

SAG(08)8

Proposal submitted to the International Atlantic Salmon Research Board relative to furthering the knowledge on marine ecology of Atlantic salmon.

August 2008

By

Phil McGinnity, Niall Ó Maoileidigh, Jamie Coughlan, Eleanor Jennings and Tom Cross.

**A STUDY OF THE RELATIONSHIP BETWEEN
OCEAN CLIMATE AND INTER-ANNUAL VARIATION IN
ADULT SUMMER MIGRATION DISTRIBUTION PATTERNS OF
ATLANTIC SALMON IN IRISH COASTAL WATERS OVER THREE
DECADES.**

SAG(08)8

Proposal submitted to the International Atlantic Salmon Research Board relative to furthering the knowledge on marine ecology of Atlantic salmon.

August 2008

By

Phil McGinnity, Niall Ó Maoileidigh, Jamie Coughlan, Eleanor Jennings and Tom Cross.

**A STUDY OF THE RELATIONSHIP BETWEEN
OCEAN CLIMATE AND INTER-ANNUAL VARIATION IN
ADULT SUMMER MIGRATION DISTRIBUTION PATTERNS OF ATLANTIC
SALMON IN IRISH COASTAL WATERS OVER THREE DECADES.**

Objectives

1. To determine, using genetic stock identification, the region and river of origin of fish captured and sampled in the Irish commercial drift net fisheries since 1980.
2. To determine the relationship between regional stock complex and individual population distribution (including survivorship, growth, timing) and key descriptors of the marine environment such as sea surface temperatures, NAO, Gulf Stream Index.
3. To predict regional population response to future marine climate scenario projections

Background

New data emerging from a genetic analysis of the Irish coastal drift net fisheries in 2005 and 2006 (National Atlantic Salmon Genetic Stock identification Programme) suggests occurrence of salmon populations from wide range of Irish and other southern European stock complex salmon populations. These data also suggest that salmon from many rivers aggregate off the west coast of Ireland before continuing their migration northwards and southwards from the area where they amass (Figure 1). Furthermore, and significantly from the perspective of understanding salmon response during their ocean migration to climate variability, the distribution or centre of this aggregation is variable among years. We hypothesise that the west coast of Ireland is an important migration route for most contributing populations that constitute the ICES defined southern population complex. The proximity of the continental shelf to Irelands coast (at it narrowest for Europe is off Irelands North West) and its significant influence on thermal and current regimes, in addition to the substantial influence of the Gulf Stream, provide strong geographical support for the

hypothesis of a migratory ‘funnelling point’ or ‘way mark’ for returning adult salmon. We further hypothesise that the variation in salmon migration patterns revealed by the recent genetic analyses and consequent impact on the fishes ocean ecology is a response to both cyclical (Gulf Stream index, NAO) and stochastic (directional climate change) changes in the marine environment between and among years. It is possible that an understanding of these oceanic processes will provide important new insights into those factors controlling marine survival in Atlantic salmon.

This proposal would seek to exploit the very significant Trans-European Genetic Stock Identification baseline being developed under the EU sponsored SALSEA-Merge Project. In addition we would seek to deploy the suite of new state of the art genetic markers also being advanced in the SALSEA-Merge Project. The proposed project would also endeavour to utilise a unique, long term, high resolution, biological archive representing of salmon scale collected systematically from the Irish drift net fisheries over three decades. There are approximately 15,000 scales in the collection. Accompanying the biological archive are data on capture location, time of capture and size at capture. It is proposed to supplement these data with information on fish age and growth rates acquired using latest methodological developments in scale imaging. Elemental isotope analysis of scales would be used to garner further biological information on the history of individual fish. Finally, both hind-casting and forecasting of oceanic climate environments would be undertaken to model fish distribution response.

This proposal is complimentary to the work being undertaken under SALSEA-Merge. Moreover the temporal component represents a significant additional element to SALSEA-Merge which aims primarily to ascertain salmon stock represents distribution at a single moment in time. The data derived from consistent (28 years) and directed sampling of a large number of fish will provide an opportunity for a significant advance in our knowledge.

We are cognisant that an opportunity exists to replicate the approach and methodology outlined above for the Greenland fishery. The Greenland fishery also represents and important long term biological archive that should represent the inter-annual temporal distribution of Atlantic salmon populations from North America and Europe and is representative of salmon at a different stage in their life cycle, specifically their winter feeding grounds. Studies of the distribution of salmon off Irelands west coast and off Greenland would be complimentary. It should be possible at some future date to integrate these studies, with the current SALSEA-Merge project to provide a broad trans-oceanic perspective of the distribution of Atlantic salmon.

Materials & Methods

The project will comprise of three work packages. As the project will be based on archive material and does not depend on collection of new seasonally dependent biological material the start date for the project is flexible. A start date of January 2009 is assumed. The data generated from the three work packages below will be combined to provide an analysis of the historical distribution of individual river and region Atlantic salmon populations in Irish waters over three decades. Also, based on future marine and freshwater climate projections

an attempt will be made to predict the distribution and migration patterns of adult Atlantic salmon on their summer spawning migrations.

Genetic analysis of archive scale collection

A representative sample of 5,000 scales will be selected from the archive scale collection. These will be assigned genetically to river and region of origin using mixed stock analysis and individual assignment methods.

Work Package Leader – Dr. Philip McGinnity, University College Cork.

Duration - January 2009 to December 2009

PDF – 6 months

Technician – 12 months

Estimated cost of work package including direct and indirect costs - €100,000

Acquisition of life history data from scales

Each set of individual scales is accompanied by information on the date of capture, location of capture, size of capture. In this work package information from the fisheries and age and growth information acquired using state of the art scale imaging will be combined to construct a detailed life history and migration distribution map for individual fish within each population as they move through the commercial fisheries.

Work package leader – Dr. Niall Ó Maoileidigh, Marine Institute, Newport, Co Mayo

Duration - July 2009 to December 2009

Technician – 6 months

Estimated cost of work package including direct and indirect costs - €25,000

Synthesis of freshwater and marine climate data

Both freshwater and marine environmental information will be synthesised in this work package. Long term data from 1980-2006 on size and timing of freshwater discharges (processed at national, regional and individual river levels) from the island of Ireland into the ocean, including information on temperatures will be collated. Data on the important indices of the marine environment which are likely to have an important bearing on adult fish migration will also be investigated, e.g. regionally specific sea surface temperatures, NAO, Gulf stream strength index. The leader for this work package has worked extensively with the Rossby Climate Research Institute in Sweden and the Hadley Climate Centre in the UK on providing climate projection information. This work package will seek to acquire freshwater and marine environment projections that could be used to predict future distribution patterns and trends of adult salmon in Irish coastal waters.

Work package leader – Dr. Eleanor Jennings, Dundalk Institute of Technology, Dundalk, Co. Louth.

Duration - July 2009 to December 2009

Technician – 6 months

Estimated cost of work package including direct and indirect costs - €25,000

Total Estimated Cost of Project - €150,000

SALSEA-Merge

Adult migration routes and distribution (2006)
data from National GSI (Ireland)

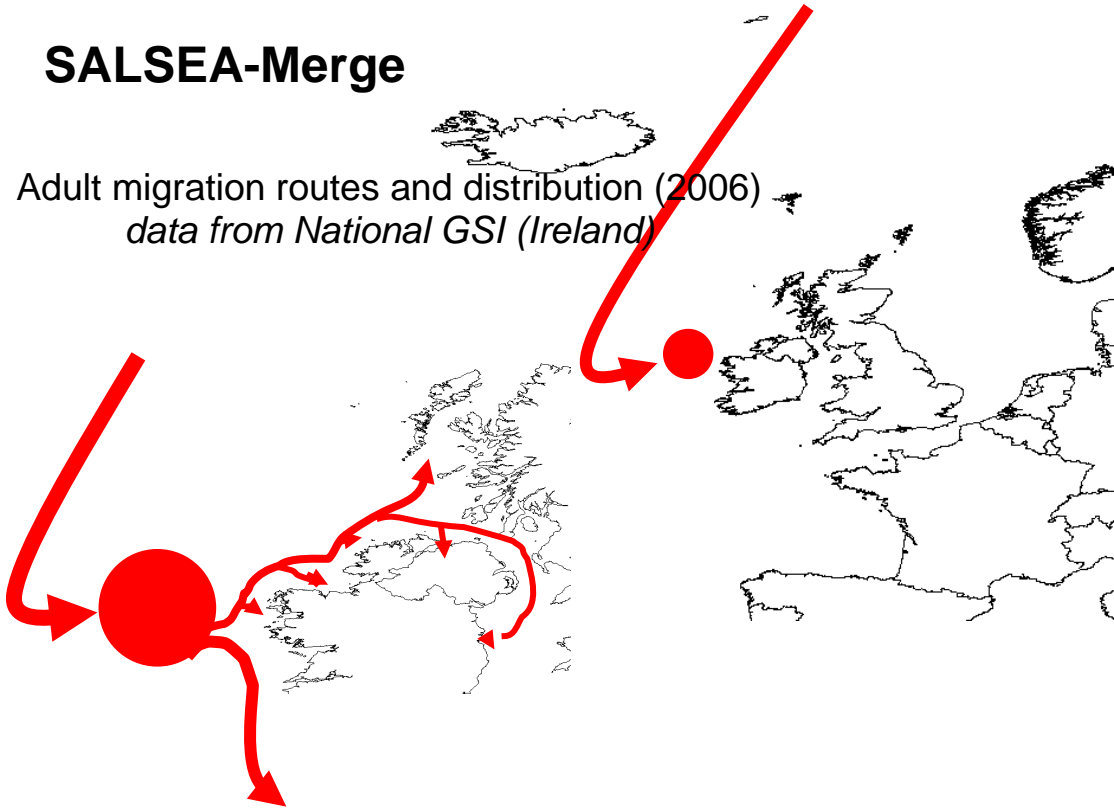


Figure 1