

	<p>International Atlantic Salmon Research Board</p> <p><i>Proposal for an Updated Comprehensive trans-European Genetic Reference Baseline to Assign Atlantic Salmon (<i>Salmo salar</i>) to Rivers and Region of Origin across the Eastern North Atlantic</i></p>	<p>ICR(23)11</p> <p>Agenda item: 7</p>
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Proposal for an Updated Comprehensive trans-European Genetic Reference Baseline to Assign Atlantic Salmon (*Salmo salar*) to Rivers and Region of Origin across the Eastern North Atlantic

Purpose

The purpose of this paper is to inform the Board of the proposal submitted by the UK for funding and provide details to enable the Board to consider the proposal and any subsequent decision.

Background

At its 2022 Annual Meeting the Board considered a proposal from the UK for a new Single Nucleotide Polymorphism (SNP) genetic baseline to assign Atlantic salmon (*Salmo salar*) sampled at Greenland, as contained in document [ICR\(22\)08](#). The Board agreed to endorse the concept of composing a new North-East Atlantic salmon genetic baseline for the purpose of assigning salmon samples from Greenland to region of origin, [CNL\(22\)10](#) paragraph 5.8.

The UK has now submitted an updated version of the Proposal endorsed last year, seeking strategic funding of €41,000 from the International Atlantic Salmon Research Fund to promote the international aspect of the initiative.

Full details of this ‘Proposal for an Updated Comprehensive trans-European Genetic Reference Baseline to Assign Atlantic Salmon (*Salmo salar*) to Rivers and Region of Origin across the Eastern North Atlantic’ are included here in Annex 1.

Decision

- the Board may wish to agree whether to fund the ‘Proposal for an Updated Comprehensive trans-European Genetic Reference Baseline to Assign Atlantic Salmon (*Salmo salar*) to Rivers and Region of Origin across the Eastern North Atlantic’.

Secretariat
Edinburgh
18 May 2023

Proposal for an Updated Comprehensive trans-European Genetic Reference Baseline to Assign Atlantic Salmon (*Salmo salar*) to Rivers and Region of Origin across the Eastern North Atlantic

Ensing, D., Gilbey, J., McGinnity, P., Verspoor, E., & Wennevik, V.

Background

Genetic Stock Identification (GSI) can be a useful tool for fisheries managers as it can identify contributing stocks in Mixed-Stock Fishery (MSF) samples. GSI studies depend on the existence of a comprehensive genetic baselines, which should include samples from all stocks likely to be present in the assignment sample and consist of genetic marker panels of sufficient discriminatory power to be able to differentiate among contributing stocks, and ideally differentiate among individual populations, i.e. more-or-less discrete reproductively isolated groups of individuals.

There are a number of genetic reference baselines in use presently across the Atlantic salmon species range facilitating stock assignment at different levels of resolution. At a continental level of resolution, fish have been assigned with high accuracy to either North American or European rivers using microsatellites (e.g. Sheehan, *et al.* 2010), and Single Nucleotide Polymorphisms (SNPs) (e.g. Jeffery, *et al.*, 2018). In the Northwest Atlantic (NAC) area a SNP baseline is also used to assign fish from the Northwest Atlantic at a relatively high-resolution to 22 regional groups (Bradbury, *et al.*, 2021). In the Northeast Atlantic (NEAC) area assignment a microsatellite genetic baseline originally developed for the SALSEA-Merge project (Gilbey *et al.*, 2018) provides accurate individual assignment of fish to eighteen European regional stock groups. However, the SALSEA reference baseline of Gilbey, *et al.* (2018) has relatively coarse assignment units in areas of its coverage (e.g. the salmon populations of Britain and Ireland are assigned to as a single group, similarly it is difficult to separate populations and regional groups in large parts of Norway. Within Europe there are also a number of other reference genetic baselines which provide enhanced resolution at a within country level, but are not based on standardised marker panel sets and as a result have limited applicability across the range. For example, in Scotland a 288 SNP marker baseline allows Scottish fish to be assigned to 18 assignment units (Gilbey, *et al.*, 2016). In Ireland a 17 microsatellite panel baseline has been used to assign to individual rivers (P McGinnity *pers. comm.*). In the northern European part of the range a 31 microsatellite baseline is available that enables assignment to 26 reporting groups (Ozerov, *et al.*, 2017) within northern Norway and Russia. The coverage of this baseline has now been extended to include also southern Norway and is expected to increase the number of reporting groups in Norway significantly (analysis ongoing at present). The same marker set has also been applied to extend the number of markers for a select set of Scottish and Irish rivers that were included in the SALSEA-Merge baseline.

Requirements

There is a need for an enhanced genetic baseline which covers species distribution across the rivers in the entire eastern Atlantic, but at a much greater resolution than is currently available. New stock assessment initiatives and associated management such as for example the Life Cycle Model (ICES 2021) would benefit substantially from stock discrimination and assignment units across the range with a single European reference baseline at a much finer resolution than is currently available.

Progress

Work has been ongoing on the development, testing and application of a new genetic baseline in Norway and Russia based on a highly discriminatory panel of 31 microsatellite loci with the comprehensive sampling of 272 rivers. In addition, 85 rivers from Scotland and Ireland have recently been included in this new baseline (37 Irish rivers 48 Scottish rivers). A final QC of genotypes from recently acquired data is now underway and assessment of the assignment resolution will commence soon. Investigations are also underway on the feasibility of converting and deploying the new Norwegian microsatellite marker panel from older Sanger sequencing technology to a new high-throughput genotyping by sequencing platform which is the state-of-the-art approach and increasingly the standard in most laboratories. A consortium of 23 scientists from all 14 European countries with salmon rivers, have expressed an interest in participating in the development of an extended and enhanced baseline based on the new Norwegian microsatellite panel.

The objectives of ongoing preparatory investigations are to determine: 1) what level of assignment resolution can be achieved with the new 31 microsatellite panel; and 2) assess whether the marker can be screened using the modern high-throughput genotyping by sequencing. Once these questions have been addressed, discussions will progress focusing on whether the new panel of markers has sufficient merit in respect of stock and individual river discriminatory power to roll out across the species European distribution or should other panels (eg SNPs) be the focus of future work. Furthermore, some consideration is being given to the advantages of adding extra markers (i.e. adaptive markers linked to important life history traits) to the panel.

Proposal

Considering that a new panel is already well established and ongoing collaborations, focusing on the development of an enhanced baseline which strategically could be valuably deployed for the assignment of salmon collected in fisheries and surveys in East- and West Greenland and in the Irminger Sea, are in early stages of discussion, some strategic funding from the International Atlantic Salmon Research Board would be extremely beneficial in promoting the international aspect of the initiative.

Thus, in the current year the request is simply for:

- 1) funding to support a hybrid two-day meeting (workshop format) at Institute of Marine Research (IMR) in Norway of interested parties to present the results of the preliminary investigations can be reported and to explore options for the development and application of a trans-European baseline. Estimated costs: €10,000;
- 2) funding to support 400 post-doc hours based at IMR in Norway to collate information on the various sample and data availability across the European and Icelandic range. Time to be also used to scope out and begin a project proposal for a large-scale multi-partner consortium to rebuild the eastern Atlantic reference baseline using the newly identified marker set. Estimated costs: €31,000.

We therefore this year seek total funding of €41,000.

Roadmap

Short-term (over next 6 months)

- QC existing 31 microsatellite reference data – ongoing;
- perform power analysis to examine levels of resolution;
- identify datasets / samples;
- investigate screening platform/marker options;
- hold meeting with interested parties to examine options for eastern Atlantic coverage.

Medium-term (over next 1-2 years)

- set-up consortium/project to rebuild reference baseline across the species range in the eastern Atlantic;
- screen samples from across eastern Atlantic with optimum marker set;
- perform and publish marker set and power analysis.

Longer-term (1+ years)

- screen marine samples from areas of interest, and/or to address specific questions of importance and use enhanced resolution to examine stock specific distributions.

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