



International Atlantic Salmon Research Board

ICR(17)3

Progress Report on SALSEA - Track

ICR(17)3

Progress Report on SALSEA - Track

1. At its 2013 meeting, the Board had agreed that a particular focus of its work should be studies to partition mortality of salmon among the phases of its marine migration. In 2014, the Board adopted a Resolution on Research on Salmon at Sea, ICR(14)6, which *inter alia*:
 - encourages NASCO Parties to continue the development of local collaborative telemetry projects;
 - encourages the development of large international collaborative telemetry projects that together build upon and expand local efforts; and
 - requests NASCO Parties to make efforts to identify funding sources to support telemetry projects.
2. To support an integrated collaborative telemetry programme, the Board organised a Telemetry Workshop in December 2014. At this Workshop, twelve outline project proposals for telemetry-based research were developed. In 2015, the Board recognised the high value of the SALSEA brand and the strong impact of NASCO as the international forum for consultation and co-operation on wild Atlantic salmon. The Board had re-affirmed its commitment to an international telemetry project under the SALSEA brand, named SALSEA - Track. Specifically, in 2015 the Board agreed that it would support SALSEA - Track as a continuing commitment to understanding the factors affecting mortality of salmon at sea, to make funds available to prepare a vision statement for SALSEA - Track and to advance existing initiatives towards an integrated collaborative telemetry programme.
3. The Board recognised that if the international telemetry programme is to proceed, it would be important to follow progress in taking forward the twelve outline projects and, where appropriate, provide support to assist with their implementation. Last year, the Board had confirmed that it endorsed these twelve projects but noted that, if they changed substantially, they should be referred to the Board's Scientific Advisory Group (SAG). It was recognised that there might be scope to combine some of these projects into larger projects within the NAC and NEAC areas. The SALSEA - Track brochure had been developed, in consultation with members of the Board/SAG and a professional fund-raiser, prior to the Board's 2016 meeting and has been widely distributed and well received. At the 2016 meeting, the representative of the European Union had indicated that the intention was to make a voluntary contribution to NASCO to support two projects relating to marine mortality with funding of €300,000 per project representing 80% of the costs with the balance of funding requiring to be found from third parties (Member States).
4. This paper provides an update on progress with the twelve outline projects and on the funding from the EU and details new telemetry projects reported through the inventory of research relating to salmon mortality at sea.

Progress on the twelve outline projects

5. In accordance with the Board's request that progress in taking forward the twelve outline projects be followed, the contact for each project was requested to provide an update on progress to date, identifying any challenges in progressing the projects and advising of any

assistance the Board may be able to offer to support implementation of the projects and in disseminating information relating to them. The responses received are summarised below:

| | |
|---|---|
| <p>Drifters and BioProbes: Options for detecting acoustically tagged fish in large geographic areas (NAC and/or NEAC)</p> | <p>Progress report (John Kocik and Fred Whoriskey): Within the Canada Atlantic Salmon Research Joint Venture, preliminary conversations have occurred between DFO, NOAA, OTN and the Atlantic Salmon Federation (ASF) as to funding some preliminary research and development to evaluate a cost-effective real time recording drifter. This tool would be able to transmit acoustic tag detections on a satellite platform eliminating the need for drifter recovery. The Ocean Tracking Network (OTN) has submitted funding requests to do the required engineering and integration work to add acoustic receivers to the MetOcean drifter and to build and test a prototype with the intent of having an operational unit ready for 2018.</p> |
| <p>New Receiver Lines/Arrays/Grids (NAC)</p> | <p>Progress report (Tim Sheehan, John Kocik, Jon Carr and Fred Whoriskey): Some progress has been made on this project in 2016. With regards to adding acoustic receiver capacity of/to marine autonomous vehicles, OTN has requested funding to add two new Slocum Gliders and two SV3 Wave Gliders to its fleet to increase North Atlantic Ocean coverage and is working within the nascent Ocean Gliders Canada to arrange to place acoustic receivers on gliders operating within marine areas used by salmon during their marine migration, including the Labrador Sea. OTN has also been working through the Horizon 2020 AtlantOS program to partner with a variety of agencies and programs (DFO, OSNAP, OceanSITES, University of Washington and others) that have established fixed moorings in the North Atlantic Ocean and Labrador Sea to add acoustic receivers to the moorings. This is significantly expanding the acoustic receiver network that could be used to track the marine movements of salmon.</p> <div data-bbox="798 1317 1177 1585" data-label="Figure"> <p>The figure is a map of the Western Atlantic Ocean and Labrador Sea region. It shows the coastline of North America on the left and the Atlantic Ocean to the right. Numerous red dots are scattered across the ocean area, representing the locations of fixed acoustic receiver deployments. A logo for the 'OCEAN TRACKING NETWORK' is visible in the bottom left corner of the map area.</p> </div> <p><i>Map of fixed deployments (red dots) of acoustic receivers operating or to be installed by 2018 in the Western Atlantic Ocean and linked to the OTN data system. Does not include receivers mounted on gliders and which are currently operating in the Labrador Sea.</i></p> <p>Starting in 2015, ASF deployed a second line of receivers (N=28) in the Strait of Belle Isle to measure the efficiency of the existing line and calibrate stage-specific survival estimates for post-smolts travelling through the Gulf of St Lawrence. ASF has had discussions with DFO (St. Johns, Newfoundland) and plans to deploy a few receivers in the Labrador Sea in 2017 (up to 20 VR2AR units are planned for deployment off the coast of Spear Harbour).</p> |

| | |
|--|---|
| | With this developing capacity, what is now needed is a solid plan/idea for the science that needs to be done, identification of critical new infrastructure that might need to be added, and identification of how the science and infrastructure will be sustained for the necessary time period. |
| Platforms of Opportunity in the NAC area: Stationary Platforms of Opportunity Receiver Exchange (SPORE) | Progress report (John Kocik): The NOAA team maintained extant opportunistic arrays in 2016 and continued working with the whale passive acoustic group. Due to expanded work in the Narraguagus Bay area and overall telemetry workload and funding issues, the telemetry monitoring on lobster traps (t-MOLT) and coastal rivers projects were suspended for 2017. These platforms were often deployed after post-smolts left US waters or in river systems without tagged smolts so impacts to salmon monitoring are minimal. Expansion of opportunities in the northwest GoM and associated waters of the Bay of Fundy remains a mutual NOAA and DFO goal. |
| NAC kelt satellite tagging | Progress report (Tim Sheehan and Jon Carr): No significant progress has been made to date due to resource needs, and current commitments. Tentative conversations within the US and with ASF as to possibly pursuing this type of effort have been conducted, but if this project were to be conducted it would not be until 2018/2019. However, the ASF has continued their kelt tagging efforts in the Gulf of St. Lawrence (Miramichi and Restigouche rivers, and Cascapedia planned for 2017), but no new efforts outside of the Gulf have been initiated. A peer reviewed manuscript on PSAT kelt tracking has recently been published (2017, doi:10.1093/icesjms/fsw220). |
| Generic Index River Sites in the NEAC area | No progress report received. |
| Malin Head to Islay Receiver Array (NEAC) | Progress report (Paddy Boylan): Following the Telemetry Workshop in London, the SeaMonitor project was developed and funding was sought under INTERREG V. A description of the project was provided to the IASRB/SAG last year (see SAG(16)4). Unfortunately, this application was unsuccessful. The project included the Loughs Agency as the lead with partners from: the Marine Institute; University of Glasgow; Queens University Belfast; Ocean Tracking Network; Marine Scotland Science; National University of Ireland, Cork; Mayo Institute of Technology, Galway; Agriculture, Food and Biosciences Institute for Northern Ireland; and the University of California, Davis, USA. The consortium is still keen to look for a mechanism to fund the project and as a result a ready-made project is available if another funding opportunity arises. The total project cost was €8.23 million but elements could be tailored into smaller projects depending on available funding. |
| North Sea Loose Array (NEAC) | No progress report received. |
| West-coast Scottish arrays (NEAC) | No progress report received. |
| Studies of migration along the European shelf edge and into the Norwegian Sea using drifters/AUVs etc (NEAC) | No progress report received. |
| NEAC kelt satellite tagging | No progress report received. |

| | |
|---|---|
| Sub-adult satellite tagging at Faroes | No progress report received. |
| Adult satellite/acoustic tagging at Greenland | Progress report (Tim Sheehan and Jon Carr): Planning (ASF, NOAA, Greenland Institute for Natural Resources) has been ongoing for a multi-year satellite/acoustic tagging effort at West Greenland starting in 2017. Preliminary plans are for 2017 activities to focus on developing and refining capture methods for supplying high quality fish for tagging. Tagging would be initiated in 2018 and continue through 2020. |

6. The response to our request for progress reports and identification of factors hindering implementation for the twelve outline projects has not resulted in information for all projects. However, for those that have responded, some have indicated that lack of resources is an issue. In the first phase of the SALSEA Programme, the Board had sought support from professional fund-raisers, Brakeley Consultants and we have maintained contact with one of those involved in the earlier work (Anne Conner) who remains very keen on the work of the Board. She volunteered to review the SALSEA - Track brochure and believes that together with the companion 'Salmon at Sea' brochure, which was developed following the Salmon Summit in 2011, the information available is informative and should be attractive to potential funders including corporates, foundations and high-worth individuals.
7. Identifying potential funders and attracting their interest in SALSEA - Track is a considerable undertaking that requires specialist skills. It would also require a clear description of the planned research and the funding required before funders could be identified and approached. The process would require professional support and Anne Conner's minimum contract would be for around £12,000 (for around 20 days of her time). However, this would only be feasible if we had planned and costed projects that could be presented to potential funders. One approach might be for the IASRB to identify one or two of the twelve projects, perhaps one North American and one European, as model projects that could be promoted in the first instance and seek advice on a fund-raising strategy in support of those projects.
8. The Resolution on Research on Salmon at Sea, ICR(14)10, which encourages NASCO Parties to continue the development of local collaborative telemetry projects, should also be supportive of applications for funding and the Board can also support telemetry projects through endorsements as it has for the twelve outline projects.

EU funding to the IASRB

9. Following the Board's 2016 meeting, applications for funding through EU 'Grants for an action' were completed for two projects and these were approved for funding (up to 80% of eligible costs). A summary of the projects and a brief report on their progress is provided below.

Understanding and comparing early mortality of European salmon populations at sea

10. *Summary:* Over recent decades, the abundance of wild Atlantic salmon stocks has been in decline throughout their migratory range despite the significant management measures put in place both domestically and at an international level. There is evidence that the initial mortality, immediately after smolts enter salt water, is very high and that this 'point

mortality' may explain most of the variation seen in return rates of salmon. Estuarine and near shore mortalities may also be occurring in the part of the marine life cycle where management intervention is feasible. This project will determine the mortality of salmon smolts and post-smolts during their migration through the lower parts of rivers, estuaries/fjords and near-shore areas through case studies using telemetry in rivers in five areas: Denmark, England, Ireland, Northern Ireland and Spain. Mortality of kelts migrating on the same route will also be investigated in Denmark. In combination with other published results, the research will provide crucial input on marine mortality to existing models used for assessment purposes and test if the measured initial mortality can explain observed variation in return rates. If causality between post-smolt mortality and run size can be established, the findings may inform future management and conservation of (some) Atlantic salmon stocks.

Total project cost (including in-kind contributions): €918,300

EU contribution to the IASRB: €299,800

Partners: DTU Aqua (National Institute of Aquatic Resources), Denmark; Centre for Environment, Fisheries & Aquaculture Science (Cefas), UK; Xunta de Galicia, Spain; Agri-Food and Biosciences Institute (AFBI), UK. In-kind contribution from Inland Fisheries Ireland.

11. *Progress to date:* The SMOLTRACK project has just started, but already good progress has been made. Central purchase of telemetry equipment has enabled partners to get a large discount to the benefit of the whole project. As a consequence, several partners have now committed to do a two season study instead of the originally planned 1 season study. The first workshop with partners was held in Galway from 28 February - 1 March 2017. The general criteria for the study were discussed and co-ordinated, an overview of the study sites was presented and a Standard Operating Procedure (SOP) was developed. The workshop also included a practical hands-on tagging course for all partners. These steps will ensure a good possibility for comparison between the sites. The acoustic systems are in place at all partners and tagging began in the last week of March, with the majority of smolts expected to be tagged in April and early May.

Sea lice model for the sustainable development of Atlantic salmon fisheries and aquaculture

12. *Summary:* This project proposes to develop a sea lice integrative model developing and refining hydrodynamic modelling, environmental variables, sea lice production on salmon farms and other data requirements to support sustainable development of aquaculture and wild salmon stocks. Existing modelling tools have been developed in Norway and Scotland. These models simulate dispersal of larval sea lice based on farm production, hydrodynamics, water temperature and salinity, and have been used to identify the role of specific salmon farming sites as recipients or sources of sea lice. In order to make directly comparable estimations of lice dispersal, and hence larval concentrations and infection pressure, the models need to be standardised. The work carried out in each country can also benefit from the exchange of ideas to ensure optimal solutions are arrived at. For this reason, we will seek to form a network that will meet with the objective of developing a standard model that can be plugged into any hydrodynamic model of local currents to generate sea lice dispersal patterns. This project will contribute to developing best management practice for sea lice control and define a range of production strategies aiming

at reducing the presence of sea lice and their negative impacts, both on farmed and wild Atlantic salmon.

Total project cost (including in-kind contributions): €618,604

EU contribution to the IASRB: €239,994

Partners: Inland Fisheries Ireland. In-kind contributions from Norwegian Institute for Nature Research; Institute of Marine Research, Norway; Marine Science Scotland; National University of Ireland, Galway

13. *Progress to date:* The EU funded NASCO project Licetrack, Sea lice model for the sustainable development of Atlantic salmon fisheries and aquaculture, began in early March 2017 when a workshop of all project partners took place at IFI headquarters in Dublin. The workshop covered items such as fieldwork planning for the sentinel cage experiment in Killary harbour, development of hydrodynamic modelling in Norway, Scotland and Ireland, development of a standard model and project budget. Sentinel cages were manufactured and delivered during the first week in May and the first batch of salmon smolts was put to sea in six cages in Killary Harbour on 8 May. These salmon smolts were removed on 16 May and lice counts undertaken. A second batch of salmon smolts was put into the sentinel cages on 16 May and sampled on 23 May. Three cages are fitted with salinity and temperature probes and velocity meters. Some mortality of salmon smolts was encountered due to high water temperatures. A bag net has also been operating in Killary since early May. Farmed salmon in the vicinity of Killary Harbour are due to be harvested in late May and the site left fallow for a period. Salmon smolts will continue to be monitored in sentinel cages during this fallow period to provide baseline data. It is expected that larger salmon will be moved to sites in Killary harbour in autumn and salmon smolts will be placed in sentinel cages to monitor lice levels during this period. The field work element of the project has progressed as set out in the project plan and work is ongoing in developing a hydrodynamic model for Killary harbour. The development of a standard model using hydrodynamic models of local currents to generate sea lice dispersal patterns in any site specific location is also being progressed.



Scottish type sentinel cage used in Killary harbor



Deploying sentinel cages in Killary harbour

14. The funding provided by the European Commission of approximately €600,000 is very much appreciated and has contributed to projects costing approximately €1.5million in total being implemented. We have been advised that additional funding is available

through the EU ‘Grants for an action’ in 2017 with €300,000 available towards eligible costs for each approved project.

Inventory of research

15. The inventory of research relating to salmon mortality at sea, SAG(17)2, includes 21 ongoing projects related to the migratory behaviour of individual fish (C16, C18, C25, C27, C29, C30, C31, C32, C33, De4, De5, Ir12, Ir13, Ir14, Ni4, N18, U4, U5, U10, U13, U16). Seven new projects involving tracking individual fish have been included since last year and these are as follows:
 - C27:** Tracking the migration behaviour of Atlantic salmon kelts (Middle and Baddeck rivers), through a unique inland brackish sea of Cape Breton, Canada;
 - C29:** Movements and survival rates of acoustic tagged smolts from Campbellton River, Newfoundland;
 - C30:** Research into factors of early marine phase post-smolt mortality using acoustic predator-detection tags;
 - C31:** Research into factors of early marine phase post-smolt mortality using acoustic predator-detection tags;
 - C32:** Migration, distribution, survival of smolts from Nashwaak River;
 - C33:** Early marine phase migration, and survival of Atlantic post-smolts from multi-sea-winter salmon populations of Quebec; and
 - Ni4:** COMPASS (Collaborative Oceanography & Monitoring for Protected Areas and Species)

In summary

16. SALSEA - Track is a novel and exciting project proposal that has the potential to answer key questions relating to the conservation and management of Atlantic salmon. The success of the project is entirely dependent upon extensive international co-operation and partnerships between scientists, public sector funders, private sector foundations, NGO groups and industry. If the necessary co-ordination and funding come together, it will undoubtedly have a high profile. Given that the Board has committed to support SALSEA - Track as a continuing effort to understanding mortality of salmon at sea, there are a number of measures it may wish to consider in order to further its goal of advancing an integrated, collaborative telemetry programme. The Board has previously recognised that it could play an important role by: supporting fund-raising initiatives; providing funds as resources permit; endorsing projects; serving as a forum for information exchange and collaboration among research groups; and facilitating co-ordination of the research programme.
17. The Board has, of course, already played a significant role in support of this initiative by funding the Telemetry Workshop that brought together the key scientists who may collaborate in future telemetry studies on salmon and at which the outline project proposals, subsequently endorsed by the Board, were developed. It has adopted a Resolution and it has prepared a

brochure which should be supportive of telemetry studies. The Board's inventory indicates that seven new telemetry studies have been initiated since last year. The NASCO/IASRB have successfully applied for EU funding to support two projects related to mortality of salmon at sea and additional funding could be made available in 2017 if acceptable projects are forthcoming. The International Year of the Salmon, although focused on outreach activities in the North Atlantic, may be supportive of research relevant to SALSEA - Track. If the Board is to engage in fund-raising to support the twelve outline projects, it will need professional advice and that will need clarification of the research to be conducted and its cost and this might best be achieved by focusing on one or two model projects. The Board will need to consider its further role in taking forward SALSEA - Track and we look forward to discussing this further at the Annual Meeting.

Chairman and Secretary of the IASRB
Edinburgh
23 May 2017