Proceedings of the national science workshop to review multi-species approaches for aquatic species

Shannan May-McNally, Roanne Collins, Karine Robert, and Lis Hersak

Ecosystems and Oceans Science Sector
National Capital Region
Fish Population Science Branch
Fisheries and Oceans Canada / Government of Canada
200 Kent Street
Ottawa, ON
K1A 0E6

2022

Canadian Manuscript Report of
Fisheries and Aquatic Sciences 3240

Fisheries and Oceans Canada | Pêches et Océans Canada

Canada

Canadian Manuscript Report of Fisheries and Aquatic Sciences

Manuscript reports contain scientific and technical information that contributes to existing knowledge but which deals with national or regional problems. Distribution is restricted to institutions or individuals located in particular regions of Canada. However, no restriction is placed on subject matter, and the series reflects the broad interests and policies of Fisheries and Oceans Canada, namely, fisheries and aquatic sciences.

Manuscript reports may be cited as full publications. The correct citation appears above the abstract of each report. Each report is abstracted in the data base *Aquatic Sciences and Fisheries Abstracts*.

Manuscript reports are produced regionally but are numbered nationally. Requests for individual reports will be filled by the issuing establishment listed on the front cover and title page.

Numbers 1-900 in this series were issued as Manuscript Reports (Biological Series) of the Biological Board of Canada, and subsequent to 1937 when the name of the Board was changed by Act of Parliament, as Manuscript Reports (Biological Series) of the Fisheries Research Board of Canada. Numbers 1426 - 1550 were issued as Department of Fisheries and Environment, Fisheries and Marine Service Manuscript Reports. The current series name was changed with report number 1551.

Rapport manuscrit canadien des sciences halieutiques et aquatiques

Les rapports manuscrits contiennent des renseignements scientifiques et techniques qui constituent une contribution aux connaissances actuelles, mais qui traitent de problèmes nationaux ou régionaux. La distribution en est limitée aux organismes et aux personnes de régions particulières du Canada. II n'y a aucune restriction quant au sujet; de fait, la série reflète la vaste gamme des intérêts et des politiques de Pêches et Océans Canada, c'est-à-dire les sciences halieutiques et aquatiques.

Les rapports manuscrits peuvent être cités comme des publications à part entière. Le titre exact figure au-dessus du résumé de chaque rapport. Les rapports manuscrits sont résumés dans la base de données *Résumés des sciences aquatiques et halieutiques.*

Les rapports manuscrits sont produits à l'échelon régional, mais numérotés à l'échelon national. Les demandes de rapports seront satisfaites par l'établissement auteur dont le nom figure sur la couverture et la page du titre.

Les numéros 1 à 900 de cette série ont été publiés à titre de Manuscrits (série biologique) de l'Office de biologie du Canada, et après le changement de la désignation de cet organisme par décret du Parlement, en 1937, ont été classés comme Manuscrits (série biologique) de l'Office des recherches sur les pêcheries du Canada. Les numéros 901 à 1425 ont été publiés à titre de Rapports manuscrits de l'Office des recherches sur les pêcheries du Canada. Les numéros 1426 à 1550 sont parus à titre de Rapports manuscrits du Service des pêches et de la mer, ministère des Pêches et de l'Environnement. Le nom actuel de la série a été établi lors de la parution du numéro 1551.

Canadian Manuscript Report of
Fisheries and Aquatic Sciences 3240

2022

PROCEEDINGS OF THE NATIONAL SCIENCE WORKSHOP TO REVIEW MULTI-SPECIES APPROACHES FOR AQUATIC SPECIES

Shannan May-McNally, Roanne Collins, Karine Robert, and Lis Hersak

Ecosystems and Oceans Science Sector
Fish Population Science Branch
National Capital Region
Fisheries and Oceans Canada / Government of Canada
200 Kent Street
Ottawa, ON
K1A 0E6

*Email addresses of corresponding authors: Shannan.May-McNally@dfo-mpo.gc.ca, Roanne.Collins@dfo-mpo.gc.ca

Cat. Fs97-4/3240E-PDF ISBN 978-0-660-42340-1 ISSN 1488-5387

Correct Citation for this publication:

May-McNally, S., Collins, R., Robert, K., and Hersak, L. 2022. Proceedings of the national science workshop to review multi-species approaches for aquatic species. Can. Manuscr. Rep. Fish. Aquat. Sci. 3240: vii + 46 p.

CONTENTS

ABSTRACT

May-McNally, S., Collins, R., Robert, K., and Hersak, L. 2022. Proceedings of the national science workshop to review multi-species approaches for aquatic species. Can. Manuscr. Rep. Fish. Aquat. Sci. 3240: vii + 46 p.

These proceedings summarize the relevant resources and discussions that resulted from a Fisheries and Oceans Canada (DFO) National Science Workshop held virtually on January 11–14, 2021. The objectives were to review science-based methods, criteria, indicators, and science work planning to support the DFO Species at Risk Program in the development of a Framework for Aquatic Species at Risk Conservation in Canada. DFO representatives from various sectors participated.

RÉSUMÉ

May-McNally, S., Collins, R., Robert, K., and Hersak, L. 2022. Proceedings of the national science workshop to review multi-species approaches for aquatic species. Can. Manuscr. Rep. Fish. Aquat. Sci. 3240: vii + 46 p.

Le présent compte rendu résume les ressources et les discussions pertinentes qui sont ressorties de l’atelier national des Sciences de Pêches et Océans Canada (MPO) tenues virtuellement du 11 au 14 janvier 2021. Les objectifs visaient l’examen des méthodes, des critères et des indicateurs fondés sur la science ainsi que la planification des travaux scientifiques afin d’appuyer le Programme sur les espèces en péril du MPO dans l’élaboration d’un cadre pour la conservation des espèces aquatiques en péril au Canada. Des représentants de divers secteurs du MPO y ont participé.

EXECUTIVE SUMMARY

A virtual National Science Nature Legacy workshop was held on January 11-14, 2021. The objective of the workshop was to develop a suite of science-based criteria and data that could be considered in identifying opportunities to apply multi-species, place-based approaches for the conservation of aquatic species at risk. General monitoring indicators and other analytical tools that could be used to measure recovery success in multi-species approaches (such as species, threat, and area-based approaches) were also discussed.

These discussions and proceedings can help to inform DFO's development of a Framework for Aquatic Species at Risk Conservation. The Department aims to develop this Framework to serve as a policy guide to improving conservation outcomes for aquatic species at risk through application of multi-species approaches, where it makes sense to do so. This Framework is in the early conceptual stages of development, and will be shaped through engagement to build on existing processes and incorporate new conservation opportunities.

The discussion was informed by a review of seven geographical areas designated as 'priority places' for conservation of aquatic species at risk under the Canada Nature Fund for Aquatic Species at Risk (CNFASAR), as well as two new places proposed as priorities under CNFASAR. The CNFASAR's ongoing conservation efforts in priority places across Canada provide a model from which to draw insight in developing further place-based approaches to conservation.

The workshop was co-chaired by Warren Wilson and Sophie Foster and included 56 participants from Fisheries and Oceans Canada (DFO) Ecosystem and Oceans Science (DFO Science) and Aquatic Ecosystems (Species at Risk Program (SARP), Integrated Planning, Marine Spatial Planning and Fish and Fish Habitat Protection Program (FFHPP)). Prior to the workshop, discussions about CNFASAR areas were held through a series of preliminary workshop calls with a broad range of scientific experts from within, and external to, DFO.

In the discussion, a number of science-based criteria and monitoring indicators were raised as potential considerations in identifying opportunities for place-based conservation approaches. These included: species richness and diversity; species aggregation; fitness consequences; threats to survival and recovery; and feasibility. These criteria resembled those used for Ecologically and Biologically Significant Areas (EBSAs), with added focus on the spatial and temporal aspects of threats and the feasibility of species recovery. However, participants felt that they needed clearly defined conservation (program) objectives for place-based and threat-based approaches to further refine science-based criteria. Given the unique challenges and opportunities related to at-risk species in a particular area, the objectives, criteria, and use of monitoring indicators may vary across regions and thus will require careful examination on an area-by-area basis.

A general lack of monitoring baselines for aquatic species at risk (e.g., population status, response to threat mitigation) was flagged as a major gap needed to measure population level changes following the implementation of multi-species actions. Standardized and long-term monitoring are necessary to better understand the effectiveness of multi-species approaches.

Recommendations for next steps included continued research and monitoring to evaluate the effectiveness of multi-species approaches, particularly place-based approaches that may be recommended in recovery documents for aquatic species at risk. In addition, the importance of

nurturing collaboration in multi-species approaches was noted. It will be important to maintain existing partnerships, as well as explore new ones within DFO, across departments, and other levels of governments (e.g., provincial, municipal). Cooperative arrangements with various jurisdictions, academia, Indigenous groups and other organizations should also be considered. This will facilitate the sharing of experience and expertise and enable, or enhance, data gathering and sharing, to increase the feasibility of multi-species conservation approaches. Overall, the input received can be used to inform the development of multi-species approaches, such as place-based and threat-based approaches for the conservation of aquatic species at risk.

These meetings and the national science workshop represent first steps to shape initial concepts related to a Framework for Aquatic Species at Risk Conservation. Information captured in these proceedings reflects early brainstorming on these concepts. DFO recognizes that extensive internal and external engagement will be necessary to shape these concepts and to develop the Framework.

TERMINOLOGY

Species at risk

- Under the *Species at Risk Act* (SARA), a species at risk is defined as "an extirpated, endangered, threatened species, or a species of special concern."
- In the context of these proceedings, species at risk refers to species that are listed as Extirpated, Endangered, Threatened, or of Special Concern under SARA, as well as species that are assessed as 'at risk' by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC).

Multi-species approaches

Multi-species approaches are conservation approaches that address the needs of multiple species at risk at the same time.

Types of multi-species approaches include:

- Place-based approaches (i.e., conservation actions for multiple species at risk found in the same geographical area).
- Threat-based approaches (i.e. conservation actions to address or mitigate a threat that affects multiple species at risk in a similar way, such as noise or fishing interactions).
- Species-based approaches (i.e. conservation actions that can be applied to multiple aquatic species at risk because they are biologically similar, such as designatable units, populations, or subspecies).

INTRODUCTION

Recognizing that wild species populations in Canada continue to decline, the Government of Canada announced Canada's Nature Legacy Initiative in Budget 2018. Under the Nature Legacy Initiative, DFO is striving to improve conservation and recovery of Canada's aquatic biodiversity from coast-to-coast-to-coast.

One way in which DFO can improve conservation outcomes for aquatic species at risk is by moving away from the mostly species-by-species conservation approaches that DFO has taken to date, and incorporating more multi-species approaches, such as place- and threat-based approaches. These multi-species approaches may be used when and where they can collectively maximize the ability to protect and recover aquatic species at risk, recognizing that in some circumstances, single-species approaches may be preferred or necessary to meet the protection and recovery obligations of the federal *Species at Risk Act* (SARA).

To guide the Department in applying multi-species approaches, SARP is leading the development of a Framework for Aquatic Species at Risk Conservation[1] ('the Framework'). The Framework will serve as a policy guide, shaped through engagement to build on existing processes and incorporate new conservation opportunities.

DFO is proposing the use of these approaches because they can help to mitigate the decline in species diversity by addressing the needs of multiple species at risk at the same time. Focusing efforts on a particular place, threat, or species grouping can bring together partners and stakeholders with shared conservation interests. This can create synergy in conservation planning and action. For example, information shared through networks of Indigenous organizations, partners and stakeholders can contribute to community stewardship as well as shared conservation planning and action, which can reduce pressures on multiple aquatic species and their habitat. Actions that focus on multiple species may also have co-benefits for the conservation of biodiversity more broadly, such as the maintenance of ecosystem services and climate change adaptation.

Developing a Framework for Aquatic Species at Risk Conservation can help identify opportunities to maximize the benefits of multi-species approaches. Many factors could be considered when identifying opportunities to apply multispecies approaches to the conservation of aquatic species at risk. For example, socio-economic considerations could include factors related to community wellbeing. The Workshop held by DFO Science in 2021 focused solely on scientific criteria to consider in identifying opportunities for the use of multi-species approaches.

The use of multi-species approaches are not new in the conservation community at large, or at DFO. In developing guidance on the use of multi-species approaches, DFO can draw upon insight gained from internationally accepted conservation tools and principles, including those set out by the United Nations Declaration of Rights for Indigenous Peoples (UNDRIP), the International Union for Conservation of Nature (IUCN), the Convention on Biological Diversity (CBD), and Open Standards for Conservation.

DFO also plans to build upon the use of multi-species approaches in recovery strategies, and explore related tools under Canada's *Fisheries* Act and the *Oceans Act;* synergies with

[1] Formerly referred to as the 'Pan-Canadian Approach for the Conservation of Aquatic Species at Risk'.

Environment and Climate Change Canada's (ECCC) Pan-Canadian Approach for Terrestrial Species at Risk (ECCC 2018); and lessons learnt from the use of multi-species approaches under DFO's CNFASAR (Figure 1). The CNFASAR, which provides contributions funding for multi-species approaches to protect and recover aquatic species at risk in priority places or impacted by particular threats, can be used as aa model for the ongoing use of multi-species approaches across Canada. Review of priority places selected under the CNFASAR helped to launch discussion at the Workshop.

These meetings and the national science workshop are a first step to shape initial concepts related to the Framework. Information captured in these proceedings reflect early brainstorming on these concepts. Further internal and external engagement will be necessary to develop the Framework beyond these initial concepts.

CNFASAR and Multi-species Approaches

Launched under the Nature Legacy Initiative in 2018, with enhanced funding in Budget 2021, the CNFASAR is a contributions program that enables partners to develop and implement multi-species approaches for places and threats that are priorities in protecting and recovering aquatic species at risk. This program brings together Indigenous communities, not-for-profit organizations, provinces and territories, and other partners to undertake these stewardship actions.

The CNFASAR began by targeting seven freshwater priority places[2] and two priority marine threats (Box 1). The process for selecting CNFASAR priority places included the development of maps to identify areas associated with significant numbers of aquatic species at risk (i.e., "hot spots") and overlapping threats. SARP used these maps in conjunction with expert opinion to choose areas characterized by conservation urgency for immediate or near-term actions and available partners to carry out projects.

BOX 1. CANADA NATURE FUND FOR AQUATIC SPECIES AT RISK

Seven freshwater priority places:

1. Fraser and Columbia Watersheds Priority Area (British Columbia)
2. Rocky Mountains' Eastern Slopes Priority Area (Alberta)
3. Southern Prairies Priority Area (Alberta, Saskatchewan, Manitoba)
4. Lower Great Lakes Watershed Priority Area (Ontario)
5. St. Lawrence Lowlands Priority Area (Quebec)
6. Southern Gulf of St. Lawrence Rivers Priority Area (New Brunswick, Nova Scotia, Prince Edward Island)
7. Bay of Fundy and Southern Uplands Watersheds Priority Area (Nova Scotia, New Brunswick)

Two marine priority threats along three coasts:

1. Fishing interactions (includes entanglement and bycatch of aquatic species at risk)
2. Physical and acoustic disturbance (includes vessel collisions and marine noise)

[2] A priority place is described as a "defined geographic area of high biodiversity value with a recognizable ecological theme and social relevance that may be intuitively identified as a distinct "place" by the people that live there and manage its infrastructure and renewable and non-renewable natural resources" (ECCC 2018).

Under CNFASAR, these collaborative, multi-species projects have been ongoing in priority places and for priority threats since 2018, and show promising results as conservation work by organizations, agencies, and other partners. With this in mind, the CNFASAR approach could serve as a useful starting point that can inform the development of the Framework.

As a next step, SARP was interested in receiving scientific guidance to help shape criteria that could be used to select places that are priorities for conservation efforts. Specifically, SARP requested DFO Science input and support to: 1) review the seven CNFASAR priority places to suggest possible refinements; 2) provide input to support the development of new proposed priority places in the Arctic Region and in Newfoundland and Labrador (NL) Region; and 3) provide guidance on monitoring indicators that could be used to report on the progress of recovery for species where place-based approaches have been used.

Preparation for the National Science Workshop

Solicitation of initial Science input commenced with a national Science workshop, as well as eight preliminary meetings that occurred before this workshop. The national Science workshop was held virtually over 4 days from January 11-14, 2021 on Microsoft (MS) Teams. At the beginning of the workshop, the co-chairs (Warren Wilson (Senior Consultant and Facilitator, Intersol Group Ltd) and Sophie Foster (DFO Science, Manager for Species at Risk and Aquatic Invasive Species)) welcomed participants, and discussed the objectives of the workshop described in the Terms of Reference (ToR; Appendix A) and the workshop agenda (Appendix B). The co-chairs invited all participants to freely contribute knowledge to the process and reviewed virtual meeting guidelines and process for exchange. Materials for breakout groups and plenary sessions were provided and discussed with participants. A total of 56 participants attended, including representatives from DFO Science, SARP, Fish and Fish Habitat Protection Program (FFHPP), and Marine Spatial Planning (Appendix C).

A preliminary meeting was held for each CNFASAR priority place prior to the national workshop to provide the opportunity for more regional scientists to learn about the initiative at an early stage and participate in a focus group discussion. These meetings occurred over the period of December 2-18, 2020. An agenda with guiding questions was provided to participants (Appendix D). The 3-hour calls were chaired by Warren Wilson over Microsoft Teams and consisted of 7-18 participants from DFO Science, DFO SARP, provincial government representatives, academics, and environmental non-governmental organizations. A summary of these meetings can be found in Appendix E.

NATIONAL SCIENCE WORKSHOP

The workshop opened with a presentation from the national SARP to provide background and context setting for participants.

Presentation: Developing a DFO Framework for Aquatic Species at Risk Conservation

Presenter: Lis Hersak (DFO SARP, National Capital Region (NCR))

An introduction to the Framework was presented, beginning with context on Nature Legacy, announced in Budget 2018, which provided DFO with the mandate and funding to transform the

way that aquatic species at risk are protected and recovered, so that Canada's conservation outcomes are improved. The Framework will provide policy guidance with respect to this transformation, and assist DFO in meeting SARA responsibilities by focusing on priority places, threats, and species. The importance of input from scientists at an early stage in the development of the Framework was emphasized. Analysis and synthesis of recommendations from this national workshop with respect to scientific criteria for place-based approaches, and guidance on monitoring indicators will be used to inform the development of the Framework, and both internal and external engagement will continue throughout its development (including ongoing discussions with DFO Science).

Following the presentation, several participants identified the need for SARP to clarify the meaning of a multi-species approach in terms of funding, especially for those species not covered by a multi-species approach. Fulfilling SARA obligations includes the need to report on a species-by-species basis, so participants questioned the ability to meet SARA requirements if SARP shifts emphasis, and funds, to key areas. Questions were also raised about considering species designated as at-risk by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) in the design and refinement of place-based approaches.

SARP representatives acknowledged that multi-species approaches may not work in all areas, and that species-specific approaches can be used to meet SARA requirements where necessary. Species assessed by COSEWIC are being considered in the Framework as part of implementing more place-based and/or ecosystem-based approaches in a proactive manner to conserve biodiversity.

New Priority Areas for CNFASAR

Building on the success of CNFASAR since its launch in 2018, DFO's SARP aimed to extend the list of priority areas to include the Arctic and NL Regions. The aim of this extension was to include considerations for multiple threats to sensitive ecosystems within these regions. To support this, DFO Science provided two presentations that summarized regional progress and considerations towards new areas that had potential for multi-species, place-based and/or threat-based recovery efforts.

Presentation: Nature Legacy Arctic Region White Paper

Presenter: Colin Charles (DFO Science, Ontario and Prairie Region)

Preliminary work from Arctic Region was presented. The approach taken for the Arctic area was to build on existing criteria from the EBSAs, Site Selections for Areas of Interest, and Marine Protected Areas (MPA) initiatives. Over 30 SARA-listed and COSEWIC-assessed marine and freshwater populations or Designatable Units (DUs) found in the Arctic Region were discussed as candidate species for developing priorities. However, as in other regions, the state of knowledge for many of these Arctic DUs is lacking (e.g., population abundance estimates, health of species, parameters for modelling). These species also face several threats and stressors including: climate change impacts on multi-year pack ice, movement of ice through the archipelago, changing landscape for freshwater species (e.g., water level changes, timing of ice break-up and freeze-up); commercial fishing (e.g., fishing gear impacts, vessel traffic, ghost gear); shipping corridors; mining and development; and risk of aquatic invasive species (AIS). Next steps for the Arctic will be to take various data layers for species distributions and threats

to create maps that overlay this spatial information to look for species hot spots, overlapping threats, and unique and vulnerable habitats in the Arctic.

Presentation: Nature Legacy Priority Places - NL Region

Presenter: Mark Simpson (DFO Science, NL Region)

Enhanced funding for the Nature Legacy initiative was announced in Budget 2021 providing an opportunity to establish an area in NL.

The NL Region waters encompass all or part of over 40 DUs as identified by COSEWIC, mostly for widely distributed marine fish and mammal species. The proposed area, in the eastern half of the Northwest Atlantic Fisheries Organization (NAFO) Subdivision 3Ps, was identified based on overlapping distributions for 31 of the 36 aquatic species at risk that are found in NL waters. The boundaries for this proposed area were also selected based on the presence of designated critical habitat for Blue Whale and Leatherback Sea Turtle, as well as corals and sponges. This proposed area also overlaps two previously identified EBSAs. Additionally, the presence of multiple threats guided the delineation of the proposed area. These include fishing and its associated impacts (e.g., bycatch, gear entanglements/ghost fishing, bottom contacting gear), aquaculture, shipping, and seismic testing.

The proposed area boundaries could be modified based on several considerations. The ecosystem in Subdivision 3Ps is currently undergoing structural changes, as higher than average temperatures in the area are associated with increasing dominance of warm water species, such as Silver Hake. This could complicate efforts to establish baselines and evaluate species responses to intervention, especially if the proposed area is to remain confined to Subdivision 3Ps. Within 3Ps, expansion or shifting of the area boundaries westward would incorporate another EBSA, as well as some Critical Habitat for Spotted Wolfish and additional Atlantic Salmon habitat; an eastward shift or expansion would also incorporate additional salmon habitat and could potentially include two freshwater species (American Eel and Banded Killifish) and their habitats.

PART 1: SCIENCE-BASED CRITERIA

Part 1 of the workshop focused on discussing science-based criteria and data that could be used to delineate place-based approaches for aquatic species at risk in Canada. Three workshop objectives were identified for Part I:

- *Objective 1a: Identify science-based criteria that could be used to delineate priority areas for aquatic species at risk.*
- *Objective 1b: Review and assess methods for how to apply science-based criteria and identify information gaps and challenges for each option.*
- *Objective 1c: Discuss Species at Risk areas that are important from a science point of view.*

The first breakout session on Day 1 of the workshop focused on Objective 1a and involved five smaller groups addressing the following discussion questions:

Are key considerations and science-based criteria for aquatic species at risk captured (see Table 1)? What science-based criteria are the most important for aquatic species at risk?

Following the breakout group discussion, several of the themes below were discussed in plenary sessions.

Program objectives: A long discussion was held in plenary on the importance of establishing overall conservation or program objectives to guide the Framework and the development of science-based criteria.

National SARP noted that their draft objective is to protect and recover the most species as effectively as possible; however, many participants were still unclear about this objective. Participants reinforced that it was important to answer the questions: why is a priority place needed, what is designation of a priority place trying to achieve, and how will it be used? Many participants agreed that objectives for these areas should be identified before evaluating current CNFASAR areas and considering new places (i.e., science-based criteria could differ if the objective(s) related to protection as opposed to management and recovery). Recovery planning requires that clear and understandable objectives are set for effective area- and threat-based planning. Regional and watershed level program objectives could also be set to cover area-specific and species-specific needs. It was recommended that the term “program objectives” be used instead of conservation objectives to avoid confusion with objectives from other initiatives such as MPAs and EBSAs.

Participants asked whether the program objective(s) would include being proactive about threats (e.g., invasive species; climate change). Objective(s) should be clear as to whether SARP is trying to manage for current habitat or for future habitat (i.e., predicted changes in species distribution with climate change).

Several participants mentioned that provisions and regulations under other federal legislation such as the *Fisheries Act* (e.g., rebuilding plans) and *Oceans Act* (e.g., MPAs) could be utilized more to prevent species from declining to the point where they need SARA-related resources. This would fit with a whole-of-Department approach to aquatic species at risk protection and recovery objectives.

Feasibility was raised as a key consideration for developing science-based criteria (i.e., where is it biologically and technically feasible to evaluate/improve conservation outcomes, assuming that sufficient baseline data are available?). The consideration of spatial and temporal scales in priority areas was also raised as being important in framing the program objective(s) and in regional prioritization. There may be situations where it would be better to prioritize protection or recovery in different portions of the priority area (e.g., areas of low human activity vs areas of high human activity). In addition, the ability to maintain or establish partnerships affects the feasibility of implementing recovery actions.

In breakout and plenary, several groups raised the importance of evaluating the suitability of place- and threat-based approaches in order to meet the program objective(s). Some participants noted that the solutions to improving species recovery (i.e., places, threats, species) are being proposed before program objective(s) have been fully defined. In some cases, priority places could be a solution to the objective (e.g., priority places provide operational efficiencies because of the aggregation of species or threats), but priority places may not always be the de-

facto solution. Similarly, focusing on threats may only be useful if the threat is understood and can be mitigated. The identification of biodiversity hotspots can help identify areas that have the greatest numbers of aquatic species at risk, possibly the greatest concentration and variety of threats, and areas where the need for critical habitat protection is highest. It does not necessarily provide information about where recovery effort will have greatest effect, as there are important considerations around feasibility (e.g., feasibility of implementing the recovery measure, likelihood that the species will respond given the level of effort that can be applied). There was a recommendation to separate prioritization into metrics of listed species versus species that can be feasibly recovered with the expected level of recovery effort. Priority could be based on several lines of thinking, such as : 1) of highest risk for extinction, 2) of highest likelihood of recovery, 3) of greatest overall benefit to the largest number of species.

Science-based criteria: Most of the discussion on Day 1 of the workshop focused on possible science-based criteria that could be used to refine CNFASAR places. It was challenging to come up with a single set of criteria given differences between places and varying data availability. Many participants again noted the challenge in identifying suitable criteria without having clear program objective(s).

With these caveats in mind, input from preliminary meetings and the national workshop were collated into a list of general and notable science-based criteria (Table 1). Key dimensions raised by participants included: richness and diversity of aquatic species at risk; aggregation (species distribution); fitness consequences (life-history characteristics); threats (spatial and temporal distribution of threats; high vs. low areas of human activity); and feasibility (biological, economic, and technical aspects). The dimensions raised aligned closely to the approach taken for EBSAs but with focus placed on overlaying threats and accounting for feasibility.

Species diversity and richness were recognized as some of the most important science-based criteria for place-based approaches. Functional diversity was also highlighted as an important criterion. Uniqueness, although complex and often vaguely defined, could be a useful criterion when attempting to maintain or find unique habitats that can be protected. The relevance of including endemic and extirpated species was discussed in the context of meeting the goals set out by the Convention on Biological Diversity (CBD). Many participants cautioned against discounting endemic or extirpated populations given that certain watersheds offer overwhelming reintroduction potential for extant species and that species' ranges may expand into novel areas with climate change.

The aggregation of species, specifically occupancy and the functional value of specific habitat to certain species (e.g., life history functions supported by certain habitats), was deemed to be an important dimension by participants. The importance of being proactive and including threats like climate change as part of this dimension was raised.

Fitness consequences, a principle used in the determination of EBSAs, was noted as a criterion. Fitness consequences refer to areas that are used by species for life history activities which make a significant contribution to the fitness of individuals of those species (DFO 2012). Critical habitat features and functions could be used as proxy for this dimension.

Spatial and temporal distribution of key threats to aquatic species at risk can help refine priority places and inform recovery actions if it is known whether a threat can be mitigated or if a species can be proactively protected from a threat. One participant noted that it will be helpful to review existing definitions related to threats and pathways of effects used by DFO programs to

ensure consistency in describing and communicating threats. Several participants noted that it is easier to tackle single threats rather than multi-threat issues, as single threats are presumably more straightforward to address and it is easier to monitor population responses.

Feasibility was brought up several times as a key dimension, especially for some of the larger CNFASAR priority areas. Biological feasibility and other criteria are not exclusive of other aspects of feasibility, such as socio-economic considerations and potential for partnerships. A benefit of having multiple species in an area is the opportunity to gather interested Indigenous and non-Indigenous groups to discuss aquatic species at risk protection and recovery, creating a sense of community and providing the opportunity to work together. The importance of early collaboration and engagement by partners was raised several times as a key consideration for establishing successful priority places, and is contingent upon clear objectives, expectations, and roles. There are several factors to account for when assessing feasibility. Cumulative effects of threats should be taken into account when assessing feasibility. Areas with multiple aquatic species at risk are often associated with greater human activity and, therefore, more threats. Careful consideration of how to weigh feasibility of recovery versus SARA status should also be a consideration. Focusing solely on feasibility may lead to an emphasis on species vulnerable to becoming threatened or endangered (i.e., Special Concern) rather than species likely to become endangered or facing imminent extinction or extirpation (i.e., Threatened or Endangered), as protection or recovery actions may be more readily accomplished than rescue actions.

Table 1. General science-based dimensions and considerations for science-based criteria that can be used to delineate or refine areas for place-based approaches.

Dimensions	General science-based criteria	Example data sources
Species richness and diversity	• Vulnerability • Endemism and rarity-weighted richness (uniqueness) • Edge of range species • Representativeness of genetic and ecological variability • Presence of umbrella species[3]	• Number of species present in an area • SARA and COSEWIC status, including extirpated species • The report series Wild Species: The General Status of Species in Canada Conservation Status • Distribution maps with species hot spots (e.g., Species at Risk mapping tool, COSEWIC status reports, International Union for the Conservation of Nature (IUCN) red list, the General Status of Species in Canada or Nature Conservancy) • Critical Habitat maps
Aggregation	• Areas where most individuals of a species are aggregated for at least some part the year • Functional diversity of habitat • Areas of high productivity • Areas of high ecological significance	• Features and attributes of critical habitat (e.g., spawning grounds, migration routes, riparian zones) or other important habitat identified in a DFO Recovery Potential Assessment (RPA), COSEWIC status report, etc. • Habitat that may be more important to species in the future (i.e., range expansion with climate change)
Fitness consequences	• Areas where life-history activities can occur that support survival and recovery of populations • Functional properties of areas	• Life-history needs from RPAs, COSEWIC status reports, recovery documents • Functions that are supported by critical habitat or other important habitat
Threats	• Spatial and temporal distribution of threats to species survival and/or recovery	• Spatial and temporal distribution of human activities such as land use and development (e.g., mining, agriculture, shipping) • Environmental parameters (e.g., water quality)
Feasibility	• Biological feasibility • Feasibility of addressing threat(s) • Feasibility of reintroduction • Expected time to recovery	• RPAs and recovery documents for recovery feasibility • Consideration and inclusion of historical or potential habitat of extirpated populations • Land or water use as a proxy for extent or degree of habitat degradation that needs restoration • Spatial and temporal distribution of threats (e.g., RPAs, IUCN red list, COSEWIC status reports) • Potential for partnerships

[3] Protecting these species also protects many other species that comprise the ecological community of its habitat

Methods to apply science-based criteria: The second breakout session focused on Objective 1b. Five small groups addressed the following discussion questions:

Is/are there an approach(es) that offer more promise – why/why not? Are there additional approaches missing from the list (see Box 2) that should be considered? Why? What additional scientific advice would you offer in the application of approaches/criteria to the identification of priority areas?

Participants generally agreed that there was no 'one-size fits all' approach for all areas, threats and species because of regional considerations, such as collaborative opportunities, and jurisdictional and/or political barriers. A combination of approaches, both bottom-up (e.g., EBSAs) and top-down (e.g., Open Standards), may be needed depending on the regional situation. A variety of prioritization approaches were suggested in breakout groups and in the preliminary meetings that could be drawn upon for the Framework (see Box 2). It was also suggested to first evaluate approaches that have been recommended in DFO recovery documents (e.g., multi-species Action Plans) and Recovery Potential Assessments (RPAs) and use that information to evaluate feasibility of protection and recovery of species in priority places. Other approaches could also be explored and operationalized where they are best suited.

Many participants suggested that the EBSA approach was a good model for prioritizing conservation areas, and that SARP could use the methods and criteria from the EBSAs (e.g., uniqueness, vulnerability) and tweak it to fit their goals and objectives. Drawing from the EBSA model, DFO's Framework would likely benefit from having a suite of program objectives (national and regional), monitoring plans and indicators, and associated reference points to maintain aquatic species at risk and habitat.

If an EBSA-like approach is to be taken, the integration of marine areas will be important. There are several geospatial datasets already prepared for the marine environment, including those from EBSAs, Site Selections for Area of Interest exercises, and existing or planned MPA networks. Overlap with marine spatial planning and other freshwater conservation efforts where aquatic species at risk have been considered can help avoid duplicative efforts. It will be necessary to ensure that results of projects funded by Nature Legacy are communicated to all relevant parties. For example, any reports and data that are submitted to SARP must then be made available to DFO Science. This will avoid any confusion about which knowledge gaps and recovery actions have been addressed, and avoid redundancy in resource allocation.

Participants felt that there were key knowledge gaps about the effectiveness of area-, ecosystem- and threat-based approaches. A discussion in plenary raised the need to consider availability of data as well as the importance of collaboration. There was a general recommendation for more baseline species monitoring to allow DFO and partners to better track and measure "success". A general lack of population and distribution data for some aquatic species at risk may bias efforts towards species that are more data-rich, resulting in some species being excluded from priority-based approaches. Continuing to monitor and evaluate emerging data as Nature Legacy and other initiatives are implemented will help to better understand the effectiveness of multi-species approaches. Reflecting on what has been done so far is key to effectively moving forward.

BOX 2. EXAMPLES OF CONSERVATION PRIORITIZATION METHODS

- **Ecologically or Biologically Significant Areas (EBSAs)**: Areas of the ocean that have special importance in terms of their ecological and biological characteristics, encompassing areas that have been shown to hold the greatest richness of species and productivity, possess rare or endemic species, or are home to unique communities of fauna and flora.
    - Convention on Biological Diversity (CBD) approach
    - DFO approach
- **Marine Protected Areas (MPAs)**: Part of the marine environment that is legally protected and managed to achieve the long-term conservation of species, ecosystems, and/or unique features.
- **MARXAN**: A decision-support system that uses simulated annealing algorithms to find many good near-optimal solutions of priority areas that meet the set objectives while minimizing the perimeters and costs (Ball et al. 2009).
- **Priority Threat Management (PTM) for biodiversity conservation**: A decision tool that identifies the threat management strategies that will recover the most species for the least cost, drawing on empirical data and expert knowledge of major threats to biodiversity, the expected benefit of management to species recovery and persistence, along with the cost and feasibility of management (Carwardine et al. 2018).
    - A three-year CNFASAR project taking place in the Saint John River watershed of New Brunswick utilizes a PTM approach to maximize the persistence of aquatic species at risk in the Saint John River watershed by determining the recovery actions with the greatest likelihood of success while effectively allocating resources (WWF Canada).
- **Open Standards for the Practice of Conservation (Miradi approach)**: Provides a systematic approach to designing, managing, implementing, monitoring, and adapting conservation efforts at any geographic, temporal, or programmatic scale (CMP 2020).
- **Alberta Environment and Parks (AEP) Cumulative Effects Assessment Joe Model**: This model assess cumulative impacts of threats, and is a robust method for geographically prioritizing recovery, regulation, research, and management actions (DFO 2019).
- **Key Biodiversity Areas (KBAs)**: Through the IUCN Taskforce on Biodiversity and Protected Areas, KBAs have been identified which possess characteristics that make them important for sustaining wildlife and biodiversity, such as areas where biodiversity is threatened or where biodiversity is geographically restricted (Tognelli et al. 2017).
- **Northwest Territories' Cumulative Impact Monitoring Program**: A source of environmental monitoring and research in the Northwest Territories (NWT). The program coordinates, conducts and funds the collection, analysis and reporting of information related to environmental conditions in the NWT.
- **The Freshwater Conservation Blueprint**: A suite of five tools developed to help assess the health of aquatic and riparian ecosystems in eastern Canadian provinces. The goal is to use this information to improve conservation throughout the region and across borders to enable better land-use planning and conservation (Nature Conservancy Canada).

Refinement of CNFASAR areas: A discussion was held in plenary about possible refinements that could be made to existing CNFASAR areas, which are an attempt at place-based conservation as well as the development of new areas in the Arctic and NL Regions. There was a general sense that the current CNFASAR areas are a useful starting point for increasing place-based conservation efforts because they cover multiple aquatic species at risk and provide both flexibility and inclusiveness to undertake projects with partners. However, many felt

that further prioritization was required to focus work to the scope where taking conservation actions is more feasible (i.e., at the watershed level). Narrowing in on smaller zones within watersheds, such as at the tertiary and quaternary level, would be a more practical scale to focus prioritization efforts (e.g., see Master et al. 1998). The importance of including tributaries in a watershed approach was highlighted. Additionally, the inclusion of marine or estuarine areas in a watershed approach, especially for anadromous species, should be considered.

Some participants noted that it should not be assumed that each region should have a priority place, threat, or species – work should be informed by the overarching objective(s), data, and locations where recovery and protection would be feasible. It was noted that if areas are too large or too inclusive, then it defeats the purpose of establishing priorities for aquatic species at risk. Taking a regional approach averages effort across species-rich to species-poor regions, which means that priorities will have as much to do with DFO regional boundaries as with underlying biodiversity, or recovery feasibility, patterns. For example, population recovery is based on underlying life history factors. Considering how these 'scale-up' within and across places was raised as an important next step for the determination, or refinement, of areas for place-based approaches. Feasibility and determining what is known about the likelihood of recovery, life history characteristics or determinants to recovery (e.g., generation time and response time), and the spatial distribution of threats is needed to prioritize spatial areas effectively.

Possible refinements to the CNFASAR areas raised in the plenary and in the preliminary meetings are documented in Table 2.

Table 2. Suggestions for possible refinements of areas used as part of the Canada Nature Fund for Aquatic Species at Risk (CNFSAR) raised by participants at regional preliminary workshop meetings and the Science National Workshop. These areas were examined to inform the Framework with regards to place-based approaches to conservation.

CNFASAR Area	Possible refinements

Fraser and Columbia Watersheds Priority Area (British Columbia)	• Area is quite large and would benefit from further prioritization of threats and species in smaller, constrained watersheds.
	  ○ Available decision support tools can assist with spatial prioritization (e.g., MARXAN).
	  ○ Information available in RPAs on recovery feasibility can help guide feasible mitigation measures.
	• More focus is needed on prioritizing regional threats and drivers that influence ecosystems (e.g., AIS).
	  ○ Consideration of cumulative impacts of threats.
	• Consideration of degraded or historical habitat that can be used for future distribution or reintroduction efforts.
	• Integration of marine areas, especially for anadromous species like Pacific Salmon:
	  ○ Consider possible overlaps with other marine spatial planning efforts
	  ○ Can refine larger marine areas into zones/subsections where feasible conservation actions can be implemented.
	• Consider other spatial data sources to address general knowledge gaps for many aquatic species at risk (e.g., SARA violations, restoration sites, permits for land use planning).

Rocky Mountains' Eastern Slopes Priority Area (Alberta)	• More focus is needed on monitoring species abundance, structure, and distribution in this area (knowledge gaps). • Given the complexity of the current larger area, can prioritize key watersheds at a scale where feasible conservation actions can be taken. • Account for climate change impacts on species distribution (i.e., potential for recolonization, range expansion).
Southern Prairies Priority Area (Alberta, Saskatchewan, Manitoba)	• This area only covers a small portion of aquatic species at risk in the Prairies and can be expanded to cover COSEWIC-assessed at-risk species (e.g., Lake Sturgeon). • Threats such as habitat fragmentation could be considered for species found outside of the current priority area (improve connectivity). • Threats to some species (e.g., Lake Sturgeon) are misrepresented for the Manitoba portion of the priority area as threats vary among rivers. • Prioritization exercises within the priority area would be beneficial to better focus conservation efforts. • Area could be refined to include both healthy and degraded habitats (i.e., include rivers for both protection and recovery).
Lower Great Lakes Watershed Priority Area (Ontario)	• Area is large, covering many aquatic species at risk and COSEWIC-assessed species, so further prioritization of threats and species in smaller, constrained watersheds would be beneficial. ○ COSEWIC/SARA status could also be weighted given it is already a result of rigorous review and prioritization. • Degree to which recovery feasibility is integrated into prioritization will drive approach and should be looked at with a scientific lens. There is a need to be more realistic about the likelihood of threat abatement. • Taxonomic diversity, natural heritage (iconic species), and functional diversity are science-based criteria that could be added. • Consideration of populations outside this area may require alternative recovery approaches.
St. Lawrence Lowlands Priority Area (Quebec)	• Area as presented focuses on the St. Lawrence River itself and does not adequately cover other nearby watersheds, marine areas, and some COSEWIC-assessed species.

	○ Coverage of the area could be expanded to include other watersheds and tributaries on the south shore of the St. Lawrence as well as the north shore to account for range expansions due to climate change. ○ The Ottawa River was noted as a gap in coverage, given that this area has several SARA-listed and COSEWIC-assessed species. ○ Marine areas could be integrated if there are no direct overlaps with other marine spatial planning efforts. ○ Need to ensure that boundaries adequately cover species hot spots as some species, such as the American Eel (a COSEWIC-assessed Threatened species), are only partially covered. • Maps with threats and barriers or obstructions to watersheds could be produced to help refine the area and prioritize future habitat and connectivity restoration. • Consider other efforts to elucidate conservation priorities in Quebec. • Consider feasibility of working in rivers and protecting riparian areas, especially in agricultural zones. • Consider an approach based on the ecological role of a group of species (e.g., freshwater mussels) or a single species that could serve as an 'umbrella species', i.e., by protecting one species or a group of species, other species that are rare, or have not been assessed yet by COSEWIC, could also be protected. • Species historical distributions (e.g., that of Copper Redhorse) could be used to promote restoration.
Southern Gulf of St. Lawrence Rivers Priority Area (New Brunswick, Nova Scotia, Prince Edward Island)	• Prioritize key watersheds within the larger area where monitoring for effectiveness of actions can feasibly be undertaken. • Watersheds in PEI were identified as a gap given only two small watersheds were identified in original area. ○ Key Atlantic Salmon rivers could be added in PEI (Cross River, North Lake, Morelle River). • Regional electrofishing datasets, which covers most rivers in the area, could be used to assess areas of higher Atlantic Salmon density as a proxy for other biodiversity. • Land use (e.g., % forest coverage) could be used as a proxy for intactness of habitat (e.g., to prioritize areas for restoration). • Threats from agricultural activities (e.g., run off, pesticides) could be considered on a watershed-level basis. • Marine sites and other unique ecological areas could be considered in the overall area.
Bay of Fundy and Southern Uplands Watersheds Priority Area (Nova Scotia, New Brunswick)	• Cape Breton Island and Bras d'Or Lake were identified as possible gaps, given the presence of several COSEWIC-assessed at-risk species such as American Eel and Atlantic Salmon. • Need for consideration of extirpated species and potential for stocking, captive breeding, expansion capacity, and reintroduction. • Threats, such as Aquatic Invasive Species (AIS) and degradation of water quality, could be considered in more detail. Land use and presence of pollutants could be used as proxy information for some of these threats. • A more ecosystem-level focus can be taken, such as protecting riparian areas and other non-aquatic habitat functions and features, stream and river connectivity. • Sub-area prioritization based on recovery feasibility and habitat importance (biogeographical modelling to observe presence/absence data and link it with environmental data) to better understand where to focus recovery efforts – this can be weighted according to the relative importance of criteria. • Recent biodiversity indices for fishes and invertebrates (e.g., Canadian Aquatic Biomonitoring Network "CABIN" and annual electrofishing surveys could help refine this area. • Incorporation of traditional and Indigenous Knowledge. • Connect with other priority-setting exercises happening in New Brunswick and Nova Scotia.

PART 2: MONITORING AND INDICATORS

Part 2 of the workshop focused on Objective 2: *Identify indicators, monitoring protocols, and strategies that could be used to measure and/or evaluate recovery success of area-based and/or threat-based approaches.* The third breakout session on Day 3 involved five small groups addressing the following discussion questions:

What are some suggested methods for measuring/monitoring effectiveness of recovery measures in priority areas? Are there broad indicators that would apply across all areas? What research, case studies, or other science is needed to assess whether area-based or threat-based approaches work?

In breakout and plenary, participants stressed the importance of ensuring that baseline data (e.g., presence/absence, distribution and/or area of occupancy) are collected to prioritize species and/or locations, guide subsequent decisions, assess effectiveness, and generally ensure best uses of Nature Legacy resources. This may be especially true for freshwater species and/or those that are not commercially harvested or not considered “iconic”. The need to implement, or make use of, monitoring programs with clearly defined goals was also emphasized, with the recognition that there is a clear distinction between freshwater and marine ecosystems in terms of available data, with marine species benefitting from the existence of several broad-scale DFO-led multi-species surveys, as well as several targeted surveys involving industry participation. In contrast, baseline/monitoring data for freshwater species is often lacking.

Although it could be challenging to use broad indicators across all priority areas, especially in freshwater systems, it would be useful to identify existing or promising (ideally non-invasive) tools that could be used at a broader scale, given limitations in terms of both human and financial resources. Examples of broader tools or monitoring indicators that could be used: distribution or area of occupancy, abundance estimates, environmental DNA (eDNA; suitable for determining presence/absence of species), telemetry, stress indicators, habitat suitability, benthic invertebrates, phytoplankton and zooplankton, and water quality. Regardless, the indicator needs to be able to track population responses or trends over time. A canary approach (e.g., choose one species that could be an indicator of the overall health of the area, or of a response to the measures) could help focus efforts and address the monitoring challenges. The determination of identifiable and detectable population level changes following implementation of recovery measures is key; the life-history of species under consideration must be understood to evaluate these changes. As well, concomitant monitoring of threats, especially climate change (e.g., Steiner et al. 2013), along with responses of key species or assemblages was recommended, as the threats will influence species recovery.

It was suggested that a comprehensive literature review be undertaken at the outset, to build on existing DFO scientific advice and the broader body of knowledge to facilitate the design of monitoring programs and the selection of indicators, and to provide information on the effectiveness of protection and recovery measures. This is particularly true regarding DFO Canadian Science Advisory Secretariat (CSAS) processes involving MPAs and EBSAs, where monitoring has been explicitly considered in several contexts. Drawing on existing work will

enable SARP to select the most efficacious and cost-effective approaches, as well as avoid those that have demonstrated limited benefit in meeting established aims.

It will be imperative to establish partnerships within the department, as well as across departments, other governments, jurisdictions and with academia and various groups to share experience and expertise and enable or enhance data gathering and sharing. The use of traditional and Indigenous knowledge (TEK/IQ) should be explored where applicable. Comprehensive programs of this nature are expensive, as well as challenging to implement and maintain, necessitating the use of cooperative arrangements wherever possible.

PART 3: SCIENCE PLANNING

Part 3 of the workshop focused on Objective 3: *Identify and prioritize national and regional DFO science needs for future Nature Legacy science work: i) gaps, ii) challenges, and iii) opportunities.*

The last breakout session of Day 4 involved five small groups addressing the following discussion questions:

> *What does SARA transformation mean for DFO science? Review/validate/add to potential priorities identified in regional pre-meetings. How can we better coordinate science pertaining to aquatic species at risk?*

SARA transformation will present opportunities to look more broadly at how DFO Science can inform aquatic species at risk initiatives and promote program goals. It should also afford better opportunities for collaboration within the department, between departments (such as ECCC, which is working towards similar goals to improve protection and recovery of terrestrial species at risk), and with other governments, stakeholders, Indigenous Groups, NGOs, and other partners.

The multi-species approach that is being promoted as part of the SARA transformation process will be challenging in that DFO's work on aquatic species at risk is often dictated by that of COSEWIC, who employs a single-species approach in their assessments and whose work exerts very direct demands on DFO Science, often with strict timelines and legislative requirements. In addition, multi-species approaches in the past have often consisted of a focal species that is subject to monitoring and research, while benefits or impacts to co-occurring species are typically evaluated to a lesser extent, or not at all. The effectiveness of the interventions to all species, and not just focal ones, will need to be examined in order to establish that the multi-species approach is truly effective, especially in areas where the various species distributions are disjunct. Additionally, in some cases, this approach will not be feasible, so alternatives (e.g., single-species interventions) will have to be considered.

It is imperative that the goals and objectives be clearly defined to guide future scientific activities/work planning. Ideally this would be done in conjunction with DFO Science colleagues who are best equipped to identify what is most feasible with resources they are given. Participants also suggested that DFO Science be allowed more latitude to direct G&C programs to a greater extent.

Long term or multi-year funding and program continuity will be necessary, to reduce administrative demands, duplication of efforts, and potential loss of organizational knowledge, as well as evaluate the effects of any program activities. The need to secure funding over longer time spans is most pronounced where the species of interest will take longer to respond to intervention. Linked to this is a need for a centralized database, as well as collaboration among various levels of government and with stakeholder groups (including Indigenous groups), NGOs, citizen scientists, as well as explicit consideration of TEK/IQ where possible (e.g., in Arctic Region). The Canadian Freshwater Species at Risk Research Network (SARNET) is an example of a productive DFO – Academic collaboration. SARNET had its origins in clear strategic planning to identify data requirements. The initiative found its success in engaging the academic and government science community in efforts to meet those gaps. With key funding from the DFO Partnership Fund and critical leverage from academic institutions, the initiative has advanced scientific knowledge of aquatic species at risk with significant discoveries and output. Coordination of efforts for all species at risk related DFO sectors and integrated planning and feedback loops among sectors will support robust and timely tracking of results, to help prevent the allocation of resources to approaches that are falling short of expected goals.

There is a need for continuous broad-scale monitoring of a sufficient duration to establish a robust time-series of data, and to serve as a baseline before responses to any protections or interventions can be quantified. This is especially true for freshwater species, which are typically associated with many knowledge gaps. As a first step, a census may be necessary to determine a distribution index for a given species or assemblage of interest. Where there are insufficient funds to establish a conventional monitoring program, the use of eDNA may be suitable to detect the presence of a priority species and monitor its response to a threat. Standardization of threat monitoring should be implemented where possible to ascertain the magnitude of impact.

When using a place-based approach, the areas should be sufficiently large and broad but also flexible, so that boundaries may be expanded or contracted as data are gathered (i.e., non-restrictive and inclusive). Watersheds were again noted as the landscape unit upon which it may be most practical to focus critical freshwater recovery efforts. Where place-based approaches are being considered, the presence of threats should be explicitly considered in selecting (or excluding) an area, or in estimating the probability of a desired outcome, as the presence of certain threats may hamper or prevent recovery.

Climate change and its associated effects (such as such as loss of sea ice in the Arctic, increased development and marine shipping; Hannah et al. 2020) was identified as a major threat by participants. Some priority could be assigned to species that are known to be sensitive to climate change. Northern regions and Arctic ecosystems could serve as climate refugia where species are less impacted and would provide a good opportunity to implement place-based approaches to conserve biodiversity or areas of high ecological value (Yurkowski et al. 2019). Given that place-based approaches are not appropriate in all circumstances, the allocation of resources for single-species approach, or for assemblages of species, outside of the priority areas should be considered, especially for those deemed iconic or characterized as especially vulnerable.

NEXT STEPS

During the breakout sessions and plenary discussions throughout the workshop, several next steps became evident. These are summarized here, in no order of priority, according to the workshop's ToR.

Identifying science-based criteria and data that could be used to delineate or refine place-based approaches for aquatic species at risk

- It is critical to develop Program (conservation) objectives that support the purpose and plan for establishing priority places, threats, and species.
- Program Objective(s) should be sufficiently specific such that it is possible to select appropriate indicator(s) and reference points quickly and easily. However, it is important not to oversimplify as the management of aquatic species at risk across Canada is by no means simple and may vary depending on the region, threat, or species involved.
- Place-based approaches should be established where the data suggest (i.e., high species richness and diversity, aggregation, and habitat with important fitness consequences), where threats are generally understood, and/or where it is feasible to improve conservation outcomes.
- Carrying out these steps (bullets 1-3) will help in choosing sound and nationally consistent monitoring indicators related to areas, threats, and species.

Methods and approaches for place-based approaches

- A one-size-fits all approach for place-based approaches is unlikely; therefore, having follow-up regional discussions, workshops, or other forums for discussion is recommended.
- Watersheds were noted as the landscape unit to focus critical freshwater recovery efforts on; CNFASAR areas could be further refined down to the watershed level (tertiary/quaternary).
- It is important to connect and align with other DFO sectors and external programs and partners (e.g., COSEWIC, IUCN) about conservation priorities and other spatial conservation initiatives (e.g., EBSAs, MPAs, Open Standards) that include aquatic species at risk when delineating boundaries of areas.

Monitoring and indicators

- Baseline monitoring to assess effectiveness of recovery actions is needed.
- To establish baselines, a census may be necessary to determine status and distribution, or proxy, for a given species or assemblage of interest.
- A comprehensive literature review will help contribute information from current or past monitoring efforts where multi-species approaches have been used.

Science planning

- Importance of evaluating approaches that have been recommended in recovery documents, RPAs, and other sources to reflect upon where it is most appropriate to use place-based and threat-based approaches.
- Continue work towards elucidating places and/or threats relevant to multiple species at risk in the Arctic Region, NL Region, and other areas, as appropriate.

- Refinement of science-based criteria based on program objectives and weighting of different conservation related elements (e.g., SARA or COSEWIC status).
- Importance of developing consistent definitions for describing threats and pathways of effects to promote communication and shared efforts between programs aimed toward recovering species.

CONCLUDING REMARKS

The workshop co-chairs briefly reviewed progress made during the workshop. The co-chairs recognized the great input provided by participants and emphasized that the workshop was the beginning of a larger process for SARP. DFO Science will continue to be engaged to help inform and shape the development of the Framework.

The workshop provided the opportunities to brainstorm, and discuss possible science-based criteria, refinements to CNFASAR areas, multi-species monitoring objectives and indicators, and science planning, as well as the potential for related synergies with other DFO programs, departments and partners. The importance of early collaboration and engagement was reiterated, and many participants during the workshop and in the preliminary meetings prior to the workshop mentioned that they appreciated the opportunity to be involved in these early discussions. The workshop was also successful in bringing together a diverse group of scientists, managers, and policy makers from across all DFO regions.

Overall, the workshop achieved many of its stated objectives and improved awareness of the developing Framework for Aquatic Species at Risk Conservation.

REFERENCES

Ball, I. R., Possingham, H. P., and Watts, M. 2009. “Marxan and relatives: software for spatial conservation prioritisation,” in *Spatial Conservation Prioritisation: Quantitative Methods and Computational Tools*, eds A. Moilanen, K. A. Wilson, and H. P. Possingham (Oxford: Oxford University Press), 185–195.

Carwardine, J., Martin, T., Firn, J., Ponce-Reyes, R., Nicol, S., Reeson, A., Grantham, H., Stratford, D., Kehoe, L., and Chadès, I. 2018. Priority Threat Management for biodiversity conservation: A handbook. J. Appl. Ecol. 56: 481-490.

CMP. 2020. Open Standards for the Practice of Conservation. Conservation Measures Partnership. Version 4.0.

DFO. 2019. Review of Alberta Environment and Parks Cumulative Effects Assessment Joe Model. DFO Can. Sci. Advis. Sec. Sci. Advis. Rep. 2019/045.

Guignion, D., Gaudet, C., and MacFarlane, R. 2019. A Renewed Conservation Strategy for Atlantic Salmon in Prince Edward Island. The Atlantic Salmon Conservation Foundation. vii + 150 pp.

ECCC. 2018. Pan-Canadian Approach to Transforming Species at Risk Conservation in Canada. Environment and Climate Change Canada. Cat. No.: CW66-582/2018E-PDF; ISBN: 978-0-660-27223-8

Hannah, L., Thornborough, K., Murray, C.C., Nelson, J., Locke, A., Mortimor, J., and Lawson, J. 2020. Pathways of Effects Conceptual Models for Marine Commercial Shipping in Canada: Biological and Ecological Effects. Can. Sci. Advis. Sec. Res. Doc. 2020/077. viii + 193 p.

Master, L.L., Flack, S.R. and Stein B.A., eds. 1998. Rivers of Life: Critical Watersheds for Protecting Freshwater Biodiversity. The Nature Conservancy, Arlington, Virginia.

Steiner, N., Azetsu-Scott, K., Galbraith, P., Hamilton, J., Hedges, K., Hu, X., Janjua, M.Y., Lambert, N., Larouche, P., Lavoie, D., Loder, J., Melling, H., Merzouk, A., Myers, P., Perrie, W., Peterson, I., Pettipas, R., Scarratt, M., Sou, T., Starr, M., Tallmann, R.F. and van der Baaren, A. 2013. Climate change assessment in the Arctic Basin Part 1: Trends and projections - A contribution to the Aquatic Climate Change Adaptation Services Program. Can. Tech. Rep. Fish. Aquat. Sci. 3042: xv + 163 pp.

Tognelli, M.F., Máiz-Tomé, L., Kraus, D., Lepitzki, D., Mackie, G., Morris, T., Carney, J., Alfonso, N., Tonn, B., Cox, N.A. and Smith, K.A. 2017. Freshwater Key Biodiversity Areas in Canada. Informing species conservation and development planning in freshwater ecosystems. Gland, Switzerland, Cambridge, UK and Arlington, USA: IUCN. vi + 42pp.

Yurkowski, D.J., Auger-Méthé, M., Mallory, M.L, Yurkowski, D.J., Auger-Méthé, M., Mallory, M.L., Wong, S., Gilchrist, H., Derocher, A., Richardson, E., Lunn, N., Hussey, N., Marcoux, M., Togunov, Ron., Fisk, A., Harwood, L., Dietz, R., Rosing-Asvid, A., Born, E., Mosbech, A., Fort, J., Grémillet, D., and Ferguson, S. 2018. Abundance and species diversity hotspots of tracked marine predators across the North American Arctic. Divers. Distrib. 25: 328–345.

APPENDIX A: TERMS OF REFERENCE

Terms of Reference: Review of the Nature Legacy Priority Places

National Science Workshop

Dates: January 11-14, 2021

Chair: Warren Wilson

Virtual – MS Teams

Context

The Government of Canada Nature Legacy Initiative provides DFO with the mandate and direction to take steps towards the shift to multi-species, place-based and threat-based approaches to SARA delivery. Seven freshwater priority places and two marine threats were identified as part of the Canada Nature Fund for Aquatic Species at Risk (CNFASAR). In support of the Department's SAR transformation, Science had been asked to review the seven CNFASAR priority places (see Annex 1) and two new proposed priority places (in the regions of Newfoundland & Labrador and Arctic) to recommend refinements, and provide guidance on monitoring indicators that can be used to report on the progress of aquatic species at risk recovery in each of these priority places.

Science is holding a virtual national workshop to: 1) review CNFASAR priority places using science-based criteria, identify key information gaps, and recommend refinements or adjustments to the boundaries of priority places; and, 2) scope scientific work required to support next steps, which may include another workshop(s) or CSAS process next fiscal year (2021-22).

Objective(s)

- Review the seven CNFASAR priority places and two new priority places, including geographic extent and location. Identify other science-based criteria and data that could be used to refine or adjust the boundaries of the priority places;

- Identify information gaps or challenges for each priority place;

- Propose options to refine or adjust the priority places to address information gaps or challenges; and,

- List general monitoring indicators or other analytical tools that could be used to measure recovery success in multi-species approaches.

To facilitate the discussions, a package will be prepared for each priority place that includes a map, key threats, aquatic species at risk distribution, as well as guiding questions such as: are there other science-based criteria that should be accounted for; what data are available to inform the other science-based criteria; is the extent of the priority area sufficient to encompass the intended species distributions and necessary habitat; what are possible challenges (science and/or management); what monitoring indicators or analytical tools could be used in this priority region, etc. This package will be shared with participants before the preliminary meeting and national workshop.

Approach and Participation

- **A preliminary meeting** will be held in each region before the national workshop to provide the opportunity for more regional scientists with the necessary expertise to participate in the discussions. Participants will be asked to review materials in advance of the pre-meeting and come prepared to discuss the guiding questions and propose recommendations to refine or adjust the priority place(s) in their region. A summary of the discussions and recommendations from each regional pre-meeting will be brought forth at the national workshop.

- The pre-meeting will be facilitated by NCR and will be held in early to mid-December over MS Teams. The meeting will be ~2 hours in length, with 8-10 participants from the region and representatives from NCR SARA Science and NCR and regional SARP (1 SARP representative per region will be asked to attend and provide a presentation on the current priority area). Participants should have expertise in aquatic species at risk and/or spatial planning, or possess local/regional knowledge of aquatic species at risk and/or threats, feasibility of implementing recovery measures, monitoring indicators, etc. to evaluate the priority place. Participation is open to externals (e.g., from the provinces or academia).

- **The national workshop** will be held the week of January 11th over MS Teams, and will be approximately 3-4 days, running from 11:30am ET to 3:00pm ET (with one day ending closer to 3:30pm ET). Approximately 30-40 science representatives from all regions including NCR Science and NCR SARP will participate in the workshop (resulting in 3-4 people per region). Participants must have attended the regional pre-meeting, and should have expertise in aquatic species at risk and/or spatial planning, or possess local/regional knowledge of aquatic species at risk and/or threats, feasibility of implementing recovery measures, monitoring indicators, etc. to evaluate the priority place. Participation is open to externals (e.g., from the provinces or academia).

- Recommendations from the regional pre-meetings will be summarized for discussion at the national workshop. Participants should come prepared to discuss the discussions and recommendations from their regional pre-meeting, as well as provide input into other priority places in other regions.

Expected Outputs

NCR SARA Science will prepare a report summarizing recommendations and next steps following the workshop.

APPENDIX B: AGENDA

Virtual Science Workshop - Review of the Nature Legacy Priority Places

LOCATION: Virtual – Microsoft Teams

DATES: January 11-14, 2021

WORKSHOP FACILITATORS: Warren Wilson and Sophie Foster (workshop will be facilitated in English, but participants are welcomed to raise discussion points and questions in either official language).

WORKSHOP SECTIONS AND OBJECTIVES

PART 1 – Identifying science-based criteria and data that could be used to delineate priority areas for aquatic species at risk in Canada:

- *Objective 1a: Identify science-based criteria that could be used to delineate priority areas for aquatic species at risk.*
- *Objective 1b: Review and assess methods for how to apply science-based criteria and identify information gaps and challenges for each option.*
- *Objective 1c: Discuss Species at Risk areas (SAReas) that are important from a science point of view.*

PART 2 - Indicators, monitoring protocols, and strategies for reporting on the effectiveness of multi-species approaches:

- *Objective 2: Identify indicators, monitoring protocols, and strategies that could be used to measure and/or evaluate recovery success of area-based and/or threat-based approaches.*

PART 3 - Science planning:

- *Objective 3: Identify and prioritize national and regional DFO science needs for future Nature Legacy science work: i) gaps, ii) challenges, iii) opportunities.*

DAY ONE – JANUARY 11, 2021	
Time	**Items**

11:30 – 12:10 pm ET	Plenary session:
	• Welcome and introduction of participants
	• Presentation: Workshop objectives from Terms of Reference, workshop process, and agenda
	  ○ Workshop materials, Google Drive resources
	  ○ Summary of pre-meetings

12:10 – 12:30 pm ET	Plenary presentation: NCR Species at Risk Program (Anne Phelps and Lis Hersak) • DFO SARA Transformation, multi-species approaches to recovery, Canada Nature Fund for Aquatic Species at Risk (CNFASAR) priority place identification

	• National goal(s), objectives and purpose of priority places, guiding principles and themes Plenary discussion on principles • Q&As

12:30 – 1:00pm ET	Plenary presentations: Work towards new priority areas in the Arctic and Newfoundland/Labrador
	• 15 min – Newfoundland and Labrador
	  ○ Presenter Mark Simpson; DFO Science NFL
	• 15 min – Arctic Region
	  ○ Presenter: Colin Charles; DFO Science O&P

1:00 – 1:30 pm ET	**Health Break**
1:30 – 2:00 pm ET	**PART 1:** Identifying science-based criteria and data that could be used to delineate priority places for aquatic species at risk in Canada. • *Objective 1a. Identify science-based criteria that can be used to delineate priority areas.* Plenary session: • Discussion on criteria, what we heard from pre-meetings, and reflection of approaches taken in Arctic and Newfoundland areas. • Establishment and plan for breakout groups. • Trial of breakout groups and access to shared documents (Google drive link).
2:00 – 3:00 pm ET	Breakout session 1: *Objective 1a. Identify science-based criteria that could be used to delineate priority areas.* • Review guiding questions and Table 1. • In your group, answer guiding questions and review/ fill out columns in Table 1 to the best of your ability.
3:00 – 3:30pm ET	Plenary session: • Key discussion points from breakout groups • Summary of Day One
3:30pm ET	**Adjourn (Day One)**

DAY TWO – JANUARY 12, 2021	
Time	**Items**

11:30 – 12:00 pm ET	Plenary session and conceptual discussion:
	• Summary of Day One - discussion around a combined Table 1
	• Day Two: Plenary discussion
	  ○ *Objective 1b: Review and assess methods for how to apply science-based criteria, and identify information gaps and challenges for each option; and*
	  ○ *Objective 1c: Discuss Species at Risk areas (SAReas) that are important from a science point of view.*

	Breakout groups: Objective 1b

12:00 – 1:00pm ET	• Participants to work in breakout groups to fill in guiding questions and Table 3.
1:00 – 1:30pm ET	**HEALTH BREAK**
1:30 – 1:45pm ET	Plenary session: Objective 1b • Conceptual discussion on a possible method/approach that could be used/refined/developed post-workshop to delineate priority areas.
1:45 – 2:30pm ET	Breakout groups: Objective 1c • Brainstorm “Species at Risk areas” (SAReas) across Canada. • Start applying criteria to SAReas. • Fill out guiding questions and Table 4.
2:30 – 3:00pm ET	Plenary session: Objective 1c • Conceptual discussion around Objective 1c. • Wrap up discussion and summary of Day Two.
3:00pm ET	**Adjourn (Day Two)**

DAY THREE – JANUARY 13, 2021	
Time	**Items**
11:30 – 12:00 pm ET	Plenary session: • Summary of Day Two (revisit combined Tables 3 & 4) • Plan for Day Three **PART 2:** Identifying indicators, monitoring protocols, and strategies for reporting on the effectiveness of priority places and priority threats • *Objective 2: Identify indicators, monitoring protocols, and strategies that could be used to measure and/or evaluate recovery success of area-based, threat-based approaches.*
12:00 – 12:30 pm ET	Plenary discussion: Objective 2 • Review guiding questions and Tables 5 as a group.
12:30 – 1:00 pm ET	Breakout groups: Objective 2 • Evaluate possible indicators for key threats (Table 5) and fill out responses to the monitoring/indicator guiding questions to the extent possible.
1:00 – 1:30pm ET	**HEALTH BREAK**
1:30 – 2:00pm ET	Continue breakout groups: Objective 2 • Review and propose possible indicators for key threats and fill out responses to the monitoring/indicator questions to the extent possible.
2:00– 3:00pm ET	Plenary session: Objective 2 • Discussion on Objective 2. • Summary of Day Two and plan for Day Three.
3:00pm ET	**Adjourn (Day Three)**

DAY FOUR – JANUARY 14, 2021	
Time	**Items**
11:30 – 11:45am ET	Plenary session: • Summary of Day Three • Plan for Day 4 **PART 3 -** Science planning: • *Objective 3: Identify and prioritize national and regional DFO science needs for future Nature Legacy science work: i) gaps, ii) challenges, iii) opportunities.*
11:45 – 12:00pm ET	Plenary presentation: Anne Phelps/Lis Hersak: General – Species at Risk Program National management needs going forward: • DFO Science competitive priorities for funding (FY 2021) • Planning and Science needs from the Species at Risk Program • Q&As
12:15 – 12:30 ET	Plenary session: Conceptual discussion on Objective 3 - what does SARA transformation mean for DFO Science? • Tables 6-7: Initial feedback heard from pre-meetings about science needs, gaps, opportunities.
12:30 – 1:00pm ET	Breakout discussion: Objective 3 • Review and brainstorm additional national and regional SARA Science priorities / opportunities to seek out following this workshop. • How can we better coordinate species at risk science? Consider the direction the Program is moving towards (i.e., SARA Transformation to priority based-approaches, Nature Legacy, and the Framework - priority areas, threats, species). • Ranking of science priorities within breakout groups.
1:00 – 1:30pm ET	Final plenary session: • Summarize national recommendations for science plan. • Discuss all outcomes of the workshop, next steps. • Close workshop.
1:30pm ET	**Adjourn (Day Four/Workshop)**

APPENDIX C: DFO WORKSHOP PARTICIPANTS

Name	Affiliation
Sophie Foster	Co-Chair; Science NCR
Warren Wilson	Co-Chair; Intersol
Alicia Cassidy	Science, Gulf Region
Andrew Drake	Science, O&P Region
Anne Phelps	Species at Risk Program, NCR
Ashley Gillespie	Species at Risk Program, O&P Region
Bethany Schroeder	Science, O&P Region
Chantelle Sawatzky	Science, O&P Region
Chris McKindsey	Science, Quebec Region
Christina Pretty	Science, NL Region
Cody Dey	Science, NCR
Colin Charles	Science, O&P Region
Colin P Gallagher	Science, O&P Region
Cory JD Matthews	Science, O&P Region
Daniel Selbie	Science, Pacific Region
Daphne Themelis	Science, Maritimes Region
Darek Moreau	Science, Maritimes Region
Doug Watkinson	Science, O&P Region
Eva Enders	Science, O&P Region
Gavin C Christie	Science, O&P Region
Guy Robichaud	Habitat Assessment, Gulf Region
Hans-Frederic Ellefsen	Science, Quebec Region
Heidi Schaefer	Species at Risk Program, Maritimes Region
Jack Lawson	Science, NL Region
Jason Stow	Science, O&P Region
Jeffrey Lemieux	Science, Pacific Region
Jennifer MacDonald	FFHPP, Maritimes Region
Jeremy Broome	Science, Maritimes Region
Joclyn Paulic	Science, O&P Region
Josh Stacey	Species at Risk Program, O&P Region
Josephine Iacarella	Science, Pacific Region
Julia Colm	Science, O&P Region
Julie Châteauvert	Species at Risk Program, NCR
Julie Stewart	Species at Risk Program, NCR
Karine Robert	Science, NCR
Karl Lamothe	Science, O&P Region
Lei Harris	Science, Maritimes Region
Lis Hersak	Species at Risk Program, NCR
Lisa Robichaud	Species at Risk Program, Gulf
Mark R Simpson	Science, NL Region
Marie-Anne Giroux	Science, Gulf Region
Nicole McCutchen	Species at Risk Program, Pacific Region
Nadine Wells	Science, NL Region
Neil Mochnacz	Science, O&P Region

Patricia Désilets	Species at Risk Program, Quebec Region
Paul Chamberland	Science, Gulf Region
Paul Grant	Science, Pacific Region
Peter Rodger	Species at Risk Program, O&P Region
Roanne Collins	Science, NCR
Scott Danford	Species at Risk Program, NCR
Shannan May-McNally	Science, NCR
Shawn Staton	Species at Risk Program, O&P Region
Shawna Powell	Species at Risk Program, NL Region
Todd Morris	Science, O&P Region
Tom Pratt	Science, O&P Region
Tyler Tunney	Science, Gulf Region

APPENDIX D: AGENDA FROM PRELIMINARY MEETINGS

Virtual Science Preliminary Meeting – Review of Priority Area

Fisheries and Oceans Canada, Ecosystems and Oceans Science

LOCATION: Virtual – MS Teams meeting

DATE: December 1st, 2020 (11-1PM PST / 2-4 PM EST)

FACILITATOR: Warren Wilson

PARTICIPANTS: Participants are encouraged to go over meeting materials and other background documents in advance of the meeting if possible (the focus being on the Guiding Questions in the meeting package). Participants are also encouraged to propose initial recommendations at this meeting or afterwards to be brought forth at a National Science Workshop in January 2021.

Participants ideally should have expertise in aquatic species at risk and/or spatial planning, or possess local/regional knowledge of aquatic species at risk and/or threats, feasibility of implementing recovery measures, and monitoring indicators to evaluate the priority place.

Meeting Agenda	
Approx. Timing	**Items**
20 min	- Welcome and introduction of participants - Review objectives of national workshop / purpose and structure of pre-meeting
15 min	- PRESENTATION (Species at Risk Program): General overview of the priority area, including current geographical extent, species, threats, and other criteria used to inform its current state
1 hour	Discussion: - Meeting package material and guiding questions will be discussed to develop initial recommendations related to: o Science-based criteria that could be used to refine or adjust the priority area; o Gaps, challenges, and/or opportunities; and o General monitoring indicators and/or analytical tools to measure recovery success in multi-species approaches
15 min	Summary of initial recommendations:

	- Draft and review bullets to summarize key discussion points and recommendations to refine or adjust the priority place - Recommendations to be brought forth at the National Science Workshop in January 2021
10 min	- Closing remarks, questions, and discussion of any follow up actions needed before the national workshop (e.g., data gathering, additional meeting, send input to meeting facilitators via email, etc.)
Adjourn	

APPENDIX E: PROCEEDINGS FROM PRELIMINARY WORKSHOP DISCUSSIONS

This appendix summarizes the main points raised in regional pre-meetings that occurred from Dec 2nd - Dec 17th, 2020 before the National Science Nature Legacy Workshop (Jan 11-14, 2021). The pre-meetings were chaired by Warren Wilson and structured based on the following five guiding questions[4] that were posed to participants before and during the pre-meeting:

1. What science-based criteria can be used to refine or adjust the boundaries of the priority area? What data are available to inform science-based criteria?
2. What science and management challenges, gaps, and/or opportunities exist in the Priority Area?
    a. Under SARA, recovering aquatic species at risk requires remediating and compensating for threats. Therefore, what are the opportunities for advancing and grouping threat-abatement approaches / mitigation actions in the priority area?
3. Based on questions 1-2, is the extent of the priority area sufficient to encompass: i) intended species / DU distributions? ii) feasible area-based/threat-based/ ecosystem-based conservation and recovery actions? If possible, provide any rationale for potential new boundaries or adjustments.
4. What monitoring and/or research needs in this priority area are most urgent going forth?
5. What monitoring indicators or analytical tools are currently being used, or could be used in this priority region to report on the outcomes of area-, ecosystem- and/or threat-based recovery actions? If possible, define how and why species/ threats/ places warrant different monitoring criteria.

SARP provided two presentations at the beginning of each meeting. One was presented by national SARP representatives to provide an overview on DFO's Framework. The other presentation focused on the specific priority area relevant to the meeting and was presented by a regional SARP representative as described below:

- "Developing a Framework for Aquatic Species at Risk Conservation": Presented by Lis Hersak and/or Anne Phelps (SARP NHQ)
- Fraser and Columbia Watersheds Priority Area: Presented by Nicole McCutchen (SARP Pacific Region)
- Rocky Mountains' Eastern Slopes Priority Area: Presented by Zing-Ying Ho (SARP O&P Region)
- Southern Prairies Priority Area: Presented by Christine Lacho (SARP O&P Region)
- Lower Great Lakes Watershed Priority Area: Presented by Josh Stacey (SARP O&P Region)
- St. Lawrence Lowlands Priority Area: Presented by Patricia Désilets (SARP Quebec)
- Southern Gulf of St. Lawrence Rivers Priority Area: Presented by Diane Amirault-Langlais (SARP Gulf)
- Bay of Fundy and Southern Uplands Watersheds Priority Area: Presented by Jennifer MacDonald (FFHPP Maritimes)

Note, a pre-meeting for a possible new priority area in NL Region was not conducted; however regional discussions about a new priority area did occur.

[4] These guiding questions were modified for Arctic region (informing a new priority area)

Fraser and Columbia Watersheds (British Columbia)

Date: December 1, 2020

Following the opening presentations, a participant asked how the priority areas will be used in terms of SARA implementation, as this context would be helpful for DFO Science. SARP explained that this approach is an opportunity to group and prioritize species for listing, recovery and mitigation of key threats. Priority areas will not be limited to listed species and include COSEWIC assessed at-risk species. It was recognized that there are situations for which this approach will not be appropriate.

A participant added that from a regional perspective there is interest in how to implement a true ecosystem-based approach. It was highlighted that science input is needed.

Guiding Question 1. A participant mentioned that there are a variety of drivers that influence ecosystems. They suggested to start by looking at regional drivers to focus where their direct impact is the greatest, so that mitigation measures can be implemented where there is greatest impact. It was suggested to consider recovery feasibility, as feasible mitigation measures may vary depending on the ecosystem or region.

A participant pointed out that there is limited knowledge on aquatic species at risk, so SARP needs to be careful about data objectivity when making large-scale decisions based on available data. A participant pointed out the large size of the CNFASAR priority areas were perhaps useful to account for uncertainty.

A participant asked whether there is interest in considering marine areas and science-based criteria applicable to marine areas. SARP explained that it is difficult to determine, as there are many initiatives happening in marine areas and potential overlaps.

The following ideas were mentioned by the participants as science-based criteria that could be used to refine the boundaries of the priority areas:

- Threat prioritization: There are common threats for Pacific species such as AIS and habitat degradation that could be prioritized in order to help further refine the priority area. Cumulative effects should be considered where possible.
- There is a need to consider where the species recovery is more likely to be successful under different climate change scenarios.
- Population distribution.
- The potential for restoration of degraded habitat should be kept in mind as a consideration for historical and future distribution of species.
- Biodiversity metrics: Aim for an area that encompasses the most aquatic species at risk, in order to cover as many species as possible.

Guiding Question 2. Participants highlighted information gaps, challenges and opportunities linked with the proposed priority area approach. It was noted again that in general there are knowledge gaps for many aquatic species at risk, especially non-iconic species.

A participant asked whether any analysis on all the species in the area or other prioritization work had already been done. If so, it would then be possible to undertake a place-based approach (e.g., identify the critical points for habitat restoration). SARP explained that

prioritization work had been done to some degree, and the area identified was delineated based on a threat mapping and species hotspot exercise. The objective is now to identify the next steps (e.g., refining based on science-based criteria).

It was discussed how species prioritization is a challenge (e.g., can lead to non-iconic and data-poor species being excluded). It was mentioned that SARP has been considering less charismatic species when developing their Framework. Keystone species were also being looked at that could serve as ecosystems indicators.

A participant pointed out the opportunity for broader engagement with the different levels of government for this Framework. It was suggested to build on existing strengths and combine efforts by enhancing already developed inter-jurisdictional collaborations, buy-in, and partnerships.

A participant inquired about the January National Science workshop and whether the intent was to build a policy or to generate data and biological knowledge. It was explained that national workshop format and objectives were still under consideration. There is recognition that differences exist amongst priority areas. The need to clarify the purpose of why priority places and threats are needed in these areas was identified. Someone noted the need to define the boundary between Science and Management roles in this initiative.

Guiding Question 3. A participant suggested that DFO could consider a threats-focused approach in priority areas as it could include drivers that might be omitted with the priority area approach. It would be valuable to identify more priority threats and be more inclusive (i.e., more species).

It was noted that the Fraser and Columbia watersheds are very different, therefore one blanket approach for both priority watersheds may not work or be as effective. It was also suggested to highlight the area in the Columbia River where Chinook and Sockeye salmon are most impacted.

Guiding Question 4. It was noted that, given general data gaps for most aquatic species at risk, it would take some time before being able to use a prioritization decision support tool. It was suggested to use regional data (e.g., environmental information, anthropogenic development maps) in the meantime or as a first step to identify recovery and mitigation measure limitations. A participant pointed out data that DFO already collects (e.g., SARA violations, restoration sites). It was suggested to connect with the FFHPP given the importance of landscape planning. FFHPP has a new integrated planning focus, and the sector is in the process of developing their policy which relates to cumulative effects and how to consider cumulative effects at a broader scale.

Guiding Question 5. Given complexities associated with prioritization, a participant raised the need to explore decision-support tools that would help making tough decisions at different spatial scales. There are available decision-support tools (e.g., R packages, MARXAN) that could be used to prioritize areas of conflict for species with available spatial and human threat and interactions information. Identifying the appropriate spatial scale could be difficult, therefore the benefits of keeping the broader areas was also discussed. However, the importance of using decision-support tools and criteria to refine larger areas into more manageable and

smaller areas which could change over time would be an improvement to the current area.

Lower Great Lakes Watersheds (Ontario)

Date: December 4, 2020

Following the opening presentations, participants noted that the biggest challenge relates to the consideration of feasibility (both logistic and scientific). The degree to which feasibility is integrated into the prioritization process will ultimately drive the approach.

Guiding Question 1. A participant asked about the criteria that were initially used to identify the CNFASAR priority areas. It was explained that the original approach included mapping the number of aquatic species at risk, threats, and some weighted criteria were initially used in combination with regional expertise. It was mentioned that using the number of species per watersheds for a prioritization criterion is a good approach.

There is a general need to identify where the efforts should take place in order to maximize benefits to the most species, but it is recognized that a priority area approach will not work for every species. It was added that this approach would help guide where to invest funds as the intent is to use this approach to guide DFO's actions in terms of aquatic species at risk delivery. A participant raised that all SARA species have already gone through a prioritization process by lieu of being identified as priority species by an independent body of experts (COSEWIC).

It was suggested to consider three main science-based criteria during the prioritization process: taxonomic diversity, conservation and natural heritage species (iconic species), and functional diversity (biological traits that functionally describe each species).

Focusing on certain species, areas or threats without the broader focus across the range of each species may be leading us down the wrong path. Not all species occur in tightly packed areas with other priority species and oftentimes there can be significant populations outside of these areas that can get tossed by the wayside when pursuing the multi-species approach. There are benefits in pursuing priority areas, but we need to keep the larger picture in mind.

After the meeting, additional suggestions and comments were provided. It was noted for the feasibility of recovery that there are several academic researchers in Canada working on conservation prioritization and engaging these individuals could be helpful. It was mentioned that it would take several years to conduct a rigorous analysis and assessment of conservation priorities. We need to also be realistic about the degree of threat abatement (active restoration) now and in the future, and how this relates to feasibility as a criterion.

Guiding Question 2. For information gaps, it was suggested to further examine existing Nature Legacy related projects and how they contribute to this initiative. Additionally, the impacts of multi-stressor (cumulative effects) vs. individual threats are still poorly understood. There needs to be new and better ways of monitoring and sampling given that some species are rare and isolated. A monitoring program that focuses on species distribution (occupancy) should be developed, which could be applied across the other priority areas.

Adaptive management will be essential but is a challenge. In general, it can be difficult to show that a given project has had a benefit on a particular species. There are also fewer populations of aquatic species at risk, making it difficult to develop and test solutions for assessing

population responses to mitigation measures. Additionally, for a population that is small or in decline, it can be more difficult to detect small population changes. Complicating this further, the time scale to see measurable improvements for some species may take several generations. Given that it may take a long time to see changes in a population's condition (e.g., health, distribution, reproduction), it was suggested to review monitoring end points and select those for which a change could be detected in the shorter term (e.g., biologically informed end points, such as body condition).

Collaboration is an essential opportunity. DFO will need to work closely with partners, jurisdictions, conservation authorities, academics, Indigenous groups, and others to harmonize efforts and data being collected to meet the objectives. SARP and Science have complementary priorities, so working together is key. Academic networks such as SARNET (Species at Risk Research Network) is one opportunity for bolstering this type of work. SARNET members have been recently focused on captive rearing and other experimental research on specific threats to aquatic species at risk. These studies make it possible to look at things that would be impossible to do in the field and which could help support decision making.

Guiding Question 3. Participants reiterated that enhancing partnerships, such as through SARNET, will be a key aspect to consider if the priority area is refined.

Someone noted that DFO should also increase capacity for reviewing and auditing funded projects in the priority areas in order to measure the degree of success and possible backsliding.

It was suggested to consider modelling watershed health as it could help SARP with decision making on where projects should be undertaken.

A participant suggested to refer to work already done through the IUCN KBA approach for the Great Lakes area when considering refinements to the area.

Guiding Question 4-5. There is a general lack of historical data for many species, which makes it difficult to examine trends through time. Standardized monitoring programs are also lacking. Without standardized data it will be very difficult to show species responses to threat mitigation. However, there are several sampling challenges given that the scope and scale of monitoring across habitats may differ greatly, therefore a standardized or blanket approach to monitoring may not be realistic in many cases. Monitoring is difficult to implement as it needs to be done consistently over at least 10 years. It is especially difficult to implement in a multi-threat environment. There is also a need for baseline threat measurements in order to be able to detect and evaluate improvement over time. However, our ability to put a target or threshold on a threat is limited.

Another participant suggested to seek ways that species or DU level monitoring could also inform priority places, threats, and species. They mentioned a risk of collecting monitoring data at a spatial scale that could not be used to infer the status or recovery of the species or DU, which may not be of value for COSEWIC.

Southern Gulf of St. Lawrence (Gulf, Prince Edward Island, Maritimes)

Date: December 7, 2020

A participant enquired whether the focus for priorities was solely on freshwater sites or if marine sites would be included as well. SARP explained that the focus is on refining the current freshwater areas first and then they would consider an expansion into marine areas where appropriate.

There was a question about the goals and objectives of the priority places approach and whether there will be capacity to see if this is an effective approach. SARP explained that it represents an opportunity for improving recovery by aligning species presence and places that are important to them (i.e., best return on investment). It was added that the department is looking to adopt these approaches at all stages of the SARA cycle and that adaptive management and monitoring for effectiveness will be included.

It was asked if the priority place boundaries can change. SARP clarified that the boundaries are not fixed, and they are looking for scientific criteria to refine these priority areas.

Guiding Question 1. A participant highlighted the importance of considering land use and suggested to include the percentage of coverage as a science-based criterion. It was also suggested to look at biophysical attributes that may help determine areas that might be impacted.

It was suggested to look at a Gulf region electrofishing dataset centered around Atlantic Salmon, which covers most of the rivers in the area of interest. The importance of standardizing the dataset was highlighted by a participant (e.g., accounting for the gear used; protocol followed). A participant referred to an Atlantic salmon stock status report for PEI (redd survey) for ideas about which rivers to consider in PEI.

Guiding Question 2. It was mentioned there would be an opportunity to link land use issues with the aquatic ecosystems (e.g., impact of fertilizers, agricultural land and practices) to address impacts. It was suggested to collaborate with other groups and departments (e.g., ECCC, Agriculture Canada, Province of NB and PEI) for information on land use. A participant then inquired whether there is a link to NB and PEI environment and local governments who approve habitat alteration projects. It was explained that DFO-FFHPP reviews the projects, but it is not certain if the complete list of projects is covered and if there are any “blanket” alteration permits for larger projects.

A participant highlighted the need and opportunity for internal partnerships given that some tributaries may be shared between regions and jurisdictions. It was suggested to identify a multi-jurisdictional prioritization approach to assess the importance of key parameters. A participant noted that monitoring in PEI is often completed by community-based groups in conjunction with the province and is usually tied to available funding which is not usually long-term. The opportunity for Indigenous community involvement was highlighted.

Guiding Question 3. There was discussion on salmon rivers and data availability. A recent publication (Guignion 2019) contains data on salmon redd counts and juvenile densities in PEI. It was suggested to consider the following salmon rivers in an updated area: Cross River, North Lake creeks, northeast of Morelle River.

It was also mentioned that there is a database on morphological analysis of benthic invertebrates available in Gulf region (DNA analysis forthcoming) which could be useful when considering a place-based or ecosystem-based approach, and possible consideration of riparian areas.

A participant mentioned that monitoring the effectiveness of a given activity in a large-scale priority area may be challenging. Refinement is key to identifying more pressing areas and managing the scale of the priority area. Although Best Management Practices (BMPs) still need to be considered, recovery measures should be implemented where threats and the habitat requirements for species are most pronounced.

SARP mentioned that the priority areas are not protected areas. These areas would be candidates to current and future funding for recovery projects. It was noted that SARP may need to more clearly identify the purpose of these areas. It was reiterated that the priority area should be where recovery efforts can be focused.

A participant suggested to align the priority areas with the work of the FFHPP Integrated Planning team who are identifying threats to fish and fish habitat as outlined in the FFHPP Policy Statement through the State of Fish and Fish Habitat reporting, ESA identification, restoration, offsetting and banking and cumulative effects assessment.

Guiding Question 4-5. For monitoring, several participants suggested considering the implementation of DNA-based biomonitoring (e.g., eDNA) coupled with another traditional monitoring approach, such as electrofishing. In addition, the following were noted for their possible importance for monitoring and developing indicators:

- Salmon spawning areas and redd counts
- Electrofishing dataset (Gulf region)
- Biophysical outlooks
- Land use (% forest covered)
- Unique ecological areas
- Salmon density movements
- Benthic invertebrates

St. Lawrence Lowlands (Québec)

Date: December 10, 2020

Following the presentation on the Framework, a participant asked for an explanation of its application to a geographically-isolated species. It was explained that a single-species approach might be used in some cases, as the multi-species or threat-based approach might not be appropriate in all circumstances.

Guiding Question 1. A participant mentioned that he was happy to see DFO's efforts with this approach. He added that the importance of environmental stressors (e.g., agriculture) should be considered in the coming years, as the province of Quebec will try to increase its food

autonomy, which will most likely lead to an increase in agriculture activity and concomitant threats.

It was mentioned that the priority area as presented does not cover the watersheds around the St. Lawrence river very well, as it is more concentrated on the river. It was suggested that the coverage of the area be extended to include certain watersheds. Specifically, it was suggested to include level 1 watersheds in the priority area. For some species it might be important to include the southern shore watersheds. It would also be important to include certain watersheds on the north shore, and to ensure that areas subject to future climatic pressures are included. Another participant emphasized the importance of the south shore tributaries, suggesting that perhaps the sub-watersheds of this region should be included in the priority area. It was mentioned that it would be important to consider the threat/barrier/watershed maps. It would also be important to consider proximal upstream threats in riparian zones.

It was reiterated that the focus of the priority area is on the St. Lawrence Lowlands only, and that we may need to extend coverage a bit to include some watersheds. A participant inquired about the use of Open Standards (which is being considered) and stated that it could help frame our thinking about the threat approach. An explanation of the Open Standards concept was then requested. It was explained that Open Standards aim to improve project performance by providing ideal practices for effectively developing, implementing and monitoring these projects. It is an adaptive management cycle that allows for the identification of biodiversity targets and the adaptation/updating of conservation measures during the project. Open Standards are supported by a project management software called Miradi. This approach is used by the Nature Conservancy of Canada.

In addition, it was suggested to consider Ecologically Significant Areas (*Fisheries Act*) in the process. The importance of accounting for the shifting of species distributions over time was also emphasized.

Guiding Question 2. It was mentioned that the biology (life cycle) of some species (e.g., mussels) is not well known. There is also limited information on preferred habitats for benthic species (e.g., mussels). More information would be needed to know which places to target and protect. Another participant noted that the reasons for declines are not well understood with respect to many of the species to which recovery efforts are being applied.

It was mentioned that it can be difficult to apply environmental regulations, and that it would therefore be important to work with the different levels of government. Consultation between the ministries and departments would also be necessary regarding the funding/subsidy programs, so that the resources are used for successful and measurable gains in terms of recovery.

A participant added that it would be useful to consider projects that extend beyond the aquatic environment (riparian zone). The importance of considering riparian zones and sub-watersheds in agricultural zones was emphasized.

It was noted that there is currently no way of knowing whether the recovery actions taken are effective; tools are needed to assess the effectiveness of these actions.

Following the discussions, participants identified the following additional points that would be important to consider in the process of identifying and implementing the priority area:

- Consideration of cumulative effects

- Need to develop indices to verify trends in species.
- Need for a capture protocol that can inform the inventory of aquatic species at risk. It would be necessary to develop monitoring indicators, at least in the main rivers.
- Need to develop less invasive indicators to assess the status of aquatic species at risk.
- Need to strengthen collaboration between DFO and the province of Quebec. A lot of provincial data (e.g., database on biodiversity) is not centralized.
- Importance of inventories (to address knowledge gaps), especially for certain species (e.g., mussels).
- Importance of considering historical data (e.g., distribution data).
- Need to consider (and implement mitigation/prevention measures for) AIS; can look to different jurisdictions for measures that have worked in the past.
- Lack of abundance data for certain fish in a precarious situation, and for lesser-known species. There is a difficulty in assessing the state of populations due to the lack of data and abundance indicators.
- Identification of priority threats and use of them in the project prioritization process.
- Consideration of impact of invasive plants. Whether or not they are fish habitat remains to be determined. There is a general lack of information on the role of invasive plants in the environment.
- Need to focus on environmental stressors and threats in riparian zones.
- Consideration of agriculture - need to support research work on the impact of pollutants/pesticides. Work with municipalities and farmers on mitigation methods.
- Collaboration with the Quebec Ministry of the Environment and the Fight against Climate Change for work on pollutants. Important to coordinate with the people who carry out pollutant inventories.
- Need for studies on the impact of pesticides on fish (e.g., look at the impacts of different agricultural practices; compare the effectiveness of field practices to reduce organic matter in rivers compared to riverbank restoration).

Guiding Question 3. For the workshop in January, it was suggested to have a map including the watersheds, with the areas for which there are species observations. This would make it possible to verify the extent of the inventories that have been carried out and to ensure that the distribution of species is well covered by the priority area.

A participant suggested considering the possibility of adding cells that would not be connected to the designated priority area. It was also suggested to consider the historical distributions of species (e.g., Copper Redhorse), to provide some idea of its potential distribution.

Guiding Question 4-5. Since many data, including data for mapping pressures, are likely to be found at the provincial government level, the importance of good collaboration between jurisdictions (especially with the provincial government) was emphasized. It was mentioned that DFO is currently in discussion with the MFFP (Government of Quebec) to obtain data on threats, to be used for a fish habitat quality mapping project. One participant suggested the development of a centralized database, involving data sharing between DFO and the province of Quebec.

A participant suggested using an approach based on the ecological role of a group of species or an umbrella species (e.g., freshwater mussel). It was mentioned that it is a challenge to protect certain group of species (e.g., freshwater mussels, benthic species). There are many aquatic

species at risk that have not yet been assessed by COSEWIC, and the use of certain umbrella species could help protect these species.

It was mentioned that the calibration of the eDNA approach and the use of Open Standards (Miradi) could be useful tools. A participant pointed out that, regarding monitoring indicators, water quality serves as a good candidate, as it integrates many of the threats into a single measurable indicator/element.

Southern Prairies (Manitoba, Saskatchewan, Alberta)

Date: December 14, 2020

Following the opening presentation, a participant enquired why they were not yet aware of this initiative. It was explained that the proposed approach is still in its beginning stages and that SARP was looking for early input from scientists familiar with the priority area or spatial prioritization approaches to help guide next steps.

Guiding Question 1. Discussions on science-based criteria that could be used to refine or adjust the boundaries of the priority area included the importance of considering the distribution of COSEWIC-assessed species (e.g., Lake Sturgeon). A participant also suggested to consider the *Fisheries Act* ecologically significant area (ESA) as it may be a useful framework.

Guiding Question 2. In terms of key information gaps, it was mentioned that more research is needed in order to better understand the types of genetic variation (e.g., SNPs) relevant to species distribution.

Another participant stressed the need for a standardized sampling process, as attention on COSEWIC-assessed and SARA-listed species is somewhat limited.

A participant pointed out the need to focus not only on the current species range, but also on its historical range, as there is habitat that could potentially be recolonized. In some regions, there are knowledge gaps on species historical ranges that would need to be addressed.

For challenges, a participant pointed out that there are multiple layers to water management in the presented priority area, which can be challenging from an inter-jurisdictional point of view. They added that habitat needs have generally not been a priority in water management decisions processes.

It was mentioned that the complexity of a given species distribution (e.g., broad distribution, numerous isolated populations) can be challenging in terms of applying recovery measures.

For opportunities, a participant indicated that in the Alberta portion, several aquatic species at risk are affected by common threats that tend to be found in the same area. The use of monitoring tools such as an eDNA monitoring program could be a good path forward for monitoring multi-species in a non-invasive manner. It was added that, in terms of monitoring indicators, it would be an opportunity for implementing a tiered approach using an eDNA approach coupled with another technique (e.g., electrofishing). A participant mentioned a DFO eDNA Science advisory process that is now published.

From a funding opportunity perspective, a participant noted that it is usually the most aquatic species at risk that get the most funding. He mentioned that it would be important to not only

recognize these groups of species, but other species as well. He suggested considering geographically isolated populations and populations that are faring well especially in terms of abundance, habitat, connectivity and genetics. It was suggested to look at the overall population assemblage within a given species.

Guiding Question 3. A participant noted that the threats to Lake Sturgeon are misrepresented for the Manitoba portion of the priority area and could be addressed in a revised version of the area. It was also mentioned that species distribution overlay with threats does not necessarily allow for a clear outcome. For example, threats to Lake Sturgeon can vary among rivers. The chosen criteria therefore need to have clearer linkages between species and threats.

A participant noted that for the Alberta portion of the priority area, the overlap between the species and the threats worked well. They added that focusing on multi-species with concurring threats would be a good approach for the Alberta portion of the area.

A participant highlighted the importance of studying population trends in both healthy and degraded habitats.

A participant asked whether the priority area approach would be to the detriment of the species that fall outside the designed boundaries. In other words, would there be consequences for the species outside the identified priority area? If so, it may be necessary to extend the priority area. It was then noted that, given the linkages between the priority area and the populations that are found outside the boundaries, there is a need to recognize areas beyond the priority area and of the linkages between them (e.g., Lake Sturgeon).

It was indicated that water management leads to potential barriers to fish movement. Allowing fishes a wider range of movement may help with species recovery.

It was reiterated that, given the good synergies between the *Fisheries Act* and SARA, considering the ESA approach would probably be helpful for prioritizing aquatic species at risk.

A participant stressed the importance of collaboration, especially given that DFO has only limited jurisdiction in the priority area. Several participants also raised the importance of collaborating and involving the Indigenous groups in the area. SARP indicated that engagement with Indigenous groups is planned but they are still at an early stage.

A participant noted the need for specific single-species recovery measures to be coupled with priority area approaches. He then inquired on the scope of the priority area approach. SARP explained that this would be a long-term approach, but that it could be refined, or criteria could be changed along the way, and that single-species approaches would be used when necessary.

Guiding Questions 4-5. Several participants considered the use of an eDNA monitoring program could be a good path forward for helping several species. It was reiterated that, in terms of monitoring indicators, there may be an opportunity to implement a tiered approach using an eDNA approach coupled with another technique (e.g., electrofishing).

Informing an Arctic Species at Risk Area

Date: December 15, 2020

For the Arctic Region Pre-meeting, the 5 guiding questions were as follows:

Guiding question 1: What scientific criteria can be used to delineate an Arctic priority area (freshwater and/or marine)? What data is available to support these criteria?

Guiding question 2: Which COSEWIC-assessed or SARA-listed species should be included?

Guiding question 3: What are key threats/species/areas for COSEWIC-assessed and SARA-listed species?

Guiding question 4: What challenges, knowledge gaps, and/or opportunities exist with establishing a priority place in the Arctic?

Guiding question 5: Is there any work that could be done in advance of the workshop to aid science participants at the workshop?

Following the opening presentation, a participant inquired whether the scope of the Arctic priority area should include freshwater systems, marine systems, or both. It was explained that as the Arctic area is unique, and that anything that both freshwater and marine systems could be considered. It was suggested not to consider the threats that are already covered off in the marine threat-based area.

A participant pointed out that the map boundaries representing physical and acoustic disturbance in the Arctic did not overlap with shipping corridors (i.e., Peel Sound, Lancaster Sound, Hudson Strait), but that it overlaps well with threats associated with fishing interactions.

Guiding Question 1. A participant mentioned that ecosystems surrounding multi-year ice are unique; they will likely shrink and become more concentrated in certain areas. Measures should be taken to protect some of these unique ecosystems (for example, use EBSA criteria in Foxe Basin).

Participants discussed and identified scientific criteria that could be used to delineate an Arctic priority area. The uniqueness of ecosystems and habitats was identified by several participants as a key criterion to consider. Multi-year ice systems, the large lakes (e.g., Great Bear Lake, Great Slave Lake) and rivers that have perennial ground water streams that support aquatic species at risk (e.g., North Slope with Dolly Varden) were all identified as unique Arctic habitats that should be included in the priority area. It was suggested to also consider the magnitude at which climate change will impact a given ecosystem, as some areas may experience greater changes than others (e.g., Hudson Bay, Beaufort Sea). It was noted that climate change may also threaten interesting Arctic fish assemblages. Species hot spots (such as Lancaster Sound) were also identified by participants as a criterion to consider.

A participant mentioned that there is a potential for fisheries expansion in the Arctic area as species are moving further north, and that it should be taken into consideration. It was noted that shipping routes should be considered in the priority area identification process. Track records may help in identifying shipping routes hotspots. A participant inquired if there might also be benefits for considering the linkages to biodiversity co-benefits as have been indicated through the Other Effective Area-Based Conservation Measures (OECM) areas work with the CBD as value added criteria for identifying priority areas, considering the ecosystem linkages between species. It was mentioned that, although the Arctic area is unique, the scientific criteria

used to identify the priority area may not necessarily have to differ from the criteria used for the identification of the Southern Canadian priority areas, even though the application would be different.

Guiding Question 2. Candidate species mentioned included:

- Marine fishes: Wolffish species (COSEWIC/SARA)
- COSEWIC-assessed: Roundnose Grenadier, Acadian Redfish, Atlantic Cod (data deficient)
- Freshwater fishes: Bull Trout (below 60th parallel)
- Anadromous: Dolly Varden
- Marine mammals, all species that have been designated as at-risk by COSEWIC (e.g., Beluga in Cumberland Sound)

Guiding Question 3. In Arctic marine systems, participants identified shipping corridors and climate change as the main threats. It was mentioned that the combination of these two threats could lead to a third: the risk of AIS expansion into high risk areas. A participant noted that Hudson Bay may be a focal point for climate change risks. A participant highlighted the importance of increasing human pressure and threats in Arctic freshwater systems. Mining and the development of roads provides access to new fishing areas that would not normally be accessible and could have impacts on species such as Dolly Varden and Arctic Char.

Guiding Question 4. Several participants highlighted different knowledge gaps such as sea ice loss progression over time, population estimations and climate vulnerability. It was mentioned that there is still little known about climate vulnerability and may not be possible yet to consider it as a criteria. A participant pointed out that the data needed may already exist (held by other groups) and that it would be a matter of applying existing data. It was noted that there are some ways to potentially find resources related to climate vulnerability, as some of the science has been summarized in grey literature (e.g., DFO publications, Area of Interest (AOI) development documents). For freshwater systems data (with respect to mining, potential roads, etc.), a participant suggested connecting with another DFO sector (i.e., FFHPP).

It was mentioned that the establishment of a priority area in the Arctic would lead to the opportunity of identifying recovery priorities and look at mitigation measure effectiveness for different projects and species. The participant added that it would be a good opportunity to test some mitigation tactics. From a management perspective, partner support and ability to enact management measures to address concerns may need to be considered as a challenge. Although management should not drive these decisions, elements of management scenarios (e.g., likelihood of success) need to be considered when applying these measures. A participant suggested to consider sea-ice associated versus ice-dependent species (literature search). There are a few species closely tied to sea ice that would be challenged by less ice or a shorter ice season. A participant indicated that population and distribution data may help tackle the climate change link (e.g., salmon distribution shifting northwards and potential impacts on Dolly Varden and Arctic Char populations).

Guiding Question 5. There was discussion on the available data sources that could be shared with the participants at the upcoming workshop:

- Maps with species distribution, threats, etc.

- Marine planning and protected areas data
- IUCN Red List shapefiles could provide a map of overlapping distribution of aquatic species at risk.
- AOI documents

It was mentioned that the MPA planning process would be the same for the freshwater ecosystems, but with different stressors, features, and species. A participant pointed out that mapping work has been done through national working groups and suggested connecting with marine spatial planning groups in DFO. A participant from SARP suggested sharing the preliminary maps with the group. These maps are not particularly detailed, but she mentioned that she can share additional information if they know of additional layers. It was suggested to dovetail freshwater and land-based SARA species (e.g., caribou) to have a better 'landscape approach' for protection. A participant mentioned that many scientific datasets are available and suggested developing a library of those that participants could browse or reference.

A participant inquired whether it would be possible to incorporate Traditional Knowledge in the workshop. SARP explained that it would not be possible for the workshop, but that they would aim to incorporate Traditional Knowledge in the Framework.

A participant suggested to work on a background piece with his team in preparation for the upcoming January workshop. He mentioned that a potential source of information that may be helpful with scoping and identifying gaps would be to dovetail with priorities identified by Northwest Territories' Cumulative Impact Monitoring Program (CIMP). The participant stressed the importance of including Indigenous co-management partners (or agencies like CIMP) in the identification of these priority areas for the Arctic at an early stage.

Bay of Fundy and Southern Uplands (Maritimes, Gulf)

Date: December 17, 2020

Following the opening presentation, a participant inquired whether there would still be funding available for single-species scientific activities with the priority area approach. The SARP explained that the Framework may impact where funds are focused given it is a resource prioritization framework, however it will not replace single-species scientific studies and approaches when they are needed. It was reiterated that advice is needed on how to scientifically prioritize species, threats, and areas.

A participant asked whether extirpated species were included in the initial priority area identification (heat mapping exercise). SARP clarified that extirpated species were not included in the initial exercise.

Guiding Question 1. It was suggested to consider including Eastern Cape Breton and Bras d'Or Lake areas as part of the priority area as they are important habitats for American Eel (COSEWIC assessed as Threatened). Since these areas also include Indigenous communities, including them in the priority area could enhance collaboration. It was reiterated that the priority area as presented encompassed both SARA-listed and COSEWIC-assessed species. A participant mentioned that a discussion on the Cape Breton area took place during the initial identification of the priority areas, but that it was decided to focus on areas where there were

both SARA-listed species and COSEWIC-assessed species. However, it was acknowledged that exclusion of areas in Cape Breton would be a gap.

It was suggested to consider extirpated species distribution when prioritizing one area over another, especially species expansion capacity in terms of reintroduction and stocking. A participant pointed out that it would be important to reflect on how an area serves the needs of a given species (i.e., step back and consider broader objectives). It was explained that it is recognized that the proposed priority area approach would not necessarily apply in all cases. Single-species approaches would still be used and needed in some situations. SARP noted that the department still needs to reflect on the implementation aspect of multi-species and threat-based approaches. The emphasis for this thinking is linked with addressing the SARA listing backlog.

It was suggested to consider interspecific interactions for the priority area. A participant mentioned that developing conceptual models to further research questions, linkages and interconnectedness could be explored (e.g., the National Oceanic and Atmospheric Integrated Ecosystem Assessment (IEA) approach).

A participant inquired as to why aquaculture was not included as a key threat. It was explained that the list of threats was obtained from SARA recovery documents and that aquaculture may not have been included as the focus for CNFASAR was on threats that could be addressed by external partners.

Further science-based criteria and data suggestion to refine priority area that were sent post-meeting:

- Additional focus should be put on riparian zones. Recently, LiDAR technology (i.e., a method for determining ranges by targeting an object with a laser and measuring the time for the reflected light to return to the receiver) has been used to calculate and map riparian zones in the Miramichi and Restigouche watersheds. For example, LiDAR is being used in the Restigouche to gather information on the slope of culverts to prioritize areas for restoration. This type of work could be useful if it was expanded to more rivers in NB, NS and PEI.
- Habitat function could be included as a science-based criterion, which is also an important criterion in the EBSA approach. For example, salmon spawning grounds, overwintering areas, important migration routes, feeding grounds, nurseries and thermal refugia that are important habitat functions to consider. River and stream connectivity is also important as fish need to have good access to these areas before spending money on restoration. Temporal aspects of these functions are important, and more emphasis could be placed on conserving areas that provide more than one function, for a wide range of species.
- Opportunity to include Indigenous and traditional knowledge.
- Biodiversity indices of fish and invertebrates: There is some CABIN data and electrofishing surveys conducted each year in the Gulf Region (focused primarily on salmon) that could be useful proxies for biodiversity.
- Water quality and land use as a threat criterion: ECCC may have some more information about which rivers are more polluted, at what time of year, and with what chemicals.

Guiding Question 2. Offsetting was identified as one of the main challenges, as it is often unknown whether measures taken lead to an effective offset. The spatial distribution of the

species was also brought up as a challenge by a participant, as there are still data gaps in terms of presence/absence distribution of species in this area. It was noted that as there are important knowledge gaps, making it difficult to focus monitoring efforts. A participant mentioned that the proposed approach would be a good opportunity to enhance collaboration among DFO sectors.

Guiding Question 3. Participants had a lengthy discussion on the size of the proposed priority area. The area as currently proposed does not encompass several important species and could be expanded. SARP explained that the goal of the proposed priority area approach is to focus on certain areas to get better results. A participant questioned whether expanding the area is the best way of reaching the approach's objective, since it is about prioritizing efforts and funding. As not all SARA species can be recovered, science advice is needed to determine where to focus the recovery efforts. Some of the suggestions regarding prioritization included the use of sub-area prioritization based on recovery feasibility and biogeographical modelling to observe presence/absence data and link it with environmental data. It was also suggested to weight the science-based criteria based on habitat importance for a given species in prioritized zones within the priority area. Another participant suggested to look at different spatial tools to refine the proposed priority area (e.g., *Fisheries Act* ecological habitat, SARA critical habitat). It was pointed out that there are several ongoing priority setting exercises for spatial analysis tools in other DFO sectors (e.g., FFHPP).

A participant noted the importance of considering the sources of uncertainties. There are areas for which little or no information is available, it would be thus better to use broad areas to reduce the risk of not considering projects that could be very helpful for species recovery. The use of electrofishing combined with eDNA collection and analysis was suggested as a path forward for addressing some of the knowledge gaps on species distribution.

Further suggestions sent post-meeting:

- An ecosystem-based approach to monitoring (multi-species, fish inverts and vegetation) instead of species-specific approach is recommended. It was mentioned that multi-species surveys and monitoring activities would be a good opportunity to enhance collaboration with partners. The importance of long-term monitoring data was also raised and opportunities to support a Maritimes large-scale freshwater inventory survey (presence/absence using eDNA, electrofishing, AIS).
- Need to create a list of general monitoring indicators or other analytical tools that could be used to measure recovery success in multi-species approaches.