



**International Atlantic Salmon Research Board**

***Report of the Twenty-First Annual Meeting of the  
International Atlantic Salmon Research Board***

**ICR(22)15**

**(Duplicated as  
CNL(22)10)**

***Report of the Twenty-First Annual Meeting of the International Atlantic  
Salmon Research Board***

***Dalmahoy Hotel & Country Club, Edinburgh, Scotland***

***5 & 7 June 2022***

**1. Opening of the Meeting**

- 1.1 The Chair, Martha Robertson (Canada), opened the meeting and welcomed members of the International Atlantic Salmon Research Board (the Board), their scientific advisers and observers to the Twenty-First Annual Meeting of the Board. She noted that this was the first time the Board had met in a face-to-face format in three years and the first time the Board had held a hybrid meeting. She noted that the representative from the Russian Federation was joining the meeting through the virtual platform.
- 1.2 The member for the United Kingdom (UK) acknowledged that the UK Government stands united with their international partners in condemning the Russian Government's actions in Ukraine. She referred to a full statement on the situation which will be read by the Head of the UK Delegation at the Opening Session of the Council of NASCO. She asked for this Statement to be included in the report of this Board Meeting. This statement is contained in Annex 1.
- 1.3 A representative of the European Union (EU) referred to a statement to be made by the EU at the Opening of the Council Meeting and asked for this to be included in the report of this Board meeting. This is contained in Annex 2.
- 1.4 The member for Norway requested that the Norwegian Opening Statement to Council be annexed to the report of this Board Meeting. This is contained in Annex 3.
- 1.5 The member for the United States noted support for the UK statement and asked for the United States' Opening Statement to Council to be annexed to the report of this Board meeting. This is contained in Annex 4.
- 1.6 The Board member for Canada also noted support for the UK statement and requested that the Canadian Opening Statement to Council be annexed to the report of this Board meeting. This is contained in Annex 5.
- 1.7 The Board member for Denmark (in respect of the Faroe Islands and Greenland) also supported the UK statement and requested that its Opening Statement to Council be annexed to the report of this Board meeting. This statement is contained in Annex 6.
- 1.8 The representative of the Russian Federation stated that the Terms of Reference for the International Atlantic Salmon Research Board and its Scientific Advisory Group have nothing about geopolitics and suggested that paragraphs 1.2 to 1.7 were not included in the Report of the Twenty-First Annual Meeting of the International Atlantic Salmon Research Board.
- 1.9 The Chair asked the other members of the Board for comment on the proposal from the Russian Federation. The Board member for the UK asked that paragraphs 1.1 to 1.7 remain in the Report and no members disagreed. The Chair stated that the Russian

Federation could request that its Opening Statement to Council be annexed to the report of this Board Meeting (Annex 7). The representative of the Russian Federation requested that this be done and reiterated that in order to succeed in addressing the main goals of the Board, the members must respect its tasks and priorities and not let geopolitics become part of its deliberations.

1.10 A list of participants is included in Annex 8.

## **2. Adoption of the Agenda**

2.1 The Board adopted its Agenda, [ICR\(22\)12](#) (Annex 9).

## **3. Review of the 2021 Inventory of Research**

3.1 The Chair noted that at its 2020 Annual Meeting, [CNL\(20\)12](#), the Board agreed changes to the ‘Inventory of Research Relating to Salmon Mortality in the Sea’. The Board had asked the Secretary to engage with the website designer to improve the prominence, searchability and utility of the new Board website and the presentation of the Inventory on that website. It was also agreed that the Secretariat should consider how the utility of the updated website can best be evaluated with the use of hit statistics and related metrics, and that these statistics should be presented annually to the Board to understand the extent to which the Inventory is used. While updated statistics were provided to the Board in 2021, it was not possible at that stage to conduct a meaningful review of the statistics as the updated Inventory was uploaded only a few months in advance of the meeting. The Board agreed to revisit the item in 2022.

3.2 The Secretary referred to the ‘Review of the 2021 Inventory of Research’, [ICR\(22\)04](#), which contained the updated hit statistics. She noted that there were 74 ongoing and 99 completed projects in the Inventory in 2021. Three new projects had been included in the Inventory as follows:

- ‘Is freshwater acidification compromising Atlantic salmon smolts survival at sea in rivers of Eastern Canada?’ (Canada);
- ‘Genetic evidence of farmed straying and introgression in Swedish wild salmon populations’ (European Union – Sweden); and
- ‘Nordic co-operation on salmon health’ (European Union – Sweden, Norway, European Union – Denmark, Denmark (in respect of the Faroe Islands and Greenland) – Faroe Islands and Iceland).

3.3 The Board member for the UK noted that the Board’s Terms of Reference (ToRs) state that the Board should evaluate the Inventory against research needs. She indicated that the UK felt that there is a knowledge gap around the issue of marine bycatch, given that there is only one Inventory entry on this matter, which is completed.

3.4 The Secretary advised the Board that the Secretariat liaises with the Secretariats of other relevant RFMOs on IUU issues which includes bycatch of salmon in other fisheries. Details are also sought on any surveillance operations which may observe bycatch of salmon. Information on this can be found in the Secretary’s Report, [CNL\(22\)06](#). She indicated that information on bycatch may also be reported through the APRs and that ICES has been asked to provide information on bycatch in pelagic fisheries in the past.

3.5 The representative of the NGOs indicated that the Atlantic Salmon Trust had funded a project at University College Dublin which looked at eDNA and how this may help in terms of bycatch. The study looked at herring and salmon flesh. He indicated that

colleagues in Norway are also using that approach and the eDNA probe developed by University College Dublin is being used in the SeaSalar Programme. Finally, the SAMARCH Programme referred to under item 5 below is an EU-funded programme between the UK and France and is giving some very interesting results in terms of sea trout and has some interesting implications for salmon. These are not looking at major offshore pelagic fisheries, but rather inshore intensive fisheries. Meetings were planned with the authorities to discuss these results with a view to consider how this can be tackled in very intensive fisheries.

- 3.6 The Secretariat was requested to ask Board members to update and check the information held in the Inventory relevant to their Party / jurisdiction in November 2022. Board members should return their updates to the Secretariat by 31 December 2022. The Secretariat was asked to post an updated Inventory spreadsheet on the website by the end of January 2023.

#### **4. Report of the Review of the Metadatabase of Salmon Survey Data and Sample Collections of Relevance to Mortality of Salmon at Sea**

- 4.1 The Board had decided previously that it could play an important role with regard to marine salmon survey data and sample co-ordination by establishing a metadatabase of existing datasets and sample collections of relevance to mortality of salmon at sea. This metadatabase was established in 2014. The Board had subsequently agreed that information on archival scale collections should also be included in the metadatabase.
- 4.2 In 2020, the ‘Working Group to Review the SALSEA-Track Programme and the Inventory of Research Relating to Salmon Mortality in the Sea’, [ICR\(20\)07](#), recommended that the metadatabase be reviewed and consideration be given as to whether other areas of the Board’s work require review. The Board agreed to this recommendation and Terms of Reference for the review, [ICR\(21\)15](#), were agreed at the Board’s 2021 Annual Meeting.
- 4.3 The Board member for the United States presented the ‘Report of the Review of the Metadatabase of Salmon Survey Data and Sample Collections of Relevance to Mortality of Salmon at Sea’, [ICR\(22\)03](#).
- 4.4 The Board recognised that the recommendations arising from the review of the metadatabase fell into two main categories: one related to the metadatabase itself; and the other related to other areas of the Board’s work. In relation to the recommendations related to the metadatabase, the Board agreed:
- that the metadatabase should not continue to be maintained. However, the metadatabase webpage should remain on the Board’s website, with caveats related to when it was last updated;
  - a single excel spreadsheet should be provided on the webpage rather than a series of PDF links; and
  - that Parties and jurisdictions be asked, through the Board members, for one final update to the metadatabase in 2022.
- 4.5 The representative of the NGOs indicated that a new salmon data resource has overtaken the need for the metadatabase. He stated that this is now live and has been very active. The link to this can be found through the Missing Salmon Alliance webpage.
- 4.6 The second category of recommendations arising from the review of the metadatabase

related to other areas of the Board's work. The Working Group recommended that the Board may wish to:

- consider its overall vision, scope and purpose;
- assess whether the funding available to the Board is commensurate with its vision, scope and purpose;
- identify the priorities the Parties now have for the Board; and
- consider establishing a process for requesting and reviewing proposals.

4.7 The Chair noted that it would be difficult to give this sufficient time and attention during an Annual Meeting. Therefore, she proposed that an Inter-Sessional Meeting of the Board should be held to deal with these important issues.

4.8 The Board member for the EU indicated that it would be important to conduct a lot of preparatory work in advance of any inter-sessional meeting of the Board and suggested that a smaller sub-group work on this in the first instance. The Board member for Norway supported this intervention.

4.9 The Chair agreed that preparatory work would be very important to move this matter forward.

4.10 The Board agreed that the following steps would be taken:

- a small Working Group comprising the Secretariat, Chair of the Board and SAG Chair would work together to prepare a background paper for the Board on this item. This paper will focus the next steps and information required;
- this paper would be circulated to Board members and the representative of the NGOs with an invitation for them to submit, if they wish, a paper outlining their views related to these questions. The Board anticipated that Board members for each Party would consult with their SAG member to ensure that the SAG's views are taken into account;
- the Working Group would collate the Board members' and NGO representative's views and outline possible ways forward for the Board;
- an inter-sessional meeting of the Board would be held to consider the recommendations relating to the other areas of the Board's work. This would be an in-person meeting with an option to participate virtually. The timing of this meeting should be agreed by the Chair and Secretary, as and when NASCO business allows, preferably in advance of the 2023 Annual Meeting.

## **5. Projects of Interest to the Board and its Work**

5.1 At its 2020 Annual Meeting, the Board agreed to retain an Agenda to allow for updates on projects of interest to the Board and its work. The Chair referred to the document entitled 'Projects of Interest to the Board and its work', [ICR\(22\)07rev](#), which contained updates for 2022 on the ongoing projects which have received funding through the Board. It also contained an update on the SAMARCH project.

5.2 A representative of the North Pacific Anadromous Fish Commission (NPAFC), Mark Saunders, made a presentation on NPAFC's Basin Events to Coastal Impacts (BECI) initiative. This ten-year UN Decade of Ocean Science (UNDOS) endorsed initiative aims to develop an international ocean intelligence system capable of assessing changes and predicting impacts on local ecosystems and communities, using salmon as an

exemplar species. The presentation is available as document [ICR\(22\)10](#) (Annex 10).

- 5.3 In response to a question from the Board member for the United States, Mr Saunders stated that ultimately the BECI initiative will impact management systems. There have been discussions in the Pacific around linking ecosystem models. He indicated that the Atlantis model is one possibility as it has a very strong connections to management decisions in relation to climate change and the results of climate change. The advantage of this ocean modelling is annual to decadal scales. A lot of climate-change modelling is over 30, 40 or even 50-year scenarios, but this would be more active, almost real time information informing forecasts and decisions on seasonal to decadal scales.
- 5.4 The Board member for the United States asked about the on-ground action or mechanisms that are envisaged to move this initiative forward (e.g. workshops, field work, funding initiatives).
- 5.5 Mr Saunders stated that the NPAFC is in the process of developing its high-level science plan. It held a series of small workshops looking at the modelling and technology required to make the link between the animals and the models. He indicated that it would involve a combination of field programmes coupled with the modelling. ROAM could complement or be part of this as ocean models need data to ground truth them. The expectation is this will be a near real time system of monitoring coupled to ocean modelling that drives stock assessments. A process should be in place by 2030.
- 5.6 In response to a question from the Board member for the EU, Mr Saunders noted that he hoped to work with larger foundations and agencies and that funding may become available through these. Many people in the Pacific were excited about the ROAM Programme and he thought that, if the field trials were successful, they could look at adapting it to work in the Pacific. If that were possible, he could see the BECI initiative moving forward with a ROAM-focused project with funding from multiple agencies. He indicated that applications for funding will be stronger if they are seen to be on a hemispheric scale.
- 5.7 The Chair referred to 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 UK sought endorsement from the Board on the concept of composing such a baseline.
- 5.8 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.

## **6. A Potential Successor to SALSEA-Track**

- 6.1 At the 2020 Annual Meeting of the Board, [CNL\(20\)12](#), it was agreed that the SALSEA-Track Programme should be closed and that any successor to the SALSEA-Track Programme should have the following attributes:

*‘be problem focused with a clearly defined internationally relevant question, which is not solely developed based on the newest technology available; have clear SMART objectives; have clear timelines; have a clear budget; be at the basin-scale; and have an identified owner / co-ordinator. Additionally, it should address issues such as: data gaps / climate change / commonalities across the jurisdictions / mechanisms for supporting new technologies’.*

- 6.2 The Chair reminded the Board that the Working Group to Review the SALSEA-Track Programme and the Inventory of Research Relating to Salmon Mortality in the Sea,

[ICR\(20\)07](#), had agreed that the ROAM Programme may be an ideal successor to SALSEA-Track and had proposed that Board members canvass colleagues for a potential successor to SALSEA-Track if the ROAM Programme was not deemed a feasible successor. The Board had recognised that the process of considering a new programme could happen alongside developments in the ROAM Programme.

- 6.3 The Board member for the United States presented an update on the ROAM Programme, as contained in document [ICR\(22\)05](#). His presentation is available as document [ICR\(22\)11](#) (Annex 11).
- 6.4 The Board member for Canada noted that the tags referred to are data storage tags (DSTs). These tags need the fish to be recaptured to recover the information from them. She indicated that this may be an issue in Canadian rivers which are very wide and it is, therefore, difficult to block the rivers completely to recapture the fish. She noted that the SMOLTrack projects are using DSTs and asked what the recovery rate was.
- 6.5 The Board member for the United States indicated that he did not have the information for the SMOLTrack projects. He stated that two kinds of tags are expected to be used in the ROAM Programme: smaller archival tags, which could be appropriate for smolt sized fishes and larger pop-off tags (PSAT) which would transmit the data when they pop off thereby removing the need to recover the fish, which could be appropriate for adult salmon. He acknowledged that there may be significant challenges, but if 100 tags were released in a monitored river with a 5% return rate, a small number of tag returns could be expected with full migration details which would be spectacular. In that situation, a small number of tag returns could supply a huge amount of information. He noted that the European projects are very keen on floating DST tags which, due to the currents, have a relatively high recovery rate. However, on the North American side of the Atlantic the currents often push the tags away from land, so DSTs are not viewed as useful given the need to recover the fish to obtain the tag.
- 6.6 The Board member for the EU indicated that the SMOLTrack projects have some index catchments where they have full catch facilities. He recognised that it would be a huge advantage to get the full history of some of the fish. He indicated that everyone is anxious to see this programme developed and help could be provided with the design of the project on the European side.
- 6.7 The Board member for Norway asked how long it would take for the project to be at the stage where the Board can consider taking it forward if the trials this year are successful.
- 6.8 The Board member for the United States stated that it was not certain given the delays so far. He indicated that the Woods Hole Oceanographic Institute (WHOI) currently has the capacity to build sound sources and advise on deployment. It is working with two commercial organizations on integrating ROAM tags into their area of expertise: with InnovaSea to produce the small archival tags; and with Wildlife Computers to produce the larger PSATs. At this point he is not sure what the Board could do to move it forwards, as next steps would be heavily reliant on the results of the field trials that are planned for summer / fall 2022.
- 6.9 The Board member for Norway asked whether it would be possible for the Board to make a decision on this next year if the field trials are successful.
- 6.10 The Board member for the United States said that this would depend on the Board's comfort zone. He stated that WHOI is pursuing the field trials and is expecting to move forward with deploying the technology in support of other ongoing projects. The

decision from the Board on how to move forward could come after reviewing the upcoming field trials or could wait further to view results from future field trials or application.

- 6.11 The representative of the EU asked what this would look like at a basin level, as the network would need to be maintained and could be used for a variety of species, not just salmon.
- 6.12 The Board member for the United States outlined a hypothetical scenario where the Board secured the funding and resources to build the network and deploy the sound sources required. If the network were available, individuals could then buy and deploy their own tags. Data recovery would be dependent on archive tag recovery or data transmission from a PSAT. The network could be operated for upwards of 10 years with no maintenance required. After those 10 years, the sound sources could be abandoned or, if planned prior, could be serviced and re-deployed.
- 6.13 In response to a question from the Board member for Norway, the Board member for the United States indicated that, at present, the tags are being made in a small laboratory at the University of Rhode Island. In future, they are expected to be made by commercial vendors who will have improved production methods and quality controls. He indicated that there are no final numbers, but they are likely to be similar, but not less than, current costs for acoustic and pop-off tags, i.e. in the region of US\$200 – 300 for the acoustic tags and around US\$4,000 for the pop-off tags.
- 6.14 The representative of the NGOs indicated that they are very excited about the ROAM Programme. He stated that four or five projects have come together this year and they are beginning to see a smolt highway off the west coasts of France, Ireland and Scotland. This year, a glider was placed in an area that was identified as producing the largest number of smolts under the SALSEA Programme and began to pick up smolt signals in that area. He suggested that the information gathered from acoustics could provide a very good test area for the ROAM technology and stated that they would be delighted to work together in terms of these areas where they have a lot of advanced information to test a lot of the issues.
- 6.15 The Board member for the United States indicated that InnovaSea has stated in the past a desire to integrate the ROAM technology into their current acoustic tags. He stated that ROAM will not supplant acoustic tags as the technology is not effective in shallow or turbulent waters so acoustics will still be necessary. He noted that adding these ‘known’ location points has the ability to improve the precision of modelling efforts greatly. Acoustic tags provide known points so a combination of both data types would be beneficial.
- 6.16 In response to a question from the Board member for Canada, the Board member for the United States indicated that the tags can remain active for up to two years, which could be an appropriate time period for use on outmigrating smolts.
- 6.17 The Board member for the United States agreed to update the Board on the success of the field trials this year when the results are available.
- 6.18 The Chair reminded the Board that, at its 2021 Annual Meeting, the Board had been asked to consider a project proposal on ‘Developing an International Atlantic Salmon Modelling and Management Initiative’ (ISMIMI). At that meeting, the Board agreed to refer the proposal to its Scientific Advisory Group (SAG) for a technical evaluation and the SAG’s report would be considered inter-sessionally by the Board.

- 6.19 The Board had considered the ‘Report of the SAG’s Technical Evaluation of the ‘Developing an International Atlantic Salmon Modelling and Management Initiative’, [ICR\(22\)02](#), inter-sessionally by correspondence. The correspondence had two components: one relating directly to the ISMMI proposal and one relating to more general issues of the Board’s funding and endorsement of the preparation of research proposals. Many members felt that the Board should not consider funding or endorsing the preparation of research proposals. However, there was no overall consensus in this regard. Therefore, during the period of correspondence it was proposed that this could be discussed during the Annual Meeting under the agenda item ‘A Potential Successor to SALSEA-Track’.
- 6.20 The Board member for Norway indicated that the Board has previously funded the preparation of projects, such as when it received seed funding to develop the SALSEA Programme. He did not feel that the Board should be prevented from doing this again. The Board has also previously endorsed the development of projects without funding them, and this has proved useful to them in getting funding from elsewhere.
- 6.21 The Board member for the EU agreed and stated that the Board’s ToRs refer to soliciting research projects which he understood to mean that it is in the Board’s ToRs to consider this.
- 6.22 The Board member for the UK agreed that the ToRs need to be clarified in this respect.
- 6.23 The representative of the NGOs stated that the idea behind setting up the Board was to allow NASCO to accept contributions. These contributions led to the development of the SALSEA Programme.
- 6.24 The Board member for Canada agreed with the representative of the NGOs. She also noted support for clarifying the ToRs.
- 6.25 The Chair noted that a review of the work of the Board is considered under item 4 of the Agenda. The Board agreed to consider this matter further alongside the recommendations of the metadatabase review.
- 6.26 The Board agreed that the Secretary should continue to seek proposals for a potential successor to SALSEA-Track.

## **7. Finance and Administrative Issues**

- 7.1 The Chair referred to the 2021 Accounts for the International Atlantic Salmon Research Fund, [ICR\(22\)06](#). The decision had been taken not to have the 2021 accounts audited and the Secretary had been asked to prepare income and expenditure statements instead.
- 7.2 The Secretary reminded the Board that most of the funds in the accounts were ring-fenced for various projects. She noted that the remaining balance in the sterling accounts was approximately £5,500. The Board had previously indicated that it wished to retain a reserve of £4,000 - £5,000.
- 7.3 The Board agreed to accept the 2021 accounts.
- 7.4 The Chair reminded the Board that, at its 2006 Annual Meeting, it 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 funds 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.



7.5 The Board agreed not to have its 2022 accounts audited. The Secretary was asked to provide income and expenditure statements for consideration at the 2023 Annual Meeting.

## **8. Other Business**

8.1 The Board member for the EU advised the Board of a freshwater project that had been initiated following the 2017 NASCO Theme-based Special Session on the risks and benefits of hatchery and stocking activities. A presentation had been given at that session by Kyle Young on the translocation of emerging salmon fry into less populated areas of the catchment through electro-fishing. EU – Ireland has conducted research on this that has shown benefits. A paper will be published shortly and a short report will be circulated to NASCO.

8.2 The representative of the NGOs referred to a new international PIT tag database for Atlantic salmon and sea trout. Working alongside colleagues from the Institute of Marine Research in Norway, the Missing Salmon Alliance (MSA) has developed a new searchable data resource for PIT tags being deployed for salmon and trout research. This would allow salmon PIT tags captured in bycatch to be identified and the information relayed back to the individuals who tagged the fish. He invited participants at the meeting to access the [database](#) and discuss it further if interested.

8.3 In response to a question from the Board member for the UK, the representative of the NGOs advised that the database has been compiled with ICES and the data from the ICES compilation of PIT tags is included in the MSA database.

8.4 The Board member for the UK suggested that it would be useful to put out a single call to data providers. Marine Scotland Science puts out a call to the Trusts and biologists in Scotland and offered to look into passing that on to the MSA database.

8.5 The representative of the NGOs agreed that this would be very useful.

## **9. Report of the Meeting**

9.1 The Board agreed the Report of its Meeting.

## **10. Date and Place of the Next Meeting**

10.1 The Board agreed that, schedule permitting, two sessions would be allocated to the Twenty-Second Annual Meeting of the Board.

10.2 The Board agreed to hold its next Annual Meeting in conjunction with the Fortieth Annual Meeting of NASCO during 6 – 9 June 2023.

## **11. Close of the Meeting**

11.1 In closing the meeting, the Chair thanked participants for their contributions, noting how great it was to be back at an in-person meeting.

### ***Opening Statement to Council Submitted by the United Kingdom***

Mr. President, Mrs Secretary, Distinguished Delegates, Observers, Ladies and Gentlemen.

First the UK Delegation must recognise the current situation in Ukraine.

Russia's assault on Ukraine is an unprovoked, premeditated attack against a sovereign democratic state. The UK and our international partners stand united in condemning then Russian government's reprehensible actions, which are an egregious violation of international law and the UN Charter. As a Permanent Member of the UN Security Council, Russia has a particular responsibility to uphold international peace and security. Instead, it is violating the borders of another country and its actions are causing widespread suffering.

The Russian Government has shown that it was never serious about engaging in diplomacy – it has deliberately worked to mislead the world, in order to mask its carefully planned aggression. As the UN Secretary-General has said, such unilateral measures conflict directly with the United Nations Charter - the use of force by one country against another is the repudiation of the principles that every country has committed to uphold.

Russia must urgently de-escalate and withdraw its troops. It must be held accountable and stop undermining democracy, global stability, and international law.

It is, however, imperative that we do not let the Russian Governments' actions overshadow the opportunities the 39<sup>th</sup> Annual Meeting provides for exploring further actions to mitigate the decline of Atlantic salmon stocks. The UK is thankful to be in attendance at this face to face meeting and is very much looking forward to working with those present here today. We hope for a successful meeting driven by collaboration and open discussion.

Despite the implementation of several important management measures to support conservation and stock rebuilding, as well as major reductions in fisheries exploitation, both across the UK and the entire range, salmon numbers have continued to decline significantly over recent decades. Therefore, the UK recognises the importance of shared responsibilities in safeguarding salmon stocks within the convention area, and the need for all parties to work together constructively to ensure we leave this iconic species in a better state than we found it, for the future generations.

Already this year the West Greenland Commission (WGC) have held important intersessional meetings to develop a vital draft regulatory measure for the mixed stock fishery at West Greenland. We would like to thank DFG for their open-ness and collaboration in drawing up a draft measure, which we look forward to developing further throughout the meetings this week. It is important to note that we remain keenly aware that the ICES catch advice continues to be that there are no catching options and that we have seen significant overfishing in recent years. Against this challenging backdrop the UK seeks to continue working collaboratively with DFG and other members of the West Greenland Commission to find a way forward which balances improved protection for salmon with respecting Greenland's cultural heritage.

The UK welcomes this year's Themed Based Special Session on the *Report from the Tromsø Symposium on the Recommendations to Address Future Management Challenges*, and we look forward to agreeing how best to build on these important recommendations.

Furthermore, the opportunity to discuss the development of Implementation Plans and Annual Reports will highlight our firm and ongoing commitment to addressing management challenges within our jurisdiction. We believe that there is much to be done, and that with time we can as

both a Party and as a collective make progress in addressing the pressures that salmon face today.

The UK firmly believes in the importance of the work carried out by NASCO and all Parties in support of sustainable salmon stocks. We look forward to a productive meeting that will continue to build on the efforts made so far, and to working successfully with all in 2022 and beyond.

Finally the UK would like to thank the secretariat for all their hard work throughout the year and particularly in enabling this face to face meeting to take place.

Thank you.

*Opening Statement to Council submitted by the European Union*

Mr President, Mrs Secretary, Distinguished Delegates, Observers, Ladies and Gentlemen:

The European Union is delighted to participate to the 39<sup>th</sup> Annual Meeting of NASCO in Edinburgh, and we would like to thank the Secretariat for all the hard work that went into the preparation of this physical meeting after two years of pandemic and virtual meetings.

Being this week in Edinburgh will help us to agree on important items that we have ahead of us in the agenda. These include the adoption of a new regulatory measure for the fishery in West Greenland, the implementation of the third Performance Review, the evaluation of Implementation Plans and Annual Progress Reports, the follow-up of the recommendations highlighted by the Tromsø Symposium, and the consideration of how NASCO should conduct its business in the future, among many others.

In this regard, the EU is looking forward to a fruitful cooperation with all the Parties during this physical meeting, and we are looking forward to decide on issues that will reinforce the conservation of wild Atlantic Salmon.

To conclude Mr. President, let me express the European Union and its Member States' full solidarity with Ukraine and the Ukrainian people.

The EU condemns in the strongest possible terms Russia's unprovoked and unjustified act of aggression against Ukraine, which grossly violates international law and the United Nations Charter, and undermines international security and stability.

The EU demands that Russia immediately cease its military actions, withdraw all its troops from the entire territory of Ukraine and fully respect Ukraine's territorial integrity, sovereignty and independence within its internationally recognised borders and abide by UN General Assembly resolution titled "Aggression against Ukraine" supported by 141 states at the 11th emergency special session.

The EU resolutely supports Ukraine's inherent right of self-defence and the Ukrainian armed forces' efforts to defend Ukraine's territorial integrity and population in accordance with Article 51 of the UN Charter.

At all times Russia must respect its obligations under international law, including international humanitarian and human rights law, including with respect to the protection of civilians, women and children.

Russia also needs to stop its disinformation campaign and cyber-attacks.

### *Opening statement to Council submitted by Norway*

Mr. President, distinguished Delegates, Observers, Ladies and Gentlemen. On behalf of Norway, I would like to thank the Secretariat for hosting the Thirty – Ninth Annual Meeting of NASCO in Edinburgh. The Norwegian delegation is pleased to return to a face-to-face NASCO meeting, and we look forward to productive discussions over the next days.

In Norway, the pre-fishery abundance of wild Atlantic salmon remains low, and the 2021 Atlantic salmon run seem to have been at a historic low level. One of the main reasons continues to be reduced survival at sea, but local and regional differences suggest that adverse human impacts strongly influence the development and status of stocks.

The Scientific Advisory Committee for Atlantic Salmon has reclassified the state of the Norwegian Atlantic salmon stocks according to the National Quality Norm for Wild Salmon, using data from the period 2015-2019. Only 21% of the populations were found to be in a good or very good state while 38 % of the populations are in a poor or very poor state. Escaped farmed salmon and salmon lice infections related to salmon farming remain as the most severe anthropogenic threats to Norwegian wild Atlantic salmon, and the present mitigation measures are insufficient to stabilize and reduce these threats.

The latest report by the Teno Monitoring and Research Group concludes that in 2021 there was not a harvestable surplus in most salmon populations in the Teno system. The forecast for the 2022 salmon run in Teno is low and indicates that this also will be the case this year. In response Finland and Norway have agreed there will be no fishing for salmon in the Teno river system in 2022. As in 2021, a decision is made to close the salmon fisheries in the Teno fjord and in coastal areas in proximity to the Teno fjord.

The occurrence of pink salmon in Norwegian rivers have increased significantly in recent years. Substantial resources were spent trying to capture as much of this alien species as possible to hinder reproduction. In 2021, 150 000 pink salmon and 103 000 Atlantic salmon were caught in Norwegian fjords and rivers. Invasive pink salmon is a new threat, and there is need for national and international measures to reduce the risk of negative impacts on native salmonids. Based on what we have learned so far, along with the historical distribution of the species in its native area, it is possible that pink salmon will colonize all rivers in Norway and rivers in the other countries around the North Atlantic if we fail at controlling the spawning. This will affect native fish species and biodiversity in general.

24 Norwegian salmon rivers are included in the national program for river liming. Salmon catches in limed rivers have increased from about 10 tons in the 1980s to 40 - 60 tons today, and at present this makes up for 10-14 % of total salmon catches in Norwegian rivers.

Of a total of 51 infected rivers by *Gyrodactylus salaris*, 39 are treated and the parasite is successfully eradicated. If all the eradication measures implemented are successful, the number of infected rivers in Norway will be reduced to eight. After several years of testing, a new method for combating *G. salaris* is now ready for use. The use of monochloramine at very low concentrations can remove the parasite from salmon fry within a few days without having negative effects on the fish. This method will be used for combatting of *G. salaris* in two of the four infected rivers in the Driva region in 2022 and 2023.

Norway strongly condemns Russia's war against Ukraine. We demand that Russia stops its aggression and withdraws its troops immediately.

Russia's invasion of Ukraine has changed European security policy and has far-reaching consequences for our bilateral relations with Russia.

It's important with unity between allies and close partners in the reaction against Russian aggression and brutality in Ukraine. We stand together with the EU and other countries to ensure that the sanctions are strong and effective.

In closing, the Norwegian delegation would like to thank the Secretariat for its efforts in all the preparations for this meeting under still quite extraordinary conditions, and we look forward to a productive and successful meeting.

*Opening Statement to Council Submitted by the United States*

Mr. President, Madam Secretary, Distinguished Delegates, Observers, Ladies and Gentlemen:

The United States is very pleased to participate in the 39th Annual Meeting of NASCO. We sincerely thank the NASCO Secretariat for their hard work in preparing for the first in-person Annual Meeting in three years. It is particularly fitting that this meeting is being held near the beautiful city of Edinburgh. A true homecoming, indeed. We have an extensive set of issues before us this week, and we are so pleased that we will be able to be together in person once again with all of our colleagues to complete our work successfully. As always, we count on the strong commitment of all Parties to ensure wild Atlantic salmon are effectively conserved and managed across the North Atlantic.

As we begin our meeting today, Mr. President, we simply cannot move on to the normal business of this organization without reiterating the U.S. position with regard to Russian aggression in Ukraine, as follows:

- Russia's initial invasion and ongoing war against Ukraine is unprovoked and unjustified. President Putin has waged a brutal war that has rendered catastrophic loss of life and human suffering in Ukraine, as well as extensive environmental damage and destruction that will extend far beyond Ukraine's borders. Russia alone is responsible for the death and destruction that this invasion continues to bring, and the world must hold Russia accountable.
- Russia's actions constitute a clear violation of Article 2(4) of the United Nations Charter, which states that all member States shall refrain in their international relations from the threat or use of force against the territorial integrity or political independence of any State.
- The U.S. Delegation stands in solidarity with its like-minded allies and partners in NASCO and the international community more generally to condemn Russia's actions in the strongest possible terms.
- We also join our partners in urgently calling on Russia to immediately cease its use of force against Ukraine, refrain from any further unlawful threat or use of force against any UN member State, and immediately withdraw all of its military forces from the territory of Ukraine within its internationally recognized borders.

While Russia's egregious actions in Ukraine are reprehensible, we cannot and should not allow this heinous situation to derail the important work of this organization. As in past years, the United States is keenly interested in addressing threats to critically endangered U.S. origin Atlantic salmon. Mixed-stock fisheries that intercept U.S.-origin salmon are of particular concern. Numbers of U.S.-origin salmon returning to home waters continue to decline. Estimated adult returns to U.S. rivers in 2021 were 676 fish. This is below both the previous 5 and 10-year mean returns (1156 and 890, respectively) and the lowest since 2014 (379). Our populations are well below recovery goals. This is a dire situation, and every fish counts. Any U.S. fish harvested in a mixed stock interceptory fishery has an outsized impact on these critically endangered populations. We take very seriously the scientific advice from ICES that continues to recommend against the prosecution of fisheries that would intercept these and other depleted populations.

A focus for the United States during the 2022 Annual Meeting will be to work collaboratively with the members of the West Greenland Commission to develop a regulatory measure that

balances the need to protect particularly vulnerable Atlantic salmon stocks that contribute to the fishery while still allowing for a small internal use fishery. We hope the WGC will be more successful than it was last year. In 2021, after extensive discussions, agreement could only be reached on a one-year interim regulatory measure. So far, the United States is cautiously optimistic that a new regulatory measure for the 2022 fishing season will provide the basis for a new agreement this year. In addition to the fishery at West Greenland, we look forward to continuing our engagement with Canada and France (in respect to St. Pierre et Miquelon) on monitoring and control of the Labrador and St. Pierre and Miquelon mixed-stock fisheries. The renewed interception of a few U.S. origin salmon in the Labrador fishery will require special attention by the North American Commission this year.

Finally, we look forward to productive discussions surrounding a number of other important issues, including the proposed considerations for alternative ways of doing business, the Recommendations from the Tromsø Symposium, matters related to the third performance review, clarifications of the staff rules and staff fund rules, and the issues surrounding the Implementation Plan and Annual Progress Report process, including the special sessions.

In closing, I want to reaffirm that the United States is fully committed to NASCO and to working cooperatively and collaboratively with our international partners to successfully address the important issues facing us this week and into the future.

Thank you.



*Opening Statement to Council submitted by Canada*

Mr. President, Distinguished Delegates, and Observers:

The Canadian delegation is pleased to return to a face-to-face meeting this year. We want to give special thanks to the NASCO Secretariat for organizing the meeting in Edinburgh, Scotland, and the unwavering support provided on various NASCO business throughout the year.

One of the highlights for Canada in 2021 was the positive review of our latest Implementation Plan. We greatly appreciate the recognition of our ongoing efforts to meet the objective of the NASCO Convention regarding the conservation and management of Atlantic salmon. Canada is committed to remaining transparent, accountable, and rational, as we progress in the implementation of targeted actions to conserve wild Atlantic salmon over the coming year. In doing so, we are keen to advocate for Indigenous peoples to have a more formalized role at NASCO, as we believe we can greatly benefit from their vast knowledge of this species.

Following on last year's disappointing outcome in the negotiation of a regulatory measure for the West Greenland salmon fishery, Canada remains hopeful that Denmark (in respect of the Faroes Islands and Greenland) will be able to concretely demonstrate their willingness and capacity to control the level of harvest and repeated overharvest in the new negotiated regulatory measure. Canada firmly believes that increased conservation efforts are still needed to reverse declining trends across the range of Atlantic salmon stocks, including reducing harvest to sustainable levels.

As always, we look forward to continuing discussions with the U.S. and France (in respect of St. Pierre and Miquelon) on the effective management, monitoring, and control of the mixed-stock fisheries in Labrador and St. Pierre and Miquelon. We continue to encourage France (in respect of St. Pierre and Miquelon) to strive to implement a comprehensive approach to the management of Atlantic salmon, in accordance with the objectives of NASCO.

The Russian Federation's attendance at the meeting this week serves as a reminder of President Putin's unjustifiable and unprovoked invasion of Ukraine. NASCO is based on a multilateral commitment to common goals to be achieved through discussion, good-faith negotiation, and compromise. We look forward to working in that spirit over the next four days, as members of NASCO focus their efforts on the many important discussions. We will continue to be mindful of the ongoing, blatant attack on these principles currently being waged by Russia on Ukraine and its people.

In conclusion, we would like to reiterate how grateful we are for the opportunity to collaborate with the Parties face to face in the coming days, and trust that we will have constructive discussions that will prove beneficial for all involved. We hope to welcome you all to Canada next year for the 40<sup>th</sup> Annual Meeting.

Thank you.

***Opening Statement to Council submitted by Denmark (in respect of the Faroe Islands and Greenland)***

Mr. President, Ms. Secretary, distinguished Delegates, Observers, Ladies and Gentlemen,

The Faroe Islands and Greenland would like to thank the Scottish authorities for their hospitality and the NASCO Secretariat for their persistent work, under ever so fast changing circumstances, on making the Annual Meeting possible as a face-to-face meeting for the first time in three years, and with a hybrid solution for the first time ever.

The Greenlandic delegation is pleased to be able to attend to the first face-to-face Annual Meeting in three years.

As we begin the NASCO Annual Meeting today, Mr. President, the Governments of the Faroe Islands and Greenland is compelled to make the following statement on our position regarding the Russian aggression in Ukraine:

Denmark in respect of the Faroe Islands and Greenland (DFG) condemns in the strongest possible terms the Russian Federation's war of aggression against Ukraine. We want to express our full solidarity with Ukraine and the Ukrainian people. We stand in solidarity with our like-minded partners in the international community and support all measures to ensure truth, justice and accountability for violations of international humanitarian law and human rights in Ukraine.

We appreciate the engagement of NASCO members to continue the important work on conserving and restoring wild Atlantic salmon. Nature does not go into quarantine under any circumstances, and so, effort must be made at all times in order to keep up with population dynamics. Greenland's commitment to the NASCO objectives has taken form as a management plan along with law enforcement and multiple new measures during the past few years. Since the introduction of a license system in 2018, many short notice changes has been made in the management of the small scale fishery, and hopefully, multiyear measures will bring stability to this small subsistence fishery, with such profound cultural importance for the Greenlandic people, an indigenous peoples.

Sadly, return rates are declining while salmon farming is increasing. Restoration cannot continue until significant steps are taken in the rivers of origin. The stock cannot survive without completely restored habitats and spawning areas.

As stated in previous years, we empathize the importance of focusing on the external factors that affect the Atlantic salmon stocks such as migratory obstacles, predation, effects of aquaculture, pollution and climate change. Thus, Greenland and the Faroe Islands urge NASCO and States of Origin to increase focus on how to address these local factors that are negatively impacting the stocks.

If in NASCO we aim to conserve and restore a wild Atlantic salmon, this organization has to point out all threats to the population and accordingly act on all threats to the population.

The latest ICES advice states that: *“Despite major changes in fisheries management in the past few decades and increasingly more restrictive fisheries measures, returns have remained low compared to historical levels. It is likely, therefore, that other factors besides fisheries are constraining production.”*

Thus, it must be of the greatest interest to NASCO to accordingly allocate time and remedies on main causes.

Salmon habitats can be restored with immediate effect on the population. Denmark has shown the way by taking all necessary measures at once. Let us focus on what works and learn from success stories. Let us focus on progress.

Mr. President, it is our hope that all NASCO members will contribute to improve conditions for the Atlantic Salmon population by taking responsibility for our own respective areas and actions.

Greenland looks forward to a week of productive discussions.

Thank you.

***Opening Statement to Council Submitted by the Russian Federation***

Mr President, distinguished Delegates, Observers, Ladies and Gentlemen.

On behalf of the Russian delegation and the Federal Agency for Fisheries, which represents the Government of the Russian Federation in NASCO, I am pleased to greet all participants of the Thirty-Ninth Annual Meeting of NASCO.

Russia, guided by agreements and resolutions of NASCO, has done much for conservation of wild Atlantic salmon. As a result of many years of work, commercial salmon fisheries are now prohibited in most rivers, and coastal fisheries remain at minimal levels and in the White Sea only, they represent a traditional type of fishing by residents of coastal communities. At the same time, recreational fishery, and especially catch-and-release fishing, demonstrated great development and was supported by the state, which helped to not only preserve many salmon populations, but also to bring them quite close to pristine state. Many salmon rivers of the Russian North, abundant with salmon, such as Belousikha, Rynda, Kharlovka, Ponoï, Varzuga have become world famous and attractive fishing destinations for both Russian and foreign anglers. In 2022, despite the known restrictions on air travel, the number of bookings has increased even compared to pre-Covid times. We are pleased that many anglers who plan to visit Russian salmon rivers this year will come from other countries.

As in previous years, we are very pleased to work together with other Contracting Parties for conservation of Atlantic salmon, an iconic species in the northern hemisphere. Again, we would like to reiterate the importance of NASCO in uniting efforts to conserve Atlantic salmon for future generations. In the new reality, the Secretariat's work is even more intense and multi-task as probably never before. We are sincerely thankful to the Secretariat for its professionalism! It greatly contributes to the solution of critical problems relating to conservation of Atlantic salmon.

The work of NASCO is regulated by the Convention. In accordance with rule 8 of the Rules of Procedure for the Council "*Unless it decides otherwise, the Council shall not discuss or take a decision on any item which has not been included in the draft agenda for the meeting*". In order to succeed in addressing the main goals of NASCO we must respect its tasks and priorities and not let geopolitics become part of its deliberations.

Thus, the discussion of issues not related to conservation of Atlantic salmon and activities of NASCO looks destructive and inefficient in the light of tasks that need to be addressed by members of the Organization.

On behalf of the Russian delegation, I wish all of us success in working together during this week. My delegation is looking forward to having important and fruitful discussions during this meeting.

***2022 Board Meeting List of Participants***

**Canada**

\*\*Cindy Breau  
Martha Robertson (Chair)  
Julien April  
Charlie Marshall  
Melissa Nevin

**Denmark (In respect of the Faroe Islands and Greenland)**

\*\*Sissel Fredsgaard

**European Union**

\*\*Cathal Gallagher  
Ignacio Granell  
John McCartney  
Michael Millane

**Norway**

\*\*Raoul Bierach  
\*Helge Dyrendal  
Peder Fiske

**Russian Federation**

\*Sergey Prusov (virtual participant). Acting Board member for the 2022 Meeting

**United Kingdom**

\*\*Nora Hanson  
Dennis Ensing

**United States**

\*\*Tim Sheehan  
\*Dan Kircheis

**IGOs**

Mark Saunders (virtual participant)

**NGOs**

Ken Whelan (Nominated NGO Representative)  
Thomas Chrosniak (virtual participant)  
Dave Meerburg  
Nigel Milner

**Secretariat**

Emma Hatfield  
Louise Forero  
Wendy Kenyon

\*\*Nominated Board Member

\*Board Adviser

**ICR(22)12**

***Twenty-First Meeting of the International Atlantic Salmon Research Board***

***Dalmahoy Hotel & Country Club, Edinburgh, Scotland***

***5 & 7 June 2022***

***Agenda***

1. Opening of the Meeting
2. Adoption of the Agenda
3. Review of the 2021 Inventory of Research
4. Report of the Review of the Metadatabase of Salmon Survey Data and Sample Collections of Relevance to Mortality of Salmon at Sea
5. Projects of Interest to the Board and its Work
6. A Potential Successor to SALSEA-Track
7. Finance and Administrative Issues
8. Other Business
9. Report of the Meeting
10. Date and Place of the Next Meeting
11. Close of the Meeting

# BASIN-SCALE EVENTS TO COASTAL IMPACTS: AN OCEAN INTELLIGENCE SYSTEM FOR A CHANGING WORLD

*A UN Decade of Ocean Science Program Proposal by the North Pacific Marine Science Organization (PICES), the North Pacific Anadromous Fish Commission (NPAFC), and partners*

Mark Saunders (NPAFC)  
Presentation to IASRB, 5 June 2022





# UN DECADE OF OCEAN SCIENCE FOR SUSTAINABLE DEVELOPMENT



**2021  
2030** United Nations Decade  
of Ocean Science  
for Sustainable Development



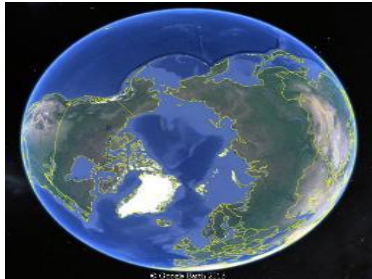
[Basin-scale Events to Coastal Impacts \(BECI\)](#)

An Ocean Intelligence System for a Changing World



**2021  
2030** United Nations Decade  
of Ocean Science  
for Sustainable Development

# UNDOS: Basin Events to Coastal Impacts Program (BECI)



- **Objective:** Develop and implement an international ocean intelligence system of monitoring, research and analytical approaches that provide timely knowledge and advice to decision makers about the impact of current and future climate on ocean conditions in high seas and coastal socio-ecological systems. Salmon will be an exemplar species but a modular approach will ultimately include all species of interest.
- **Lead organizations:** North Pacific Marine Science Organization (PICES)/North Pacific Anadromous Fish Commission
- **Partners (to be confirmed):** Pacific Salmon Foundation, Tula Foundation/Hakai Institute, International Council for the Exploration of the Sea, Pacific Salmon Commission, National Center for Ecosystem Analysis and Synthesis, Long Live the Kings, North Pacific Rim countries/agencies, North Pacific Research Board, and others.
- **Duration:** 2021-2030
- **Organization and Scale:** Proposed as special project in PICES and potential cost for the decade is \$85-\$100M (through in-kind and donations). Phase 0 planning is underway with goal to complete a science plan in the next six months and receive formal approval from PICES.
- **Transformative elements:** basin scale partnership, enhanced monitoring through the use of remote and autonomous technology, coupling of biophysical ocean models, ecosystem models and salmon life history models to inform annual to decadal predictions and projections to support management.



## Basin-scale Events to Coastal Impacts (BECI)

An Ocean Intelligence System for a Changing World



# TRANSFORMATIVE ELEMENTS

- basin scale partnership
- enhanced monitoring of ocean conditions and fish distribution through the use of remote and autonomous technology, tagging and microchemistry.
- data mobilization and synthesis
- coupling of biophysical ocean models with ecosystem models and salmon life history models to inform annual to decadal predictions and projections to support management.



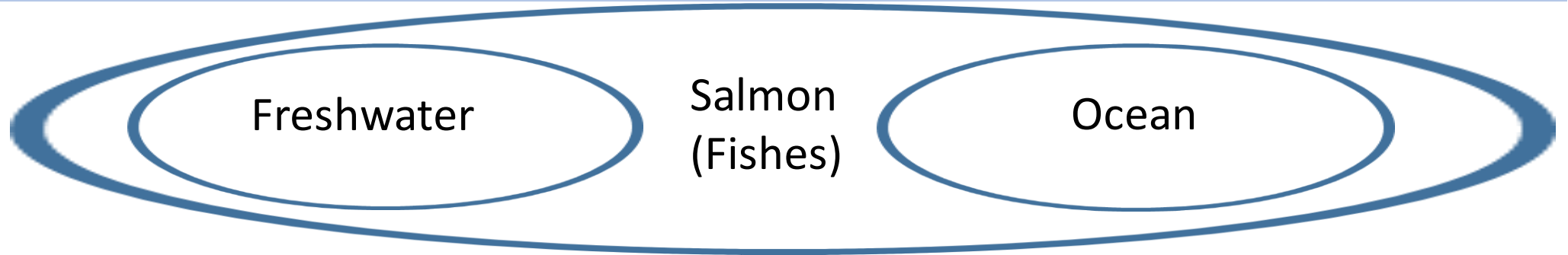
[Basin-scale Events to Coastal Impacts \(BECI\)](#)

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# AN OCEAN INTELLIGENCE SYSTEM

Surveillance



Data Mobilization

Modelling and Research

Decision Support & Communication



Understanding Processes linking ocean conditions to fish production

Connecting climate change to freshwater and ocean impacts on salmon.



Community Impacts - Inclusion - Communication



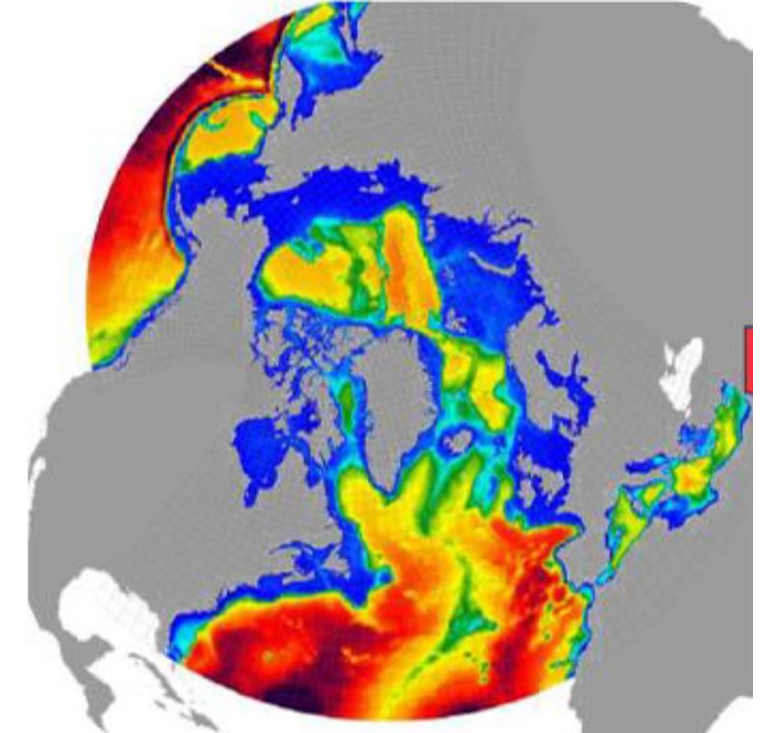
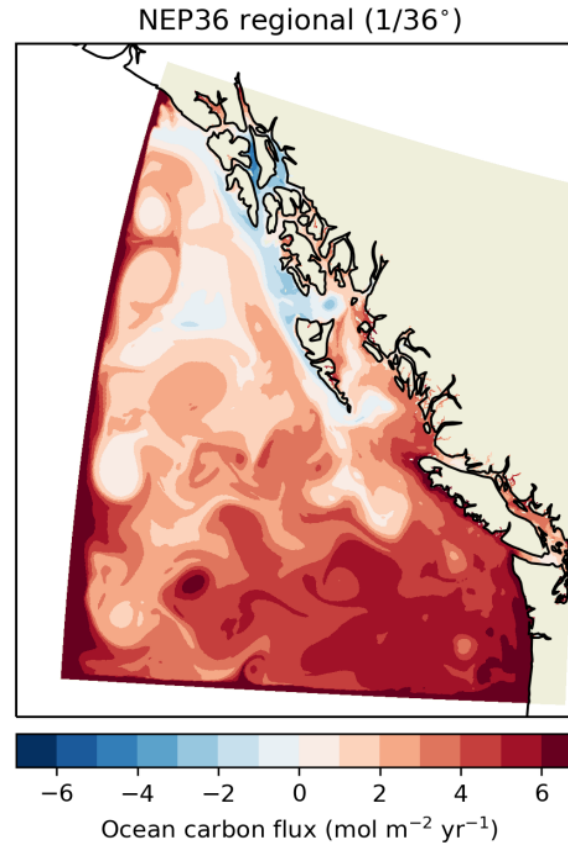
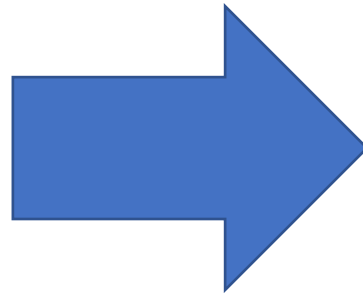
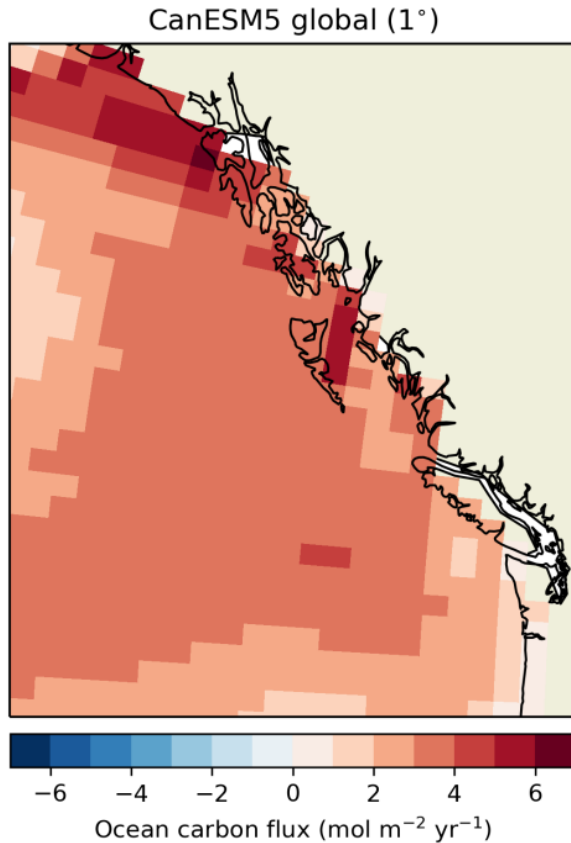
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2021  
2030 United Nations Decade  
of Ocean Science  
for Sustainable Development

# USING OCEAN MODELS TO UNDERSTAND MECHANISMS AND DRIVE PREDICTIONS AND PROJECTIONS



Figures from Neil Swart: Canadian Centre for Climate Modelling and Analysis, Environment and Climate Change Canada.



[Basin-scale Events to Coastal Impacts \(BECI\)](#)

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# BECI TIMELINE

- **BECI Planning Phase 0 Present – September 2022**
  - Establish Interim Project Office. Tula Foundation to provide administrative support for BECI for 6-12 months
  - Develop high level BECI Implementation/Science plan through four workshops
  - Submit plan to PICES for approval as Special Project
- **Phase 1 - Detailed Planning Phase and Initial Implementation - October 2022-October 2023**
- **Phase 2 - BECI Implementation Phase October 2023-December 2030**



[Basin-scale Events to Coastal Impacts \(BECI\)](#)

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# IASRB CONSIDERATIONS

- Endorsement of BECI by the UN DECADE and a strong connection between PICES and ICES in the UN DECADE through their SMARTNet Program makes engagement in BECI by Atlantic partners a ready opportunity.
- The IYS has demonstrated that salmon research and management agencies across the Northern Hemisphere share common problems and can benefit from collaboration. BECI is a significant opportunity to leverage investments by partners across the hemisphere to address the crisis we collectively face with salmon.



[Basin-scale Events to Coastal Impacts \(BECI\)](#)

An Ocean Intelligence System for a Changing World



ICR(22)11



**NOAA**  
**FISHERIES**  
NEFSC

# ROAM Update

for  
NASCO's  
International Atlantic Salmon Research Board

June 5, 2022



# Acknowledgements

Simon Thorrold  
Camrin Braun



Godi Fischer  
Melissa Omand  
Tom Rossby

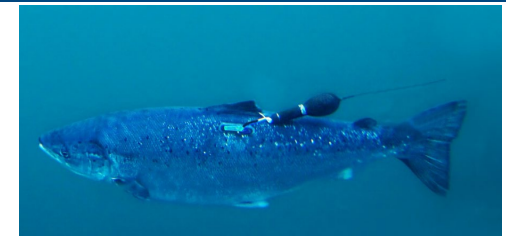


# Electronic tagging technologies

- Have advanced our understanding of the marine ecology for many species
- Two primary tags used for Atlantic salmon:
  - Ultrasonic acoustic tags
    - Since 1994
    - Tag emits a signal that receivers detect and record
  - Pop off Satellite tags (PSAT)
    - Since 2008
    - Geo-positioning from collected data (e.g. temperature, depth, light, magnetic fields)



# Pros and Cons



## Acoustic

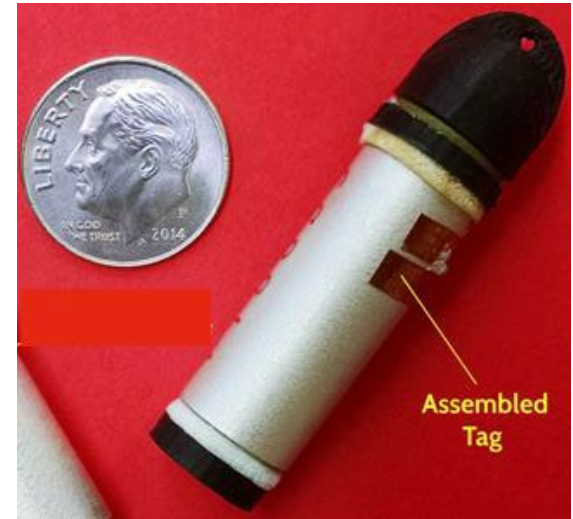
- Small tag size
- Precise locations
- Impacts considered minimal
- Limited tag life
- Small receiver detection radius
- Data from monitored areas
- Monitoring large expansive areas is logistically and economically challenging

## PSAT

- Long-term deployment
- Continuous data collection
- Daily '*precise*' modelled locations
- Large tag size
- Impacts on behaviour
- Behaviour may be incompatible with data requirements
- Sub-set of data informative
- Imprecise location estimates

# ROAM (RAFOS Ocean Acoustic Monitoring) tag

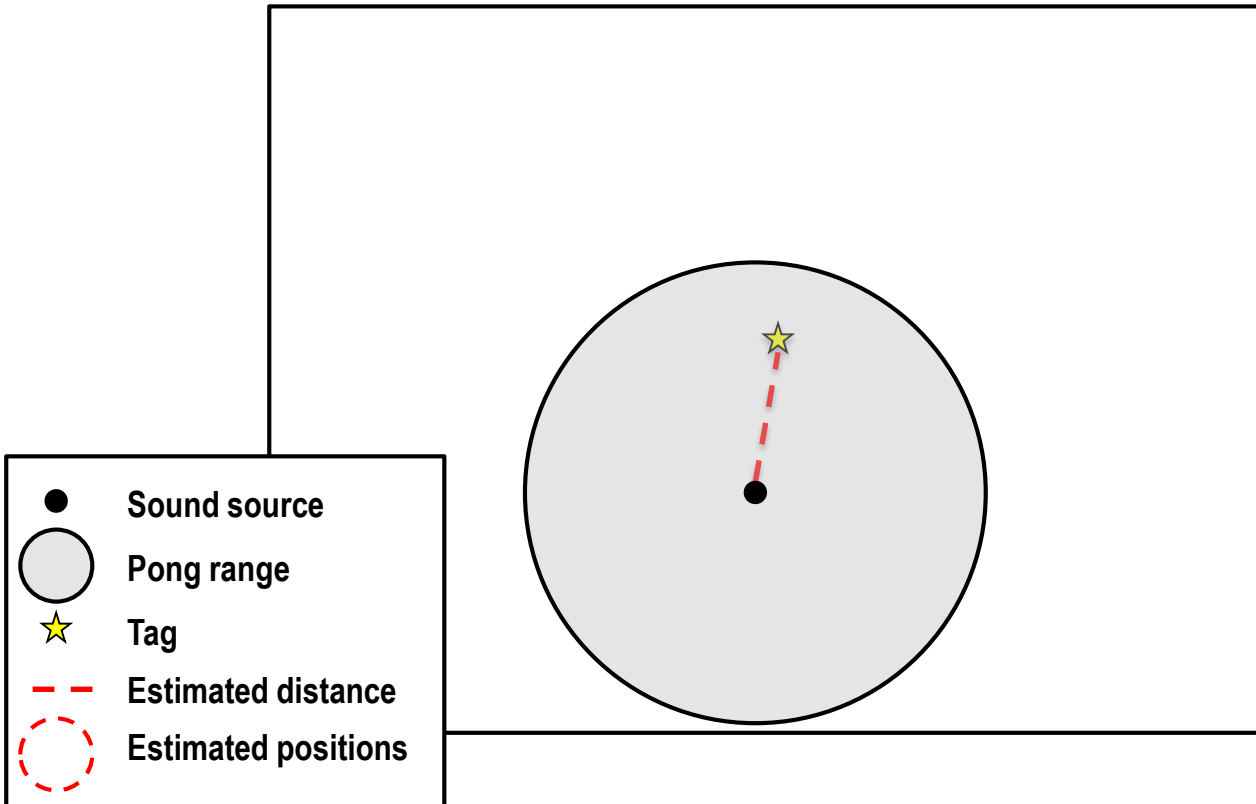
- Evolution of a common oceanographic monitoring tool
  - Modification and miniaturization
- Overview:
  - Moored sound sources
    - 10-year life span
    - Upwards of 1000 km per source
  - Tag is the hydrophone
  - Relatively precise ( $\pm$  few km) geolocation
  - Temperature and depth
  - Archive (*smolt*) and pop-off satellite (*adults and sub-adults*) tags



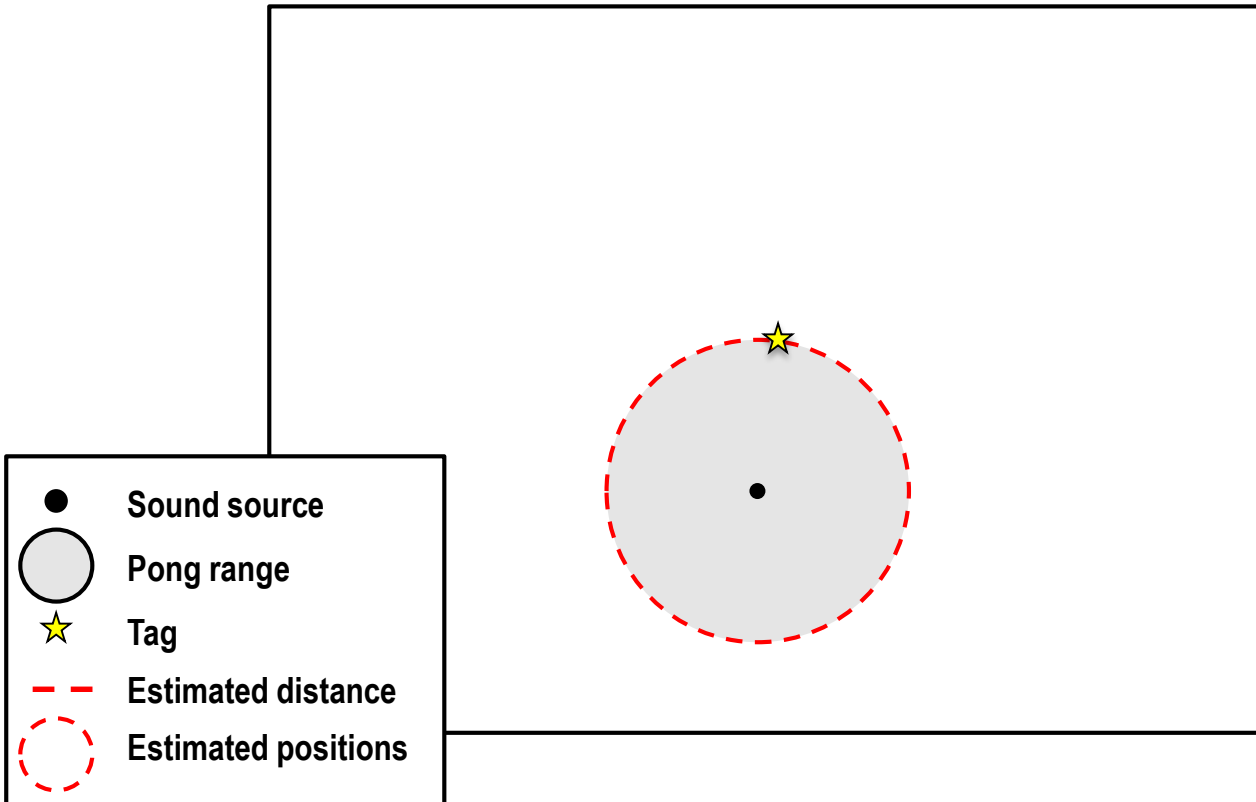
# Sound Source



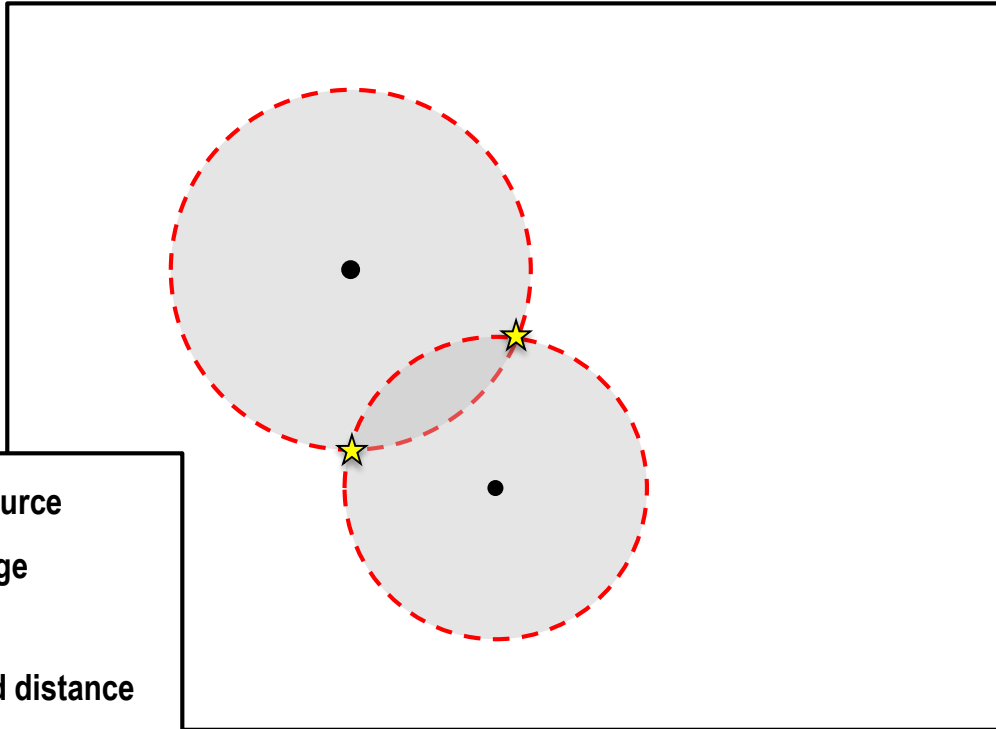
# Single sound source:



# Single sound source: presence/absence



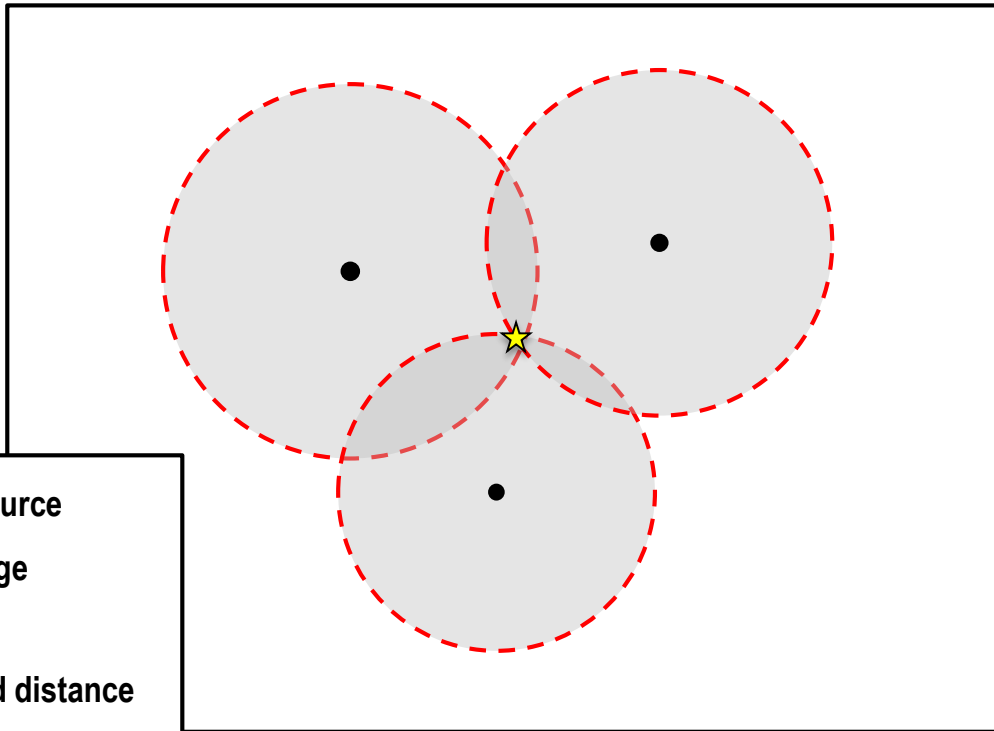
# Two sound sources: two possible locations



- Sound source
- Pong range
- ★ Tag
- - Estimated distance
- Estimated positions



# Three sound sources: one precise location



- Sound source
- Pong range
- ★ Tag
- - - Estimated distance
- Estimated positions

# Timeline

## 2017

- 1<sup>st</sup> presented to IASRB

## 2018

- Bronger and Sheehan (2019)
  - Approach holds promise
  - Challenges/unknowns remain
- Update provided to IASRB
  - Continued support (including £4,000) and interest

## 2019

- 1<sup>st</sup> ROAM 'salmon' sound source
- Field trial cancelled

## 2020

- Field trial scheduled
- Covid

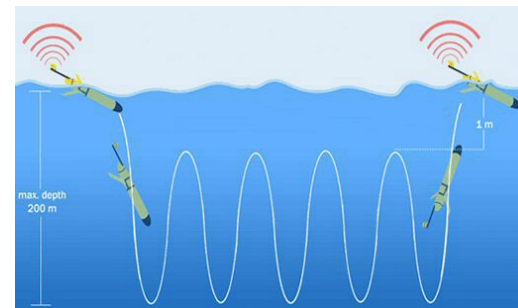
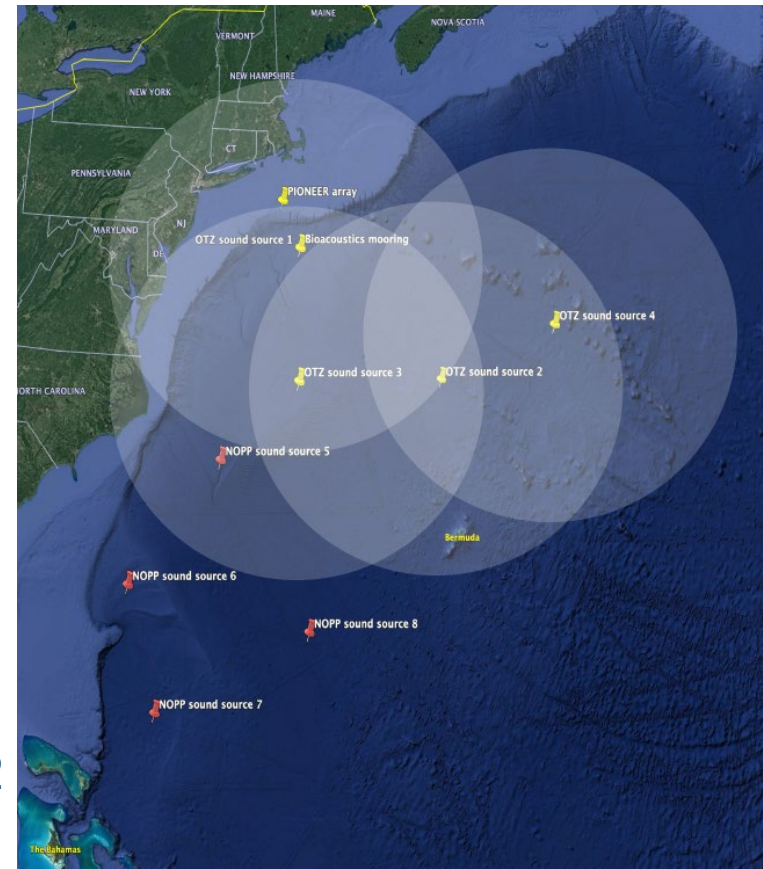
## 2021

- WHOI's Ocean Twilight Zone project
- Tag development progress
- Field trials not possible



# 2022 update

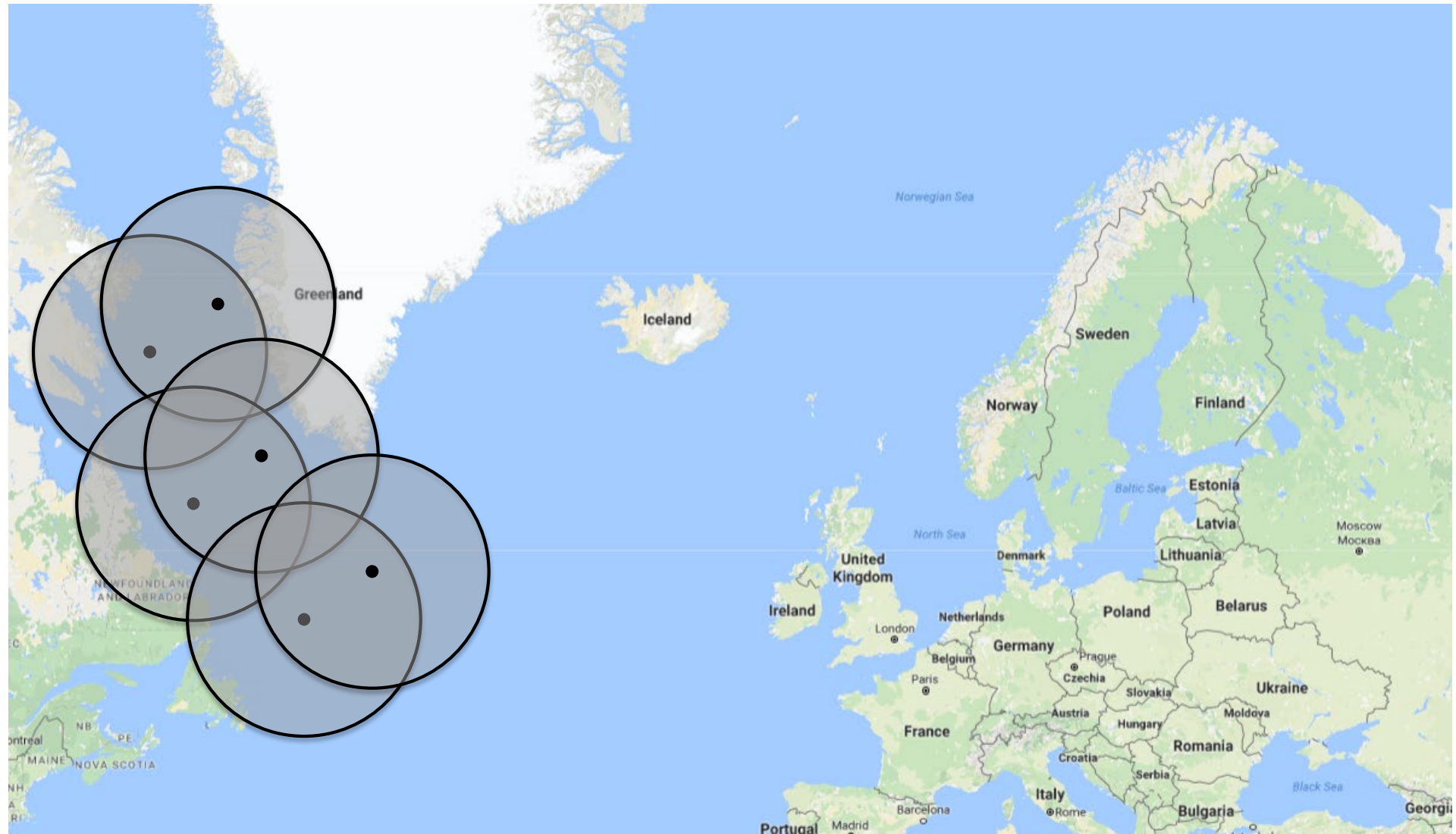
- 2 sound sources deployed
- Multiple *opportunistic* field test during summer 2021
  - Sub-optimal test design
  - Multiple equipment breakdowns
  - 1 semi-successful trial
    - 1<sup>st</sup> open ocean test, 200m depth, 14 of 32 pongs detected at <100 km
    - Geolocation estimates within ~1 km
- Two *dedicated* field trials scheduled for summer 2022
  - Dedicated glider mission (NE US to Bermuda)
  - Large pelagic double tagging
- Multiple funding proposals pursued
  - NW Atlantic and Great Lakes
- Ocean Twilight Zone project
  - ROAM sub-project moving forward



# Summary

- Offers the potential to accurately track further out to sea throughout the marine stage than previously able
  - New use for an old technology
  - Different tag types allow for different research approaches
  - Overall cheaper cost
  - Field testing is needed
- Prime for within and cross-basin multi-species collaborations

# Atlantic Salmon focused study



# Atlantic Salmon focused study

