STATEMENT OF WORK

Project Title: Investigation of Nearshore Migration of Atlantic salmon in the Gulf of Maine Region

Project Period: September 15, 2007 – September 15, 2009

1. BACKGROUND

The Atlantic salmon's anadromous life cycle involves major migrations between natal rivers and oceanic feeding grounds. Extensive research on the freshwater phase of the life cycle has reveled much about the factors affecting juvenile production, but much less is known about the salmon's life in the estuary and at sea. Monitoring in rivers around the North Atlantic over the last thirty years has confirmed that there has been a significant decline in overall marine survival, particularly for southern North American and European stocks. Major restrictions on exploitation of salmon have been introduced but, to date, salmon stocks have not responded as expected. Lack of understanding of factors affecting survival of salmon at sea is the key obstacle to management of Atlantic salmon and to our ability to rebuild stocks.

In response to concerns about the reduction in survival of Atlantic salmon at sea, the North Atlantic Salmon Conservation Organization (NASCO) established the research priority of improving our understanding of the migration and distribution of salmon at sea in relation to feeding opportunities and predation. This research program is called "Salmon at Sea" or SALSEA and was developed by scientists from all of NASCO's Contracting Parties.

The SALSEA program contains a comprehensive mix of freshwater, estuarine, coastal and offshore elements, ensuring a comprehensive overview of factors which may affect the marine survival of Atlantic salmon. There is a need to improve our understanding of factors affecting marine mortality in the inshore zone, such as those influencing the fitness of migrating smolts, those affecting the ability of fish to move from fresh to salt water (and back) and anthropogenic factors operating within the inshore zone. Effort should be expended to locate areas where losses occur and identify the causes of loss.

2. PROJECT DESCRIPTION AND TASKS

This contract is intended to synthesize information and improve our understanding of factors affecting the estuarine and nearshore mortality of Atlantic salmon. The contract will have a geographical emphasis on ecosystem processes connected to Atlantic salmon in estuaries and coastal environments of the Gulf of Maine (GoM) and outer Bay of Fundy. A temporal emphasis on April through July for smolts/postsmolts and April through October for returning adults will provide additional focus. An improved understanding will be gained through compilation and assessment of existing data on smolt and adult salmon migration. These data will be integrated with other data sets on environmental conditions and other biota at the appropriate spatial and temporal scales. Data on other species will also be examined to look for predator, prey,

competitor relationships as well as trends in abundance, growth, and survival. The contract will also bring together fishery scientists and managers, biological oceanographers, physiologists, climatologists, meteorologists, and professionals from other disciplines in workgroup settings that will produce multidisciplinary syntheses and hopefully foster future collaboration.

The work will be conducted by holding a series of workshops to collect and analyze data on specific components of the investigation. Experts will be identified and invited to participate in the Focus Workshops and Consolidated Workshop. These experts will include biologists working with Atlantic salmon as well as experts on hydrology, biological oceanography, coastal ecosystems, and other fields of knowledge that affect salmon and their ecosystems. The information and insights gained by these workshops will inform a broader workshop to integrate the various workshop products and gain a collective and comprehensive view of early nearshore migration and mortality. A steering committee will be formed to help plan and guide the implementation of this work. Primary workshop focus areas and needs are presented below, but these may be refined by the steering committee.

Workshop Focus Area 1 – Salmon Physical Ecosystems

This workshop will examine the status and trends of physical (discharge, temperature, salinity, movement of coastal currents, etc.) factors in rivers, estuaries, and coastal waters utilized by Atlantic salmon. Change has been documented independently in salmon ecosystems, e.g. in rivers - reduced winter ice cover and earlier spring freshets and in the ocean - shifts in the North Atlantic Oscillation. However, these changes in independent ecosystems have not been compared in an integrated fashion from the perspective of an organism that must transition across environments within a fixed seasonal time frame. By bringing together hydrologists, oceanographers and biologists, this workshop should quantify the gradients (thermal, salinity, etc.) that salmon must cross and if they have changed over time in extent or seasonality. The workshop should also address if salmon populations responded or adapted to any of these changes. Existing data will be compiled and examined to determine the impact of key physical variables on the ecology and success of smolts and adults during the transition from freshwater to the open ocean.

Workshop Focus Area 2 – Salmon Biological Ecosystems: Predators, Prey and Prey Buffers

This workshop will examine the population status and seasonal abundance of organisms that interact with Atlantic salmon as predators, prey, competitors, parasites, or potentially as a predator buffer. Predation on out-migrating smolts and returning adults has potential to have major impacts on populations. Shifting balances of feeding guilds can also influence food availability and quality. Commercial salmon production could increase parasite populations or attract predators. Existing data will be consolidated to provide a multi-species synthesis of the salmon biological ecosystem, its seasonality, and changes in structure and function. All of this information will be

integrated to examine spatial and temporal overlaps and to look at changes over time in distribution, abundance and timing. The unique vertical positioning of Atlantic salmon in the surface waters should also be addressed relative to the role of habitat partitioning for optimal growth compared to a potentially narrow scope of feeding opportunities.

Workshop Focus Area 3: Biological Characteristics

This workshop will identify key biological variables among smolts that may affect marine survival and document any changes in these characteristics across stocks of both wild and hatchery-reared origin over time. Historical data will be reviewed and analyzed for differences in survival rates related to changes in smolt attributes. Where historical information on smolt size is not available but data from returning adult scales exists, the group will analyze and assess these data over periods when salmon abundance and/or fishery exploitation regimes have changed. For hatchery stocks, release dates and locations will be compared to river discharge, temperatures, and operation of hydroelectric facilities to determine influences on overall marine survival.

Workshop Focus Area 4: Salmon Nearshore Action Plan

This workshop will identify actions for managers to utilize information synthesized in this workshop to not only conserve Atlantic salmon populations but help enhance nearshore survival. These recommended actions should be precautionary in nature and focus on a functioning Atlantic salmon ecosystem not only the species. Topics might include –prescribing biological and physiological smolt characteristics that should be targeted; maintaining ability of run time shifts in hatchery populations; identification of contaminants in use and contributing to marine mortality of salmon; methods to mitigate predation – harassment, exploitation, development of alternative prey source; in the inshore area; etc. In addition to these actions, area where more information and research is needed before actions occur should be identified.

Consolidated Workshop – Early Migration through the Inshore Zone: fresh waters, estuaries and coastal waters

The findings of the Focus Workshops will be used to scope out the content and format of the Consolidated Workshop. The Consolidated Workshop will integrate the information and attempt to draw conclusions using existing information on early marine migration. Where possible, conclusions will be drawn and factors affecting survival will be identified. In other cases, priority areas for additional data collection or assessment will be identified. The Consolidated Workshop will end with an action plan to summarize our understanding of early migration through the inshore zone and factors affecting that survival, will identify key areas of uncertainty and describe priority research to address those information gaps.

3. DELIVERABLES AND DEADLINES

Sept 2007 – Dec 2007: A steering committee will be formed in cooperation with NOAA. The steering committee will refine the workshop focus areas, determine experts to be invited to each workshop, and goals and objectives.

Deliverable: A report will be prepared and presented which identifies the workshop focus areas, experts, and goals and objectives. Due Date: January 31, 2008.

Jan 2008 – March 2008: Invited experts will be contacted and the workshops will be scheduled. Locations will be identified and arrangements made for the workshops and for travel of the invited experts.

Deliverable: A report will be prepared and presented describing the workshops, locations and associated arrangements as well as the participants. Due Date: April 30, 2008.

April 2008 – April 2009: Focus Workshops will be held. Steering Committee will meet to draft agenda for the Consolidated Workshop, identify and contact appropriate experts, and make initial arrangements for the Consolidated Workshop.

Deliverable: A summary report from each Focus Workshop will be provided within 60 days of that workshop. Due Date: 60 days after each workshop.

Deliverable: A proposal for the Consolidated Workshop will be drafted and presented including a draft agenda, invited experts and meeting arrangements. Due Date: May 31, 2009.

May 2009 – August 2009: Consolidated Workshop will be held.

Deliverable: A summary report from the Consolidated Workshop to include compilation of existing information and conclusions of Consolidated Workshop participants on status of existing knowledge and priority areas for management, additional data collection, analysis and integration. Due Date: September 2009.