ICR(18)06
(ADOPTED BY THE COUNCIL – DUPLICATED AS CNL(18)09)

Report of the Seventeenth Meeting of the International Atlantic Salmon Research Board

Holiday Inn by the Bay, Portland, Maine, USA

11 June 2018

1. Opening of the Meeting

1.1 The Chair, Mr Rory Saunders (USA), opened the meeting and welcomed members of the Board, their scientific advisers and observers to Portland. In light of the recent paper, CNL(18)10, reviewing the rules of procedure, he highlighted the need for clarity in communication. He updated the attendees on the current nominated Board members.

1.2 A list of participants is contained in Annex 1.

2. Adoption of the Agenda

2.1 The Board adopted its Agenda, ICR(18)04 (Annex 2).

3. Finance and Administrative Issues

3.1 The Secretary introduced document ICR(18)02 presenting the Board's audited accounts for 2017. At the end of 2017, the balance of the International Atlantic Salmon Research Fund was £472,784. Of this, approximately £463,693 is ring-fenced for the EU funded projects. For the Board's general account, the year-end balance was £9,091 after the sum of £5,000 was paid to the Atlantic Salmon Trust to support the workshop for the Likely Suspects Framework and £2,000 for the costs of the audit. The Board had previously agreed that it was desirable to retain a reserve of £4,000 - £5,000.

3.2 At its 2006 Annual Meeting, the Board recognised that it was not necessary to have the accounts audited annually and agreed that, in future, the Board's accounts should be audited as required in relation to the grants held. For years in which an audit is not conducted, details of the Board's income and expenditure statements would be circulated to the members of the Board and discussed at its Annual Meeting. In accordance with this decision, the Board decided not to have its 2018 accounts audited. The Secretary was asked to provide income and expenditure statements.

3.3 At its 2017 Annual Meeting, the Council asked the Secretary to prepare a review of the procedures relating to the work of the Board. The Secretary provided a summary of the review CNL(18)10, including the history of the establishment of the Board, its rules of procedure and past and current membership. In conducting the review, the Secretary identified some issues that remain somewhat unclear, including the clarification of the role of the Scientific Advisory Group (SAG) for which there are no Terms of Reference currently. he Secretary's review did not make any recommendations, rather it simply highlights some issues that may require some clarification. The Chair thanked the Secretary for the review and requested any comments from the members of the Board.

3.4 The Board discussed the process of revising its Rules of Procedure in light of the Secretary's review and the independent status of the Board. The Board agreed that the Chair should propose new rules of procedure and clarify the Terms of Reference for the

Board and the SAG, in consultation with the Secretary, members of the Board, and current and past Chairs of the SAG. These recommendations would then be discussed at an inter-sessional meeting of the Board to be conducted by conference call.

4. Report of the Scientific Advisory Group

4.1 The Chair of the Board's Scientific Advisory Group (SAG), Dr Niall Ó Maoiléidigh, presented a report on the Group's meeting, SAG(18)07 (Annex 3). During its meeting the SAG had:

- elected Mr Gérald Chaput (Canada) as the Chair of the SAG and clarified its nominated members;
- discussed the Updated Inventory of Marine Research. Ten new projects have been included since last year, some of which have been ongoing for some time and one of which is completed. One of these new projects involves tracking individual fish;
- agreed not to review the Inventory of Marine Research until 2020 at the earliest;
- been informed that there was no update in the metadatabase of salmon survey data and sample collections;
- received an update on the International Year of the Salmon (IYS) with respect to research links with the NPAFC. It was noted that the Terms of Reference for the IYS North Atlantic Steering Committee (NASC) state 'through the International Atlantic Salmon Research Board, identify research priorities, review research proposals and coordinate any research programmes implemented' concerning activities relating to Atlantic salmon. While outreach is the agreed focus of the IYS in the North Atlantic, it had also been previously agreed that there could be benefits from improved exchanges between scientists working around the salmosphere. Two Atlantic led projects have already engaged with Pacific researchers and involved them in the Likely Suspects Framework workshop (November 2017) and in the ROAM project. In the Pacific, the focus for the IYS is on developing a programme of research and gaining funding to deliver it by 2022. The NPAFC IYS Secretariat has produced a Draft Research Prospectus proposing various projects and activities against each of the IYS themes. In developing this document, the NPAFC IYS Secretariat reviewed the IASRB inventory of research and included projects of interest in the draft prospectus. Both the Chair of the IASRB and SAG had been involved in correspondence with the NPAFC IYS Secretariat in relation to this document. The SAG had considered this document (contained in paper SAG(18)03) in which they were asked to make recommendations to the Board on how NASCO should engage with the NPAFC prospectus. The SAG participants were very positive about collaborations to take forward the stated signature projects, but were unable to make a recommendation on whether a hemispheric research study group was required to develop, enable and deliver IYS research;
- discussed developments in relation to SALSEA – Track (see item 5 below);
- received an update on the project entitled 'Enhancement of a North American Atlantic salmon genetic baseline for individual and stock identification and application of the baseline to historical scales collected at West Greenland' which had been funded through the Board. This project is now complete;
- received an update on the AST's Likely Suspects Framework. Following the Board's 2017 Annual Meeting, it had been agreed that the Board would provide £5,000 of funding to support this framework being developed by the AST; and

- received an update on the telemetry programme being conducted by the Atlantic Salmon Federation.

4.2 The Chair of the Board thanked Dr Niall Ó Maoiléidigh for the report and his work as Chair of the SAG over the last four years. The Board then discussed several items relating to the SAG report.

4.3 The Board discussed the ROAM project at length. Mr Tim Sheehan (USA) gave a brief verbal update on the recent workshop held on 7 – 8 June outlining that the approach was utilising developing telemetry technology and therefore advised that there were a number of caveats and risks to take into account concerning delivery. The EU member of the Board recognised that whist the technology was in its infancy, there were advantages to future salmon research. The EU Board member also provided a brief overview of the draft project proposal SalmoQuest, which seeks to support the development, testing and use of ROAM technology in EU and Norwegian waters. By investing in the development of technologies, they would be tailored to the needs of salmon research. The member of the Board from Norway indicated that he would like to see a ROAM project initiated in 2019 as part of the IYS and that he would consider making an approach to Norway for funding if a more detailed project proposal could be provided. The EU Board member was supportive of the inclusion of a ROAM initiative as part of IYS and indicated a willingness to also explore funding opportunities for 2019. A workshop was discussed to facilitate the further development of a detailed ROAM research plan which would then be presented at the next IASRB Annual Meeting. The members of the Board were supportive of this approach and decided to make a sum of up to £4,000 of the Board's funds available towards a second ROAM workshop, if needed. Mr Mark Saunders from the North Pacific Anadromous Fish Commission (NPAFC) IYS Secretariat highlighted the relevance of the ROAM initiative to the Pacific basin and indicated that he would welcome the opportunity for Pacific researchers to take part in any development of it.

4.4 A mechanism to support the Likely Suspects Framework was discussed. The NGO representative to the Board had identified a number of activities that could take forward the conclusions from the November 2017 workshop. The Board agreed the following action: the Chair of the Board will request that the Secretary liaise with ICES about the possibility of organizing a data workshop to clearly identify and prioritise data gaps in relation to candidate mortality factors. It is anticipated that cost associated with such a workshop would be minimal as attendees would cover their own expenses.

4.5 The Board noted that the SAG saw great value in the IYS signature projects identified in the SAG(18)03 document. However, there was no clear recommendation from the SAG with regards to how NASCO should engage with the NPAFC Draft Research Prospectus and therefore IYS hemispheric research. The Board discussed the proposal from Mr Saunders that a hemispheric research study group could be the mechanism for dealing with research that crossed both basins. Members of the Board were reluctant to create another group due to the potential challenges in people having the capacity and resources to engage with it. Mr Saunders raised that whilst informal communication was welcomed, the Pacific IYS team were seeking a contact point or group with which to pursue the many IYS research ideas. The Board determined that IYS research projects should be considered in the same way as all NASCO research and were therefore not prepared to commit to an IYS Research Study Group at this time. The Board agreed that informal communication among the NPAFC Secretariat, the Board Chair and the SAG Chair should continue.

5. Developments in relation to SALSEA – Track

5.1 In 2014, the Board had endorsed the need for an international acoustic tracking programme and adopted a Resolution (ICR(14)10) encouraging Parties to continue the development of local collaborative telemetry projects, encouraging the development of large international collaborative projects building on local efforts and encouraging Parties to make efforts to identify funding sources. The Board had noted that the telemetry programme should build on the success and identity of the SALSEA Programme.

5.2 In 2015, the Board received a report from its Telemetry Workshop that had, *inter alia*, developed 12 outline project proposals. The Board had recognised that it would be important to liaise with the outline project leaders with a view to following progress and, where appropriate, to provide support to assist with their implementation. The Board also recognised the high value of the SALSEA brand and the strong impact of NASCO as the international forum for consultation and cooperation on wild Atlantic salmon. The Board reaffirmed its commitment to an international telemetry project under the SALSEA brand, named 'SALSEA – Track' by making funds available to prepare a vision statement for SALSEA – Track and other mechanisms as resources allow.

5.3 The Chair introduced document ICR(18)03 (Annex 4) providing an update on developments in relation to SALSEA – Track. Since the Board's 2016 Annual Meeting, applications for funding from the European Union were successfully completed and funding has been granted for three projects. The progress on each is detailed in the document (ICR(18)03) and a brief update was provided verbally by the EU member of the Board. Briefly, two projects involving smolt telemetry that have recently shown great progress were highlighted. First, the Smoltrack I project was initiated on January 1 2017, involving partners from Northern Ireland, England, Ireland, Spain and Denmark. The purpose of the project is to determine the mortality of salmon smolts / post-smolts during their migration through the lower parts of rivers, estuaries / fjords, and nearshore areas through case studies using telemetry in rivers of five areas: Denmark, England, Ireland, Northern Ireland and Spain. Additionally, mortality of kelts migrating on the same route will also be investigated in Denmark. Salmon will be tagged with acoustic transmitters and their subsequent migration will be followed via acoustic listening stations. This will provide novel data on lower-river and estuarine / coastal behaviour and mortality, as well as to evaluate the method's applicability in a broader context. Beside the scientific aims, the project is intended to bring together a group of experts to provide advice on best practices and Standard Operating Procedures for this type of study. Second, the Smoltrack II project was initiated on January 1 2018, involving partners from Northern Ireland, England, Ireland, Spain, Sweden and Denmark. The project aims at expanding the platform and collaboration of Smoltrack I by including more partners (Sweden is included now, taking the total number of study sites to eight). The geographical span of the project now ranges over most of the salmon distribution area in the EU from north to south and east to west. The project specifically aims to identify specific predators causing the documented loss of smolts from the Smoltrack I project and make comparisons between survival of wild and hatchery-reared salmon smolts. Blood sampling will be used to evaluate smolt quality and sex as they exit rivers to test if gender and physiological background affects the chance of survival. Lastly, the project will do a pilot study to test the feasibility to tag genetically assigned large salmon at the Faroe Islands or Greenland and track the return migration.

5.4 Progress reports were received for 6 of the 12 outline projects developed at the Telemetry Workshop. Lack of funding or resources remains an issue hindering implementation of some of these projects.

6. Other Business

6.1 There was no other business.

7. Report of the Meeting

7.1 The Board agreed a report of its meeting.

8. Date and Place of the Next Meeting

8.1 The Board agreed to hold its next meeting in conjunction with the Thirty-Sixth Annual Meeting of NASCO and ahead of the IYS Symposium preceding the meeting. The meeting would therefore be held on Saturday 1 June 2019.

9. Close of the Meeting

9.1 The Chair thanked participants for their contributions and closed the meeting.

Annex 1

List of Participants

Canada
**Tony Blanchard
Doug Bliss
Gérald Chaput
Patricia Edwards

Denmark (in respect of Greenland and the Faroe Islands)
**Birita i Dali
**Tommy Petersen

European Union
Bernard Blazkiewicz
Dennis Ensing
Jaakko Erkinaro
**Cathal Gallagher
John McCartney
Michael Millane
Niall Ó Maoiléidigh
Arnaud Peyronnet
Lawrence Talks

Norway
**Raoul Bierach
*Helge Dyrnedal
Peder Fiske

Russian Federation
****Alexander Khatuntsov
Alina Nikolaeva
Sergey Prusov

United States
Julie Crocker
Rory Saunders (Chair)
**Tim Sheehan

ICES
Martha Robertson

IGOs
Suam Kim
Mark Saunders

NGOs
David Meerburg
Nigel Milner
Robert Otto

Ken Whelan (NGO Member)

Secretariat
Emma Hatfield
Sarah Robinson

** Nominated Board Member
* Nominated Board Advisor

Annex 2

ICR(18)04

Seventeenth Meeting of the International Atlantic Salmon Research Board

Holiday Inn by the Bay, Portland, Maine, USA

11 June 2018

Agenda

1. Opening of the Meeting
2. Adoption of the Agenda
3. Finance and Administrative Issues
4. Report of the Scientific Advisory Group
5. Developments in relation to SALSEA – Track
6. Other Business
7. Report of the Meeting
8. Date and Place of the Next Meeting
9. Close of the Meeting

Annex 3

SAG(18)07

Report of the Sixteenth Meeting of the Scientific Advisory Group of the International Atlantic Salmon Research Board

Holiday Inn by the Bay, Portland, Maine, USA

11 June 2018

1. Opening of the Meeting

1.1 The Chair of the Scientific Advisory Group (SAG), Dr Niall Ó Maoiléidigh (European Union), opened the meeting and welcomed participants to Portland.

1.2 A list of participants is contained in Annex 1.

2. Adoption of the Agenda

2.1 The SAG adopted its Agenda, SAG(18)05 (Annex 2).

3. Election of Officers

3.1 The Secretary gave an overview of the protocol concerning the election of Chair.

3.2 Tim Sheehan (USA) proposed Gérald Chaput (Canada) for the Chair of the SAG and Jaakko Erkinaro (EU) seconded the nomination. The SAG elected Gérald Chaput as its Chair, to serve for period of two years.

4. Review of the Updated Inventory of Research and the Metadatabase of Salmon Survey Data and Sample Collections

Research Inventory

4.1 The Chair presented an overview of the Inventory of Research Relating to Salmon Mortality in the Sea, SAG(18)02. For 2018, the total annual expenditure on the 63 ongoing projects (5 of which are uncosted) is approximately £8.5 million. Approximately 47% of the expenditure is associated with long-term monitoring programmes. He indicated that there are ten new projects, some of which have been ongoing for some time and one of which is completed. One new project involving tracking individual fish has been included since last year. The new projects are as follows:

Canada

- Atlantic Salmon Research Joint Venture – Life History Modelling Project for Wild Atlantic
- Atlantic Salmon Research Joint Venture – Atlantic Salmon Post-smolt Trawl and Troll Survey in the Strait of Belle Isle
- Atlantic Salmon Research Joint Venture – Current status of knowledge, data, and research efforts on Atlantic salmon at Greenland: what do we have, what do we need, and what should we do moving forward?
- Atlantic Salmon Research Joint Venture – Development of Acoustic Tracking Capabilities for Drifter Buoys

European Union – Denmark

- Salmon Rehabilitation Plan: monitoring numbers of spawners, spawning and nursery areas in four Atlantic salmon rivers and the achievement of the objective of self-reproduction
- SMOLTRACK

European Union – UK (England and Wales)

- Salmonid Management Round the Channel project (SAMARCH)

European Union - UK (Northern Ireland)

- The marine survival of Atlantic salmon from the River Bush, Northern Ireland

European Union – Sweden

- Monitoring of *Gyrodactylus salaris* in salmon rivers, with focus on the Swedish west coast

Norway

- ATLANTIC SALMON AT SEA - factors affecting their growth and survival (SeaSalar)

4.2 The SAG has previously recognised that, as there is insufficient time available to review the inventory thoroughly at its meetings or at the meetings of the ICES Working Group on North Atlantic Salmon, the Board had agreed that review of the inventory should be conducted by a SAG Sub-Group every 3 or 4 years. The inventory was last reviewed in 2012 by the Sub-Group on the Future Direction of Research on Marine Survival of Salmon and, if the agreed schedule is followed, the next review of the inventory would be due in 2017. However, the SAG noted that one of the purposes of the review is to identify research needs and it recognised that the Board has agreed that its current priority is to partition mortality of salmon along their migration routes through telemetry studies (SALSEA – Track). The SAG also considered that it might be appropriate to wait until after the IYS to conduct the next review of the inventory. The SAG, therefore, recommends to the Board that the need for a further review of the inventory should be reconsidered at earliest in 2020 and that the Board may need to be consulted should it be later than this.

4.3 In the context of any review, the Chair stressed the need to only include projects relating to marine survival in the inventory. The SAG agreed that marine survival could be linked to the freshwater environment and projects addressing the characteristics of smolts heading out to sea, including laboratory-based studies, would be a valuable addition to the database. Long-term monitoring programmes should include smolt and adult counts to provide estimates of marine survival in order to be relevant to the inventory. The Chair suggested that the categories on the inventory return template could be clarified in this regard and proposed that the Secretariat could address this suggestion. Further clarifications to the template were also proposed by SAG i.e. to ensure the annual costs were detailed for each year of the project, rather than the estimated cost of the research project, to link each project to the relevant NASCO research themes and to link each project to the relevant SALSEA research heading.

Metadatabase

4.4 In 2015, the SAG discussed the high value of archival scale collections which, as a result of advances in analytical methods, can now be used for genetic, stable isotope and further growth studies. Additional information may be obtained in the future in

response to further advances in analytical methods. The SAG had noted that these collections may be lost when individual scientists retire unless appropriate arrangements are in place to archive them and ensure their safe storage so that they may be available for analysis. Even if the scales themselves are not lost, the information accompanying them could be or they could be damaged while in storage. It was recognised that the Board could play a role in identifying such scale collections, raising their profile with a view to safeguarding them for future use. The IASRB agreed that information on these scale collections should, as a first step, be included in the IASRB metadatabase. Accordingly, Parties / jurisdictions were requested to provide details to the Secretariat of any archival scale collections. The Board had also agreed that information on the West Greenland Sampling Programme Biological Characteristics database should be included in the metadatabase. The following new datasets have been included in the metadatabase since 2016:

- Kolarctic Coastal samples;
- PINRO Atlantic salmon scales collection;
- USA origin juvenile and adult scale samples;
- West Greenland Sampling Database.

4.5 There are no further updates on the metadatabase for this year and the Chair encouraged Parties / jurisdictions to contribute details of scale collections for inclusion in the metadatabase. The Chair highlighted that an Irish metadatabase was in preparation as part of the Nationally funded 'Unlocking the Archive Project' 2017 to 2020.

5. Update on the International Year of the Salmon with respect to Research Links with the NPAFC

5.1 At its Thirty-Third (2016) Annual Meeting, the Council had recognised that an International Year of the Salmon (IYS) could provide a very good opportunity to raise awareness of the factors driving salmon abundance, the environmental and anthropogenic challenges they face and the measures being taken to address these. An Outline Proposal for an IYS, entitled '*Salmon and People in a Changing World*', which included a proposed rationale, vision, themes and timings for the IYS, together with details of its scope, a governance model and initial budgetary considerations, was broadly accepted by the Council subject to some provisional points of clarification. The focal year of the IYS is 2019 with the intention that research will continue through to 2022.

5.2 The Terms of Reference for the North Atlantic Steering Committee (NASC) state 'through the International Atlantic Salmon Research Board, identify research priorities, review research proposals and coordinate any research programmes implemented' concerning activities relating to Atlantic salmon. While outreach is the agreed focus of the IYS in the North Atlantic, it has also been previously agreed that there could be benefits from improved exchanges between scientists working around the salmosphere.

5.3 In the Pacific, the focus for the IYS is on developing a programme of research and gaining funding to complete it by 2022. The NPAFC IYS Secretariat has produced a Draft Research Prospectus proposing various projects and activities against each of the IYS themes. In developing this document, the NPAFC IYS Secretariat reviewed the 2017 IASRB inventory of research and included projects of interest in the draft prospectus. Both the Chair of the IASRB and of the SAG were involved in correspondence with the NPAFC IYS Secretariat in relation to this document.

5.4 The Chairman invited Mr Mark Saunders (NPAFC) to present document SAG(18)03, containing the NPAFC Draft Research Prospectus. Mr Saunders highlighted that there are numerous research opportunities in the context of the IYS research themes / outcomes that, over the course of the IYS, will lead to a situation where salmon and people are resilient in a changing world. Using climate as a driver of change as a key example of a hemispheric challenge that requires research, Mr Saunders detailed possible signature projects of interest to both the Pacific and Atlantic which could be progressed through potential collaborations. The NPAFC IYS Draft Research Prospectus and these potential and planned projects highlighted common research requirements with the North Atlantic. He suggested that a Research Study Group comprising scientific representatives from the Pacific and Atlantic would progress the proposed signature projects further.

5.5 The Chair thanked Mr Saunders for his presentation and asked Members of the SAG to consider how the SAG and the Board should engage with hemispheric research projects and what mechanism should be used to manage this engagement. Mr Saunders outlined the role of the Study Group which would be to: facilitate collaboration of researchers at a hemispheric scale; develop an inventory of relevant researchers and projects and report results relative to IYS objectives; and co-ordinate symposia and workshops to ensure communication of results and to facilitate collaboration. He further suggested that other expected outcomes would be in identifying overlapping initiatives and providing appropriate fora to allow scientists from each hemisphere to spend more time with each other and learn from science being carried out in area. He reiterated that there is a high degree of overlap in research interests in the two basins and that he was looking for endorsement from the SAG that there should be a joint way forward for hemispheric research. The Chair noted the prospectus was a good document which clearly highlighted the areas where collaborations would be advantageous. However, he suggested that the key issue was to consider how projects are progressed and undertaken at the hemispheric scale and asked the SAG to consider whether a Research Study Group as proposed was the best approach.

5.6 Professor Whelan (NGOs) cited the 'Likely Suspects Framework' as an example of what was required, although at a smaller scale, as there were common issues to overcome such as the commitment, resources and finances individuals have to dedicate to the co-ordination work and development of projects. Focusing on one or two key signature projects was suggested as a possible way forward. The Chair proposed that he would report to the Board that the SAG acknowledge the great benefits that engaging at the hemispheric level for IYS research would bring, but that consideration needs to be given to how this could be progressed given the need for extra commitments, resources and finance requirements for some individuals and Parties.

6. Developments in relation to SALSEA – Track

6.1 In 2014, the IASRB had endorsed the need for an international telemetry programme and adopted a Resolution (ICR(14)10) encouraging Parties to continue the development of local collaborative telemetry projects, encouraging the development of large international collaborative projects building on local efforts and encouraging Parties to make efforts to identify funding sources. The Board had noted that the telemetry programme should build on the success and identity of the SALSEA Programme and had recognised that there may be a role for the Board in co-ordinating efforts and supporting fund raising initiatives. In 2014, a Telemetry Workshop organized by the Board had developed 12 outline project proposals utilising telemetry. The Board had recognised that if the international telemetry programme is to proceed, it would be important to liaise with the project leaders with a view to following progress and, where

appropriate, to provide support to assist with their implementation. In 2015, the Board had 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 reaffirmed its commitment to an international telemetry project under the SALSEA brand, namely SALSEA – Track. Specifically, the Board agreed to support SALSEA – Track as a continuing commitment to understanding the factors affecting the 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. In 2016, the Board had confirmed that it endorsed the twelve projects but noted that, if they changed substantially, they should be referred to the SAG. It was recognised that there might be scope to combine some of these projects into larger projects within the North American and North-East Atlantic Commission areas.

6.2 In 2017, the SAG was advised that funding had been provided to the IASRB for two projects through an EU 'grant for action' award. These projects were 'Understanding and comparing early migration of European salmon populations at sea' and 'Sea lice model for the sustainable development of Atlantic salmon and fisheries'.

6.3 The Chair referred participants to paper ICR(18)03. There are three parts to the paper updating on the SALSEA – Track initiative; the SAG participants were reminded that this will be talked about at the Board meeting and asked if they had any questions but none were forthcoming.

6.4 In 2017, the SAG received a report on a new approach to tracking, 'ROAM', based on a technique for sub-surface oceanographic monitoring. This technique may offer potential for fine scale positioning of salmon at sea obtained with satellite tags and related archival tag technologies. The Council had recognised that it would be important for the Board to be kept informed of developments in relation to this technology.

6.5 Mr Tim Sheehan provided an update on a workshop entitled 'Introduction and overview of the ROAM (RAFOS Ocean Acoustic Monitoring) approach to marine tracking' which was held at the Woods Hole Oceanographic Institute in Woods Hole, Massachusetts, USA. A total of 27 scientists and managers from both the North Atlantic and Pacific basins attended. Representatives from different tag manufacture companies also attended. The workshop had a number of different objectives which focused on sharing the technical details of the approach and providing a forum for discussion on the appropriateness of the ROAM approach to tracking Atlantic and Pacific salmonids during their entire marine phase.

6.6 ROAM technology is still in the development phase. The workshop provided a lot of details describing the sound sources, the fish tags, and how the system worked. There was also some information presented describing preliminary field trials conducted in 2017 and descriptions of field trials planned for 2018. It was noted numerous times during the workshop that this approach to marine tracking would be applicable to a wide array of different species.

6.7 Mr Sheehan also provided a brief summary of planned future efforts related to the further development of the ROAM approach. In addition to the field trials, preparations will continue for the implementation of the SALSEA – Track outlined Labrador Sea tracking project utilising Atlantic salmon caught and released at Greenland. Tagging is set to begin in 2018 and will use traditional Pop-off Satellite Archival Tags (PSAT) with an expectation to transition to ROAM PSAT tags in 2019. Preliminary discussions between researchers from the United States, Canada, the EU and Norway about a potential new collaborative telemetry effort were initiated. The project would focus on

evaluating and testing the ROAM system in the Northeastern Atlantic, working to develop floating ROAM archive tags, and tracking of marine-phase Atlantic salmon with ROAM. Workshop attendees from the Pacific Ocean committed to engage in further discussion with their Pacific colleagues about the applicability of the ROAM approach for Pacific-based research.

6.8 Mr Dave Meerburg (ASF Canada) briefly updated the SAG on its smolt and kelt tracking studies in the Gulf of St Lawrence, stating that the programmes are continuing and expanding.

7. Progress Reports on Projects Funded by the IASRB

7.1 Mr Tim Sheehan indicated that the United States had previously made a contribution of £16,900 (US$26,000) to the IASRB to support an extension of a study undertaken in 2014 / 15 (SAG(15)4). The extension study was led by Dr Ian Bradbury, Fisheries and Oceans Canada, and was entitled 'Enhancement of a North American Atlantic Salmon genetic baseline for individual and stock identification'. The funds were used to support the genetic processing and analysis of approximately 670 individual scale samples collected from the West Greenland fishery to obtain region of origin assignments for North American origin fish. The target years were 1970, 1971, 1972, 1976, 1980, 1981 and 1982. These years were selected to increase the sample size of North American region of origin assignments prior to 1990. Previous work supported by the Board (SAG(15)4) presented a time-series of North American region of origin contributions to the West Greenland fishery (1968 - 2014); however, sample size prior to 1990 was low. Mr Sheehan advised the SAG that the study had now finished, however, edits are still needed to the report and once complete it will be emailed to the Board.

7.2 Following its 2017 Annual Meeting, the Board had agreed to make £5,000 available to support a 'likely suspects' model being developed by the Atlantic Salmon Trust (AST). Professor Ken Whelan presented document SAG(18)04, which contained a progress report on the development of the model. Professor Whelan began by thanking the Board for the seed funding it had provided, noting that this money leveraged further financial support for the project. In addition to the recommendations from the workshop, actions as a consequence of these recommendations were suggested. Thanks were given to Mr Mark Saunders for enabling Pacific input to the workshop. Pacific attendees were open to sharing their expertise and experience making an excellent addition to the meeting. A PDF of the Likely Suspects Framework will be sent out with the papers of the Annual Meeting and Professor Whelan welcomed any comments.

7.2 The Chair commented that it was impressive to note how far the initiative had come in one year. He also noted how endorsement and seed funding from the Board had benefitted the project and was an example of how the Board could facilitate linking great ideas to funding and resources.

8. Review of Project Applications for Potential Funding by the IASRB

8.1 Under the Board's Guidelines for Submitting Proposals for Research, Workshops, Symposia and Other Activities for Support by the IASRB, ICR(09)10, applications seeking either only endorsement by the Board or funding support from the Board may be considered. Applications are reviewed by the SAG which makes its recommendations to the Board. There had been no applications for funding or support since the 2017 Annual Meeting.

8.2 The Board had previously agreed that it would be important to have reserves available to it so that it could continue to support initiatives such as the Greenland and Faroes GSI projects, where the Board's support had assisted in securing additional funding

from other sources. These projects had resulted in new information of value to management with limited financial support from the Board. The Sub-Group on the Future Direction of Research on Marine Survival of Salmon had noted in 2012 that the Board had very limited resources and recognised that if it is to continue to play a role in supporting research on salmon at sea, it should consider how it can address this situation.

8.3 It was pointed out in relation to the lack of projects being submitted that this was not due to the availability of projects seeking funding, but due to the lack of money available from the Board to contribute to them.

8.4 The SAG agreed that a workshop to identify and obtain data to define specific salmon domains which was proposed by the Likely Suspects Workshop would be brought to the attention of the Board. This would require communication with ICES to provide support for the workshop.

9. Other Business

9.1 The Chair took the opportunity to provide some reflections given that the meeting was his last as Chair of the Group. Concerning the future of the group he raised the current structure and time limitations, suggesting that this may be addressed as the part of the Board review and any recommendations that may result from it. He also discussed the possibility of an extra working group meeting.

9.2 The SAG noted several suggestions which could alleviate some of the current limitations with the current meeting arrangements including: the IASRB meeting could be scheduled for the day following the SAG meeting to allow more time to be allocated and enabling more opportunity for discussion; noting that as many of the SAG participants are on the ICES Working Group on North Atlantic Salmon, an additional SAG meeting before or after the Working Group meeting could be possible; an additional virtual meeting could be organized easily before the NASCO Annual Meeting; scheduling an additional meeting could be kept open and scheduled if required.

10. Report of the Meeting

10.1 The SAG agreed the report of the meeting.

11. Date and Place of the Next Meeting

11.1 The SAG agreed to hold its next meeting in conjunction with the Thirty-Sixth Annual Meeting of NASCO (5 - 7 June 2019) and in advance of the IYS Symposium. The date of the next meeting of the SAG will therefore be Saturday 1 June.

12. Close of the Meeting

12.1 The Chair of the SAG thanked the participants for their contributions. He wished the incoming Chair best wishes for his appointment and closed the meeting.

Annex 1 of SAG(18)07

List of Participants

Canada
Tony Blanchard
Doug Bliss
**Gérald Chaput
Patricia Edwards

European Union
Bernard Blazkiewicz
**Jaako Erkinaro
Cathal Gallagher
Denis Maher
John McCartney
Michael Millane
**Niall Ó Maoiléidigh (Chair)
Lawrence Talks

Norway
**Peder Fiske

Russian Federation
Alina Nikolaeva
**Sergey Prusov

United States
Rory Saunders
**Tim Sheehan

ICES
Martha Robertson

IGOs
Suam Kim (NPAFC)
Mark Saunders (NPAFC)

NGOs
David Meerburg (NGO Member)
Nigel Milner
Robert Otto
Andy Walker
Ken Whelan

Secretariat
Emma Hatfield
Sarah Robinson

** Nominated SAG Member

SAG(18)05

Sixteenth Meeting of the Scientific Advisory Group of the International Atlantic Salmon Research Board

Holiday Inn by the Bay, Portland, Maine, USA

11 June 2018

Agenda

1. Opening of the Meeting
2. Adoption of the Agenda
3. Election of Officers
4. Review of the Updated Inventory of Research and the Metadatabase of Salmon Survey Data and Sample Collections
5. Update on the International Year of the Salmon with respect to Research Links with the NPAFC
6. Developments in relation to SALSEA – Track
7. Progress Reports on Projects Funded by the IASRB
8. Review of Project Applications for Potential Funding by the IASRB
9. Other Business
10. Report of the Meeting
11. Date and Place of the Next Meeting
12. Close of the Meeting

Annex 4

ICR(18)03

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, among other things:

   - 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. In 2017 and early 2018, funding was made available through a European Union funding mechanism to support three projects relating to marine mortality.

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:

Drifters and BioProbes: Options for detecting acoustically tagged fish in large geographic areas (NAC and/or NEAC)	**Progress report (John Kocik and Fred Whoriskey):** The Ocean Tracking Network has contracted MetOcean and Vemco to produce a cost-effective, real-time recording drifter buoy. Three initial units have been received and are undergoing modifications to prepare them for field testing in autumn 2018.
New Receiver Lines/Arrays/Grids (NAC)	**Progress report (Tim Sheehan, John Kocik, Jon Carr and Fred Whoriskey and Martha Robertson):** Some progress has been made on this project in 2016. With regards to adding acoustic receiver capacity of/to marine autonomous vehicles, OTN has ordered two new Slocum Gliders and intends to order two SV3 Wave Gliders within calendar year 2018 to increase its fleet and add North Atlantic Ocean coverage. OTN is also 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, others) that have established fixed moorings in the North Atlantic Ocean and Labrador Sea to add acoustic receivers to the moorings. An inventory of potential buoys has been developed, maintenance schedules for them have been identified, possible gear conflicts (i.e. notably the presence and cycling of ADCPs (acoustic Doppler current profilers) co-deployed on the buoys) are being evaluated, and we hope to begin some deployments in 2018. We are also working with teams from the University of Windsor interested in tracking Greenland halibut in the Norwegian Sea, and with a team from Dalhousie University, Memorial University of Newfoundland and the Groundfish Enterprise Allocation Council that plans to deploy additional receivers in 2018 on the continental shelf off of Newfoundland. These deployments will complement our ability to track the marine movements of salmon with acoustic telemetry. Starting in 2015, ASF deployed a second line of receivers (N=28) in the Strait of Belle Isle (SoBI) to measure the efficiency of the existing line and calibrate stage specific survival estimates for post-smolt traveling through the Gulf of St Lawrence. ASF and DFO deployed a new receiver array along the Labrador coast about 80km north of SoBI (near Port Hope Simpson) in 2017. Twenty acoustic release VR2AR receivers were deployed extending 16 km from the shore towards the shelf. This array will be expanded in 2018 with the addition of 20 new receivers. 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. In support of this, a telemetry workshop took place in Halifax Nova Scotia in December 2017 designed to build upon a workshop held in December 2014 by the North Atlantic Salmon Conservation Organization's (NASCO) International Atlantic Salmon Research Board (IASRB). Partners and invited experts were assembled to develop a collaborative and coordinated telemetry program in North America within which would be nested individual telemetry projects occurring across the species range in the Northwest Atlantic. The scope of the workshop was to review past and ongoing studies in the North Atlantic to help

	inform future research based on data needs/gaps, to further discussions related to North American and Greenland related SALSEA-Track components, and to develop a path forward for research programs to estimate and partition marine mortality of wild Atlantic salmon by improving our knowledge of salmon migration and distribution patterns. The workshop was support by the Atlantic Salmon Research Joint Venture and a final report will be available in autumn 2018.
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 2017 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 2017-2018. 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. With expanded availability of acoustic releases, NOAA is considering again partnering with lobstermen to evaluate this platform for 12 month monitoring. Expansion of opportunities in the northwest GoM and associated waters of the Bay of Fundy remains a mutual NOAA, ASF, 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 2019/2020 at the earliest. However, ASF has continued their kelt tagging efforts in the Gulf of St. Lawrence (Miramichi and Restigouche rivers, and Cascapedia), but no new efforts outside of the Gulf have been initiated.
Generic Index River Sites in the NEAC area	No progress report received.
Malin Head to Islay Receiver Array (NEAC)	**Progress report (Paddy Boylan):** SeaMonitor is an EU INTERREG V application which aims to investigate the migration of mobile marine species (Atlantic salmon, sea trout, basking shark and common skate) through the use of acoustic tracking technology on the north coast of the island of Ireland and the west coast of Scotland. The project proposes setting up a network of acoustic receivers in conjunction with two Autonomous Underwater Vehicles (AUV's) (Figure 1). In addition hydrophones would be deployed to investigate cetacean presence / distribution and common seals satellite tagged (on the east coast of Ireland - also potentially used as bioprobes for acoustically tagged fish). A decision on funding is expected in July 2018.
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) continues in preparation of a multi-year satellite/acoustic tagging effort at West Greenland starting in 2018. Field activities in 2017 focused on exploring the feasibility of capturing study animals via trolling with rod and reel. Trolling was conducted for a total of 10 hours, 11 salmon were hooked, and 7 were landed. The landed fish ranged in size from 66-74 cm total length; all within the size range for consideration for tagging. Tagging activities will be initiated in 2018 and are expected to continue through 2021 at a minimum. Tagging in 2018 will utilize traditional pop-off satellite tags (PSAT, Microwave Telemetry Inc. X-tags). Tagging in 2019 will utilize traditional pop-off satellite tags (Microwave X-tags) and the new ROAM pop-off satellite tags. Tagging in 2020 and beyond will utilize ROAM PSAT tags only. Opportunities for increased acoustic tagging are being considered. Preliminary funding for the project is expected to come from NOAA, ASF, and the Woods Hole Oceanographic Institute and external funding opportunities will also be pursued. Discussions with potential collaborators with interests in European origin salmon, other species that also utilize the coast of Greenland and or the Labrador Sea, and other researchers interested in acoustic telemetry methods in the Labrador Sea are continuing.

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 remains 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.

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 further application, under the same funding mechanism, for a third project was made and approved in late 2017. 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 was initiated on January 1 2017, involving partners from Northern Ireland, England, Ireland, Spain and Denmark. The purpose of the project is to determine the mortality of salmon smolts/postsmolts during their migration through the lower parts of rivers, estuaries/fjords, and nearshore areas through case studies using telemetry in rivers of five areas: Denmark, England, Ireland, Northern Ireland and Spain. Additionally, mortality of kelts migrating on the same route will also be investigated in Denmark. Salmon will be tagged with acoustic transmitters and their subsequent migration will be followed via acoustic listening stations. This will provide novel data on lower-river and estuarine/coastal behavior and mortality, as well as to evaluate the method's applicability in a broader context. Beside the scientific aims, the project is intended to bring together a group of experts to provide advice on best practices and SOP for this type of studies.

    The project tagging has now been completed including the second season that was enabled due to the good central purchase agreement made on Telemetry equipment. A second workshop was held in Pontevedra, Spain in March 2018, where the progress was evaluated and Standard Operating Procedures (SOP) updated. All partners managed to tag the necessary fish. At all places there is a loss of smolt during the initial migration through the lower river and estuary. The specific regions differ, with some having the largest mortality in Freshwater, while others have the largest loss in the estuary (Table 1). Predation is suspected to be the main reason.

	Tagged	Lost FW (%)	Lost Estuary (%)	Survived (%)
Ulla, Spain	100	92	3	5
Minho, Spain	50	44	2	54
Bush, Northern Ireland	99	62	13	62
Eeriff, Ireland	40	70	0	30
Tamar, England	100	29	13	58
Skjern, Denmark	265	25	33	42

The results are being processed, but some site specific papers are expected to be produced, as well as an overall paper on the results.

Comparing mortality of European salmon populations at sea using multiple -method telemetry studies

12. *Summary:* The Smoltrack II project was initiated on January 1 2018, involving partners from Northern Ireland, England, Ireland, Spain, Sweden and Denmark. The project aims to expand the platform and collaboration of Smoltrack I by including more partners (Sweden is included now, taking the total number of study sites to eight). The geographical span of the project now ranges over all of the salmon distribution area in the EU from north to south and east to west. The project specifically aims to identify specific predators causing the documented loss of smolts from the Smoltrack I project and make comparisons between survival of wild and hatchery-reared salmon smolts. Blood sampling will be used to evaluate smolt quality and sex as they exit rivers to test if gender and physiological background affects the chance of survival. Lastly, the project will do a pilot study to test the feasibility to tag genetically assigned large salmon at the Faroe Islands or Greenland and track the return migration.

Total project cost (including in-kind contributions): €539,000

EU contribution to the IASRB: €260,000

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

13. *Progress to date:* The first project tagging (smolts) in 2018 has been completed. The data are not yet finally compiled (Automatic listening station and manual tracking has to be completed first). A workshop was held in Pontevedra, Spain in March 2018 (in prolongation of the Smoltrack I workshop), where studies and analysis were discussed and agreed and the Standard Operating Procedures for Smoltrack I were adapted for the present project, including procedures for bloodsampling and genetic analyses. The pilot study on salmon at sea is still in the planning phase and awaits discussion with North American colleagues in mid-June 2018.

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

14. *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. n 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

15. *Progress to date:* A project workshop took place in Dublin on March 2nd 2017. Partners gave an overview of the use of sentinel cages for monitoring sea lice distribution in Norway and Scotland and possible sampling strategies were discussed. Discussion took place on hydrodynamic model development and the "Dispersal Model for Sea Lice" used in Norway was discussed. The model estimates abundance and distribution of infective salmon lice copepodids with a high resolution in time and space. It uses real values of current, temperature, salinity from numerical current models. Coastal, wind and freshwater runoff models feed into a fjord model and the pathogen model is generated based on hatched eggs (farmed fish only), vertical behaviour, development / growth and mortality. Uncertainties in the model include hatching success (mortality) and no. of eggs in egg strings, reported lice counts and sources of lice from wild fish. Results of the model are validated from field observations.

    An overview of sea lice hydrodynamic modelling in Scotland (POLCOMS hydrodynamic modelling) was also presented. The hydrodynamic model is based on surface currents and tracking of biological particles informed by knowledge of sea lice biology and behaviour (this has been validated against historic datasets). Additional overview was given on the Scottish Shelf Model (FVCOM) which is climate-based integrated with passive particle tracking (four seasons, model yet to be fully validated). This model shows connectivity of lice emanating from aquaculture installations over substantial areas of the Scottish coast. It was stated that POLCOMS is more relevant to the present project.

    Data requirements for the development of an Irish model was also discussed. An EFDC model will be used for Ireland (*c*. 70 m resolution). Data on bathymetry; tides; horizontal currents (will be monitored under sentinel cages); vertical current structure; determination of haloclines and thermoclines; and salinity/ temperature structure will be collected. Quantification of river inflows (salinity and temperature etc.; diffuse runoff) will also be undertaken. Temperature and salinity sensors will be deployed in the study area, Killary Harbour. Accounting for significance of upwelling / down-welling was discussed. Initial horizontal and spatial distributions of lice and data on life cycle durations and characteristics are required. Data on mortality effects, light, temperature, salinity, density, current speed, vertical migration etc. as well as data on mortality and decay rates are required.

    Based on the workshop discussions, the sampling strategy for use of bag nets and sentinel cages to provide data for model development was finalised. Discussions also progressed on development of a standard model that can be used with any hydrodynamic model of local currents to generate sea lice dispersal patterns.

Scottish type sentinel cage used in Killary harbor

Deploying sentinel cages in Killary harbour

16. The funding provided by the European Commission of approximately €800,000 is very much appreciated and has contributed to projects costing approximately €2 million in total being implemented.

Inventory of research

17. The inventory of research relating to salmon mortality at sea, SAG(18)02, includes 22 ongoing projects related to the migratory behaviour of individual fish (C16, C18, C25, C27, C29, C30, C31, C32, C33, De4, De5, De7, Ir12, Ir13, Ir14, Ni4, N18, U4, U5, U10, U13, U16). One new project involving tracking individual fish has been included since last year as follows:

De7: SMOLTRACK – Exploring the mortality of smolts and post-smolts during their migration through the lower rivers, estuaries/fiords and near-shore areas.

In summary

18. 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.

19. 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 one new telemetry study has been initiated since last year. The NASCO / IASRB have now successfully applied for EU funding to support three projects related to mortality of salmon at sea. 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. 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
6 June 2018