



ICR(12)8

A Proposal for Pilot project to undertake genetic stock of origin identification of European salmon captured at West Greenland

ICR(12)8

A Proposal for Pilot project to undertake genetic stock of origin identification of European salmon captured at West Greenland.

Dr. Philip McGinnity & Professor Tom Cross (University College Cork), Dr. John Gilbey (Marine Scotland Science), Professor Paulo Prodöhl (Queen's University Belfast) and Professor Eric Verspoor (Aberdeen University)

Background

Fish from North America and Europe, both from the Northern and Southern European population complexes; contribute to the salmon stocks found off West Greenland. European salmon caught at West Greenland appear to be predominantly, if not exclusively, non-maturing one-sea-winter fish. These are fish that mature after two or more winters at sea, and are commonly known as multi-sea-winter (MSW) maturing fish. Marine survival indices for MSW fish in the North Atlantic have declined and remain low.

Both Northern NEAC MSW and Southern NEAC MSW stocks are currently considered to be at just about full reproductive capacity. However, at a country level, stocks from several jurisdictions are deemed to be below conservation limit (CL) thresholds. Furthermore, within the countries there are many individual river stocks, which are now below their CL (WGNAS, 2011).

For 2013 and 2014, the forecasts for salmon of pre fishery abundance (PFA) are less optimistic and suggest that the Southern MSW complex, in particular, is at risk of suffering reduced reproductive capacity in the future (WGNAS, 2011). The difference in terms of survival performance at sea, between the two European stock complexes, and the survival of fish from specific regions within the complexes, including differences among individual populations within regions, may reflect differential exposure to particular critical factors related to marine survival. Establishing what these factors might be will help in predicting pre-fisheries abundance and management of both high seas and home water fisheries.

Advances in microsatellite DNA profiling methodologies and statistical genetics approaches now make it possible to identify, with remarkable accuracy, salmon caught at sea to their natal region and, in some cases, to their river of origin. With regards to European fish, the SALSEA-Merge project has facilitated the development of a unique molecular assignment protocol – GRAASP: Genetically-based Regional Assignment of Atlantic Salmon Protocol – based on a suite of 14 microsatellites. The GRAASP database comprises 26,813 Atlantic salmon individuals from 467 locations, in 284 rivers, encompassing 370,000 pieces of genetic information representing ~ 85% of the non-Baltic European salmon production. The GRAASP tool is capable of delivering both broad and medium scale regional assignment. At the broad geographical scale, it

currently recognises three regional assignment units (RAUs), namely, Iceland, Northern Europe and Southern Europe. Furthermore, at the finest supportable scale, it can distinguish 17 geographically cohesive regional subdivisions or RAUs (see Figure 1). Several high resolution microsatellite databases for genetic stock identification are now available in Ireland (the Beaufort NGS panel), UK (Scotland-FASMOP), UK (N. Ireland), UK (England & Wales, ASAP), Norway and France that allow, in many instances, river specific assignments.

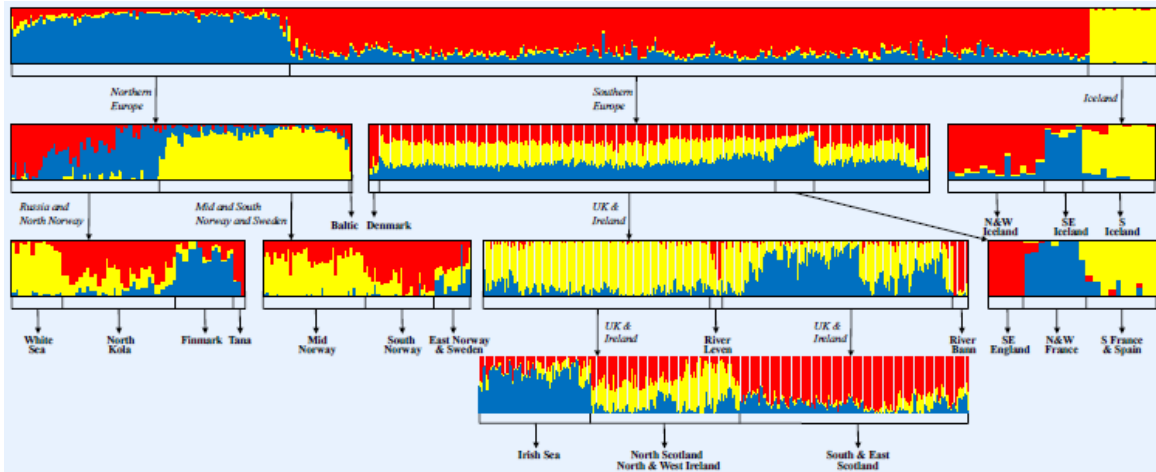


Figure 1. Hierarchical organisation of 17 GRAASP Regional Assignment Units (RAUs).

Objective

Marine sampling has been ongoing at West Greenland for best part of five decades as part of the International Baseline Sampling Programme. Recently, this programme has been enhanced by the SALSEA West Greenland sampling programme in an endeavour to provide data for investigating hypotheses on the causal mechanisms driving stock-specific performance in the ocean (i.e. marine survival).

Building on this work, it is proposed here to deploy the GRAASP and other National Atlantic salmon genetic databases to carry out a pilot study. The objective of this study will be to determine the region and/or river of origin of a strategic subset of historical and contemporary samples comprising fish scale and tissue collections from Atlantic salmon captured in both commercial and experimental fisheries at West Greenland.

Work Plan

The project will be co-ordinated and carried out by the proponents.

Genetic typing of the samples will be undertaken by the Beaufort Fish Populations Genetics Group (Ireland), led by Professor Prodöhl, using an ABI3730XL 96 capillary

system. Fish would be screened for the Beaufort microsatellite salmon marker panel, which is a combination of the GRAASP and the Irish NGS panels. Genotyping will be carried out on a subset of samples collected between 2002 and 2010, which have been made available for the analysis (Table 1). It is anticipated that in the order of 1,500 samples will be analysed as part of the pilot project the number of samples processed depending on available funding. Should the project proposal outlined here be funded, genotyping can commence March 1, 2012 with scored genotypes available for assignment analysis April 30, 2012.

Table 1. Samples available from west Greenland for genetic assignment as part of proposed pilot project

Year	N. America	Europe
2002	341	160
2003	1210	569
2004	1232	456
2005	583	184
2006	859	334
2007	921	202
2008	1594	259
2009	1521	142
2010	991	249
Total	9252	2555

The GRAASP genotypes will be used by the Marine Scotland Genetics Unit at the Freshwater Fisheries Laboratory, led by Dr Gilbey, to provide regional assignments to SALSEA Level 1- Level 4 groupings. A workshop will be held at the end of May at Queen’s University in Belfast to consider the results and finalise a combined report detailing the assignments, and the relevant levels of confidence at the various geographical levels of resolution, and the implications of the results for future research directions. On the basis of these GRAASP assignments, tissue samples and genotype data will then be made available to the relevant individual National laboratories for assignment to higher resolution regional groups and to individual rivers within those specific jurisdictions. National laboratories will undertake this work on their own cognisance. This hierarchical approach to the assignment at different regional levels is illustrated in Figure 2.

The analysis of the marine distribution and the implications of the results will be led by Dr McGinnity and Professor Verspoor but will involve input from all parties. The results of the assignments emanating from each of the individual institutions will be combined to produce a final report, which will be submitted to the funding agency for June 2012.

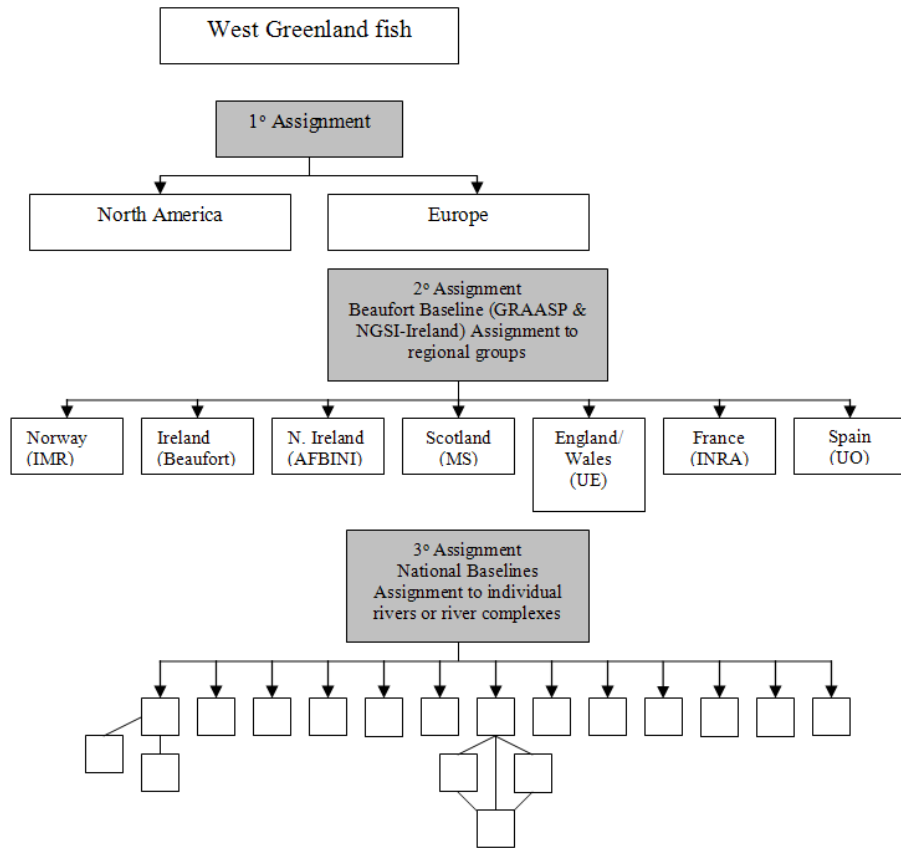


Figure 2 Flow diagram showing hierarchical organisation of process to assign fish captured at west Greenland 2002-2011 to region and river of origin.

Projected Costs

Genotyping (Beaufort Fish Populations Genetics Group)

Genotyping costs per fish: £12

Total fish genotyped: 1,500

Total genotyping cost: £18,000

Assignments (Marine Scotland)

Assignment of genotype data, statistical and GIS analysis of assignments data: £3,500

Report writing: £1,000

Statistical Analysis and Report completion (Aberdeen)

Statistical analysis of assignment data: £2,000

Report writing: £1,000

Statistical Analysis and Report completion (University College Cork)

Statistical analysis of assignment data: £1,500

Report writing: £1,000

The cost of holding a two day workshop and the associated travel expenses for participants would be in the order of £2,000.

The total envisaged cost would be approximately £30,000.