an adult trap at the Saco Falls Fishway on the Pleasant River from May to November. The fishway is owned by BSRFH and the trap is currently being designed by Alex Haro at the USGS Conte Laboratory. It will be constructed of aluminum grated panels (3.81 cm clear spacing), have an entry funnel with plastic fingers, and be fastened to a concrete abutment in the fishway. Water depth will allow fish processing and no lift system will be needed.

The Veazie fish trap in integral with the vertical slot fishway at the Veazie Hydroelectric Project (FERC No. 2403) on the Penobscot River. The trap consists of an aluminum cage structure designed to intercept adult Atlantic salmon at the top of the fishway. The trap is connected to an electronic winch system, which enables the cage to be hoisted up, providing shallow water for careful fish handling and processing.

The final design of a fish lift for the Milford Dam (FERC No. 2534) is being prepared. Based on the designs on hand the lift will be operational from April 15 to November 15 annually. It will have a main hopper (10' x 14' x 4' or 560 cf) with crowder braille and vee trap gate that has a cycle time of 8 minutes. There will be a secondary hopper (5' x 5' x 3' r75 cf) near the upstream end of exit flume to allow trapping and sorting into a 12' diameter circular sorting tank and secondary tanks for salmon and alewives. There will also be a counting window on the flume.

Fish lifts in the Kennebec River watershed at Lockwood (FERC No. 2574A) and Benton Falls (FERC No. 5073A) and on the Androscoggin River at Brunswick (FERC No.

2284A) are associated with hydro-electric facilities. The Lockwood Project has a fish lift with trapping, sorting and trucking capabilities located on the west side of the powerhouse. An attraction flow attract the fish through the tailrace fish lift enhance gate into the lower flume of the fish lift. The fish will then swim through a vee-gate crowder and remain in the lower flume of the lift. During the cycling process, the vee-gate crowder will close to hold the fish in the hopper area. The water-filled hopper lifts the fish to the holding tank elevation and the fish are sluiced into the discharge tank in the sorting/trucking portion of the facility. The fish passage system at Benton Falls consists of an automatically adjusted entrance gate, horizontally moving crowder system, a separation screen, a single hopper, an adjustable exit flume trip gate system, an elevated exit flume to the impoundment equipped with a viewing window and blockage screen, a downstream migrant bypass pipe to the tailrace and attraction flow piping. Fish lift operation, typically, scheduled daily from 0500 to 2000, is normally automated, but the fish lift also can be operated manually.

Counting River Herring at Trapping Facilities:
To capture river herring, three of the trapping facilities installed by DMR are modified as follows: on the Dennys River the weir grates are covered with 2.54 cm mesh lobster trap wire to direct alewives into either the original trap box or a net enclosure upstream of a removed grate section; on the Penobscot 2.54 cm coated trap wire mesh is attached to the interior sides, floor, and stop gate of the Veazie trap and a nylon brush door sweep added to the edge of the false floor to prevent escapement between the false floor and the sides; on the Narraguagus River the same coated trap wire mesh is attached to the sides of the trap and nylon rope laced through the bars on the exit gate to capture American shad greater than 40 cm.

For two of the five years alosids will be trapped either in the original trap box or a net enclosure upstream of a removed grate section of the modified Dennys River weir. During the spawning run, the weir is tended several times daily starting in the late morning to early afternoon and ending in the early evening when upstream movement of alewives has ceased. Counts of alewives are made by determining the number in a full dip net and then counting the number of full nets deposited upstream. Three different capacity nets are used (20, 30 and 50 fish) to transfer alewives upstream during the peak of the run. When there are fewer fish entering the trap, alewives are individually counted.

In three of the five years covered by this agreement BSRFH will modified the trap at the Cherryfield Ice Control Dam on the Narraguagus River to count shad and for install an underwater camera in the fishway trap to record alewives passing during days the commercial alewife harvester is required to allow escapement. Counts of alewives on the video will be based on a stratified sampling plan. Davies et al. (2007) documented that it was possible to reduce sampling requirements to 4 randomly chosen 1 minute intervals per day to achieve an estimate of the true population within 20% and with 95% confidence.

Since 2009 the extent of the river herring run above the Veazie Dam has been documented. In conjunction with the tending of the trap for salmon, alewives were dipnetted from the modified trap, counted, and passed directly upstream. At Milford, BSRFH river herring will either be counted using an automated fish counting device like those used at Benton Falls or manually sorted and counted manually similar to the Lockwood and Brunswick facilities. The automated system at Benton Falls uses a Lotek automated fish counting device that measures changes in conductivity as fish swim through resistivity sensors. The sensor array consists of 16 four inch diameter tubes stacked 2 wide and 8 tall. The counting device is calibrated multiple times throughout the season by passing fish sized objects through the tube and adjusting sensitivity of the sensors. In addition, allotments of known number of fish are released and allowed to pass through the counting tubes, with the count compared to the actual number released. The decision on initial counting methods will likely be influenced by the size of the run.

Redd Surveys

BSRFH will perform redd counts by mid-November 2011 to 2016 in selected river and river reaches in the geographic range of the GOM DPS. Redd counts will be conducted either by foot on small tributaries, brooks, and streams or by canoe in larger rivers. Redd counts will be conducted by visibly searching for oval areas that have recently been brushed clean of algae, silt, or debris by females digging egg pits. Redds are enumerated and geo-referenced using a portable Global Positioning System (GPS), but are not disturbed or sampled during the surveys.

Electrofishing

BSRFH will conduct electrofishing surveys throughout the GOM DPS based on a statistically determined stratified sampling plan, with approximately 350 sites in riverine habitat in the Dennys, Machias, East Machias, Narraguagus, Sheepscot, Pleasant, Kennebec, Androscoggin, and Penobscot watersheds. BSRFH will utilized pulsed, DC, back-pack electrofishing techniques to capture juvenile Atlantic salmon for data (density, size, distribution), fish (broodstock), and fish parts (*i.e.* otoliths, scales, or tissue). At most sites a single timed pass catch per unit effort (CPUE) method will be used. The method is based on standardized wand sweeping protocols for a specified time period, typically 300 seconds of wand time. Fish relative abundance (CPUE) is presented in fish/minute and, if the area sampled is measured, in fish/unit. Each year of the agreement there will be a new set of random sites selected to produce the GOM DPS index of juvenile abundance. From these a portion (likely 10%) will be identified where depletion as well as CPUE estimates will be made. Method changes might affect CPUE, however, would not affect juvenile populations estimates based on multiple pass removals, with three passes standard. For estimates, blocking seines will placed at the top and bottom of the sampling site. Atlantic salmon captured on each run will be counted, measured, weighed, and released or held outside the section until the survey is completed. Atlantic salmon will be anesthetized with MS-222 prior to processing. These sites will maintain a record of catchability for gear and methods and be used to calibrate CPUE data among years. BSRFH will be conducted electrofishing sampling from late August to September. Written protocols for conducting electrofishing surveys and collecting biological data and tissue samples from juvenile salmon are reviewed annually and revised as needed (BSRFH 2010).

Smolt traps

Rotary Screw Traps (RST) will be operated in selected rivers (Table 4 in Project Narrative) in April, May, and June. The RST relies on an Archimedes screw built into a screen-covered cone that is suspended between two pontoons. The RST, made of aluminum, is designed to float in the river and capture smolts moving downstream. The large end of the cone is placed upstream into the stream current while the lower half of the cone remains in the water. Water pressure forces the Archimedes screw to turn the cone. Downstream migrating smolts enter the trap through the large cone opening and then are directed into a holding box at the end of the trap. A Norwegian design alternate smolt trap, which has a floating holding box and net leads, will be used on one stream too small for RST.

PIT Tag system

PIT antennas have been installed at the entrance and exit of fish ways at Veazie, Great Works (with two fish ways), Milford, and West Enfield Dams on the mainstem and Howland Dam on the Piscataquis River and at Mattaceunk (Penobscot) and Browns Mills, Dover-Foxcroft, and Guilford (Piscataquis), and Pumpkin Hill in 2011. BSRFH will work with the USGS Cooperative Research Unit to maintain PIT data collection system at these dams on the mainstem and major tributaries in the Penobscot River watershed. BSRFH will tag adult Atlantic salmon, initially at the Veazie trap and later at the Milford lift, with 12 mm full duplex Destron Fearing 134.2 "Super II" PIT tags before they are released to the river. In addition other diadromous species that are captured will also be tagged and included in the monitoring. In collaboration with USGS, PIT detection equipment will be operated at other sites in the Penobscot River watershed that will provide data of mutual interest to BSRFH and NMFS. These sites will be selected to encounter the other species tagged.

River herring assessment on Penobscot estuary tributaries

Counting methods for river herring in two tributaries to the Penobscot estuary are being developed in conjunction with NMFS, Orono. The initial system used on Sedgeunkedunk Stream included a temporary weir faced with 2.54 cm mesh lobster trap wire and a bank of automated fish counting devices in tubes. Refining this counting system and developing one for Souadabscook Stream will be done in conjunction with NMFS, Orono. The counting system in Souadabscook Stream will either be similar to that in Sedgeunkedunk Stream or will involve a pound net and manually counting similar to the Dennys. During the period these temporary river herring counting systems will be operated (April and May), adult Atlantic salmon are unlikely to be ascending these small streams to spawn.

Habitat

BSRRFH will survey habitat in a very limited number of sub-watersheds focusing on streams or stream segments where connectivity or management has changed in the previous year (i.e. installed arched culvert restores salmon access to a tributary that had not been surveyed). Habitat survey involves walking streams, and recording data on the location of meso-habitat breaks (GPS points), substrate, bankfull width, and other physical habitat features. BSRFH will monitor ambient temperatures for the growing season (May to October) using anchored automated, electronic data loggers at locations throughout the GOM DPS.

DMR manages Dennys River flows using a gate in the dam to adjusting water releases from Meddybemps Lake based on the Dennys River Instream Flow Incremental Methodology (IFIM) data and rule curve for Meddybemps Lake. The summer low flow target is approximately 80 CFS at the USGS Dennys River gauge, but somewhat lower flows do not severely decrease the amount of salmon habitat.

Hatchery Support

There are three field activities associated with the Hatchery Support Element of the agreement; marking, stocking, and electrofishing. Electrofishing methods were described above and are used to collect broodstock and to assess the contribution of hatchery products to recovery. For the period of the agreement, BSRFH will provide coordination, technical and operational assistance, and logistical support for Atlantic salmon marking programs for Maine rivers. This includes: marking all GLNFH parr that are stocked into the Penobscot River watershed with an adipose clip and a coded wire tag (CWT); all CBNFH 0+ parr stocking in the Sheepscot River with an adipose clip; and assisting with the NMFS smolt marking program smolts. All smolts stocked in the Pleasant and Narraguagus rivers will receive an adipose clip; those in the Narraguagus will also have size specific Visual Implant Elastomer (VIE) injected into eye tissue. A portion of the Penobscot smolt stocked will receive adipose clip and VIE.

BSRFH will plan and conducted stocking trips to distribute fry and eggs in rivers within the geographic range of the GOM DPS. Fry stocking trips are scheduled in late April and early May, and typically only two days are required for a river specific stock, the exception being the Penobscot, where trips occur over more than a week. Fry are distributed from canoes or on foot, using a small aquarium dip net, or by pouring out the fry from buckets or coolers. The number of fry released is estimated visually using the size of the dip net (a "typical" full net holds about 1000 fry) and knowledge of the number of fry loaded per cooler. Fry are stocked in "clumps" of between roughly 1000 and 5000 fish, depending on the size and character of the habitat at intervals of 100-500 m.

Eggs are planted through a funnel inserted into spawning gravel after water has been pumped into the substrate to prepare egg pits. The funnel and a pipe connected to a running pump are inserted into the gravel to the desired depth. When the depth is reached, the pipe is removed from the funnel leaving only the funnel in the gravel. Eggs are then poured underwater into the funnel. When sufficient time has passed for the eggs to reach the lower end of the funnel, it is lifted several inches and more eggs can be poured in. Two to three groups of eggs can be deposited each time the funnel is inserted.

Since 1978, the BSRFH has collected adult Atlantic salmon in the Penobscot River at the Veazie Dam fish trap and transported to CBNFH to provide broodstock for USFWS hatcheries in Maine. The USFWS broodstock program is used to supply the Penobscot River with fry, parr, and smolts. The Kennebec River is stocked with eyed eggs from Penobscot River captive reared broodstock. Parr are collected from the Dennys, East Machias, Machias, Pleasant, Narraguagus, and Sheepscot rivers during juvenile assessment work or in adjacent habitat using CPUE methods. These parr are reared to maturity and may either be stocked as pre-spawn adults or serve as broodstock for river specific hatchery juveniles stocked in the geographic range of the GOM DPS. This proposed research will be used to fund BSRFH broodfish collection and transport activities; which will decrease over the period of the agreement.

A2. Proposed Administrative/Lab/Data Analysis

The project is a co-operative agreement that requires open communication, data exchange, and substantial direct involvement of NMFS staff in Orono. Projects are jointly planned, completed, and documented. The results of sampling and data analyses are transmitted through reports or updated databases. Proposed administrative activities are detailed in Appendix A. The nature of that involvement is detailed throughout the Project Outline. Selected examples are:

NMFS Regional Operations and Budget staff will review and approve Semi-annual Reports that will be posted on the DMR website.

After submitting each Semi-annual Report, DMR will collaborate with NMFS, NEFSC Maine Field Station Chief to produce and distribute a Management Highlights document that summarizes stock status, recommends management and assessment actions, and documents actions taken by BSRFH based on recommendations in previous Highlights or Semi-annual Reports.

DMR and NMFS will meet in February to review BSRFH activities and analyses covered in the preceding two semi-annual reports and review and revise Element Plans from the narrative portion of the Co-operative Agreement. There will also be an annual September meeting to review NMFS (NEFSC and NER) activities and analyses over the previous year, review protocol documents, and discuss databases. In addition, every 7-8 weeks the BSRFH Co-operative Agreement Principal Investigators and NMFS, NEFSC and NER technical/scientific leads in the Maine Field Station will meet to discuss topics of mutual interest.

NMFS will provide DMR BSRFH access to the needed number of rotary screw traps and parts for maintenance in March each year and allows BSRFH use of them for the smolt emigration period. BSRFH returns traps to NMFS designated storage areas at the end of the season, with a written assessment of needed parts and maintenance. BSRFH and NMFS staff will develop annual work plans and operate RST sites jointly.

B. Considered but Rejected Alternatives

Alternatives to funding the proposed studies outlined in Section A were considered, but determined to be infeasible because they would not fulfill the purpose of the project. Activities are directed at sampling different life stages of Atlantic salmon and spawning alewife either where they reside (freshwater streams) or as they migrate into freshwater. Times and locations are chosen based on the behavior of the species, altering these would defeat the purpose of the sampling. A variety of sampling methods are included in the proposal, attempting to optimize the efficiency and effectiveness of the gear at each sample site, while minimizing mortality to all species captured. Sampling locations are distributed throughout the geographic range of the GOM DPS Atlantic salmon to ensure that assessments are comprehensive.

No practical sampling alternative exists for electrofishing. Juvenile Atlantic salmon habitat is characterized by relatively shallow, swift flowing areas of rivers and streams with coarse (cobble) substrates. Entrapment or entanglement nets (trawls, seines, trap nets, hoop nets, gill nets, etc.) could not be effectively fished to capture juvenile salmon in these habitats. Experimental angling or the use of toxicants would result in excessive mortality of sampled specimens. Snorkeling could potentially be used to collect population-level data; however, no fish (broodstock) or fish parts (i.e. otoliths, scales, or tissue) could be collected. Electrofishing in freshwater is conducted in late summer and early autumn. The method is not effective in cold water, or at higher stream flows making spring, winter, and late autumn sampling inefficient. Early summer sampling is not conducted because juvenile salmon are smaller and less vulnerable to capture and warm water temperatures increase the potential for mortality.

No practical alternative exists for collecting data on adult Atlantic salmon. Fish traps currently installed in the Dennys, Narraguagus, and Penobscot Rivers allow DMR to safely and effectively intercept and count salmon and river herring and collect biological data from adult Atlantic salmon. Short of installing similar trap devices in alternative locations, no other active or passive collection technique would enable the entire adult population in these rivers to be sampled. Although techniques, like hydroacoustics or DIDSON, could possibly be used to enumerate runs of salmon in Maine rivers, biological data could not be collected from individual fish as fish are not collected by these methodologies.

There are no alternatives to the smolt traps presently being used to capture smolt available. The traps have a passive capture design, flow through live-well, and are modular; making it possible to locate them in remote sections of free flowing rivers. These features make the trap both efficient and very gentle on the fish collected. Fyke and Oneida trap nets or picket weirs could be used. The nets do not have live-wells to protect smolts and weirs are difficult to maintain in high spring flows and are not particularly portable.

PIT (passive integrated transponder) technology is used frequently in fisheries management and behavioral research. PIT tags range from 8-32 mm long, identify individual fish, and are inexpensive and long lasting because they contain no battery. To monitor fish behavior in as large of a system as the Penobscot, PIT tag antennas are located in fishway entrances and exits and act as checkpoints for the migrating fish. Because of the low cost, the behavior of a large number of individuals of several species can be studied. Radio, acoustic, and satellite tags are not practical alternatives. Their initial higher cost would limit the number of tagged individuals and prevent accurate population level information on the distribution of spawning salmon and river herring in the Penobscot River watershed.

There is no alternative to marking that effectively identifies juvenile Atlantic salmon reared in USFWS hatcheries. DMR will be applying marks selected for the program by NMFS, who have evaluated a variety of marks and determined that in addition to an adipose clip; VIE are to used for smolt and CWT for parr. These marks have low loss rates and predictable detection rates in live fish of any size.

There are no practical alternatives to redd counts and habitat monitoring. Failure to manage the flow in the Dennys River to protect summer rearing habitat would result in lost productive capacity of the river.

A powered egg planter used on the west coast of the United States and an egg planter developed by the Swedish Salmon Research Institute were used as models during the period BSRFH was developing egg planting methods. Neither of these alternatives resulted in acceptable emergence rates nor were they adaptable to planting large numbers of eggs in a short period of time with a limited crew. The process developed by BSRFH protects the eggs from mechanical damage during planting, and can be used to efficiently plant large numbers of eyed eggs in a short period of time with a small crew.

No practical alternatives exist for administrative, lab, or data analysis activities. Timely and accurate processing and analyses of collected data and samples are necessary to understand the status and trends of populations of wild Atlantic salmon in Maine and to understand the effects and effectiveness of management and other human actions on salmon populations. Failure to attend meetings would put Maine and the United States at a disadvantage in regional and international fishery management by reducing the quality of assessments and thus management advice.

C. No Action Alternative

The no action alternative is that BSRFH would not be funded to conduct assessment and research activities, which have been identified by the Atlantic Salmon Recovery Framework (2010) as necessary to facilitate and assess recovery of the GOM DPS.

IV. AFFECTED ENVIRONMENT

Activities in the proposed July 1, 2011, to June 30, 2016, Atlantic Salmon Freshwater Assessment and Research Project will occur in freshwaters of the State of Maine throughout the geographic range of the GOM DPS of Atlantic salmon and at fishways in dams (Figure 1). No marine closed areas are to be sampled. Sampling is from April to December. No sampling is by angling or relates to any commercial fish species harvested in freshwater, so exemptions to season are not needed.

A. Physical Environment

About 76.2 % of Maine's surface area is forested (Hepinstall et al. 1999); water and wetlands make up another 15.2 %. The remaining land is agricultural (7.3%), developed (1.3%) or bare rock (0.1). Annual precipitation averages between 104 and 118 cm in the three climate zones of the state (Jacobson et al. 2008); with coastal areas receiving the most precipitation.

The principal rivers where BSRFH will conduct assessment and research under this proposed research are within the Dennys, East Machias, Machias, Pleasant, Narraguagus, Penobscot, Sheepscot, Kennebec and Androscoggin watersheds (including tributaries to their estuaries). Waters included in the proposed activities are distributed among the three Salmon Habitat Recovery Units (SHRU) defined by NOAA for the geographic range of the GOM DPS. The three SHRUs are: 1) the Merrymeeting Bay SHRU which incorporates two large basins: the Androscoggin and Kennebec, and extends east as far as, and including the St. George watershed; 2) the Penobscot Bay SHRU which includes the entire Penobscot basin and extends west as far as, and including the Ducktrap watershed, and east as far as, and including the Bagaduce watershed; and 3) the Downeast Coastal SHRU which includes all the small to medium size coastal watersheds extending east of the Penobscot SHRU as far as, and including the Dennys River watershed.

Individual river descriptions below are excerpted from the July 1999 Status Review of Atlantic salmon (Colligan et al. 1999) and information on flooding in major river basins the ENSR Corporation (2007).

Merrymeeting Bay is a 16 km estuary where the Androscoggin and Kennebec River meet nearly 32 km inland from the Atlantic Ocean. These two river systems and several smaller coastal rivers, including the Sheepscot River comprise the Merrymeeting Bay SHRU. The Androscoggin begins in northwestern Maine at Umbagog Lake, journeys through New Hampshire, then re-enters Maine near Bethel, eventually emptying into

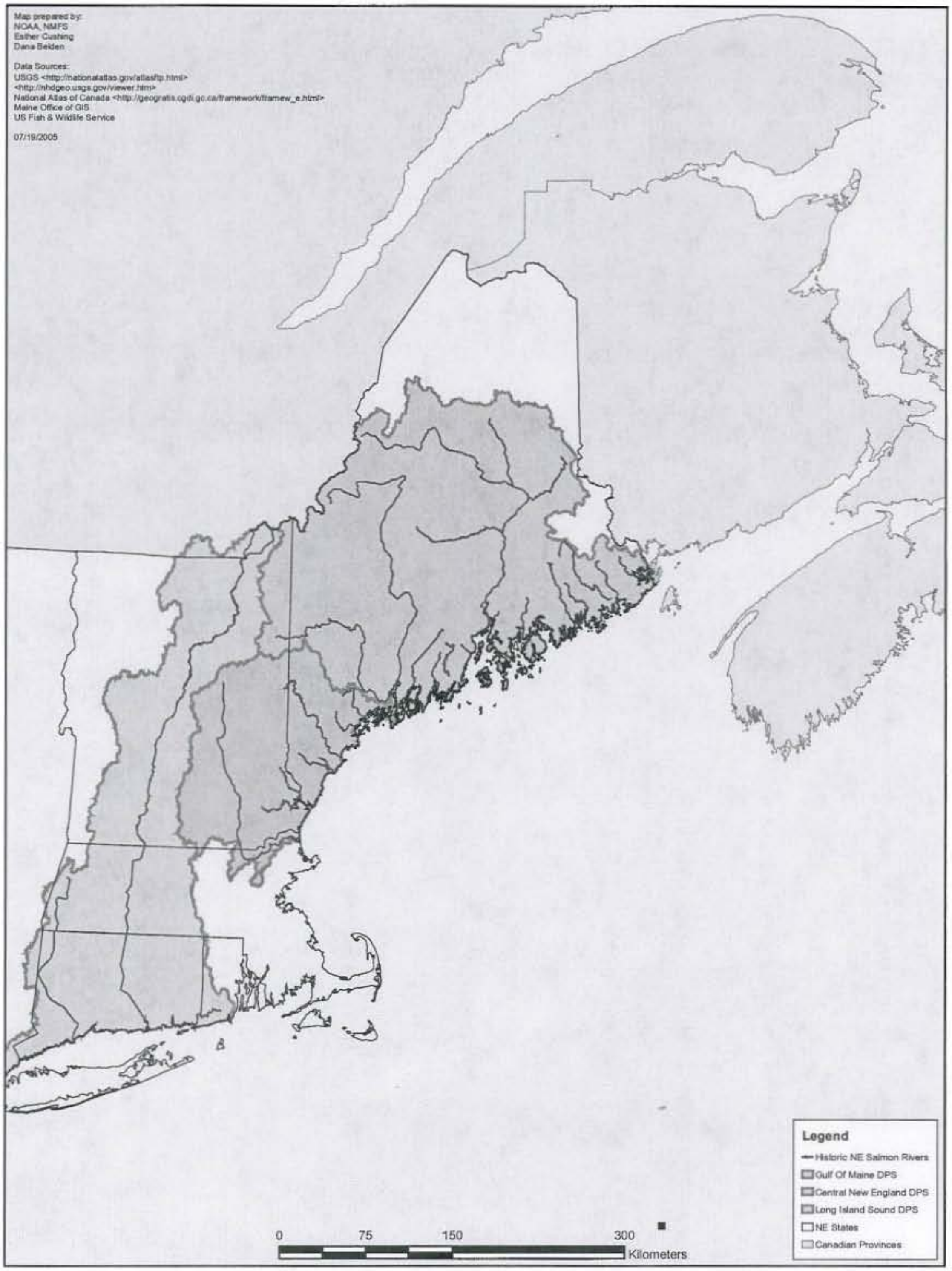

Figure 1. The geographic range of the Gulf of Maine Distinct Population Segment of Atlantic Salmon in relation to the other New England DPSs described by Fay et al. (2006).

Merrymeeting Bay. It is 287 km long and has a watershed area of 9,100 km^2. The river flows generally south but with numerous bends past the towns of Errol and Milan and the city of Berlin before turning east at the town of Gorham, New Hampshire to cut across the northern end of the White Mountains and enter Maine. Continuing east, the river passes over a set of falls in the town of Rumford that is impassable to anadromous fishes. The river passes through Lewiston and Auburn, turns southeast, passes the community of Lisbon Falls and reaches tidewater just below the final falls in the town of Brunswick. The Kennebec River originates from Moosehead Lake and the Moose River, flowing approximately 370 km to Merrymeeting Bay. The drainage area for the entire watershed is 15,203 km^2, with 8,925 km^2 of that in the Lower Kennebec River Watershed which lies in south central Maine. The Sandy River is within this lower watershed and originates in the Sandy River Ponds at an elevation of 520 m in Sandy River Plantation. The river flows south to a confluence with Chandler Mill Stream in Maine Township E and then easterly joining Saddleback Stream and Orbeton Stream. The river then flows southeasterly through the villages of Phillips and Strong to Farmington and flows northeasterly from Farmington Falls through New Sharon to discharge into the Kennebec River in Norridgewock a short distance south of the Madison town line.

The Sheepscot River originates as a series of hillside springs in West Montville, Waldo County and flows a distance of 54.7 km to the estuary near Alna. The West Branch of the river originates at Branch Pond in Kennebec County, flows a distance of 24 km and enters the main stem in Sheepscot. The Dyer River, the largest of the tributaries, has a length of 27.3 km and flows to the estuary. The Sheepscot River drainage includes 24 lakes and ponds and encompasses an area of 59,052 ha. The upper portion of the Sheepscot River estuary resembles a fjord, whereas the lower portion is typical of Maine watersheds, with mud flats and salt marsh covering large areas. Sheepscot Falls, located in the upper estuary, is composed of ledge, and the site of a former dam.

The Penobscot River is Maine's largest river, the major river in the Penobscot Bay SHRU. The Penobscot River watershed comprises an area approximately 257 km long and 249 km wide (MASRSC 1983). In its upper reaches, the Penobscot is divided into two branches: East Branch and West (Main) Branch. The East Branch originates at Matagamon Lake and flows of distance of 76 km to its confluence with the West Branch near Medway. The West or Main Branch originates near Caucomgomoc Lake in northern Maine. The Penobscot River watershed includes hundreds of tributaries, ponds, and lakes too numerous to list. Major tributaries include the Passadumkeag River, Piscataquis River, Mattawamkeag River, Kenduskeag Stream, and Pleasant River. The Pleasant River flows into the Piscataquis River near Milo. The Pleasant River is about 64 km long.

Elevations in the drainage range from 0 to 5,268 feet above sea level. The topography ranges from steep mountains including Maine's highest (Mt. Katahdin) to rolling hills and extensive bogs, marshes and wooded swamps. Most of the upper watershed is forested, intensively harvested for pulp and saw logs and sparsely settled. Stream channels within the watershed range from high gradient channels in the headwaters to low gradient channels dominated by fine sediment in the forested lowlands. The majority of channels historically used by Atlantic salmon for spawning and rearing (e.g., East Branch Penobscot, Piscataquis, Pleasant Rivers) are often channels of moderate gradient.

The Dennys, East Machias, Machias, Pleasant, and Narraguagus Rivers are all located within the coastal region of eastern Maine and, thus, the Downeast Coastal SHRU. This region of eastern Maine is relatively unsettled. The eastern coastal basins are made up primarily of forest, wild blueberry barrens, and heath (MASRSC 1982a; MASRSC 1982b). Topography in the upper reaches of the watersheds generally ranges from low to moderately steep in the headwater areas.

The Dennys River originates in Lake Meddybemps in the town of Meddybemps, Washington County, Maine. The drainage area of the Dennys River is 34,188 ha, and it flows a distance of 32 km to Cobscook Bay. In addition to Lake Meddybemps, Cathance and Little Cathance Lakes are located in the headwaters of the drainage. The confluence of Cathance Stream, a major tributary, is located approximately 1.0 km upstream from tidewater. The upper reach of the river, from Lake Meddybemps to the falls is flat and slow moving. The reach from the falls to Cathance Stream has flat water stretches and a few riffle areas. The estuary is large, has numerous coves and bays, and numerous peninsulas and islands between Dennysville and the ocean.

The East Machias River originates at Pocomoonshine Lake in the towns of Princeton and Alexander in Washington County, Maine. The river has drainage of 65,009 ha that contains 26 lakes and ponds, and over 50 named tributaries. It flows a distance of 59.5 km to Machias Bay. The watershed is sparsely settled and forested with a mix of spruce and fir. Organic materials from wetlands and bordering lakes and ponds discolor the waters of the river. The East Machias and Machias Rivers enter the same estuary and the lower 3.2 km of the estuary is common to both rivers.

The Machias River drains an area of over 119,140 ha. It originates from the five Machias Lakes and flows 98 km to Machias Bay. The watershed is located in Washington and Hancock Counties and more than 160 tributaries and 25 lakes and ponds exist in the system. A natural gorge at the mouth of the river in the town of Machias may impede the passage of salmon during periods of extreme high flow. The Machias estuary is elongate, at approximately 9.6 km in length, but relatively narrow.

The Pleasant River watershed in Washington County originates at Pleasant River Lake in Beddington and drains an area of 22,015 ha. It flows 45 km to the head of tide in the town of Columbia Falls. There are few lakes in the watershed, and the tributaries are a network of small feeder streams with a combined length of 109.4 km. The river water exhibits a high degree of red-brown coloration caused by leaching of roots, leaves, and other organic materials that originate from extensive peat bogs in the drainage. The bogs provide water during dry periods, storage during wet periods, and moderate discharge in the basin.

The Narraguagus River originates at Eagle Lake, flows through Washington and Hancock Counties, and drains an area of approximately 60,088 ha. The main stem drops a total of

124 m over a distance of 69 km to the head of tide in Cherryfield. The West Branch of the Narraguagus, a major tributary, has a drainage area of approximately 18,100 ha and reaches the main stem 3.2 km upstream from the head of tide. There are more than 402 km of streams and rivers in the drainage and about 30 lakes and ponds, with three of the lakes exceeding 162 ha in size. The topography of the headwaters consists of rocky hills and ridges, and glacial outwash plains dominate the lower portions of the watershed.

All these watersheds have the following habitats required for Atlantic salmon to survive and reproduce: (1) spawning in late autumn, (2) feeding and sheltering during the growing period in the spring, summer, and autumn, and (3) overwintering. In addition, free migration among these habitats and the sea is necessary. A Maine salmon stream is characterized by moderately low (10 ft./mile. 0.2%) to moderately steep (75 ft./mile, 1.4%) gradient. Substrate is composed of gravel, cobble, and boulder, although there is usually some bedrock outcrop in steeper sections and fine gravel to coarse sand in lower gradient sections. It is critical that bottom materials be sufficiently permeable to permit percolation of water, especially in spawning reaches. There are regular occurrence of riffles and pools, with the average spacing of pools or riffles about five to seven times the channel width. The physical attributes ensure a high degree of oxygen saturation essential to salmon growth and survival.

Within these rivers, the physical environment of sampling sites will depend on the species and life stage targeted. Atlantic salmon habitat is best described using combinations of depth, water velocity, substrate, and cover (Elson 1975; Gibson 1993; Baum 1997). Young salmon prefer riffles or rapids sections with velocities ranging from 1.6 ft./sec. to 2.1 ft./sec., depths of 4 to 14 inches, and substrate consisting of gravel and cobble (fry) or cobble and boulder (parr). To overwinter, young salmon either move into pools or crevices between larger substrate. Spawning occurs on gravel bars or tails of pools where the current (1.0 - 2.6 ft./sec.) is accelerating and water depth (8 - 20 inches) is decreasing. Adult salmon require resting and holding areas as they migrate upstream. Holding pools are deep (> 2 ft.), well shaded, and have cool temperatures (spring holes or groundwater seeps). Resting pools typically lack depth, cover, or cool temperatures.

Habitat for Atlantic salmon is further constrained by water quality; with the species requiring cool, clear, circumneutral stream water. All life stages require cool water and dissolved oxygen concentrations near saturation (Trial and Stanley 1995). Spawning occurs between 4.4 and 10 C, with 6 C, optimal for egg fertilization. Development can occur at temperatures as low as – 0.5 C but not above 12 C. The best young salmon growth occurs when temperatures are between 16 C and 18 C. However, even at daytime temperatures near 23 C salmon can survive if there is nighttime cooling of several degrees. Oxygen concentrations of 6 mg/l or greater are required for saturation at these temperatures. Water temperature, in conjunction with increased discharge, is a trigger for upstream movement of adult salmon and for smolt emigration. Salmon survival is optimal when stream pH is circumneutral (5.4 to 6.7). When pH ranges from 4.7 to 5.0, juvenile abundance is reduced. Naturally reproducing populations of salmon cannot exist in rivers with mean annual pH less than 4.5. Atlantic salmon typically occur in clear streams, where turbidities do not exceed 40 NTU. Above these levels, the ability of salmonids to feed is compromised, and depending on the duration of the event, can affect growth and survival.

B. Biological Environment

The fish species present in Maine watersheds vary depending on the distance from the estuary (Yoder et al. 2007). In the lower reaches of the rivers, anadromous and resident fish species are present. The most common anadromous fish species include lamprey (*Petromyzon marinus*), alewife (*Alosa pseudoharengus*), rainbow smelt (*Osmerus mordax*), Striped bass (*Morone saxatilis*), American shad (*Alosa sapidissima*), Atlantic herring *(Clupea harengus*), and blueback herring (*Alosa aestivalis*). Shortnose sturgeon (*Acipenser brevirostrum*) and Atlantic sturgeon (*Acipenser oxyhynchus*) are known to occur in the lower Kennebec, Androscoggin, and Penobscot rivers. Resident species present in the lower reaches are primarily warmwater fishes including smallmouth bass (*Micropterus dolomieui*), white sucker (*Catostomus commersoni*), sunfish (*Lepomis spp.*) and various minnows. Typically the upper reaches of the watersheds contain both warmwater and coldwater species including brook trout (*Salvelinus fontinalis*), smallmouth bass, white sucker, cusk (*Lota lota*), sculpin (*Cottus cognatus*), and a variety of Cyprinidae including dace and minnows. The catadromous American eel (*Anguilla rostrata*) are distributed throughout the watersheds. Of these fish species, only the shortnose sturgeon (*Acipenser brevirostrum)* is federally-listed as Endangered (Table 1).

Table 1. Species of freshwater and terrestrial animals and plants listed as Threatened or Endangered under the ESA and that occur within the State of Maine. Marine mammals and turtles were excluded because there are no project activities in the ocean.

Status	Animal Species
T	Lynx, Canada (Contiguous U.S. DPS) (*Lynx canadensis*)
T	Plover, piping except Great Lakes watershed (*Charadrius melodus)*
E	Sturgeon, shortnose (*Acipenser brevirostrum)*
E	Tern, roseate northeast U.S. nesting pop. (*Sterna dougallii dougallii)*
Status	**Plant Species**
E	Lousewort, Furbish (*Pedicularis furbishiae*)
T	Orchid, eastern prairie fringed (*Platanthera leucophaea*)
T	Pogonia, small whorled (*Isotria medeoloides*)

Aquatic macroinvertebrates typical of Maine waters with unimpaired water quality (Huryn et al. 2002) include mayflies (Ephemeroptera), caddisflies (Trichoptera), dragonflies and damselflies (*Odonata*), stoneflies (*Plecoptera*), crayfish (*Decapoda*) and mussels (*Pelecypoda*). No aquatic invertebrates are federally listed (Table 1).

A variety of avian and mammalian piscivores forage in Maine salmon rivers, including bald eagle (*Haliaeetus leucocephalus*), double crested cormorant (*Phalacrocorax *auritus*), osprey (*Pandion haliaetus*), belted kingfisher (*Megaceryle alcyon*), common merganser (*Mergus merganser*), northern river otter (*Lontra Canadensis*), and harbor seals (*Phoca vitulina concolor*). Ecological links between Atlantic salmon and the Canada lynx (*Lynx canadensis*) that occurs in Maine are unlikely, as are links with Piping Plover (*Charadrius melodus*) because their ranges are outside the GOM DPS. The Roseate tern (*Sterna dougallii dougallii*) occurs in coastal Washington County, and likely have some food items in common with Atlantic salmon smolt.

The three federally listed plant species (Table 1) either occur in Aroostook County (Lousewort and Orchid) or in southern Maine (Pogonia), outside the geographic range of the Gulf of Maine Distinct Population Segment.

C. Socioeconomic Environment

The 2000 census information presented below was taken from ENSR Corporation (2007) and tables of county and municipal populations linked on the Maine State Planning Office website http://www.maine.gov/spo/economics/census/.

The Kennebec River Basin contains all or portions of four cities (Hallowell, Augusta, Gardiner, and Waterville), eighty-six towns, 129 unincorporated areas, and falls within nine counties. The population within the river basin was 211,000 in 2000. Of the watershed residents, 20% resided in cities. The Androscoggin River basin contains all or portions of sixty-three towns, three cities (Auburn, Bath, and Lewiston), thirty-seven unincorporated areas, and falls within six counties. The population within the drainage basin increased to 169,000 in 2000, with the proportion of the population residing within cities decreasing from 44 % to 32% over the period since 1990. The Penobscot River Basin contains all or portions of three cities (including Bangor, Brewer, and Old Town), 108 towns, and 184 unincorporated areas, and falls within seven counties. The population within the drainage basin was 172,000 in 2000 with approximately 29 percent residing in cities. While there are not population estimates for each of the coastal watersheds, a reasonable approximation of the 2000 population in the watersheds included in the Downeast SHRU is 77,800 (sum of the populations of Washington and Hancock Counties (33,900) and the adjacent Hancock County (51,800) minus the population of the St Croix watershed (7,900).

An assessment of Maine's biggest industries (Rose 2004) based on number of people employed is applicable to the geographic range of the GOM DPS, given that the three major watersheds cover most of the state. The largest employment categories in Maine are related to food services and health care (5 of the top 10). The "big industries" (those with higher proportions of jobs than the national norm) employing Maine residents are commercial fishing (17X = 17 times the national proportion), leather manufacturing (16X), forestry (5X), paper manufacturing (4X), lumber and wood products manufacturing (3X), tourism (2X), and ship and boat building (2X). In addition tourism, which roughly supports about 58,000 Maine jobs, is thus Maine's largest industry (Rose 2004), and much more concentrated in Maine than in the nation. The 27,600 jobs directly related to natural resource in Maine 2002 were divided among: farm employment (10,500); fishing, hunting, trapping (8,400); forestry and logging (6,100); and agricultural and forestry support services (2,600). Including those industries that are directly dependent on these natural resources doubles the employment numbers.

V. IMPACTS OF THE PROPOSED ACTION AND ALTERNATIVES

State and Federal efforts to restore Atlantic salmon in New England were analyzed in accordance with National Environmental Policy Act (NEPA) standards in the "Restoration of Atlantic Salmon to New England Waters Final Environment Impact Statement" (USFWS 1989). An EA, completed by the State of Maine and NOAA on the previous cooperative agreement for proposed activities for May 2006 to May 2011, resulted in a Finding of No Significant Impact and Environmental Assessment. The Status Review for Anadromous Atlantic Salmon (*Salmo salar*) in the United States (Fay et al. 2006) also provides a thorough review of Atlantic salmon population assessment work conducted for the GOM DPS, determining no likely demographic effects.

A1. Proposed Field Activities

Physical Environment

BSRFH proposed activities do not disrupt normal river processes or riparian areas and will have no lasting impact on the physical environment. There are no construction, excavation, placing fill, dredging, or habitat restoration activities in the July 1, 2011, to June 30, 2016, Atlantic Salmon Freshwater Assessment and Research Project. Generally, most study activities are short-term and occur within a relatively small footprint within each of the rivers. Temporary disturbance of the physical environment in the rivers or along the banks will be associated with people wading, launching and using canoes, and deploying gear (i.e. nets, thermographs, weir, rotary screw traps, alternate smolt traps). BSRFH has no authority over the town-owned Cherryfield Dam, which does impact Atlantic salmon habitat in the Narraguagus River.

Biological Environment

Biological sampling will occur in freshwaters of the State of Maine throughout the geographic range of the GOM DPS of Atlantic salmon and at fishways in dams. Field activities are directed at sampling different life stages of Atlantic salmon and spawning alewife either where they reside (freshwater streams) or as they migrate into freshwater. BSRFH has consulted with USFWS on these activities and holds Federal Fish and Wildlife Endangered/Threatened Species Permit (number TE 697823 –2 with effective dates 6/13/2008 – 6/13/2013). The following assessment of the impacts to the biological environment focuses on the fish community. No birds or mammals have been captured during any BSRFH Atlantic salmon assessment activities, and the effects of sampling on aquatic and terrestrial plant communities are short-term and occur within a small footprint. No activities occur in or near Roseate tern habitat.

Atlantic Salmon

BSRFH staff are fully trained in safe collection and handling procedures for Atlantic salmon; handling all life stages during annual research and assessment activities. The MASC has established protocols specifically designed to limit stress resulting from collecting salmon as adults and juveniles. Based upon the number of adult salmon handled by the BSRFH, mortality rates at the traps have been less than 0.3% since 2001 (Table 2). Mortality of juveniles during electrofishing has ranged from 6 to 17 juveniles per 1,000 salmon handled; with most of the mortality annually (60 to 95 %) occurring to young-of-the-year (YOY) (Table 3). Mortality of smolts attributed to capture in RST on Maine rivers ranged from 0.09 % to 1.3 % over the period 1997 to 2008 (Music et al. 2010).

Adult and juvenile Atlantic salmon migrations could be delayed by adult and smolt trapping operations; available data do not indicate that either are having any appreciable effects on migration rates in the rivers.

Table 2. History of mortality of adult Atlantic salmon at traps operated by BSRFH within the geographic range of the expanded GOM DPS from 2001 to 2009.

YEAR	2001	2002	2003	2004	2005	2006	2007	2008	2009	Overall
Total Number Dead at Traps	7	0	2	3	17	1	0	2	1	33
Total Number of Returns	780	784	1113	1321	968	1044	916	2184	2033	11143
Total Number of Recaptures	24	15	62	42	58	64	31	177	144	617
Total number HANDLED	804	799	1175	1363	1026	1108	947	2361	2177	11760
Mortality/Handled	0.00871	0	0.0017	0.0022	0.01657	0.0009	0	0.00085	0.00046	0.002806

Table 3. History of mortality of juvenile Atlantic salmon captured during electrofishing assessments throughout Maine from 2001 to 2009. The proportion of the dead that were young-of-the-year (YOY) is noted.

Year	2001	2002	2003	2004	2005	2006	2007	2008	2009
Total Dead	21	36	69	38	59	37	100	32	47
P of dead YOY	0.57	0.86	0.77	0.95	0.59	0.86	0.95	0.91	0.81
Alive	3,677	3,814	4,460	5,412	4,966	5,522	5,772	4,445	5,355
Total Captured	3,698	3,850	4,529	5,450	5,025	5,559	5,872	4,477	5,402
Dead/1,000 handled	5.7	9.4	15.2	7.0	11.7	6.7	17.0	7.1	8.7

Other Fish Species

Each of the life stage assessments proposed result in the capture of non-target species. However, the proposal does not include plans for collecting fish or invertebrates of any species (i.e. retained dead). Tables documenting the average annual number of non-target fish caught and released alive during adult (Table 4) and juvenile (Tables 5 and 6) Atlantic salmon population assessment work for the years 2005 to 2009 follow. Non-native fish species are in **bold text** in all three tables. Shortnose sturgeon, an ESA-listed species, has never been captured or encountered during any previous Atlantic salmon assessment work.

Table 4. Annual average by-catch of fish species (common name) during population assessments for stream resident juvenile Atlantic salmon using electrofishing, by major river drainage and total for study area.

Species	Dennys	Ducktrap	East Machias	Grand Manan Channel	Lamoine Coastal	Androscoggin	Kennebec	Machias	Narraguagus	Passagassawakeag	Pennamaquan	Penobscot	Pleasant	Saint George	Sheepscot	TOTAL
Alewife, searun	1	14	229					1	471					1	12	729
American eel	89	11	162	55	29		21	30	178	27	17	159	44	10	142	971
Banded killifish				2												2
Black crappie																0
Blacknose dace	73	87	235	162		12	199	223	559	47	19	1,187	62	73	234	3,172
Blackspotted stickleback							1									1
Blueback herring			2					1								3
Brook trout	3	49	76	6	15	1	103	53	78			117	9	2	2	513
Brown bullhead	2		2					2	3			4			1	14
Brown trout						2	75				1				9	87
Chain pickerel	1		1					5	2			2			4	14
Common shiner	20	20	9	12			8	34	86			209	22		133	552
Creek chub	16	25	54	19	1		2	124	82	2		211	13		15	564
Cusk												25				25
Dace Species			182					121					10			313
Fallfish	72		67	29			2	191	83	21		199	34	7	409	1,113
Finescale dace																0
Golden shiner	6		3					16	3			11	2			41
Lake chub		4						1	10	8		37				60
Largemouth bass		1	3									18			5	27
Longnose sucker																0
Minnow Species			3					63				3			1,257	1,325
Ninespine stickleback				3												3
Pumpkinseed			2	3			1	1	35			35	1		6	83
Rainbow trout												1				1
Redbreast sunfish				6			3									9
Sea lamprey		6	3		1				1			6	2		6	24
Shiner Species	16							14				7	2			39
Slimy sculpin						2	203					287				492
Smallmouth bass	40		25	2			7	7	59			166	1	8	92	405
Stickleback Species								1								1
Sucker Species												2				2
Sunfish Species			1					1	70			63				135
Threespine stickleback									1			1	1			3
White perch			18													18
White sucker	47	4	82	40	32		17	56	103	18		162	26	3	21	610
Whitefish Species								2								2
Yellow perch			1									2				3

Table 5. Annual average by-catch of fish species (common name) during population assessments for adult Atlantic salmon at fish traps in dams (Veazie and Cherryfield) or at a weir (Dennys) and total for the study area.

Species	Cherryfield	Dennys	Veazie	Total
Alewife, searun	910	47,862	475	49,246
American shad	173		<1	174
Blueback herring		3		3
Brook trout		1	1	2
Brown trout			1	1
Fallfish			2	2
Lake trout			1	1
Landlocked salmon			4	4
Sea lamprey	4		206	210
Smallmouth bass			213	213
Striped bass			378	378
White perch		1		1
White sucker	156	0	300	456

Table 6. Annual average by-catch of fish species (common name) during population assessments for Atlantic salmon smolts at RST or alternate and total for the study area.

Species	Narraguagus	Piscataquis	Sheepscot	Total
Alewife, searun	967		3,168	4,134
American eel	128		103	231
American shad	<1		11	11
Banded killifish			1	2
Blacknose dace	5	3	90	99
Brook trout	46	12	2	60
Brown bullhead	10	1	13	24
Brown trout			1	1
Chain pickerel			8	8
Common shiner	279	67	462	808
Creek chub	7	19	123	148
Cusk		1		1
Dace Species		<1	10	11
Fallfish	70	18	64	152
Fathead minnow		9	44	53
Finescale dace		9		9
Golden shiner	962	14	757	1,732
Lake chub		1		1
Largemouth bass		<1	9	10
Longnose dace	0			0
Minnow Species	67		267	334
Ninespine stickleback	19		27	46
Northern redbelly dace	45	8	<1	54
Pumpkinseed	20		29	49
Rainbow smelt	22		8	30
Redbreast sunfish	2			2
Sea lamprey	7		133	140
Shiner Species		7	3	11
Smallmouth bass	7	4	3	14
Striped bass			1	1
Sunfish Species	2		3	5
Threespine stickleback	2	1	8	11
White perch			27	27
White sucker	138	181	96	415
Yellow perch			2	2

Socioeconomic Environment

The proposed activities will have no negative impact on the socioeconomic environment. The project will employ BSRFH staff, result in purchases of supplies and equipment, and thus, contribute to the Maine economy. This contribution is insignificant in comparison to industries in the state.

A2. Proposed Administrative/Lab/Data Analysis/Monitoring

Physical Environment

Biological Environment

Socioeconomic Environment

The proposed activities will have no negative impact on the physical, biological, and socioeconomic environment as they will not occur in the field. The project will have a minor positive impact on the socioeconomic environment by employing BSRFH staff, resulting in purchases of supplies and equipment, and thus, contributing to the Maine economy. These proposed administrative activities will have no positive effects on the physical or biological environment.

C. Impacts of No Action

Physical Environment

The No Action alternative would have no impacts (positive or negative) on the physical environment as there would be no field work.

Biological Environment

The No Action alternative would hamper assessing recovery efforts for Atlantic salmon. As previously indicated, additional research and monitoring are required to understand the status and trends of populations of wild Atlantic salmon in Maine and to understand the effects and effectiveness of management and other human actions of salmon. Because the research and assessment activities proposed by BSRFH have been identified as priority tasks necessary to prevent extinction or to identify those actions necessary to prevent extinction of endangered Atlantic salmon in the Final Recovery Plan for the Gulf of Maine Distinct Population Segment of Atlantic Salmon (NMFS/USFWS 2005), the No Action alternative is not an acceptable alternative.

Socioeconomic Environment

The No Action alternative would have no impacts (positive or negative) on the socioeconomic environment.

Cumulative Effects

Overview

Cumulative effects are defined in the CEQ Regulations (40 CFR 1508.7) as "the impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions." Any impacts resulting from field activities performed by BSRFH are additive to existing environmental impacts to Atlantic salmon in Maine.

Temporal and Geographic Scope of Cumulative Impacts Analysis

This analysis is limited to the geographical area within which the proposed research would operate (Figure 1). In all instances, the analysis attempts to take into account past, present, and reasonably foreseeable future actions that are occurring or may occur within the next five years. In all cases, the information presented and analysis conducted is commensurate with the overall impacts associated with this action. All analyses are projected for five years into the future.

Past, Present, and Reasonably Foreseeable Future Fishery Actions

There are commercial and recreational fisheries within the estuaries and freshwaters of the geographic range of the GOM DPS. The past and current commercial fisheries for American eel elvers, alewife, white sucker, and rainbow smelt have the potential to intercept at least one life stage of Atlantic salmon. Smolt captures in the smelt fishery and in elver nets (prior to excluder regulations) have been documented. Alewife harvest occurs in rivers during the period of adult salmon migration, and harvesters have captured kelts and bright salmon. Similarly white sucker nets could capture parr, smolt, and adult salmon moving within watersheds in the spring. The by-catch in these fisheries is likely to be small given the limited spatial and temporal overlap with migrating salmon and the infrequent reporting of by-catch despite reasonable levels of enforcement oversight by Maine Fisheries Agencies.

Recreational angling occurs for many species of freshwater and anadromous fish throughout the range of the GOM DPS. The potential exists for anglers to misidentify and retain juvenile Atlantic salmon as brook trout, brown trout, or landlocked salmon. Capturing an adult Atlantic salmon, while legally fishing for a variety of species is also possible. Only antidotal data are available on incidental catches by recreational anglers within the range of the GOM DPS. DMR estimates that between 0 and 3 Atlantic salmon were caught and released annually over the last five years in areas closed to Atlantic salmon angling.

Non-Fishing Activities

Non-fishing activities that introduce chemical pollutants; sewage; changes in water temperature, salinity, dissolved oxygen, and suspended sediment into the environment pose a risk to the human environment. Examples of these activities include, but are not limited to, point source pollution, agricultural and urban runoff, land development, transportation, and recreational activities. Many of these have occurred in the past and present and will continue in the reasonably foreseeable future. Wherever these activities co-occur, they are likely to work additively or synergistically to decrease habitat quality and, as such, may indirectly constrain the sustainability of the GOM DPS salmon population and non-target species. It is likely that these projects would have negative impacts caused from disturbance and construction activities in the area immediately around the affected research area. Given the wide distribution of the proposed research, minor overall negative effects to habitat, target species, and non-target species are anticipated. In part, this project is intended to assess impacts to egg, smolt, juvenile, and adult life stages from these activities.

Further, these projects are permitted by other Federal and State agencies, who conduct examinations of potential biological, socio-economic, and habitat impacts. These reviews limit and often mitigate the impact of these projects. The jurisdiction of these authorities is in "waters of the U.S." and ranges from inland riverine to marine habitats offshore in the EEZ.

Effects on Physical Environment

There are no significant direct or indirect impacts of the assessment and research activities proposed by BSRFH for the period of July 1, 2011, to June 30, 2016, expected on the physical environment. In fact, habitat management and restoration activities will improve habitat over time. As such, impacts of this activity would mitigate other negative factors. The proposed action is not expected to adversely affect critical habitat of these species. The Maine Department of Marine Resources (DMR) staff is fully trained in habitat management and restoration. As a result, actions will be positive in net impact and managed under the GOM DPS under US Fish and Wildlife Service's Threatened and Endangered Species Permit TE 697823-2 with effective dates 6/13/2008-6/13/2013. (See Section V Part A, Atlantic Salmon).

Effects on Biological Environment

A risk analysis assessment performed by the National Research Council of the National Academies (2003) estimated that research contributes to 3% of all mortality of Atlantic salmon in Maine. Fay et al. (2006) provided a thorough review of Atlantic salmon population assessment work for the GOM DPS; determining no likely demographic effects. The other fish species likely to be captured during the proposed research and assessment activities are common in Maine freshwaters; able to sustain any low levels of mortality that might occur during handling and release.

As there are no significant adverse direct or indirect impacts of the assessment and research activities proposed by BSRFH for the period of July 1, 2011, to June 30, 2016, expected on the biological environment. Further these actions combined with other Federally funded fisheries and wildlife projects (e.g. USGS, USFWS, NMFS) within the GOM DPS are not expected to result in significant cumulative effects on the biological environment. The proposed action is not expected to significantly affect threatened or endangered species, marine mammals or critical habitat of these species. The Maine Department of Marine Resources (DMR) staff are fully trained in safe collection and handling procedures for Atlantic salmon at all life stages and have developed protocols specifically designed to limit stress resulting in handling of all fish species. Overall cumulative biological effects are managed under US Fish and Wildlife Service's Threatened and Endangered Species Permit TE 697823-2 with effective dates 6/13/2008-6/13/2013. (See Section V Part A, Atlantic Salmon). This permit has take limits as notification triggers that monitor in near real-time adverse impacts on critical life stages such as adults.

Effects on Socioeconomic Environment

As there are no significant adverse direct or indirect impacts of the assessment and research activities proposed by BSRFH for the period of July 1, 2011, to June 30, 2016, expected on the socioeconomic environment. Further these actions combined with other federally-funded projects within the GOM DPS are not expected to result in significant cumulative effects on the socioeconomic environment. In fact, activities related to research and assessment under this grant generate audiences at outreach events and provide public connection to natural resources through connections with Salmon Clubs, schools, outreach events, and other educational venues. Economically, a restored Atlantic salmon population would have valuable economic impacts on the region.

In summary, the total impact of NMFS funding of the activities proposed by BSRFH on Atlantic salmon is expected to be insignificant in comparison to factors identified by the NMFS/USFWS (2005) and National Research Council (2003). More importantly, the minor biological effects that may occur during the studies will be balanced and mitigated by the minimal positive cumulative effects of the overall program. Data collected by BSRFH during the studies will be used for the recovery of Atlantic salmon in Maine.

VI. PERSONS/AGENCIES CONSULTED

John Kocik, National Marine Fisheries Service
James Hawkes, National Marine Fisheries Service
Christine Lipsky, National Marine Fisheries Service
Jeff Murphy, National Marine Fisheries Service
Antonio Bentivoglio, US Fish and Wildlife Service
Norm Dube, Maine Department of Marine Resources
Gail Wippelhauser, Maine Department of Marine Resources
Richard Dill, Maine Department of Marine Resources
Oliver Cox, Maine Department of Marine Resources
Merry Gallagher, Maine Department of Fish and Wildlife
Bradford Allen, Maine Department of Fish and Wildlife

REFERENCES CITED

Baum, E.T. 1997. Maine Atlantic Salmon – A National Treasure. Atlantic Salmon Unlimited, Hermon, Maine.

Bureau of Sea Run Fisheries and Habitat. 2010. Atlantic Salmon Trap Operating and Fish-Handling Protocols. Revised June 2010. 41 pp.

Bureau of Sea Run Fisheries and Habitat. 2010. Standard Operating Procedure for Juvenile Atlantic Salmon Sampling by Electrofishing in Wadeable Streams. Updated March 2010. 20 pp.

Colligan, M. A.; Kocik, J. F.; Kimball, D. C.; Marancik, G.; McKeon, J. F.; Nickerson, P. R. 1999. Status Review for Anadromous Atlantic Salmon in the United States. National Marine Fisheries Service/ U.S. Fish and Wildlife Service Joint Publication. Gloucester, MA 232 pp.

Elson, P.F. 1975. Atlantic salmon rivers, smolt production and optimal spawning: an overview of natural production. International Atlantic Salmon Foundation. Special Publication Series Number 6:96-119.

ENSR Corporation. 2007. Historic Flooding in Major Drainage Basins, Maine. http://www.maine.gov/spo/flood/riverbasin.html (accessed Dec 28, 2010).

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. 283 pp.

Gibson, R. J. 1993. The Atlantic salmon in freshwater: spawning, rearing and production. Reviews in Fish Biology and Fisheries 3:39–73.

Gorsky, D. 2005. Site fidelity and the influence of environmental variables on migratory movements of adult Atlantic salmon (Salmo salar L.) in the Penobscot River Basin, Maine by Dimitry Gorsky. M.S. Thesis. University of Maine, Orono, ME. 67 pp

Gorsky, D., J. Trial, J. Zydlewski, J. McCleave (2009) The Effects of Smolt Stocking Strategies on Migratory Path Selection of Adult Atlantic Salmon in the Penobscot River, Maine. North American Journal of Fisheries Management 29:949-957.

Huryn, A.D., V. M Butz Huryn, C.J. Arbuckle, and L. Tsomides. 2002. Catchment land-use, macroinvertebrates and detritus processing in headwater streams: taxonomic richness versus function. Freshwater Biology 47:401-415.

Hepinstall, J.A., S.A. Sader, W.B. Krohn, R.B. Boone and R. Bartlett. 1999. Development and testing of a vegetation and land cover map of Maine. Maine Agricultural and Forest Experiment Station, Technical Bulletin 173, 104pp.

Jacobson, G.L., I.J. Fernandez, P.A. Mayewski, and C.V. Schmitt. 2009. Maine's Climate Yesterday, Today, and Tomorrow. 2009. Maine Policy Review 17:16-23.

Mackey, G. 2009. A retrospective review of salmon returns and alewife harvest within the DPS: The relationship between alewife abundance and adult Atlantic salmon returns in the Narraguagus and Penobscot Rivers.

Maine Atlantic Sea Run Salmon Commission. 1982a. The Narraguagus River. An Atlantic Salmon Management Report. Prepared for E.T. Baum and R.M. Jordan. Bangor, Maine.

Maine Atlantic Sea Run Salmon Commission. 1982b. he Machias River. An Atlantic Salmon Management Report. Prepared for J.S. Fletcher, R.M. Jordan, and K.F. Beland. Bangor, Maine.

Maine Atlantic Sea Run Salmon Commission. 1982c. The Sheepscot River. An Atlantic Salmon Management Report. Prepared for A.L. Meister. Bangor, Maine.

Maine Atlantic Sea Run Salmon Commission. 1983. The Penobscot River. An Atlantic Salmon Management Report. Prepared for E.T. Baum. Bangor, Maine.

Mather, M. E. 1998. The role of context-specific predation in understanding patterns exhibited by anadromous salmon. Canadian Journal of Fisheries and Aquatic Sciences. 55: 232-246.

Music, P.A., J.P. Hawkes, and M.S. Cooperman. 2010. Magnitude and Causes of Smolt Mortality in Rotary Screw Traps: an Atlantic Salmon Case Study. North American Journal of Fisheries Management. 30:713–722.

National Research Council of the National Academies. 2004. Atlantic Salmon in Maine. The National Academies Press. Washington, DC.

National Marine Fisheries Service and U.S. Fish and Wildlife Service. 2005. Final Recovery Plan for the Gulf of Maine Distinct Population Segment of Atlantic Salmon (*Salmo salar*). National Marine Fisheries Service, Silver Spring, MD.

National Marine Fisheries Service, Maine Department of Marine Resources, U.S. Fish and Wildlife Service, Penobscot Indian Nation. 2010. Atlantic Salmon Recovery Framework. August 2010 draft. 106 pp.

Rose, G. 2004. Maine's Biggest Industries; Structural Overview of the Maine Economy. Maine State Planning Office. Augusta, ME. 6pp.

Saunders, R., M. A. Hachey, and C. W. Fay. 2006. Maine's Diadromous Fish Community: Past, Present, and Implications for Atlantic Salmon Recovery. Fisheries. 31:11, 537-547.

Stanley, J.G. and J.G. Trial. 1995. Habitat suitability index models: nonmigratory freshwater life stages of Atlantic salmon. Biological Science Report 3. 18 pp.

Sustainable Ecosystems Institute. 2007. Review of Atlantic Salmon Hatchery Protocols, Production, and Product Assessment. Portland OR. 91 pp.

U.S. Fish and Wildlife Service. 1989. Final Environmental Impact Statement. Restoration of Atlantic Salmon to New England Rivers. Newton Corner, MA.

Yoder, C. O., R. F. Thoma, L.E. Hersha. 2007. Maine Rivers Fish Assemblage Assessment: Development of an Index of Biotic Integrity for Large Rivers. Final Project Report to U.S. EPA, Region I, MBI Technical Report MBI/2008-11-2.

VIII. FINDING OF NO SIGNIFICANT IMPACT (FONSI)

FINDING OF NO SIGNIFICANT IMPACT
AND
ENVIRONMENTAL ASSESSMENT
Maine Department of Marine Resources Grant
Proposed Activities for
July 1, 2011 to June 30, 2016
NOAA Award NA10NMF4720235

Finding of No Significant Impact for proposed study, "Atlantic Salmon Freshwater Assessments and Research"

National Marine Fisheries Service

National Oceanic and Atmospheric Administration Administrative Order 216-6 (NAO 216-6) (May 20, 1999) contains criteria for determining the significance of the impacts of a proposed action. In addition, the Council on Environmental Quality regulations at 40 C.F.R. 1508.27 state that the significance of an action should be analyzed both in terms of "context" and "intensity." Each criterion listed below is relevant in making a finding of no significant impact and has been considered individually, as well as in combination with the others. The significance of this action is analyzed based on the NAO 216-6 criteria and CEQ's context and intensity criteria. These include:

1) Can the proposed action reasonably be expected to jeopardize the sustainability of any target species that may be affected by the action?

Response: The proposed action is not expected to jeopardize the sustainability of the target species. Most organisms will be released alive. (See Section V Part A, Atlantic Salmon)

2) Can the proposed action reasonably be expected to jeopardize the sustainability of any non-target species?

Response: The proposed action is not expected to jeopardize the sustainability of non-target species. Most organisms will be released alive. (See Section V Part A, Other Fish Species)

3) Can the proposed action reasonably be expected to cause substantial damage to the ocean and coastal habitats and/or essential fish habitat as defined under the Magnuson Stevens Act and identified in FMPs?

Response: The proposed action is not expected to cause damage to ocean or coastal habitats. (See Section V Part A, Physical Environment, for a discussion regarding effects of the proposed studies to ocean or coastal habitats.)

4) Can the proposed action be reasonably expected to have a substantial adverse impact on public health or safety?

Response: The proposed action will not have adverse impacts on public health or safety (See Section V Part A, Socioeconomic Environment).

5) Can the proposed action reasonably be expected to adversely affect endangered or threatened species, marine mammals, or critical habitat of these species?

Response: The proposed action is not expected to adversely affect threatened or endangered species, marine mammals or critical habitat of these species. The project may likely have minimal direct effects to listed Atlantic salmon *(Salmo salar).* The Maine Department of Marine Resources (DMR) staff are fully trained in safe collection and handling procedures for Atlantic salmon and have developed protocols specifically designed to limit stress resulting from collection of salmon. As a result, Atlantic salmon mortality rates of those handled have been low *(e.g.,* less than 0.02%). DMR is authorized to conduct recovery activities within the GOM DPS under US Fish and Wildlife Service's Threatened and Endangered Species Permit TE 697823-2 with effective dates 6/13/2008-6/13/2013. (See Section V Part A, Atlantic Salmon)

6) Can the proposed action be expected to have a substantial impact on biodiversity and/or ecosystem function within the affected area (e.g., benthic productivity, predator-prey relationships, etc.)?

Response: The proposed action is not expected to have a substantial impact on biodiversity or ecosystem function. Most organisms will be released alive. (See Section V Part A, Other Fish Species)

7) Are significant social or economic impacts interrelated with natural or physical environmental effects?

Response: The proposed action will not result in any significant social or economic impacts; therefore, there are not any expected social or economic impacts interrelated with significant natural or physical environmental effects. (See Section V Part A, Socioeconomic Environment).

8) Are the effects on the quality of the human environment likely to be highly controversial?

Response: Due to the minimal impact on the human environment, the impact of this study is not expected to be highly controversial.

9) Can the proposed action reasonably be expected to result in substantial impacts to unique areas, such as historic or cultural resources, park land, prime farmlands, wetlands, wild and scenic rivers or ecologically critical areas?

Response: There are no known historic or cultural resources, park lands, prime farmlands, wetlands, wild and scenic rivers or ecologically critical areas in the study area. Thus, the proposed action is not expected to affect such resources. (See Section V Part A, Physical Environment)

10) Are the effects on the human environment likely to be highly uncertain or involve unique or unknown risks?

Response: No. The proposed fisheries sampling methods are well documented and widely-used. (See Section V Part A)

11) Is the proposed action related to other actions with individually insignificant, but cumulatively significant impacts?

Response: The proposed action is not expected to result in cumulatively significant impacts (see Section V).

12) Is the proposed action likely to adversely affect districts, sites, highways, structures, or objects listed in or eligible for listing in the National Register of Historic Places or may cause loss or destruction of significant scientific, cultural or historical resources?

Response: There are no known districts, sites, highways, structures, or objects listed in or eligible for listing in the National Register of Historic Places within the study areas. Due to the minimal impact on the human environment, the proposed action is not likely to adversely affect scientific, cultural, or historical resources. (See Section V Part A, Physical Environment,)

13) Can the proposed action reasonably be expected to result in the introduction or spread of a non-indigenous species?

Response: No non-indigenous species will be introduced or spread during this study (see Section V for protocols).

14) Is the proposed action likely to establish a precedent for future actions with significant effects or represents a decision in principle about a future consideration?

Response: The proposed action is not likely to establish a precedent for future actions with significant effects and does not represent a decision in principle about a future consideration. This survey methodology has been extensively employed in the past and has been shown to be scientifically valid.

15) Can the proposed action reasonably be expected to threaten a violation of Federal, State, or local law or requirements imposed for the protection of the environment?

Response: The proposed action is not expected to threaten a violation of Federal, State, or local law or requirements imposed for the protection of the environment. The researcher that will be conducting these studies will comply with all associated laws and permitting requirements. (See Section III, Part A, Proposed Field Activities.)

16) Can the proposed action reasonably be expected to result in cumulative adverse effects that could have a substantial effect on the target species or non-target species?

Response: The proposed action is anticipated to have minimal impacts to any of the affected resources, habitats, and human communities in the study areas. The proposed study combined with other activities will not result in significant cumulative impacts (see Section V).

DETERMINATION

In view of the information presented in this document and the analysis contained in the supporting Environmental Assessment prepared for the Maine Department of Marine Resources study, "Atlantic Salmon Freshwater Assessments and Research", it is hereby determined that the proposed study will not significantly impact the quality of the human environment as described above and in the supporting Environmental Assessment. In addition, all beneficial and adverse impacts of the proposed action have been addressed to reach the conclusion of no significant impacts. Accordingly, preparation of an EIS for this action is not necessary.

June 29, 2011

Patricia A. Kurkul
Regional Administer for Northeast Region, NMFS

Date

Appendix A. Proposed administrative actions associated with the BSRFH for Segment 5 of Cooperative Agreement.

Activity	Administrative Actions
A. Adult Salmon Stock Assessment	Post the BSRFH Atlantic Salmon Trap Operating and Fish-Handling Protocols on the Maine Salm Framework website and have the document peer reviewed by 2012. NOAA Fisheries Service provides peer reviewed module on identifications to append to BSRFH Atlantic Salmon Trap Operating and Fish-Handling Protocols by 2012. Results of annual review of BSRFH Atlantic Salmon Trap Operating and Fish-Handling Protocols (conduct before April 15). Provide a dated version of the document within 10 days following any annual or in-season revision including protocols for: the new Saco Falls counting operation (target date April 2011) and the new Milford Dam fish lift (target date April 2012). Trap catch summaries, covering 14 days or less, when trapping facilities are operational, distribute NOAA Fisheries Service scientists and managers and interested parties using e-mail and web-base communications. Summary tables documenting number and timing of adult returns, marks and injuries observed, an counts of other species for counting facilities in Maine (Standard Formats). Photo documented examples of wounding to NOAA Fisheries Service transferred with adult trap database (Table 1). Report on Action Team and Management Board decisions on converting Dennys Weir from seasor to emergency operations. NOAA Fisheries Service provides an updated Scale Imaging Plan and a table that details the numb adult scales by sea age and river that they will be requesting at the end of the trapping season. Mounted scale and tissue samples from captured salmon, with audited database identifier codes to NOAA Fisheries Service (Table 1). Summary table documenting age and origin of adult returns based on scale reading and statistical assignments (Standard Formats). Immediate notification and annual reporting of any captive-reared adult Atlantic salmon that are nc from the Gulf of Maine DPS conservation hatchery recovery program (potential Aquaculture escap Map and summary tables documenting the geographic (UTM coordinates, Zone 19 North, NAD 19 map datum) and temporal extent of annual redd surveys and number and location of redds, with the probable origin of salmon constructing each redd noted (Standard Formats). Interim and final protocol for assigning probabilistic origin to redd locations in database for sub-watersheds where captive reared adults are stocked. Adult return (with age and origin) and redd count (with probable origin) database annual updates f Maine rivers. Distribute to NOAA Fisheries Service staff, USFWS, and USASAC database stewar (Table 1).
B. Juvenile Assessments, parr and smolt	Post the BSRFH Electrofishing Protocols on the Maine Salmon Framework website and have the document peer reviewed by 2013. Results of annual review of BSRFH Electrofishing Protocols (conduct before July 15). Provide a dated version of the document within 10 days following any annual or in-season revision Document describing the GOM DPS juvenile abundance sampling program; including geographic, management, and habitat strata, site selection process, and estimate models developed by NOAA Fisheries Service, USFWS, and BSRFH biologists (July 2011). Sites will be distributed in geograp management, and habitat strata based on estimation models developed by NOAA Fisheries Service USFWS, and BSRFH biologists and the sampling will integrate index (multiple pass density estim and CPUE sites. Sampling will include the Narraguagus, Machias (DE SHRU), Sheepscot and Sar (MB SHRU) rivers. Summary tables documenting number and location of electrofishing sites selected for sampling du the next summer and early autumn by strata in the May semi-annual report (Standard Format). Summary tables of estimated juvenile salmon abundance, in the previous year, for selected geogra and management strata and for the GOM DPS in the May semi-annual report (Standard Format).

Activity	Administrative Actions
	Inventory of scale and tissue samples from captured stream resident salmon with to NOAA Fisheri Service in the November semi-annual report.
	Electrofishing database updates for Maine rivers. Distribute to NOAA Fisheries Service, USFWS, USASAC database steward per annual data distribution plan (Table 1).
	Annual Standard Operating Procedures for smolt traps that are the responsibility of BSRFH to NO by 25 March annually.
	NOAA Fisheries Service provides BSRFH access to the needed number of rotary screw traps and p for maintenance in March each year and allows BSRFH use of them for the smolt emigration perio BSRFH returns traps to NOAA Fisheries Service designated storage areas at the end of the season, with a written assessment of needed parts and maintenance.
	Summary table documenting smolt trapping sites being operated by BSRFH as of April 30 each ye the May semi-annual report (Standard Format).
	Summaries covering approximately 7 days of BSRFH smolt trapping activities distributed to NOA Fisheries Service scientists for internal use. Summaries covering approximately 14 days prepared distributed to and managers and interested parties, using e-mail and web-based communications (Standard Formats).
	Summary tables of smolt population estimates, emigration timing, and biological data for traps that the responsibility of BSRFH in the November semi-annual report (Standard Format).
	NOAA Fisheries Service provides an updated Scale Imaging Plan and a table that details the numb smolt scales to be collected by river 30 days before the start of smolt trapping.
	Mounted scale and tissue samples from smolts captured on the Narraguagus and Sheepscot rivers v audited database identifier codes to NOAA Fisheries Service as per annual tissue sample data trans plan (Table 1).
	Fully audited electronic staging databases from juvenile smolt assessment work undertaken by BSI (one per location), with preliminary age based on scales, by August 31 (Table 1).
	NOAA Fisheries Service staff will provide BSRFH with annual updates of the statewide smolt trapping data archive, and will provide access to smolt scales and scale image data at NOAA Fishe Service.
	Summary tables of cohort vital rates (e.g. large parr to smolt survival; smolt to adult survival) base cohort abundance estimates (Standard Format).
Estuarine Ecosystems and Diadromous Fish Communities	Summary tables of spawning escapement estimates, run timing data, and proportions of alewife an blueback herring at existing sites (Standard Format).
	Summary tables of spawning escapement estimates, run timing data, and proportions of alewife an blueback herring at sites on Souadabscook and Sedgunkdunk streams (Standard Format).
	Documented predictive models of alewife/blueback herring run timing, with results of model validation.
	Reports comparing temporal and inferring spatial overlap of alewife/blueback herring populations (modeled or existing) and smolt for years and rivers with data on their emigration timing.
	Reports on projects to test assumptions and hypotheses related to the ecosystem benefits of river herring in Atlantic salmon freshwater habitat. [Proposals 2011, Evaluate methods 2012, Project sta 2013, Reports 2014, 2015]
	Reports on projects to test assumptions and hypotheses related to the ecosystem benefits of diadror fishes in Atlantic salmon freshwater habitat. [Proposals 2011, Evaluate methods 2012, Project start 2013, Reports 2014, 2015]
Dam Related Connectivity	Identify the primary agency responsible for PIT tag detection system at dams in the Penobscot Riv and either a reference for or summary table of dates of operations.
	An electronic copy or link to a document describing the PIT tag detection system design and tag insertion methods for diadromous fishes (dated revised version within 10 days any BSRFH change
	An electronic copy or link to a document describing PIT detection database structure and an electr copy of the archive database of PIT tagged fish and detection data (updated annually).
	A summary table of PIT tags inserted into diadromous fishes, including Atlantic salmon, at sites w BSRFH operates or coordinates operation of adult salmon counting facilities on the Penobscot Riv
Activity	**Administrative Actions**

	Maps and tables of the movements of PIT tagged individuals within the Penobscot River watershec (Standard Formats). Tables of upstream travel times for PIT tagged Atlantic salmon (initial focus to develop analytical methods) and other species with sufficient numbers tagged (probably alewife/blueback herring) by month and segment of the Penobscot River (Standard Formats). Report(s) or thesis(es) evaluating the effects fish age and origin and of month, river hydrology, and dams on movements of selected adult diadromous fish within the Penobscot River watershed.
Habitat Assessment and Restoration	GIS-compatible habitat database updates to NOAA Fisheries Service and USFWS as significant database updates become available, providing data to estimate CSE for newly accessible habitat. Provide GIS projects and spatial analyses tools to NOAA and USFWS biologists as they are availa Summary graph and report documenting Dennys River streamflow management each water year (October to September) in the November Semi-annual Report.
Conservation Hatchery Support	Adaptive stocking recommendations included in reports of analyses integrating Elements 1, 2, 4, 5, 6). Report on grading practices and data for GLNFH parr marked submitted to CHAT Marking Work Group chair and USASAC database steward. Data for CBNFH parr marked submitted to CHAT Marking Work Group chair and USASAC datat steward. Summary table of coordination, technical and operational assistance, and logistical support to NOA Atlantic salmon marking programs for Maine rivers (Standard Format). Summary table of annual sea run Atlantic salmon broodstock collection, marking (all years), and transport (2011 only) to USFWS hatcheries (Standard Format). Summary table of activities to develop a comprehensive Broodstock Management Plan for capture sea run GOM DPS broodstock from the Penobscot River (Standard Format). Summary tables documenting USFWS genetic analyses of naturally reared adult returns to the Penobscot River (Standard Format). Annual summary table of Atlantic salmon juveniles collected from the Narraguagus, Dennys, Sheepscot, Machias, East Machias, and Pleasant rivers during planned juvenile sampling that were transported (2011) or transferred to USFWS for transport to hatcheries (2012-2015) for rearing as river-specific broodstock (Standard Format). Summary table of participation in work revising the comprehensive Captive Broodstock Managem Plan for captive GOM DPS broodstocks from Maine rivers. The Genetic Diversity Action Team is responsible for the plan document. Identify the sites additional to juvenile assessment plan (Element 2) on the Upper Piscataquis Rive the Electrofishing Archive Database. Identify the sites additional to juvenile assessment plan (Element 2) on the Pleasant River above Sa Falls Upper in the Electrofishing Archive Database. Summary table of BSRFH participation (funded by NOAA Fisheries Service) in trips to stock CBN and GLNFH products in the May Semi-annual Report. Interim and completion report(s) on the contribution of captive reared spawners to redd production interactions sea-run spawners based on tagging and observing captive reared spawners from the conservation hatchery program stocked into Northern Stream, East Machias River (2011 - 2014). Delivery date for audited staging data (entry funded by NOAA Fisheries Service) to USFWS in the November Semi-annual Report.

Activity	Administrative Actions
DELIVERABLES INTEGRATING Activities	After submitting each Semi-annual Report, collaborate with NOAA Fisheries Service, NEFSC Mai Field Station Chief to produce and distribute (within 45 days) a Management Highlights document summarizes stock status, recommends management and assessment actions, and documents actions taken by BSRFH based on recommendations in previous Highlights or Semi-annual Reports. After being reviewed and approved by NOAA Fisheries Service Regional Operations and Budget s Semi-annual Reports will be posted on the DMR website. Summary tables documenting BSRFH activities coordinating and assisting in research and outreacl (Standard Format). Three working papers submitted to the USASAC (Outer Bay of Fundy area, Gulf of Maine DPS, a Saco River area). BSRFH biologists attending the meeting are expected to present these three and other relevant working papers. A BSRFH lead author will collaborate with NOAA co-author(s) to produce a USASAC working pa on smolt assessments, with sections for the three areas. USA National Report working paper submitted to ICES WGNAS, written in collaboration with NC Fisheries Service staff, USASAC database steward, and selected USASAC members. The Senior Salmon Biologist is expected to present the USA National Report and participate in the ICES WGN meeting annually. Journal format appendices to semi-annual reports that document integrated analyses of data from n than one element. These analyses will include: vital rates (e.g. survival, growth, and emergence) fc cohorts of GOM DPS juvenile salmon; relationships among life stage abundances, size at age, and physical habitat and ecological conditions; and effectiveness of actions to recover the GOM DPS. Identify sub-watersheds or reaches in the geographic range of the GOM DPS, based on spatial distribution and status of Atlantic salmon populations, where habitat condition reduce or enhance productivity (i.e. embedded substrate, low large wood loading, lost connectivity, channel altered by human activity, invasive species). Submissions for peer reviewed publication where analyses are of broad value. February meeting, with NOAA Fisheries Service (organized by BSRFH) to review BSRFH activiti and analyses covered in the preceding two semi-annual reports and review and revise Element Plar from the narrative portion of the Co-operative Agreement. September meeting, with NOAA Fisheries Service (organized by NOAA Fisheries Service) to revi NOAA Fisheries Service (NEFSC and NER) activities and analyses over the previous year, review protocol documents, and discuss databases. Meetings every 7-8 weeks of BSRFH Co-operative Agreement Principal Investigator and NOAA Fisheries Service, NEFSC and NER technical/scientific leads in the Maine Field Station and, depending on discussion topics, other mutually agreed upon staff. Participation (attendance and presented papers or posters about work conducted as a part of this cooperative agreement coauthored with NOAA Fisheries Service) in: Salmon Forum (ME and/or C three people over two year cycle; Regional meetings (e.g. Atlantic International Chapter AFS, Northeast Fish and Wildlife Conference, Maine Water Forum) – at least two people annually; Nati meetings (e.g. AFS) – average one person annually; Table of database delivery dates in each Semi-annual Report.
Salmon Spatial Ecology and Ecosystem Research	Document outlining potential spatial ecology and ecosystem synthesis, analysis, and research proje of mutual interest to NOAA Fisheries Service and BSRFH resulting from joint coordination meetir for the Element by 2013.
	Student(s) prepared executive summary of research activities and findings in the May semi-annual report (for research funded by this agreement).
	Summary tables documenting BSRFH activities coordinating and assisting in research related to tl Element (Standard Format).
	Summary tables documenting BSRFH activities serving on Graduate Committees related to this Element (Standard Format).