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Proceedings of the Zonal Advisory Meeting on the Pre-COSEWIC Assessment for Atlantic Salmon

Part I: Review of Information for Designatable Units
October 26–29, 2020
Virtual meeting

Part II: Review of Information Newfoundland and Labrador
February 1–4, 2021
Virtual meeting

Part III: Review of Information Province of Quebec
December 15–16, 2020
Virtual meeting

Part IV: Review of Information Maritime Provinces
January 18–22, 2021
Virtual meeting

Chairpersons: Travis Van Leeuwen (Parts I and II), Charley Cyr (Part III), Cindy Breau (Part IV)
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Foreword

The purpose of these Proceedings is to document the activities and key discussions of the meeting. The Proceedings may include research recommendations, uncertainties, and the rationale for decisions made during the meeting. Proceedings may also document when data, analyses or interpretations were reviewed and rejected on scientific grounds, including the reason(s) for rejection. As such, interpretations and opinions presented in this report individually may be factually incorrect or misleading, but are included to record as faithfully as possible what was considered at the meeting. No statements are to be taken as reflecting the conclusions of the meeting unless they are clearly identified as such. Moreover, further review may result in a change of conclusions where additional information was identified as relevant to the topics being considered, but not available in the timeframe of the meeting. In the rare case when there are formal dissenting views, these are also archived as Annexes to the Proceedings.

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SUMMARY

These Proceedings summarize the relevant discussions and key conclusions that resulted from a Fisheries and Oceans Canada (DFO), Canadian Science Advisory Secretariat (CSAS) Zonal Advisory Peer Review meeting on October 26–29, 2020 and February 1–4, 2021 in Newfoundland and Labrador Region (Parts I and II); on December 15–16, 2020 in Quebec Region (Part III); and on January 18–22, 2021 in Maritimes and Gulf Regions (Part IV). Several working papers were produced compiling existing DFO information relevant to the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) status assessment for anadromous Atlantic Salmon in Canadian waters. These papers were presented, and peer reviewed during virtual meetings which included participation from DFO Science, Resource Management, and Aquatic Ecosystems/Ecosystems Management Sectors staff, and external participants from COSEWIC, provincial governments, Indigenous organizations, and non-governmental organizations. The conclusions resulting from this review will be provided in the form of several Research Documents providing information to COSEWIC to inform the status assessment of Atlantic Salmon. The Research Documents and supporting Proceedings will be made publicly available online on the CSAS website.

INTRODUCTION

A Fisheries and Oceans Canada (DFO) Canadian Science Advisory Secretariat (CSAS) Zonal Advisory Peer Review meeting was held in four parts: October 26–29, 2020 and February 1–4, 2021 in Newfoundland and Labrador (NL) Region (Parts I and II); December 15–16, 2020 in Quebec Region (Part III); and January 18–22, 2021 in Maritimes and Gulf Regions (Part IV). The purpose of these meetings was to review the existing DFO information relevant to the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) status assessment for Atlantic Salmon *(Salmo salar*) in Canadian waters. DFO-held data related to the status and trends, threats to the species inside and outside Canadian waters was considered, and the strengths and limitations of the information were summarized. For the Quebec Region, information was provided by the ministère des Forêts, de la Faune et des Parcs (Department of forests, wildlife and parks) of the provincial government of Québec. The review focused on anadromous Atlantic Salmon populations, which refer to salmon born in freshwater that spend part of their life history in saltwater and return to freshwater to spawn.

The Terms of Reference (ToR) for the science review (Appendix A) were developed in response to a request for an updated report on the best available DFO information to support COSEWIC.

Notifications of the science review and conditions for participation were sent to meeting participants with relevant expertise from within DFO (Science, Resource Management, Fish and Fish Habitat Protection Program [FFHPP], Aquatic Invasive Species National Core Program [AIS NCP], and Aquatic Ecosystems/Ecosystems Management Species at Risk Program), COSEWIC status report author(s) and members (Co-Chairs and/or Species Specialist Subcommittee [SSC] experts), provincial governments, Indigenous organizations, non-governmental organizations, and other experts.

At the beginning of each meeting, the designated Chairperson discussed the role of participants and the definition and process around achieving consensus decisions and advice. Chairpersons invited all participants to contribute knowledge to the process, with the goal of delivering scientifically defensible conclusions and advice based on the weight of evidence. Participants were reminded that everyone at the meeting had equal standing and that they were expected to contribute to the review process if they had information or questions relevant to the Working Paper (WP) being discussed. Chairpersons reviewed virtual meeting guidelines and the process for exchange using Microsoft Teams.

The conclusions and advice resulting from this review will be provided in the form of 13 Research Documents to COSEWIC to inform the next assessment of anadromous Atlantic Salmon in Canadian waters. These will be made publicly available on the CSAS website.

PRE-COSEWIC REVIEW OF ANADROMOUS ATLANTIC SALMON IN CANADA, PART I: DESIGNATABLE UNITS

The following WP was prepared and made available to participants prior to the meeting (abstract provided in Appendix B):

Lehnert, S.J., Bradbury, I.R., April, J., Wringe, B.F., Van Wyngaarden, M., and Bentzen, P. 2023. Pre-COSEWIC Review of Anadromous Atlantic Salmon (*Salmo salar*) in Canada, Part 1: Designatable Units. DFO Can. Sci. Advis. Sec. Res. Doc. 2023/026. iv + 156 p.

The meeting Chair opened the meeting and welcomed participants, reviewed the role of CSAS in the provision of peer-reviewed advice, and gave a general overview of the CSAS process. The Chair reviewed the ToR for the meeting (Appendix A) and the Agenda (Appendix C), highlighting the objectives and identifying the Rapporteurs for the process. In total, 45 people participated in the Part I meeting led out of NL Region (Appendix D).

As part of the meeting introduction, a presentation was given by a member of the Science group on species at risk from the National Capital Region about the purpose of the pre-COSEWIC and COSEWIC species assessment processes.

PRESENTATION OF WORKING PAPER

The following WP authors were present: S.J. Lehnert, I.R. Bradbury, J. April, B.F. Wringe, and P. Bentzen.

Several presentations were provided by DFO Science (NL Region) that summarized the WP described by the abstract within Appendix B. Each Designatable Unit (DU) was presented and reviewed separately.

The presentations provided background on COSEWIC criteria, previous Atlantic Salmon DUs 1–16 recognized by COSEWIC in 2010, and a review of the weight of evidence approach developed by the WP authors to evaluate DU structure for anadromous Atlantic Salmon by incorporating new data (genetic/genomic) that have become available in the last 10 years. The weight of evidence approach included a decision tree to evaluate genetic discreteness based on genetic data, and evolutionary significance based on evidence of genomic based adaptation, life history differences, and geological and climate-linked differences. The authors proposed 20 genetically discrete and evolutionarily significant units (i.e., DUs) of anadromous Atlantic Salmon, not considering the original Lake Ontario DU (it remained as DU 11).

GENERAL DISCUSSION

While it was understood from the ToR that the intent of this peer-review process and WP was to focus on anadromous Atlantic Salmon, further clarification was requested for external audiences to ensure the audience did not assume the WP included non-anadromous populations of Atlantic Salmon. The participants agreed to add this clarification to the WP.

Uncertainties related to the weight of evidence approach, how they were accounted for, and how they were communicated to the audience were discussed by the group. Since the weight of evidence approach and decision tree framework were built upon the 1–16 recognized COSEWIC DU structure (COSEWIC 2010), there were questions about the risk of DU structure changing if the authors chose not to use the 2010 DUs as a starting point. The authors noted that there was good evidence (e.g., published phylogenic trees, genetic and life history data, demographic data) to support using the 2010 DUs as a starting point for the re-evaluation of DU boundaries. The importance of describing the order in which information was considered in the decision tree was also discussed by the participants for reproducibility and clarity purposes. The participants agreed to amend the WP to add language that supported the suitability of the recognized 1–16 DUs in the decision tree framework and would adjust the branches in decision tree to better show the ordering of information considered in the reevaluation of DUs.

For the Labrador DU, it was suggested that the boundaries of the three subdivided DUs (Northern Labrador, Lake Melville, and Southern Labrador) should be illustrated on a map. The group noted that this could be included as an appendix to the WP.

For the Northeast Newfoundland DU, there were discussions around the weight of evidence of genetic data needed to support a new boundary shift for this DU. The participants found that the evidence was unclear, and it was recommended to add a table to the WP with sampling data and locations (e.g., list of rivers sampled, smolt age) for this DU, and it was noted that this was applicable to all Atlantic Salmon DUs. This would provide COSEWIC with the necessary information to evaluate possible boundary changes. In the case of DU 3, the group did not reach consensus on the changes to the boundary and authors agreed that they would re-evaluate the boundary and compile more data to evaluate support for evolutionary significance criteria of the proposed DU.

For the South Newfoundland DU, there was a discussion around the boundaries of this DU if it were to be subdivided, specifically at Cape Race, located at the southeastern tip of the Avalon Peninsula. While there was consensus from the group to break Northeast Brook Trepassey into its own DU, there was agreement to revisit this recommendation in the WP and add additional support for this separation.

Discussions around Quebec DUs involved the addition of Corneille River to the Quebec Eastern North Shore DU. This river was disjunct or non-contiguous with the rest of the DU and the group agreed to support this addition by adding information to the WP that clearly showed genetic groupings across rivers (arranged west to east, a layout that was recommended for all genetic plots in the WP).

The participants noted that some additional context was needed to explain that the Ontario DU was not covered by this process, given that the DU was assessed by COSEWIC as extinct. A participant mentioned that a reintroduction program was in place in Lake Ontario involving individuals not related to the original DU.

There was agreement to add additional context related to a single salmon river (Round Hill) being representative of the Nova Scotia (NS) Southern Upland DU, and on the genetic grouping of Gaspereau River relative to the other areas around the Bay of Fundy.

For DUs that overlap with other countries (e.g., Outer Bay of Fundy DU overlaps with Maine populations in the United States), it was agreed to add additional data in the WP to better show the degree of distinctiveness or overlap among transboundary populations.

CONCLUSIONS

The authors agreed to make revisions based on the feedback provided by participants during the meeting. Overall, there was no dissent on the WP by the participants and the paper was accepted as a Research Document.

RECOMMENDATIONS

Recommendations were provided throughout the Research Document but are summarized below for each of the DUs of Atlantic Salmon recognized by COSEWIC in 2010. The bullets below identify additional context on DUs as outlined by the group.

1. **Nunavik:** Unchanged, one proposed DU.

2. **Labrador:** Subdivided into three DUs (Northern Labrador, Lake Melville, and Southern Labrador).
    - Additional biological characteristic information required to support subdivision (information exists, but was not reviewed in Part I; revisited in Part II of the meeting in the NL Region).
3. **Northeast Newfoundland:** Proposed boundary change with northwest Newfoundland.
    - Consensus was not reached. Genetic data were supportive of a boundary change based on genetic discreteness, but uncertainty with determining evolutionary significance limited a DU boundary change. Biological data (e.g., sea age of maturity) needed to be compiled and reviewed.
    - A review of boundaries, including the possibility of another DU on the northern peninsula (St. Genevieve to Sops Arm), was undertaken prior to Part II of the meeting.
4. **South Newfoundland:** One DU subdivided into three DUs:1) South Newfoundland east, 2) South Newfoundland west, 3) Northeast Brook Trepassey.
    - Northeast Brook Trepassey is a small river with evidence of genetic discreteness and evolutionary significance, however enhanced evidence needed to be compiled to support the boundaries of this DU.
    - Within these DUs, some evidence of genetic discreteness suggested the possibility of subdivision, such as southern Avalon and the western portion of the south coast of Newfoundland, but available information was not sufficient.
5. **Southwest Newfoundland:** Remained as one DU.
    - Boundary with Northwest Newfoundland will be reevaluated.
6. **Northwest Newfoundland:** Proposed boundary change with northeast Newfoundland.
    - Consensus was not reached. Genetic data were supportive of a boundary change based on genetic discreteness, but uncertainty with determining evolutionary significance limited a DU boundary change. Biological data (e.g., sea age of maturity) needed to be compiled and reviewed.
    - A review of boundaries, including the possibility of another DU on the northern peninsula (St. Genevieve to Sops Arm), was undertaken prior to Part II of the meeting.
7. **Quebec Eastern North Shore**: Physical boundaries unchanged, but one new river was added (Corneille River; disjunct or non-contiguous).
    - Additional information to support evolutionary significance (e.g., life history comparison, stocking history, watershed connectivity, and characteristics) was added on Corneille River and was revisited at Part III of the meeting in the Quebec Region.
8. **Quebec Western North Shore**: Proposed boundary change with inner St. Lawrence DU.
    - Biological information, life history characteristics, and any other additional data to support the proposed boundary change was reviewed at Part III of the meeting.
9. **Anticosti:** Remained as one DU.
10. **Inner St. Lawrence:** Proposed boundary change with Quebec western north shore.

- Biological information, life history characteristics, and any other additional data to support the proposed boundary change was reviewed at Part III of the meeting.

11. **Lake Ontario DU:** No data were presented or reviewed (non-anadromous).
12. **Gaspé-Southern Gulf of St. Lawrence:** Subdivided into two DUs as proposed: 1) Gaspe, 2) Southern Gulf-Eastern Cape Breton (merged).
    - Biological information, life history characteristics, and any other additional data (e.g., stocking history) to support evolutionary significance was reviewed at Part IV of the meeting in the Gulf Region.
13. **Eastern Cape Breton:** Proposed DU (merged) – Southern Gulf of St. Lawrence-Cape Breton.
    - Biological information, life history characteristics, and additional data (e.g., stocking history) to support evolutionary significance was reviewed at Part IV of the meeting.
14. **NS Southern Upland:** Subdivided into two DUs: 1) NS Southern Upland east, 2) NS Southern Upland west.
    - Round Hill River data (including historical records) were to be reevaluated; however, data presented suggests it was limited.
    - Biological information, life history characteristics, and any other additional data (e.g., stocking history) to support evolutionary significance was reviewed at Part IV of the meeting.
15. **Inner Bay of Fundy:** Proposed possibility of removing a river from this DU.
    - Re-assessed existing life history information and other genetic and genomic data to support genetic discreteness and evolutionary significance to support changes of Gaspereau, and additional data (e.g., spatial distribution, historical data). Reviewed at Part IV of the meeting.
16. **Outer Bay of Fundy:** Proposed possibility of adding a river to this DU.
    - Re-assessed existing life history information (e.g., data associated with Serpentine) and other genetic and genomic data to support genetic discreteness and evolutionary significance to support changes of Gaspereau, and additional data (e.g., spatial distribution, historical data). Reviewed at Part IV of the meeting.
    - Evaluated discreteness of this DU with adjacent United States anadromous Atlantic Salmon populations to assess potential rescue. Reviewed at Part IV of the meeting.

General Research Recommendations

Research recommendations were documented that may assist with future Atlantic Salmon DU assessments. Most of these research recommendations were not expected to be addressed in the upcoming COSEWIC status report, but rather could help guide future research needs.

- Address large gaps in Atlantic Salmon spatial and temporal coverage in Canada for both life history and genetics/genomics.
- Organize a zonal prioritization exercise or initiative to assess regional and fine-scale sampling needs.

- Investigate existing and new tools to address sampling gaps to assess discreteness and evolutionary significance (e.g., GIS and other spatial tools to characterize river morphology; environmental DNA (eDNA) to assess presence or absence of salmon in rivers).
- Organize archival data to revisit aspects of evolutionary significance (i.e., standard practice for accessing/collecting/documenting biological data) in Parts II-IV to inform DU designation.
- Address a need for Standard Operating Procedures (SOP) for sample collection and storage (e.g., need to identify differences between one-off sampling vs. more long-term sampling).
- Investigate the utility of archival scale samples to leverage existing samples and any SOP that may be developed.

Research to Support the Weight of Evidence Decision Tree Approach

a. **Discreteness**: Determine areas that have inadequate coverage for analysis using genetic panels (e.g., microsatellites, single nucleotide polymorphisms [SNPs]). Archival scales and tissues where available may be used (see general research recommendations), but new sampling may be needed.
    - NL: North Avalon peninsula and northwest/northeast peninsula.
    - Coastal rivers of Bay of Fundy (outside Inner Bay of Fundy, St. John watershed, southern uplands).
    - Cape Breton lowland rivers.

b. **Evolutionary Significance:** Genomic data (e.g., 200K SNP panel, whole genome array); new sampling would be required.
    - Ungava Bay.
    - Eastern north shore of Quebec.
    - Newfoundland: north Avalon peninsula and northwest/northeast peninsula.
    - Southern uplands of Nova Scotia.
    - Outer Bay of Fundy.
    - Cape Breton lowland rivers.

c. **Evolutionary Significance:** Biological characteristics. Archival scale and tissue samples when available may be used, but new sampling may be needed.
    - The number of rivers adequately sampled and assessed annually is very small and diminishing.
    - Genetic baseline allows the use of archival samples to assign Atlantic Salmon to regional groups and evaluate evolutionary significance through biological characteristics.

d. **Evolutionary Significance:** Geo-climate features. New sampling may be required.
    - Physical and chemical characteristics of rivers are poorly documented; improvements are desired.
    - GIS and other spatial tools could be used as a starting point to characterize river morphology and links to evolutionary significance (e.g., size of rivers as a proxy for

population sizes; gradient as a proxy for adaptation; number of rivers as a proxy for metapopulation structure).

DU Specific Research Needs

- Northeast and Northwest Newfoundland: Additional sampling needed in Northeast Newfoundland.
- South Newfoundland: Sampling to support a possible fourth DU on the Avalon peninsula.
- Eastern Cape Breton: Additional sampling and analysis needed to determine if there are any life history differences between fish that use rivers that drain into Bras D'Or lake and those that drain out to the Atlantic Ocean.
- NS Southern Upland: More data needed in this DU, specifically around Round Hill and Annapolis River Basin.
- Outer Bay of Fundy: More research needed on St. John River and headwaters in the US that flow into Canadian DU 16 (as well as other transboundary populations with the potential to rescue Canadian DUs).

PRE-COSEWIC REVIEW OF ANADROMOUS ATLANTIC SALMON IN CANADA, PART II: NEWFOUNDLAND AND LABRADOR

The following WPs were prepared and made available to participants prior to the meeting (abstracts provided in Appendix B):

Kelly, N.I., Burke, C., Lancaster, D., Lehnert, S., Loughlin, K., Van Leeuwen, T., Dempson, B., Poole, R., Robertson, M., and Bradbury, I. In prep. Updated information on Atlantic Salmon (*Salmo salar*) populations in Labrador of relevance to the COSEWIC status report. CSAS Working Paper.

Kelly, N.I., Burke, C., Lancaster, D., Lehnert, S., Loughlin, K., Van Leeuwen, T., Dempson, B., Poole, R., Robertson, M., and Bradbury, I. In prep. Updated information on Atlantic Salmon (*Salmo salar*) populations in insular Newfoundland of relevance to the COSEWIC status report. CSAS Working Paper.

The meeting Chair opened the meeting and welcomed participants, reviewed the role of CSAS in the provision of peer-reviewed advice, and gave a general overview of the CSAS process. The Chair reviewed the ToR for the meeting (Appendix A) and the Agenda (Appendix C), highlighting the objectives and identifying the Rapporteurs for the process. In total, 31 people participated in the Part II meeting (Appendix D).

PRESENTATION OF WORKING PAPERS

The following WP authors were present: Kelly, N.I., Burke, C., Lancaster, D., Loughlin, K., Van Leeuwen, T., Dempson, B., Poole, R., Robertson, M., and Bradbury, I.

The meeting opened with a presentation by DFO Science (NL Region) that provided a summary of DUs in NL and potential changes discussed in Part I of this process.

Next, a series of presentations was provided by other DFO Scientists from the NL Region over the course of the three day meeting to summarize the two WPs described by the abstracts within Appendix B. The presentations provided an overview of salmon populations in each Salmon Fishing Area (SFA) in Newfoundland and Labrador (DUs 1–6), including life history characteristics, abundance trends, estimated total returns, threats, and other information relevant to COSEWIC.

GENERAL DISCUSSION

Overview of salmon populations in DU 1 Nunavik and DU 2 Labrador (Northern Labrador, Lake Melville, Southern Labrador)

The first day of the meeting focused on Labrador DUs. It was noted that many salmon rivers in Labrador have limited monitoring (e.g., rivers around Lake Melville), and there was some discussion around the accuracy and completeness of sample coordinates and names of salmon rivers of the Labrador DUs. Given limited monitoring data, the participants suggested the use of other available data (e.g., recreational angling data; subsistence; and food, social, and ceremonial [FSC] fisheries) to validate the population trends observed at counting fences. Harvest rates from recreational and FSC fisheries were not included in estimates of total returns in the WP; therefore, the authors of the WP agreed to add time series that included exploitation rates from these sources.

The group pointed out that the egg per fish ratio calculation in the WP for Labrador DUs seemed higher than expected. There was a suggestion to check the calculations for the egg per female fish ratio to make sure they were properly corrected for sex ratio.

Several key threats to Labrador DUs were discussed. It was noted that retention of large salmon in the West Greenland fishery should be estimated in the WP using available catch data (likely around 10% of Labrador salmon were vulnerable). Predation from Striped Bass (range has expanded northward) and increased development (e.g., roads, causeways, dams) also may have affected populations. Low fecundity and marine survival was noted. Overall, the cause of declines observed in Labrador rivers is still poorly understood.

Although outside the scope of the meeting, several participants noted that there was anecdotal evidence of fall run alternate spawners in Labrador (e.g., Alexa River in Grouse Point) which may have been a life history characteristic of interest for COSEWIC. Participants also noted that there seemed to be a missing salmon population in Bonavista Bay, with salmon prevalent in Southwest Pond.

DU 3 (Northeast Newfoundland) and DU 4 (South Newfoundland East and South Newfoundland West)

Day two of the meeting focused on DUs 3 and 4. Following the presentation for DU 3, there was some confusion regarding how river age, defined as smolts that survived to come back to spawn as adults, and virgin sea age were presented. The size cutoffs chosen in the WP may have resulted in the misclassification of some fish. The authors of the WP agreed to review the data and provide clarification in the WP since this was relevant for all DUs.

There was a discussion around whether the location of counting fences was an accurate representation for run timing; some fences are close to the mouth of rivers whereas others are not. The WP authors agreed to double check if other estimates were available or make this caveat clear in the WP.

During the discussion on threats to DUs 3 and 4, the participants suggested adding information on the intensification of aquaculture on the south coast of Newfoundland, and in particular the possible importance and magnitude of sea lice impacts on wild salmon populations. Although outside the scope of this meeting, there was additional information on aquaculture related threats available from the province of NL (e.g., aquaculture production, escaped fish, monthly sea lice counts) and the scientific literature (e.g., recent studies on sea lice impacts on salmon in Ireland and Norway).

Past and current stocking programs of salmonids, angling pressure in periods with high water temperature, future hydroelectric projects, percentage of fish caught in fisheries in St. Pierre and Miquelon, and seismic testing impacts were also raised as relevant threats for the COSEWIC status report, but there was limited DFO data to add. It was noted that there may be some DFO information related to hydroelectric threats in the DFO Recovery Potential Assessment (RPA) Science Advisory Report for the southern coast relevant to DU 3 that could have been added to the WP.

DU 5 (Southwest Newfoundland) and DU 6 (Northwest Newfoundland)

Day three of the meeting focused on DU 5 and DU 6. The participants had questioned how river age, generation time, and accessible habitat for salmon were determined. It was agreed upon to add further clarification to the WP since this background was applicable to all Newfoundland and Labrador DUs.

A participant pointed out that the run timing for salmon in Lomond River (early July) was earlier than described in the WP because there was a waterfall that was not easily passable, thus making the run timing appear later.

When threats for DUs 5 and 6 were discussed, it was noted that some salmon rivers on the west coast of Newfoundland had higher gradient and thus may have been more vulnerable to extreme events because of their geography. The participants suggested adding wording to the WP on extreme events or conditions for which DFO has records, such as flash floods, periods of low water levels, and/or high water temperatures that could impact DUs.

Another threat discussed was illegal fishing and poaching. The group suggested to check with DFO Conservation and Protection to see if there were any time series to better describe this threat. It was raised that the province of NL may also have time series to describe the threat of illegal fishing and poaching which could be of relevance for COSEWIC.

CONCLUSIONS

The authors agreed to make revisions based on the feedback provided by the participants during the meeting. Overall, there was no dissent on the WPs by the participants and both papers were accepted as Research Documents.

RECOMMENDATIONS

There was discussion regarding spatial gaps in data and understanding of threats for many of the DUs. Uncertainty about applying trends from monitored rivers to all rivers in a DU was also raised several times as a key concern. Comparing returns to available habitat to estimate exploitation rate from angling was suggested as a means to increase confidence in results. In particular, this approach was recommended as a strategy for reexamining the Labrador DUs in the future, as these northern DUs had only a few monitored rivers which represented large areas. A participant noted that electrofishing rivers to test if models could accurately predict population abundance could be prioritized over operating counting fences, as electrofishing is generally less labour-intensive. Some participants noted the importance of bolstering monitoring for northern DUs given possible impacts from climate change.

PRE-COSEWIC REVIEW OF ANADROMOUS ATLANTIC SALMON IN CANADA, PART III: QUEBEC

The following working document was prepared and made available to meeting participants before the meeting (see summary in Appendix B):

April, J., Bujold, J.-N., Bujold, V., Cauchon, V., Doucet-Caron, J., Gagnon, K., Guérard, M., Le Breton, S., Nadeau, V. and Plourde-Lavoie, P. 2022. Pre-COSEWIC Review of Anadromous Atlantic Salmon in Canada: Zonal Peer Review – Quebec Region. CSAS Working Paper.

The meeting chair welcomed participants, reviewed the role of CSAS in the provision of peer-reviewed advice, and gave a general overview of the CSAS process. After the participants introduced themselves, the Chair reviewed the terms of reference (Appendix A) and the agenda (Appendix C) for the meeting, highlighting the objectives and identifying the Rapporteur for the process. In all, 29 people participated in Part III of the meeting (Appendix D). The conclusions and advice resulting from this review will be provided in the form of a research document to COSEWIC to inform the next assessment of the Atlantic Salmon in Quebec waters.

DFO PRE-COSEWIC PROCESS AND COSEWIC SPECIES ASSESSMENT PROCESS (STATUS REPORT)

An overview of DFO's pre-COSEWIC process and the way DFO provides relevant peer-reviewed information for COSEWIC's status report was provided.

PRESENTATION OF THE WORKING PAPER

The following authors of the working paper were present: April, J., Bujold, J.-N., Bujold, V., Cauchon, V., Doucet-Caron, J., Gagnon, K., Guérard, M., Le Breton, S., Nadeau, V. and Plourde-Lavoie, P.

GENERAL DISCUSSION

Basic principles of the species' biology, designatable units, population manipulation and life history characteristics

Regarding the question of what time frame should be used for the assessment of Atlantic Salmon populations, the group recommended that results be presented over three generations (as required by COSEWIC) and indicated that a text concerning the broader temporal frame should be included in the report to explain the historical context.

With regard to the relevance of considering habitat in each DU to determine the spawner requirement for the population, one participant expressed reservations about the habitat model presented in relation to the spatial scale used. It was noted that this would be discussed later with the presenters.

Clarification was provided concerning the fecundity value used by the Quebec Department of Wildlife, Forests and Parks (MFFP). MFFP describes fecundity in terms of number of eggs per kilo (Leclerc 2015). After all, a large salmon produces more eggs than a small one.

Habitat characteristics and climate change

A participant mentioned that the temperature index used to calculate the habitat suitability index (HSI) seems quite crude and appears to differ between south and the north, and asked whether the index was derived for each river or adjusted in relation to the geography of the river. It was noted that the index is fairly crude, and that is why MFFP wants to update it. For each river mouth, the number of growing days should be considered (maximum vs. minimum across Quebec and linear relationship of this range with the number of growing days in Quebec).

A participant asked whether the growth index corresponds to age of smoltification. It was explained that there is a certain correspondence with age of smoltification, and with rivers' nordicity.

Another participant suggested that climate change projection calculations be performed for a period closer to the present (2010–20 instead of 2011–40). One of the authors would check into the feasibility of adopting this approach.

Participants discussed the updated information related to the HSI, among other things. One participant noted that the water temperature predictions seem to suggest that growing conditions for salmon will improve in most rivers and asked whether this would have a positive effect on the production of juveniles and smolts. It was explained that although present data seem to indicate that a substantial loss of productivity could occur, particularly in DU 13, and that a marked increase in productivity may be observed for certain rivers in the north, an exhaustive portrait of the situation is not yet available. Therefore, it is not possible to draw any specific conclusions about changes in production in the different DUs.

Abundance, fishing and threats

Participants discussed the accuracy of the estimates related to removals by individuals fishing for food. It was mentioned that the accuracy of the data varies considerably from one river to another. Agreements signed with certain communities make it possible to obtain more accurate data. MFFP uses what are considered to be the most accurate data for each river/community, which may include the use of historical data.

A participant asked whether the biological reference point of 200 individuals per river is related to the genetic and demographic components. It was explained that the biological reference point of 200 individuals per river relates only to the genetic conservation threshold. A participant pointed out that the area of conservation of a population cannot be determined solely on the basis of the genetic conservation threshold; the two conservation thresholds (e.g., genetic and demographic) must be considered.

Participants discussed the number of fish caught in the recreational fishery per unit of effort. One participant asked how fisher use data are compiled. One of the authors explained that the use data are more accurate for rivers with structured access than for rivers with free access. In low use areas, fishing success data are used, but it is important to note that even in remote areas, there are controlled zones (e.g., outfitters) which provide accurate data that are used to estimate use. The accurate data from outfitters provide confidence in the estimates of removals.

A discussion ensued on river assessment categories. It was mentioned that the approach of Caron and Fontaine (1999) is not perfect, but it has the advantage of obtaining values for all the rivers in Quebec, which is useful for a macroscopic approach. This approach is used to get a general picture of the number of spawners in the rivers.

The discussion on the main threats focused mainly on integrating threats into the calculator. A participant explained the COSEWIC threat assessment process. It was pointed out that the threats calculator is not completed by the status report writers, but rather by COSEWIC, at a later stage. It was decided that common wording should be agreed upon with the other DFO Regions, when the four Pre-COSEWIC meetings are held, so that the information on threats can be presented in a coherent and standardized manner for all the DUs.

Status of Gaspé and Lower St. Lawrence populations: abundance and threats (DU 15)

The participants discussed the way information is processed in the threats calculator. One participant underscored the importance of carefully distinguishing between the scope and severity of a threat. Although another participant suggested that the threat category "forest roads and culverts" be emphasized to a greater extent in the calculator. The group agreed to check with the other jurisdictions/regions and then reach agreement with them on how the threat is dealt with in the calculator, to ensure consistency.

It was noted that although this DU has the highest habitat suitability index in Quebec and the largest number of spawners, it is nonetheless affected by various threats that could have a negative impact.

Status of Nunavik populations: abundance and threats (DU 1)

The participants discussed the characteristics of this DU, including fishing for food, social and ceremonial purposes. It was mentioned that Indigenous Atlantic Salmon fisheries are carried out mainly during the summer in this DU.

A participant said that although this DU is called "Nunavik populations", it corresponds to populations in the Ungava region. It was also pointed out that the catch data for Greenland and Labrador indicate that salmon presenting characteristics of Ungava populations are harvested there that some of these salmon therefore undertake large migrations.

Status of Lower North Shore populations: abundance and threats (DU 4)

A participant asked whether information is available on smolt size in the Corneille River in relation to average age, so that the data can be compared with the data for neighbouring rivers. The authors agreed to provide participants with this information. It was noted that the Corneille River belongs to DU 10, not DU 4 as is currently indicated, and that this information needs to be corrected.

The participants talked about the incidental catches that are made in some areas of this DU, notably in the St-Paul River. A participant wondered whether incidental catches should be included in the threats calculator in some cases. Another participant pointed out that it could be difficult to determine the impact of these incidental catches.

Status of Eastern North Shore populations: abundance and threats (DU 10)

A question was asked about whether the dams located on the rivers in this DU were constructed on impassable falls. It was mentioned that, according to habitat data, the Lac-Robertson Dam on the Véco River has a set of falls that are probably impassible 2.5 km downstream of the dam and it does not have a fishway. It was agreed that this information would be added to the report.

There was further discussion on the habitat suitability index (HSI). A participant mentioned that it would be helpful to have the unadjusted HSI (i.e., not adjusted as a function of water temperature) in order to examine the physical factors that affect the HSI. The participants agreed to share these data.

Status of Western North Shore populations: abundance and threats (DU 11)

The participants discussed the history of the stocking campaigns that have been conducted in the different rivers in this DU. One of the report authors mentioned that, according to the available data, the last major stocking efforts took place in the 1970s, but experimental stocking was probably done in the 1980s.

Discussion ensured on the impact of the 28 dams in this DU on the movement of salmon. One participant asked whether some of these dams restrict the movement of salmon. One author pointed out that the information presented included all the inventoried dams and that a more in-depth analysis would be required concerning the potential loss of connectivity caused by these dams.

Atlantic Salmon did not use the Rivière aux Rochers often prior to the stocking campaigns. One participant recommended that an effort be made to distinguish between historical abundance linked to stocking and natural abundance. Following discussion, it was suggested that the Rivière aux Rochers be excluded from the summary of trends for the entire DU. It was also suggested that further checks be made to determine whether other rivers should be excluded from the calculation of the summary of trends for the entire DU.

The participants talked about the counts of salmon that are conducted on the different rivers in the DU. The authors agreed to share the partial count data for the Godbout River and count data from the fishway on the Moisie River with the writers of the status report.

Status of Anticosti Island populations: abundance and threats (DU 12)

Since the size data indicate that multi-sea-winter salmon range from 58 to 63 cm, a participant asked whether there were salmon larger than 63 cm in this DU. One author said that there were some, but because catching fish longer than 63 cm is prohibited in this DU, no data are available. A participant suggested that historical data be used to derive size/age distributions for this size range.

The authors agreed to provide the temperature data (i.e., obtained with thermographs) to the writers of the status report. A participant asked whether river discharge data were available. It was explained that there are currently four temperature recording stations on the Island. The mean temperature is about 16 degrees, which is not very high compared to the temperature in the other DUs.

Status of Inner St. Lawrence populations: abundance and threats (DU 13)

Participants discussed the different anthropogenic pressures that are present in this DU (e.g., dams, construction, and agriculture). It was mentioned that in the Rivière à Mars there is a dam that restricts migration and about 30% of the salmon run is transported upstream of the dam. One participant added that the optimal conservation threshold is targeted for the population downstream of the dam and that the rest of the population is generally transported upstream. Transport is generally limited by the water temperature; it is not carried out if the water temperature is too warm. It was noted that in certain rivers, depending on conditions, all the salmon are relocated upstream of the dam (e.g., Malbaie River).

A participant mentioned that some outbreaks of disease had been observed among salmon in the Restigouche River and asked whether this had been seen in other rivers. There have been outbreaks of furunculosis in the Restigouche River; the magnitude of these outbreaks varies among years. The outbreaks were generally observed after the spawning period. MFFP tried to capture some dying salmon for analysis, but the results were not conclusive. It was stated that the situation is not alarming since only a few dying individuals have been recorded each year. More significant mortality events occurred in the early 2010s (in Gaspé rivers: infection involving saprophytes of the genus *Saprolegnia*) but it is difficult to determine the cause.

A discussion ensued on incidental catches. On some rivers, harvesting of anadromous brook trout (sea trout) is allowed during the salmon fishing period. One participant mentioned that there is also a fall fishing period for anadromous brook trout in the downstream portion of certain rivers; fishing for juvenile brook trout there is popular, but the catch of adults is generally marginal. Owing to the location and the period involved, the incidental take of salmon is limited. In salmon rivers, fly fishing is mandatory. This limits the occurrence of incidental catches where a fish is hooked in part of its body other than the mouth.

One participant asked about the genetic stock used for the reintroduction of salmon in the Jacques-Cartier River. The response was that several sources may have been used but the information needs to be confirmed. It was recommended that when information becomes available on the genetic stocks used for the reintroduction of salmon in the Jacques-Cartier River, it should be shared with the participants.

CONCLUSIONS

The authors agreed to make revisions based on the comments provided by meeting participants. There was no disagreement concerning the information presented, and the working document can be published as a research document. The level of detail to be included in the Quebec research document, notably on the interpretation of threats, and the level of detail in the other regions' research documents should be aligned, after all the pre-COSEWIC meetings on the Atlantic Salmon have been held, to standardize the information for the different DUs as much as possible.

RECOMMENDATIONS

The following research recommendations were formulated during the discussions:

Western North Shore of Quebec (DU 11):

- Impact of dams in terms of the potential loss of connectivity (preventing natural migration of salmon) on the Rivière de la Trinité.
- Impact of acidification of North Shore rivers on the survival of smolts.
- Impact of riprap on warming of the water, for example, in the Rivière à Mars and the Saint-Jean River in the Saguenay.

PRE-COSEWIC REVIEW OF ANADROMOUS ATLANTIC SALMON IN CANADA, PART IV: GULF AND MARITIMES

The following nine WPs were prepared and made available to participants prior to the meeting (abstracts provided in Appendix B):

Goguen, G., Caissie, D. 2022. Hydrometeorological conditions for Atlantic salmon rivers in the Maritime provinces. DFO Can. Sci. Advis. Sec. Res. Doc. 2022/016. vi + 41 p.

Dauphin, G. 2022. Information on Atlantic Salmon (*Salmo salar*) from Salmon Fishing Area 15 (Gulf New Brunswick) of relevance to the development of a 2nd COSEWIC status report. DFO Can. Sci. Advis. Sec. Res. Doc. 2022/050. iv + 50 p.

Cairns, D.K., Roloson, S.D., MacFarlane, R.E., and Guignion, R.E. 2023. Information on Atlantic Salmon (*Salmo salar*) from Salmon Fishing Area 17 (Gulf Prince Edward Island) of relevance to the development of a 2nd COSEWIC status report. DFO Can. Sci. Advis. Sec. Res. Doc. 2023/043. v + 92 p.

Reader, J.M., Hardie, D.C., McWilliam, S., Brunsdon, E.B., Notte, D., and Gautreau, M. 2024. Updated information on Atlantic Salmon (*Salmo salar*) Inner Bay of Fundy populations (IBoF; part of SFAs 22 and 23) of relevance to the development of a 2nd COSEWIC status report. DFO Can. Sci. Advis. Sec. Res. Doc. 2024/057

Reader, J.M., Hardie, D.C., McWilliam, S., Brunsdon, and E.B., Gautreau, M. 2024. Updated information on Atlantic Salmon (*Salmo salar*) populations in southwest New Brunswick (outer portion of SFA 23) of relevance to the development of a 2nd COSEWIC status report. DFO Can. Sci. Advis. Sec. Res. Doc. 2024/051

Taylor, A.D., Raab, D., Hardie, D.C., and Brunsdon, E.B. 2024. Updated information on Atlantic Salmon (*Salmo salar*) Eastern Cape Breton populations (ECB; SFA 19) of relevance to the development of a 2nd COSEWIC status report. DFO Can. Sci. Advis. Sec. Res. Doc. 2024/049. v + 69 p.

Raab, D., Taylor, A.D., Hardie, D.C., and Brunsdon, E.B. 2024. Updated information on Atlantic Salmon (*Salmo salar*) populations in Nova Scotia's Southern Upland (SU; SFAs 20, 21, and part of 22) of relevance to the development of a 2nd COSEWIC status report. DFO Can. Sci. Advis. Sec. Res. Doc. 2024/050. v + 65 p

Daigle, A. 2023. Information on Atlantic Salmon (*Salmo salar*) from Salmon Fishing Area 18 (Gulf Nova Scotia) of relevance to the development of a 2nd COSEWIC status report. DFO Can. Sci. Advis. Sec. Res. Doc. 2023/007. iv + 44 p.

Douglas, S., Underhill, K., Horsman, M., and Chaput. G. 2023. Information on Atlantic Salmon (*Salmo salar*) from Salmon fishing area 16 (Gulf New Brunswick) of relevance to the development of a 2nd COSEWIC report. DFO Can. Sci. Advis. Sec. Res. Doc. 2023/033. v + 75 p.

The meeting Chair opened the meeting and welcomed participants, reviewed the role of CSAS in the provision of peer-reviewed advice, and gave a general overview of the CSAS process. The Chair reviewed the ToR for the meeting (Appendix A) and the Agenda (Appendix C), highlighting the objectives and identifying the Rapporteurs for the process. In total, 62 people participated in the Part IV meeting (Appendix D).

PRESENTATION OF WORKING PAPERS

The following WP authors were present: Brunsdon, E.B, Cairns, D.K., Caissie, D., Chaput, G., Daigle, A., Dauphin, G., Douglas, S., Goguen, G., Hardie, D.C., McWilliam, S., Raab, D., Reader, J.M., Roloson, S.D., and Taylor, A.D.

Following the opening remarks, presentations were provided by the relevant DFO scientists (see Appendix C for detail on presentations). The presentations occurred over the course of the five-day meeting to summarize the nine WPs described by the abstracts within Appendix B. The first presentation covered hydrometeorological conditions for salmon rivers over the last 20 years in the Maritimes. The remaining presentations provided an overview of salmon populations in each SFA (16–23), including life history characteristics, abundance trends, estimated total returns, threats, and other information relevant to COSEWIC.

GENERAL DISCUSSION

Hydrometeorological Conditions in Maritimes Provinces

Long-term trends and hydrometeorological conditions over the last 20 years for salmon rivers in the Maritimes Provinces were presented and discussed, including the occurrence of extreme events (e.g., periods of high or low flows). This habitat related information is relevant to COSEWIC because some areas in the Maritimes have been impacted by more extreme hydrometeorological events which can influence salmon population dynamics (e.g., low flows could have led to fewer or no fry in particular months).

The participants asked the WP authors to add the month(s) when extreme high or low flows occurred to help improve understanding of the relationship between climate and population trends across salmon rivers in the Maritimes. It was mentioned that there is an Environment and Climate Change Canada (ECCC) dataset on precipitation that could clarify some of the variability seen in the precipitation data presented in the WP, but that it was outside the scope of the meeting.

SFA 15 (Restigouche, Gulf New Brunswick)

It was noted that there are many data gaps in this SFA for rivers outside the Restigouche and Nepisiguit rivers. The group commented on data gaps for fry and suggested that the WP authors re-examine existing DFO data on salmon fry. A fry index that dates back to the late-1990s and covers 13 sites was raised as a possible data source. The participants suggested that WP authors re-examine each tributary to the extent possible to compare the number of fry with the number of spawners, which could better inform juvenile and adult trends (i.e., fry index as a proxy for spawners). A participant also commented that a First Nations group on the Nepisiguit may have relevant adult count data for COSEWIC. A participant noted that catch data from the Matapedia River does not reflect salmon abundance when excluding catch and release data because of the major regulatory changes that occurred on this river since 2014 (for instance mandatory release of all large salmon).

During the discussion of threats, the group found that that the rationale for the chosen threat scope and severity categories in the WP was not always clear. The participants recommended that all WP authors add or check their descriptors for threat rankings in order provide sufficient detail for COSEWIC to assess DU-specific threats.

The following was also raised by the group regarding threats. For ‘illegal fishing and poaching’, the threat category was changed to moderate severity (i.e., medium population impacts) from serious given uncertainties with the data source. WP authors agreed to add text to describe possible impacts of effluent from the Atholville dam under the threat category 'mortality with water use'. Atholville is not thermally regulated, and water effluent can reach about 50 degrees Celsius. The addition of missing descriptors for mining impacts, including a forthcoming zinc mine in Caribou Mines that has the potential to affect salmon in Nepisiguit river, was mentioned. For the threat category 'shipping transport and noise' it was noted that there is substantial boating traffic in the Restigouche River. Data on boat traffic in estuaries during salmon outmigration could be obtained from the Port of Dalhousie and Port of Belledune, but was outside the scope of the meeting. Information to support catch and release mortality in the Matapedia River could be found in an annual report released by the Province of Quebec (e.g., MFFP 2021). Several participants noted a paper by Teffer et al. (2020) that could be of relevance to COSEWIC to inform the threat of aquaculture activities in the Restigouche (e.g., signature of bacteria and viruses that have possible correlation to aquaculture activities).

SFA 16 (Miramichi, Gulf New Brunswick)

Participants discussed population trends and threats to salmon in SFA 16. There was some question around using spawning salmon vs. returning salmon (which are declining overall) as the metric to base population size. The participants agreed to use spawners as the metric given that COSEWIC bases population size on animals that have the capacity to spawn. If returning salmon are harvested before they spawn, then they are not contributing to the next cohort. To help clarify, the group asked the WP authors to add specifics about using spawners as the metric to base population size.

There was a discussion on the history of stocking in this SFA and how the risks and benefits of stocking are still unclear. The participants agreed to add descriptors of stocking programs in SFA 16 using information available from the DFO Introductions and Transfer Committee (ITC). The Province of NB may also have some additional information on stocking programs for salmonids (e.g., Brook Trout and landlocked salmon), which could be of relevance to COSEWIC but was outside the scope of the meeting.

It was suggested that some additional history on disease in SFA 16 could be added to the WP (e.g., history of Furunculosis and kidney disease), although the impacts of disease are likely low.

SFA 17 (Prince Edward Island)

The participants had a discussion regarding the calculation of population size based on fluvial areas. Not all fluvial areas contain salmon given the small size of many rivers in Prince Edward Island (PEI) and the unique geology and geography. WP authors agreed to elaborate on how they calculated potential population size, including how they defined small and large rivers. The WP authors also noted that population sizes for salmon in SFA 17 are low and may be subject to adverse genetic effects such as inbreeding. However, a participant raised a paper by Consuegra et al. 2005 which suggests that:

1. endangered populations can maintain relatively high levels of genetic variation despite their small size, and;
2. marked population declines may not necessarily result in a significant loss of genetic diversity.

During the discussion on threats, there was some discussion about missing information on current and past of stocking history in this SFA. There was agreement by WP authors to add descriptors of stocking programs in the threat section using DFO data available from the ITC. A paper by Perrier et al. (2016) was raised as a resource for monitoring short-term fluctuations in population sizes, effective number of breeders, and adult population sizes in a context of stocked populations. Information regarding recent stocking activities in the Morell River could be obtained from the Province of PEI or other sources, but it was noted this was outside the scope of the meeting. Interactions between salmon and other non-native salmonids that are being stocking across PEI (e.g., Rainbow Trout and Brown Trout) could also be of relevance to COSEWIC. Potential anoxic events in estuaries and rivers (e.g., Dunk River) were also discussed as a threat to salmon in PEI.

SFA 18 (Western Cape Breton)

Following the presentation, there were questions about the significance levels of declines seen in the juvenile time series. The WP authors agreed to note the significance level in the WP and add a generation time data table in report.

When threats were discussed and similar to previous SFAs, the participants asked for information on current and past stocking history and hatchery programs to be included in the WP. The authors agreed to compile any DFO data from the ITC and DFO Aquaculture related to the rivers, species (e.g., Atlantic Salmon, Rainbow Trout, and Brown Trout), numbers released and stock origin. Some of this information may be available from the Province of NS and hatchery managers for the Margaree River, but was outside the scope of this process.

The COSEWIC representative asked about low fry densities in the Margaree River in 2003 due to extreme climate conditions, and whether there was a detectable impact on the return of spawners from those year classes. It was noted that it led to a small decrease in adult returns, but that the WP authors would re-examine these year classes. Information related to other extreme climate events, including low water events and a 200-year flood October 2015 in the Margaree River would be compiled by DFO authors to the extent possible.

Other threat related discussions included adding more detail and data on damming operations in NS (e.g., Chéticamp) and recreational angling data available from the Province of NS, but was deemed outside the scope of this process.

SFA 19 (Eastern Cape Breton)

Most of the discussion for SFA 19 centered around threats in freshwater and marine environments. Several participants mentioned escapees from aquaculture and stocking as ongoing issues given major expansion of Rainbow Trout aquaculture and potential non-direct genetic effects of stocking salmonids. The group suggested to add maps and tables to the WP with aquaculture facilities, potential expansion sites (e.g., around Bras d’Or Lake, Whycocomagh Bay) and stocking activities to allow for COSEWIC to fully assess the severity of this threat. Maps and tables could encompass aquaculture management areas in the SFA, including the individual facilities, whether facilities are active, production trends over time, and species (e.g., Atlantic Salmon, Rainbow Trout). Some of this information would be available from DFO sources (e.g., ITC, Aquaculture Management Program, Coldbrook Biodiversity facility) and could be added to the WP while some of the data that was identified was outside the scope of this process. These sources may also have information relevant to COSEWIC on zooplankton and phytoplankton depletion near aquaculture facilities, which could be leading to a decline in the abundance and survival of forage fish such as capelin that are food sources for salmon (Mills et al. 2013).

SFAs 20 and 21 (Southern Uplands)

Many populations in this SFA are located near to aquaculture sites; therefore, like other SFAs, the participants asked for any DFO information related to non-active and active aquaculture activities be added to the WP. The Province of NS may have additional information on active sites and production which could be relevant to COSEWIC. Similar to SFA 19, the decline in the quantity and quality of key forage fish such as capelin near sites of aquaculture was mentioned (Mills et al. 2013). A participant also asked for all WP authors to verify whether salmonids involved in stocking programs (e.g., Rainbow Trout, Brown Trout) are capable of reproducing (i.e., non-sterile). Use of sterile fish helps to minimize adverse effects to wild salmon from aquaculture and introductions and transfers; therefore, it is important to note where non-sterile fish have been released.

Another threat that was noted as lacking some information in the WP was Aquatic Invasive Species (e.g., Smallmouth Bass). The regional AIS NCP and the Province of NS could have additional data of relevance to COSEWIC.

SFA 22 (Inner Bay of Fundy)

Salmon in this SFA have experienced severe declines and are maintained through a Live Gene Bank (LGB) Program. There was discussion about whether genetic analyses could distinguish between wild fish and stocked fish from the LGB Program or escaped aquaculture fish. The WP authors noted that it was complex but that fish with aquaculture origins (i.e., European alleles) could be identified – distinguishing wild fish from LGB fish is harder. In the WP, it was mentioned that the Portapique River was non-LGB supported but had higher densities of fish. The WP authors noted fish observed in the Portapique during a 2014 broad electrofishing survey appeared to predominantly originate from the Stewiacke River according to genetic analysis. A participant flagged that these fish are likely LGB contributions that have strayed into the Portapique given its location between other rivers supplemented with LGB fish.

During the discussion on threats, some participants mentioned that they have observed what appears to be self-sustaining populations of non-native Rainbow Trout in the Big Salmon River. The Atlantic Salmon Federation (ASF) representative noted that there was an electrofishing dataset from 2007–09 and possibly swim survey data that could be of relevance for COSEWIC. The WP authors agreed to check into this data and indicate sites where Rainbow Trout have been observed.

The participants noted some possible DFO data gaps related to information on fish passage and water crossings as only roads and rail was mentioned in the WP. The WP authors agreed to check with the DFO FFHPP to inquire about additional information on water crossings that could supplement the threats section. It was noted that NS Power may have some flow record data from White Rock Generation Facility that could be shared with COSEWIC status report authors, as well as some data from temperature loggers.

During a discussion on the threat of disease and parasites, a participant suggested that information on escapees and disease load documented in Teffer et al. (2020) would be of relevance for COSEWIC.

SFA 23 (Outer Bay of Fundy)

Following the presentation, there was a question about the authors' confidence in the external sexing of males and females in July, given that it is difficult at that time of the year. The lead authors agreed to add some details and associated caveats about their sexing methods in the WP, and noted that they are now doing genetic sexing because of concerns of underestimating females in the Mactaquac River and overestimating them in the Nashwaak River.

For threats, the participants asked for descriptors to be added for hook and release mortality vs. retention mortality in recreational fisheries, specifically any new information since the 2010

COSEWIC status report. Poaching was also discussed as a threat and several participants wanted clarity on how poaching was defined in the WP. The participants asked for poaching information to be re-examined using information from DFO Conservation and Protection.

Similar to other SFAs, descriptors for stocking activities, including recent and past history of stocking in the region was noted as a gap. WP authors agreed to add information on stocking of salmon or other fishes from DFO sources (e.g., Fishery [General] Regulations sections 52 and 56, ITC).

To better document threats to fish passage, the group noted that there are potential plans regarding the future of the Mactaquac Dam that should be included and considered in the WP, given that DFO has the licensing mandate.

It was noted that ASF has been doing electrofishing presence and absence surveys for many rivers in SFA 23. Information on the status of the Mactaquac Dam could also be obtained from NB Power. Both of these data sources were outside the scope of the meeting, but could be of relevance for COSEWIC.

CONCLUSIONS

The authors agreed to make revisions based on the feedback provided by the participants during the meeting. Overall, there was no dissent on the WPs by the participants and all papers were accepted as Research Documents.

RECOMMENDATIONS

Recommendations were provided through the Research Documents but are summarized below for each of the SFAs.

SFA 15 (Restigouche, Gulf New Brunswick)

- Given data gaps for many sites in this SFA, additional surveys would be beneficial to determine and interpret trends. Field work to sample juveniles in this SFA occurred in 2008 but has not been repeated. Additional snorkel counts on the Matapedia or other salmon rivers could be combined with angling catches to identify a relationship between catch numbers and population trends.

SFA 16 (Miramichi, Gulf New Brunswick)

- There is a need to examine the effects of warming water temperature on juvenile salmon in the Miramichi and other SFAs. It was hypothesized that returning adults may be less affected by warm water than juveniles because juveniles have no way to escape warm temperatures; however, juveniles may be more tolerant than adults to high water temperatures.
- Explore dynamics behind declining size-at-age of multi-sea winter fish and small salmon which was not seen for large salmon.

SFA 17 (Prince Edward Island)

- A significant source of uncertainty for assessing the number of spawners in this SFA was the ratio of redds to spawners, which was derived from only one river in one year. There was also uncertainty about the accuracy of identification of Atlantic Salmon redds, as Brook Trout redds are similar in appearance. It was recommended to repeat this exercise in other areas in order to provide a better estimate.

- More research is needed on the impacts of Rainbow Trout stocking on salmon.

SFA 18 (Western Cape Breton)

- Investigate whether there was a detectable impact of climate on the return of spawners from year classes affected by an extreme climate event in 2003.
- More research is needed to understand impacts of interactions between Atlantic Salmon and Brown Trout.

SFA 19 (Eastern Cape Breton)

- Investigate possible impacts associated with bivalve aquaculture on wild salmon in this SFA. Intensive bivalve aquaculture can deplete phytoplankton in some areas, which could be limiting the production of zooplankton, and reduce the availability of food to planktivorous fish.

SFAs 20 and 21 (Southern Uplands)

- None discussed, although the high proportion of females in LaHave River was mentioned to be a curious observation.

SFA 22 (Inner Bay of Fundy)

- None discussed.

SFA 23 (Outer Bay of Fundy)

- Additional studies are needed on the impacts of disease, bacteria, and viruses originating from aquaculture on Atlantic Salmon in different areas and at different times in the Atlantic Salmon lifecycle. Risks are still not clearly understood.

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APPENDIX A: TERMS OF REFERENCE

Pre-COSEWIC Assessment for Atlantic Salmon

Zonal Advisory Meeting – Newfoundland and Labrador, Maritimes, Gulf and Quebec Regions

Part I: Review of information for Designatable Units – October 26–29, 2020
Virtual meeting

Part II: Review of information Newfoundland and Labrador – February 1–4, 2021
Virtual meeting

Part III: Review of information province of Quebec – December 15–16, 2020
Virtual meeting

Part IV: Review of information Maritime Provinces – January 18–22, 2021
Virtual meeting

Chairpersons:

- Travis Van Leeuwen (DFO NL), Parts I and II
- Charley Cyr (DFO Quebec), Part III
- Cindy Breau (DFO Gulf), Part IV

Context

The implementation of the federal *Species at Risk Act* (SARA), proclaimed in June 2003, begins with an assessment of a species' risk of extinction by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC). COSEWIC is an independent advisory panel to the Minister of Environment and Climate Change Canada that has been established under Section 14(1) of SARA to perform species assessments, which provide the scientific foundation for listing species under SARA. Therefore, an assessment initiates the regulatory process whereby the Governor in Council (GiC), on the recommendation of the Minister of Environment and Climate Change Canada, must decide whether to accept COSEWIC's assessment and add a species to Schedule 1 of SARA, which would result in legal protection for the species under the Act. If the species is already on Schedule 1 of SARA, the Minister may decide to keep the species on the list, reclassify it as per the COSEWIC assessment, or to remove it from the list (Section 27 of SARA). The Minister's recommendation to the GiC is informed by advice from the competent minister(s). The Minister of Fisheries, Oceans and the Canadian Coast Guard is competent minister for aquatic species.

Fisheries and Oceans Canada (DFO), as a generator and archivist of information on marine species and some freshwater species, is to provide COSEWIC with the best information available to ensure that an accurate assessment of the status of a species can be undertaken.

Previously, Atlantic Salmon (*Salmo salar*) was assessed by COSEWIC in 2010 as comprising 16 Designatable Units of which the Lake Ontario DU was assessed as extinct in Canada (COSEWIC 2010). An update of the status for the 15 previously defined and extant Designatable Units was identified on COSEWIC's Fall 2019 call for bids.

Objectives

The overall objective of this process is to peer-review DFO existing information relevant to the COSEWIC status assessment for Atlantic Salmon in Canadian waters, considering data related to the status and trends, threats to the species inside and outside Canadian waters, and to summarize the strengths and limitations of the information. The DFO held data and information up to and including the calendar year 2019 will be made available to the authors of the species status report, the co-chairs of the applicable COSEWIC Species Specialist Subcommittee, and to COSEWIC.

Specifically, DFO information relevant to the following will be reviewed to the extent possible:

1. **Life history characteristics**
    - Growth parameters: age and/or length at maturity, maximum age and/or length;
    - Total and natural mortality rates and recruitment rates (if data are available);
    - Fecundity;
    - Generation time (taken as the mean age of parents);
    - Early-life history characteristics; and
    - Specialized niche or habitat requirements, if any.
2. **Review of Designatable Units**

Available information on population differentiation, which could support a COSEWIC decision of which populations below the species' level would be suitable for assessment and designation, will be reviewed. This information will include:

- Genetic information to support definition of DUs;
- Summary of life history information, previously published and in particular new information, to support the genetic information on population structure; and
- Extent to which manipulation of populations through intentional supplementation activities (hatchery stocking, adult transfers), recovery actions for endangered populations, and introgression with aquaculture escaped salmon may have otherwise modified the population structure for wild Atlantic Salmon in eastern Canada.

3. **Compilation and review of data to support the assessment of population status relative to the COSEWIC criteria for the species in Canada as a whole, and for each Designatable Units identified, if any.**

COSEWIC Criterion A - Declining Total Population

a. Summarize overall trends in population size (both number of mature individuals and total numbers in the population) over as long a period as possible and in particular for the past three generations. Additionally, present data on a scale appropriate to the data to clarify the rate of decline.

b. Identify threats to abundance where declines have occurred over the past three generations, summarize the degree to which the causes of the declines are understood, and the evidence that the declines are a result of natural variability, habitat loss, fishing, or other human activity.

c. Where declines have occurred over the past three generations, summarize the evidence that the declines have ceased, are reversible, and the likely time scales for reversibility.

COSEWIC Criterion B - Small Distribution and Decline or Fluctuation: for the species in Canada as a whole, and for Designatable Units identified, using information in the most recent assessments:

a. Summarize the current extent of occurrence (in km²) in Canadian waters.

b. Summarize the current area of occupancy (in km²) in Canadian waters.
c. Summarize changes in extent of occurrence and area of occupancy over as long a time as possible, and in particular, over the past three generations.
d. Summarize any evidence that there have been changes in the degree of fragmentation of the overall population, or a reduction in the number of meta-population units.
e. Summarize the proportion of the population that resides in Canadian waters, migration patterns (if any), and known breeding areas.

COSEWIC Criterion C – Small Total Population Size and Decline and Very Small and Restricted: for the species in Canada as a whole, and for Designatable Units identified, using information in the most recent assessments:

a. Tabulate the best scientific estimates of the number of mature individuals.
b. If there are likely to be fewer than 10,000 mature individuals, summarize trends in numbers of mature individuals over the past 10 years or three generations, and, to the extent possible, causes for the trends.
c. Summarize the options for combining indicators to provide an assessment of status, and the caveats and uncertainties associated with each option.
d. For transboundary stocks, summarize the status of the population(s) outside of Canadian waters. State whether rescue from outside populations is likely.

4. **Describe the characteristics or elements of the species' habitat to the extent possible, and threats to that habitat.**

   Habitat is defined as "in respect of aquatic species, spawning grounds and nursery, rearing, food supply, migration and any other areas on which aquatic species depend directly or indirectly in order to carry out their life processes, or areas where aquatic species formerly occurred and have the potential to be reintroduced."

   a. Describe the functional properties that a species' aquatic habitat must have to allow successful completion of all life history stages.

      In the best cases, the functional properties will include both features of the habitat occupied by the species and the mechanisms by which those habitat features play a role in the survivorship or fecundity of the species. However, in many cases the functional properties cannot be described beyond reporting patterns of distribution observed (or expected) in data sources, and general types of habitat feature known to be present in the area(s) of occurrence and suspected to have functional properties. Information will rarely be equally available for all life history stages of an aquatic species, and even distributional information may be missing for some stages. Science advice needs to be carefully worded in this regard to clearly communicate uncertainties and knowledge gaps.

   b. Provide information on the spatial extent of the areas that are likely to have functional properties.

      Where geo-referenced data on habitat features are readily available, these data could be used to map and roughly quantify the locations and extent of the species' habitat. Generally, however, it should be sufficient to provide narrative information on what is known of the extent of occurrence of the types of habitats identified. Identify the activities most likely to threaten the functional properties, and provide information on the extent and consequences of those activities.

5. **Threats**

A threat is any activity or process (both natural and anthropogenic) that has caused, is causing, or may cause harm, death, or behavioural changes to a species at risk or the destruction, degradation, and/or impairment of its habitat to the extent that population-level effects occur. Naturally limiting factors, such as aging, disease and/or predation that limit the distribution and/or abundance of a species are not normally considered threats. However, they may be considered threats if they are altered by human activity or may pose a threat to a critically small or isolated population.

Past threats and future threats are important for determining COSEWIC status designations related to past and future population declines (Criterion A) and declines in habitat, area quantity and quality, locations (Criterion B), and mature individuals (Criterion C). For Criterion A it is important to determine the threat source but also if the causes of reduction are clearly reversible, understood, and if they have ceased.

The basis for the COSEWIC assessment with respect to impacts of current and future threats on population trajectories is the completion of a Threat Calculator which considers 11 major threat categories each of which has more than one secondary subdivision category. For each relevant subdivision threat the scope, timing, and severity are determined. The Threat Calculator categories are based on IUCN Threats Classification Scheme (Version 3.2).

COSEWIC's operational guidelines require consideration of both the imminence of each identified threat, and the strength of evidence that the threat actually does cause harm to the species or its habitat. The information and advice from the Pre-COSEWIC review should provide whatever information is available on both of those points. In addition, the information and advice should include at least a narrative discussion of the magnitude of impact caused by each identified threat when it does occur.

The review of information related to threats should include:

- Review and update, as appropriate, the analyses of threats to Atlantic Salmon summarized in DFO and MRNF (2009) and in published Recovery Potential Assessments for Atlantic Salmon DUs previously assessed as threatened or endangered (DFO 2008, 2013a, 2013b, 2013c, 2014a, 2014b).
- Data and information on status and threats of mixed stock fisheries that occur within (Labrador subsistence fisheries) and outside territorial waters of Canada (Saint Pierre and Miquelon, Greenland).
- Review information and describe uncertainties relative to the scope, timing and severity of the categories of threats defined in the COSEWIC Threat Calculator and considering:
    - It is important to determine the magnitude (severity), extent (spatial), frequency (temporal) and causal certainty of each threat.
    - Distinction should be made between general threats (e.g., agriculture) and specific threats (e.g., siltation from tile drains), which are caused by general activities.
    - The causal certainty of each threat must be assessed and explicitly stated as threats identified may be based on hypothesis testing (lab or field), observation, expert opinion or speculation.

- Review information and describe uncertainties on plausible future threats including the geographic or distinct ecological area(s) associated with the threats as well as areas not currently under threat but that may be affected in the future by these plausible threats.
- Review information to support assessment of the exposure, sensitivity, and adaptive capacity of the species to climate change, including any data, analyses, or models that indicate vulnerability to particular impacts of climate change.

6. **Manipulated Populations**

An increasing number of wildlife species have seen their distribution or genetic make-up manipulated by humans, deliberately or accidentally. COSEWIC has developed guidelines to help determine the eligibility of populations for inclusion in wildlife species status assessments.

- Information available to DFO should be provided to facilitate such determination.

7. **Other**

Finally, as time allows review status and trends in other indicators that would be relevant to evaluating the risk of extinction of the species. This includes the likelihood of imminent or continuing decline in the abundance or distribution of the species, or that would otherwise be of value in preparation of COSEWIC Status Reports.

Expected Publications

The following publications from the peer-review meeting will be posted on the CSAS website:

- Proceedings
- Research Document(s)

Expected Participation

The objective of the meeting is to assemble and review DFO existing information in support of the assessment of the species status by COSEWIC. No management advice is developed in this process. An opportunity is provided to Indigenous organizations to share Indigenous Traditional Knowledge that would be relevant to the assessment of status by COSEWIC. As such participation in this process is expected from:

- Fisheries and Oceans Canada (Science, Fisheries Management, Fish and Fish Habitat Protection Program, Aquatic Invasive Species National Core Program [AIS NCP], Species at Risk Program)
- COSEWIC status report author(s)
- Member(s) of COSEWIC (Co-Chairs and/or SSC experts)
- Provincial governments
- Indigenous organizations

References Cited

COSEWIC. 2010. COSEWIC assessment and status report on the Atlantic Salmon *Salmo salar* (Nunavik population, Labrador population, Northeast Newfoundland population, South Newfoundland population, Southwest Newfoundland population, Northwest Newfoundland population, Quebec Eastern North Shore population, Quebec Western North Shore population, Anticosti Island population, Inner St. Lawrence population, Lake Ontario population, Gaspé-Southern Gulf of St. Lawrence population, Eastern Cape Breton population, Nova Scotia Southern Upland population, Inner Bay of Fundy population, Outer Bay of Fundy population) in Canada. Committee on the Status of Endangered Wildlife in Canada. Ottawa. xlvii + 136 pp.

DFO. 2008. Recovery Potential Assessment for Inner Bay of Fundy Atlantic Salmon. DFO Can. Sci. Advis. Sec. Sci. Advis. Rep. 2008/050.

DFO. 2013a. Recovery Potential Assessment for the South Newfoundland Atlantic Salmon (*Salmo salar*) Designatable Unit. DFO Can. Sci. Advis. Sec. Sci. Advis. Rep. 2012/007.

DFO. 2013b. Recovery Potential Assessment for Southern Upland Atlantic Salmon. DFO Can. Sci. Advis. Sec. Sci. Advis. Rep. 2013/009.

DFO. 2013c. Recovery Potential Assessment for the Anticosti Island Atlantic Salmon Metapopulation. DFO Can. Sci. Advis. Sec. Sci. Advis. Rep. 2013/070.

DFO. 2014a. Recovery Potential Assessment for Eastern Cape Breton Atlantic Salmon. DFO Can. Sci. Advis. Sec. Sci. Advis. Rep. 2013/072.

DFO. 2014b. Recovery Potential Assessment for Outer Bay of Fundy Atlantic Salmon. DFO Can. Sci. Advis. Sec. Sci. Advis. Rep. 2014/021.

DFO and MRNF. 2009. Conservation Status Report, Atlantic Salmon in Atlantic Canada and Québec: PART II – Anthropogenic Considerations. Can. MS Rep. Fish. Aquat. Sci. No. 2870. 175 p.

APPENDIX B: ABSTRACTS OF WORKING PAPERS

Part I. Designatable Units

Lehnert et al. 2023. The Committee on the Status of Endangered Wildlife in Canada (COSEWIC) recognizes 16 Designatable Units (DUs) of Atlantic Salmon (*Salmo salar*). Last assessed by COSEWIC in 2010, this species is currently up for reassessment. As a primary generator and archivist of data related to Atlantic Salmon, Fisheries and Oceans Canada (DFO) is responsible for compiling and reviewing information on the species to help inform the upcoming reassessment. Here, as Part 1 of the pre-COSEWIC review of Atlantic Salmon, we focus on re-evaluating the DU structure. Over the last decade, new genetic and genomic data have become available that can be used to improve our understanding of the DU structure. COSEWIC's definition requires that a DU represents a discrete and evolutionarily significant unit of the species; therefore, we develop a framework using a weight of evidence approach to ensure that all DUs proposed here meet criteria for both discreteness and significance. Our approach incorporates genetic and genomic datasets, as well as life history and climate information. Our approach led to the subdivision of four of the previously defined COSEWIC DUs into multiple units, including the subdivision of Labrador, South Newfoundland, Gaspé-Southern Gulf of St. Lawrence, and Nova Scotia Southern Upland. In addition, based on a weight of evidence, we determined that some DUs required re-evaluations of their boundaries, which led to changes of the previously recognized DU boundaries in Quebec (between Western North Shore and Inner St. Lawrence) and in Newfoundland (between Northwest and Northeast Newfoundland). Re-evaluation of boundaries also supported that southern Gulf populations were not discrete from eastern Cape Breton populations, and thus these populations were combined into a single DU. Further, we identified two populations that belong in adjacent DUs, which would result in non-contiguous boundaries. This included Corneille River in Quebec (physically located in Western North Shore DU but groups with Eastern North Shore DU) and Gaspereau River in the Inner Bay of Fundy (physically located in Inner Bay of Fundy DU but groups with Outer Bay of Fundy DU). Overall, using newly available data, we propose that there are 20 DUs of Atlantic Salmon that are supported by evidence of discreteness and significance, and we propose new names and numbering for these 20 putative DUs.

Part II. Newfoundland and Labrador

No Abstract Provided.

Part III. Québec

April et al. 2023. This document presents an update of the information and analyses on the Atlantic Salmon in Quebec gathered since the first review conducted in 2010, and is intended to support the reassessment of the status of the Atlantic Salmon (Salmo salar) by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC). The information presented includes life history characteristics, habitat description, population abundance and threats to the species. A review of the data shows that the biological characteristics of the Atlantic Salmon and its freshwater habitats vary greatly among populations. Demographic trends also show high variability between populations. Although declines in salmon abundance were recorded in several rivers during the 1980s and 1990s, abundance levels have remained relatively stable over the past 20 years. In other rivers, abundance levels were fairly stable throughout the time series beginning in 1984. A few rivers remain in slow decline. However, no population appears to have become extinct, and the species' range has remained largely unchanged over time. The pressure exerted by various types of fishing, which is relatively well controlled and documented, has continued to decrease. Several other threats whose impacts are less well understood have a combined effect on Atlantic Salmon populations.

Part IV. Gulf and Maritimes

Goguen and Caissie 2022. This study provides historical information on hydrometeorological conditions and trends for Atlantic Salmon (*Salmo salar*) rivers within the Maritime provinces. In total, 8 rivers were studied and at each river, discharge characteristics (high flow, low flows, and streamflow timing) were presented as well as long-term trends in the discharge time series. Long-term mean air temperatures and precipitations were presented at 8 meteorological stations close to the studied rivers as well as annual and summer air temperature trends. A spatial variability in mean annual air temperature exists within the Maritime provinces and air temperatures varied between 4.8°C (Bathurst) and 6.6°C (Halifax). Northern rivers experienced lower winter flows followed by a pronounced snowmelt runoff in the spring. The southern rivers experienced more mixed snow/rainfall dominated winters with correspondingly higher winter flows. The spring high flow period was also different among rivers where northern rivers tended to reach their high flow later (May) than southern rivers (April). The summer low flow period generally extended between the end of July to early September. Significant floods and low flow events have been observed within the study area over the past 20 years. For instance, many rivers experienced close to a 100-year flood event (Nashwaak River, 2010; St. Marys River, 2003; LaHave River, 2003; Northeast Margaree River, 2010). Similarly, 100-year low flow events were observed in Miramichi (2002), Nashwaak (2001) and LaHave (2016), rivers. Timing of high flow events differed among provinces as well; the majority of high flow events in NB rivers occurred near the spring freshet whereas high flow events in NS rivers were spread out throughout the year. As in previous studies, river temperature across the region shows some variability (both at the spatial and temporal scales). The Nashwaak and Little Southwest Miramichi rivers showed a significant number of days where daily Tmax was greater than 23°C during the summer period (29 and 32 days on average per year, respectively). In contrast the Restigouche River (Butters Island) showed less that 10 days on average per year. When looking at the mean annual air temperature trends, most stations showed a significant increase in the Maritime provinces. The increase in mean annual air temperature was between 1.2°C (Charlottetown) and 2.0°C (Bathurst) over the past 100 years. Increase in summer air temperatures were also significant at most sites over the past 100 years, but slightly lower (1–1.7°C). Results also showed a significant increase in precipitation at 50% of the sites, with increases between 10-31 mm per decade. The high flow timing was significantly earlier at 75% (6/8) of the rivers representing a 2–3 days change per decade. The timing of summer low flow only showed one significant decrease in the timing (Wilmot River; 9 days per decade). Some rivers showed a significant increase in summer (July and August) water temperatures over the past 25 years (Little Southwest Miramichi River, Kedgwick River and Restigouche River at Butters Island). The increases were in the order of 0.8°C to 2.2°C per decade.

Dauphin 2022. This document presents information on Atlantic Salmon (*Salmo salar*) from Salmon Fishing Area (SFA) 15 (northern New Brunswick in DFO Gulf Region) of relevance to the development of the status report by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC). There are 19 rivers with confirmed presence of Atlantic Salmon in this area of which the Restigouche River is the largest river. Data are presented and interpreted relative to the following: biological characteristics, stocking of fish, area of occupancy based on juvenile surveys, indicators of adult abundance from monitored rivers, freshwater production based on juvenile surveys and smolt production, and factors which may be constraining Atlantic Salmon abundance. For the rivers in this area, the indices of adult abundance suggest that there were more salmon in the mid to late-1980s than there have been in the past 15 years. As a result of changes in fisheries management, spawning escapement has increased from the 1970s and early-1980s resulting in increased abundance of juvenile salmon. The principal threats in SFA 15 are: habitat alteration including habitat fragmentation due to non-compliant culverts, hydroelectric power generation, disease, unreported poaching and aboriginal catches and cumulative effect of ecosystem changes.

Cairns et al. 2023. To support preparation of a forthcoming COSEWIC review, this report assembles data on Atlantic Salmon (*Salmo salar*) biology, demographics, habitat, and threats for Prince Edward Island (Salmon Fishing Area 17). Historical accounts indicate that the original PEI Atlantic Salmon population was dominated by late-run and large (≥63 cm) fish. These characteristics are retained in small rivers. At least 38,826,353 Atlantic Salmon have been stocked in PEI in 1880-2020, mostly in larger rivers. The proportion of early-run and small salmon has been increased in larger rivers by the stocking of fish intended to increase summer angling opportunities. Sea ages of returning adults are generally one year for small salmon and two years for large salmon. Return rates for fish of hatchery origin range from 0.5 to 5.9%. Data on return rates of naturally spawned fish are unavailable. In the Morell River, PEI's traditionally most important salmon river, mean fecundity is 3,143 eggs for small salmon and 4,963 eggs for large salmon. The egg phase (1 year), juvenile phase (mean 2.32 years), and sea phase (mean 1.77 years) sum to 5.09 years, which is the mean generation time of the population. The typical early life history pattern of PEI Atlantic Salmon occurs in rivers, with eggs hatching as fry, fry developing into parr, and parr turning into smolts which leave on marine migrations. However, some juvenile males mature precociously, and some parr occupy ponds and estuaries. The ancestral trait of late-run and large returnees is shared by Atlantic Salmon in southeast New Brunswick and northern Nova Scotia. Genetic data on salmon in stocked rivers suggest an affinity with salmon in a broad geographic area centered in the southern Gulf of St. Lawrence. However, genetic samples from two small rivers in northeastern PEI clustered with each other but did not show affinities with samples from elsewhere in Canada. Redd counts for the period 1990-2019 showed rising trends in four rivers and falling trends in five rivers. Redd counts for the period 2004-19 showed rising trends in 13 rivers and falling trends in six rivers. Seventy-one PEI rivers are large enough that they probably supported Atlantic Salmon populations in pristine times. For 2000-19, juvenile electrofishing and redd surveys detected Atlantic Salmon at least once in 40 rivers, but detected Atlantic Salmon in every monitored year in only 12 rivers. The spawning population of Atlantic Salmon on PEI is estimated at 717, based on redd counts. Sediment deposition on spawning and rearing habitat is a major threat to Atlantic Salmon on PEI. Additional threats include pesticide-related fish kills, water extraction for municipal and irrigation purposes, climate change leading to more frequent droughts and higher water temperatures, fish passage impairment by dams (including beaver *Castor canadensis* dams), and competition with non-native rainbow trout (*Oncorhynchus mykiss*).

Reader et al. 2024. (Inner Bay of Fundy [IBoF]; part of SFAs 22 and 23). The purpose of this research document is to provide an update of Fisheries and Oceans Canada (DFO) information for the Inner Bay of Fundy (IBoF) Atlantic Salmon (*Salmo salar*) population (Designatable Unit 15) to support the development of a second status report of Atlantic Salmon in eastern Canada by the Committee on the Status of Endangered Wildlife in Canada. Information pertaining to IBoF Atlantic Salmon populations within Salmon Fishing Areas 22 and 23 is compiled in this review, including population status, trends, life history characteristics, habitat and threats.

Abundance of IBoF Atlantic Salmon is presently at critically low levels, listed as endangered and protected under the federal *Species at Risk Act*. Persistence of the populations is currently maintained through a Live Gene Bank (LGB) program focused on three rivers: the Stewiacke and Gaspereau in Nova Scotia, and the Big Salmon in New Brunswick. IBoF salmon assessment and monitoring activities undertaken by DFO Science primarily on the Big Salmon and Gaspereau rivers over the last 20 years have been in association with the LGB program and all incorporate genetic analyses. Estimated adult abundance on the Big Salmon River is presently below 4% of its conservation requirement and estimated egg deposition has declined at a rate greater than 60% over the last three generations (13 years). Since 2006, annual egg depositions from sea-run returns to the Gaspereau River have never exceeded 10% of the conservation requirement. A great majority of adults returning to the Big Salmon River continue to mature as small salmon (<63 cm fork length) after one-sea-winter and include a high percentage of females but the occurrence of repeat spawners is much less prevalent than in earlier years (1960s and 1970s). The Gaspereau River population is comprised of a higher proportion of maiden two-sea-winter salmon compared to the Big Salmon River adult returns. Most adults returning to the Gaspereau are progeny of LGB releases whereas more than 75% of returns to the Big Salmon are from the residual wild population or of unknown origin. The mean return rate of combined origin small salmon to the Big Salmon River over the past 13 years is extremely low at 0.29%.

Overall, the recent available DFO data for IBoF Atlantic Salmon indicates that population abundance has not improved and may have further declined over the past three generations despite significant conservation and supplementation efforts. Given the current lack of recruits from natural spawning and very high marine mortality, the LGB program remains critical to population recovery when marine survival rates increase to a level where these populations can be self-sustaining.

Reader et al. 2024. (outer portion of SFA 23). The purpose of this research document is to provide an update of Fisheries and Oceans Canada (DFO) information for the Outer Bay of Fundy (OBoF) Atlantic Salmon (*Salmo salar*) population (Designatable Unit [DU] 16) to support the development of a second status report of Atlantic Salmon in eastern Canada by the Committee on the Status of Endangered Wildlife in Canada. Information pertaining to OBoF Atlantic Salmon populations in southwest New Brunswick, corresponding to the outer part of Salmon Fishing Area 23, is compiled in this review, including population status, trends, life history characteristics, habitat and threats.

Evaluation of the status of Atlantic Salmon in the OBoF is based on adult abundance monitoring for a number of index populations. For the Saint John River (SJR) upriver of Mactaquac Dam, the Nashwaak River (a tributary to the SJR downriver of Mactaquac Dam), and the Magaguadavic River, adult salmon counts and estimates of returns to enumeration facilities (e.g., fishway, counting fence) and subsequent spawners are assessed using a comparison of the estimated egg deposition (calculated from the estimated abundance and biological characteristics of Atlantic Salmon stocks) relative to a reference point known as the conservation egg requirement. Overall, the recent available data for OBoF Atlantic Salmon indicates that populations are persisting at low abundance levels and continuing to decline. Estimated adult abundance on the SJR upriver of Mactaquac Dam and on the Nashwaak River is presently 4% and 5% of their respective conservation requirements, and estimated egg deposition has declined at rates in excess of 75% over the last three generations (15 years) for both index populations. Adult returns to the Magaguadavic River were two MSW salmon in 2019, and have averaged less than 2 fish for the past decade. Small (one-sea-winter) and large (multi-sea-winter) salmon returning to rivers in the OBoF have both declined over the last three generations, approximately 81% and 79%, respectively. Moreover, these declines represent continuations of declines greater than 70% extending back over 25 years to 1993.

Within the OBoF DU, threats of highest concern include the operation of hydro facilities in freshwater and unfavourable conditions in the marine environment linked with depressed population phenomena, along with aquaculture operations. To compensate for additive mortalities associated with hydroelectric dams and low marine survival, the salmon enhancement program at the Mactaquac Biodiversity Facility is currently being adaptively managed to produce captive spawning adults from wild-caught juvenile salmon and distribute to tributaries above Mactaquac Dam surplus offspring as unfed fry for supplementation purposes. However, freshwater threats, combined with low marine survival, still appear to be limiting recovery of the salmon populations in the SJR.

Taylor et al. 2024. The purpose of this research document is to summarize and update the present status and recent trends of Atlantic Salmon populations in the Eastern Cape Breton (ECB) Designatable Unit (DU) of relevance to the development of the status report by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC). There are 46 watersheds known to contain or have contained Atlantic Salmon in the DU, and additional smaller streams have been identified as likely to contain or historically contained Atlantic Salmon.

Atlantic Salmon population monitoring in ECB has focused on five river systems: Middle; Baddeck; North; Grand; and Clyburn. Assessments on these rivers have been based on fishery-independent counts by dive surveys or at a fish ladder and/or recreational catch reports. Of these five populations, two (Grand and Clyburn) show marked declines in adult abundance over the last three generations of available data. Two populations (Middle and Baddeck) have remained relatively stable at abundances below their conservation requirements and one population (North) is estimated to be near or above its conservation requirement in recent years. Recreational catch data for other rivers in the ECB DU suggests that Atlantic Salmon abundance is low throughout most of the DU. Intermittent electrofishing surveys also indicate that juvenile densities are below reference values at many locations throughout the ECB DU, although juvenile salmon are still widely distributed. A number of threats to Atlantic Salmon are identified in the freshwater and estuarine/marine environment of the ECB DU, including illegal fishing/poaching, salmonid aquaculture, marine ecosystem change, disease and parasites, and many others.

Raab et al. 2024. The purpose of this research document is to summarize and update the present status and recent trends of Atlantic Salmon populations in the Southern Upland (SU) Designatable Unit (DU 14) of relevance to the development of the status report by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC). Based on genetic evidence, regional geography and differences in life history characteristics SU Atlantic Salmon is considered to be biologically unique (Gibson et al. 2011) and its extirpation would constitute an irreplaceable loss of Atlantic Salmon biodiversity.

Within the SU DU, there are at least 72 rivers thought to contain, or to historically have contained Atlantic Salmon. The assessment of stock status is based on abundance of adults, juveniles and smolts in selected rivers, and the available data indicate that the abundances of SU Atlantic Salmon populations are low and declining. Region-wide comparisons of juvenile density data from more than 50 rivers indicate significant ongoing declines and provide evidence for river-specific extirpations. As of the most recent regional electrofishing survey, presence can be documented in 41% (22 of 54) of rivers that were assessed. Annual adult abundance data from four rivers show declines of 95% to 100% from maximum abundance, and Salmon returns to the SU index rivers (LaHave and St. Mary's) have been below the conservation requirement every year for the past three generations of available data. The regional estimate for Atlantic Salmon predicts that in 2019 the SU DU would have produced less than 4% (2.42–6.35 million eggs) of the estimated regional conservation requirement of 187.95 million eggs. A number of threats to Atlantic Salmon are identified in the freshwater and estuarine/marine environment of the SU DU, including habitat fragmentation, invasive fish species, acidification of freshwater habitat, illegal fishing/poaching, salmonid aquaculture, and marine ecosystem change.

Daigle 2023. This document presents information on Atlantic Salmon (*Salmo salar*) for rivers in Salmon Fishing Area 18 (SFA 18; Northumberland Strait Nova Scotia and Western Cape Breton) of relevance to the development of the status report by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC). There are 55 potential Atlantic Salmon rivers in SFA 18. Of these, the Gulf Nova Scotia (GNS) program focuses its monitoring efforts on four index rivers within SFA 18: The Margaree River, West River Antigonish, East River Pictou, and River Philip. For the Margaree River in 2019, the estimated eggs in the returns of small salmon and large salmon combined were 3.9 times greater than the lower reference point (LRP) value. The salmon population has remained above the LRP for the duration of the Margaree monitoring program (1987 to present). However, returns to all rivers in SFA 18 remain below the long-term return average. The principal threats in SFA 18 are: habitat shifting and alteration, extreme temperatures, and droughts, all of which are related to global climate change.

Douglas et al. 2023. In support of the Committee on the Status of Endangered Wildlife in Canada's (COSEWIC) reassessment of Atlantic Salmon (*Salmo salar*), this document updates information and analyses for Atlantic Salmon in Salmon Fishing Area (SFA) 16 since the first review in 2010. The 39 salmon rivers in SFA 16 are included among the rivers that COSEWIC first identified in the Gaspé-Southern Gulf of St. Lawrence Designatable Unit (DU). The largest runs of Atlantic Salmon in SFA 16 return to the Miramichi River where monitoring programs have been conducted annually since the 1950s to collect biological information on the stock and to estimate the size of the population. Several indices of abundance for adult salmon in the Miramichi River were reviewed and all showed declines over the time series of information available including the last 16 year period which is the equivalent of three generation times for this population. While population estimation has not been attempted in other smaller rivers recently, annual monitoring programs in the Tabusintac, Kouchibouguac, Kouchibouguacis, and Richibucto rivers all indicate that runs of adult salmon persist in those rivers. The number of adult salmon returning to SFA 16 were estimated to have peaked at just under 130 thousand fish in 1986 and declined to less than 20 thousand salmon in 2019, the lowest value of the time series. The rates of change in abundance for adult salmon in SFA 16 have declined by 43% for the time series and by 68% in the last 16 years (2003-19). Juvenile salmon abundance determined from electrofishing surveys also showed declining trends over the last 16 years in the Miramichi River and other smaller rivers of southeastern New Brunswick. Adult and juvenile salmon from SFA 16 continue to be widely dispersed in the freshwater and marine habitats during their different life cycle phases. Threats to Atlantic Salmon are generally poorly understood and many are likely working together to limit salmon abundance in SFA 16.

APPENDIX C: AGENDAS

CSAS Zonal Peer Review Process
Pre-COSEWIC Assessment for Atlantic Salmon – Part I: Review of information for Designatable Units

Chairperson: Travis Van Leeuwen
***Rapporteurs*: Shannan May-McNally and Darienne Lancaster**
October 26-29, 2020
Virtual Meeting using *Microsoft Teams*

Monday, October 26

Time	Topic	Presenter
1 PM (NST)	Opening remarks and overview of Regional Peer Review Process	*T. Van Leeuwen*
-	The DFO Pre-COSEWIC process and the COSEWIC species assessment process	*K. Robert*
-	Background on COSEWIC criteria of DUs	*S. Lehnert*
-	Discussion	*All*
-	Review Atlantic Salmon and the Approach/ or Framework used to identify DUs	*S. Lehnert*
-	Discussion	*All*

Tuesday, October 27

Time	Topic	Presenter
10:30 AM (NST)	Previous DUs 1-16 Analysis/Results and Changes to DUs. Each DU will be reviewed separately	*S. Lehnert*
-	Discussion	*All*

Wednesday, October 28

Time	Topic	Presenter
10:30 AM (NST)	Overview of Proposed New DUs	S. Lehnert
-	Discussion	*All*
-	Drafting of Summary Conclusions for Part I	*All*
-	Drafting of Research Recommendations for Part I	*All*

Time	Topic	Presenter
-	Upgrading of Working Paper and Next Steps	*D. Richards*
-	Closing Remarks and *ADJOURN*	*T. Van Leeuwen*

Thursday, October 29 (if necessary)

CSAS Zonal Peer Review Process

Pre-COSEWIC Assessment for Atlantic Salmon – Part II: *Review of information for Newfoundland and Labrador*

Chairperson: Travis Van Leeuwen
***Rapporteurs*: Shannan May-McNally and Darienne Lancaster**
February 1-4, 2021
Virtual Meeting using *Microsoft Teams*

Monday, February 1

Time	Topic	Presenter
10:30 AM (NST)	Opening remarks and overview of Regional Peer Review Process	*Chair*
-	Summary of Newfoundland and Labrador Designatable Units (DUs) and potential changes	*I. Bradbury*
-	Discussion	*All*
-	Overview of salmon populations in DU 1 Nunavik and DU 2 Labrador (Northern Labrador, Lake Melville, Southern Labrador)	*N. Kelly*
-	Discussion	*All*

Tuesday, February 2

Time	Topic	Presenter
10:30 AM NST	Salmon in DU 3 Northeast Newfoundland	*N. Kelly*
-	Discussion	*All*
-	Salmon in DU 4 (South Newfoundland East and South Newfoundland West)	*N. Kelly*
-	Discussion	*All*

Wednesday, February 3

Time	Topic	Presenter
10:30 AM (NST)	Salmon in DU 5 Southwest Newfoundland	N. Kelly
-	Discussion	*All*
-	Salmon in DU 6 Northwest Newfoundland	*N. Kelly*

Time	Topic	Presenter
-	Discussion	*All*
-	Summary	*Chair*
-	Upgrading of Working Papers and Next Steps	*E. Parrill*
-	Closing Remarks and *ADJOURN*	*Chair*

Thursday, February 4 (if necessary)

CSAS Zonal Peer Review Process

Pre-COSEWIC Assessment for Atlantic Salmon – Part III: *Review of information province of Quebec*

Chairperson: Charley Cyr
***Rapporteurs*: Karine Robert and Hans Frederick Ellefsen**
December 15–16, 2020
Virtual Meeting using Microsoft Teams

Tuesday, December 15

Time	Topic	Presenter
9:00 am	Opening remarks	*Chair*
-	DFO's pre-COSEWIC process and COSEWIC's species assessment process (status report)	*K. Robert*
-	Basic principles of the species' biology, designatable units, population manipulation and life history characteristics	*J. April*
-	Discussion	*Everyone*
-	Habitat characteristics and climate change	*J.-N. Bujold*
-	Discussion	*Everyone*
-	Abundance, the fishery and threats	*M. Guérard*
-	Discussion	*Everyone*

Wednesday, December 16

Time	Topic	Presenter
9:00 am	Opening remarks	*Chair*
-	Status of Nunavik populations: abundance and threats	*V. Nadeau*
-	Discussion	*Everyone*
-	Status of Lower North Shore populations: abundance and threats	*S. Le Breton*
-	Discussion	*Everyone*
-	Status of Eastern North Shore populations: abundance and threats	*S. Le Breton*
-	Discussion	*Everyone*
-	Status of Western North Shore populations: abundance and threats	*S. Le Breton*

Time	Topic	Presenter
-	Discussion	*Everyone*
-	Status of Anticosti Island populations: abundance and threats	*S. Le Breton*
-	Discussion	*Everyone*
-	Status of Inner St. Lawrence populations: abundance and threats	*K. Gagnon, P. Plourde-Lavoie, J. Doucet and S. Le Breton*
-	Discussion	*Everyone*
-	Status of Gaspé and Lower St. Lawrence populations: abundance and threats	*J. Doucet and V. Bujold*
-	Discussion	*Everyone*
-	Next steps	-
-	Closing remarks	-
-	Adjournment of meeting	-

CSAS Zonal Peer Review Process

Pre-COSEWIC Assessment of Atlantic Salmon – Part IV: *Review of information Maritime Provinces*

Chairperson: Cindy Breau
***Rapporteurs*: Shannan May-McNally and Darienne Lancaster**
January 18–22, 2021
Virtual Meeting using *Microsoft Teams*

Monday, January 18

Time	Topic	Presenter
9:00 am – 12:00 pm	Opening remarks and overview of Regional Peer Review Process	*Chair*
	Hydrometeorological conditions for salmon rivers in the Maritimes Provinces	*D. Caissie*
13:00 – 16:00	Salmon Fishing Area 15 (Restigouche, Gulf New Brunswick)	*G. Dauphin*

Tuesday January 19

Time	Topic	Presenter
9:00 – 12:00	Follow-up on the previous day and continue discussions (if required)	-
	Salmon Fishing Area 16 (Miramichi, Gulf New Brunswick)	*S. Douglas, G. Chaput*
13:00 – 16:00	Salmon Fishing Area 17 (Prince Edwards Island)	*D. Cairns*

Wednesday January 20

Time	Topic	Presenter
9:00 – 12:00	Follow-up on the previous day and continue discussions (if required)	-
	Salmon Fishing Area 18 (Western Cape Breton)	*A. Daigle*
13:00 – 16:00	Salmon Fishing Area 19 (Eastern Cape Breton)	*D. Raab*

Thursday January 21

Time	Topic	Presenter
9:00 – 12:00	Follow-up on the previous day and continue discussions (if required)	-
	Salmon Fishing Areas 20 and 21 (southern Uplands)	*D. Raab*
13:00 – 16:00	Salmon Fishing Area 22 (Inner Bay of Fundy)	*S. McWilliam*

Friday January 22

Time	Topic	Presenter
9:00 – 12:00	Follow-up on the previous day and continue discussions (if required)	-
	Salmon Fishing Area 23 (Outer Bay of Fundy) – presenter Jeffrey Reader	*J. Reader*
13:00 – 16:00	Wrap-up	-

APPENDIX D: LIST OF PARTICIPANTS

Participant List for Part I.

Name	Affiliation
Alyx MacDonald	The Confederacy of Mainland Mi'kmaq
Brendan Wringe	DFO Science – Maritimes Region
Brian Dempson	DFO Science – NL Region
Chantelle Burke	DFO Science – NL Region
Charley Cyr	Centre for Science Advice – Quebec Region
Christopher Hendry	DFO Aquatic Ecosystems – NL Region
Cindy Breau	DFO Science – Gulf Region
Colin Webb	Nunatsiavut Government
Craig Purchase	Memorial University of Newfoundland
Curtis Pennell	DFO Science – NL Region
Darek Moreau	DFO Science – Maritimes Region
Darienne Lancaster	DFO Science – NL Region
Don Hutchens	Salmonid Association of Eastern Newfoundland
George Russell Jr.	NunatuKavut Community Council
Gerald Chaput	DFO Science – Gulf Region
Greg Stevens	DFO Resource Management – Maritimes Region
Guillaume Coté	Ministère des Forêts, de la Faune et des Parcs
Guillaume Dauphin	DFO Science – Gulf Region
Harry Murray	DFO Science – NL Region
Ian Bradbury	DFO Science – NL Region
Ian Fleming	Memorial University of Newfoundland
Jackie Kean	DFO Resource Management – NL Region
Jon Carr	Atlantic Salmon Federation

Name	Affiliation
Julien April	Ministère des Forêts, de la Faune et des Parcs
Karine Robert	DFO Science – National Capital Region
Kimberley Robichaud-Leblanc	DFO Aquatic Ecosystems – Maritimes Region
Kristin Loughlin	DFO Science – NL Region
Lottie Bennett	Centre for Science Advice – Maritimes Region
Lydia Stevens	DFO Aquatic Ecosystems – Maritimes Region
Mark LaFlamme	Centre for Science Advice – Gulf Region
Martha Robertson	DFO Science – NL Region
Nick Kelly	DFO Science – NL Region
Paul Bentzen	Dalhousie University
Roanne Collins	DFO Science – NL Region
Ross Claytor	COSEWIC
Sal Poirier	Madawaska Maliseet First Nation
Sarah Deller	DFO Aquatic Ecosystems – Maritimes Region
Sarah Lehnert	DFO Science – NL Region
Shannan May-McNally	DFO Science – National Capital Region
Shawna Powell	DFO Aquatic Ecosystems – NL Region
Steven Duffy	DFO Science – NL Region
Sue Forsey	DFO Aquatic Ecosystems – NL Region
Tammy Rose-Quinn	DFO Resource Management – Maritimes Region
Tara McIntyre	Centre for Science Advice – Maritimes Region
Travis Van Leeuwen	DFO Science – NL Region

Participant List for Part II.

Name	Affiliation
Brian Dempson	DFO Science – NL Region
Chantelle Burke	DFO Science – NL Region
Christopher Hendry	DFO Aquatic Ecosystems – NL Region
Colin Webb	Nunatsiavut Government
Craig Purchase	Memorial University of Newfoundland
Curtis Pennell	DFO Science – NL Region
Darienne Lancaster	DFO Science – NL Region
Don Hutchens	Salmonid Association of Eastern Newfoundland
Dustin Raab	DFO Science – Maritimes Region
Erika Parrill	Centre for Science Advice – NL Region
George Russell Jr.	NunatuKavut Community Council
Gerald Chaput	DFO Science – Gulf Region
Ian Bradbury	DFO Science – NL Region
Ian Fleming	Memorial University of Newfoundland
Jennifer Duff	DFO Communications – NL Region
Jon Carr	Atlantic Salmon Federation
Julien April	Ministère des Forêts, de la Faune et des Parcs
Kristin Loughlin	DFO Science – NL Region
Martha Robertson	DFO Science – NL Region
Nick Kelly	DFO Science – NL Region
Rebecca Poole	DFO Science – NL Region
Rex Porter	DFO Science – NL Region
Roanne Collins	DFO Science – NL Region
Ross Claytor	COSEWIC

Name	Affiliation
Ross Hinks	Miawpukek First Nation
Shannan May-McNally	DFO Science – National Capital Region
Shawn Gerrow	Parks Canada
Shawna Powell	DFO Aquatic Ecosystems – NL Region
Steven Duffy	DFO Science – NL Region
Sue Forsey	DFO Aquatic Ecosystems – NL Region
Travis Van Leeuwen	DFO Science – NL Region

Participant List for Part III.

Name	Affiliation
Alexandre Dionne	DFO Ecosystems Management – Quebec Region
Charles Cusson	Atlantic Salmon Federation
Charley Cyr	Centre for Science Advice – Quebec Region
Cindy Breau	DFO Science – Gulf Region
David Hardie	DFO Science – Maritimes Region
Emmanuel Sandt-Duguay	Association de Gestion autochtone Mi'gmaq et Malécite
France Pouliot	DFO Ecosystems Management – Quebec Region
François Caron	Ministère des Forêts, de la Faune et des Parcs
Gerald Chaput	DFO Science – Gulf Region
Guillaume Dauphin	DFO Science – Gulf Region
Hans-Frederic Ellefsen	DFO Science – Quebec Region
Isabel Thibault	Ministère des Forêts, de la Faune et des Parcs
Isabelle Gauthier	Ministère des Forêts, de la Faune et des Parcs
Jean-Christophe Guay	Hydro-Québec
Jean-Nicolas Bujold	Ministère des Forêts, de la Faune et des Parcs
Jérôme Doucet-Caron	Ministère des Forêts, de la Faune et des Parcs
Julien April	Ministère des Forêts, de la Faune et des Parcs
Karine Gagnon	Ministère des Forêts, de la Faune et des Parcs
Karine Robert	DFO Science – National Capital Region
Lisa Robichaud	DFO Aquatic Ecosystems – Gulf Region
Maxime Guérard	Ministère des Forêts, de la Faune et des Parcs
Maylinda Leclerc-Tremblay	Ministère des Forêts, de la Faune et des Parcs
Myriam Bergeron	Fédération Québécoise pour le Saumon Atlantique
Patrick Plourde-Lavoie	Ministère des Forêts, de la Faune et des Parcs

Name	Affiliation
Pedro Nilo	DFO Science – Quebec Region
Sébastien Ross	Ministère des Forêts, de la Faune et des Parcs
Soazig LeBreton	Ministère des Forêts, de la Faune et des Parcs
Valérie Bujold	Ministère des Forêts, de la Faune et des Parcs
Véronique Nadeau	Ministère des Forêts, de la Faune et des Parcs

Participant List for Part IV.

Name	Affiliation
Abby Daigle	DFO Science – Gulf Region
Abidemi Adesola	DFO Science – Maritimes Region
Alan McNeill	Government of Nova Scotia
Allison Moody	Parks Canada
Alyssa Naismith	DFO Aquatic Ecosystems – Maritimes Region
Alyx MacDonald	The Confederacy of Mainland Mi'kmaq
Andrew Taylor	DFO Science – Maritimes Region
Beth Lenentine	DFO Science – Maritimes Region
Brendan Wringe	DFO Science – Maritimes Region
Carole-Anne Gillis	Gespe’gewaq Mi’gmaq Resource Council
Chris Connell	Government of New Brunswick
Cindy Breau	DFO Science – Gulf Region
Corey Clarke	Parks Canada
Daniel Bourque	DFO Aquatic Ecosystems – Gulf Region
Daniel Caissie	DFO Science – Gulf Region
Darek Moreau	DFO Science – Maritimes Region
David Cairns	DFO Science – Gulf Region
David Hardie	DFO Science – Maritimes Region
Devin Ward	Mi'gmawe'l Tplu'taqnn Incorporated
Dustin Raab	DFO Science – Maritimes Region
Ed Parker	DFO Aquatic Ecosystems – Maritimes Region
Eric Brunsdon	DFO Science – Maritimes Region
Fabiola Akaishi	DFO Aquatic Ecosystems – Gulf Region
Gabriel Goguen	DFO Science – Gulf Region

Name	Affiliation
Gerald Chaput	DFO Science – Gulf Region
Greg Stevens	DFO Resource Management – Maritimes Region
Guillaume Dauphin	DFO Science – Gulf Region
Ian Bradbury	DFO Science – NL Region
James Bridgeland	Parks Canada
Jared Tomie	Parks Canada
Jeffrey Reader	DFO Science – Maritimes Region
Jenna MacEachern	DFO Science – Gulf Region
John Whitelaw	Parks Canada
Jon Carr	Atlantic Salmon Federation
Julien April	Ministère des Forêts, de la Faune et des Parcs (MFFP)
Karyne Bellehumeur	Parks Canada
Kimberley Robichaud-Leblanc	DFO Aquatic Ecosystems – Maritimes Region
Kristin Loughlin	DFO Science – NL Region
Kyle Hicks	Nova Scotia Power
Lisa Robichaud	DFO Aquatic Ecosystems – Gulf Region
Louise De Mestral	DFO Science – Maritimes Region
Lydia Stevens	DFO Aquatic Ecosystems – Maritimes Region
Marc Trudel	DFO Science – Maritimes Region
Marie-Andrée Giroux	DFO Science – Gulf Region
Mark LaFlamme	Centre for Science Advice – Gulf Region
Martha Robertson	DFO Science – NL Region
Mathieu Vienneau	DFO Resource Management – Gulf Region
Mélanie Roy	DFO Science – Gulf Region
Ross Claytor	COSEWIC

Name	Affiliation
Sal Poirier	Madawaska Maliseet First Nation
Sarah Deller	DFO Aquatic Ecosystems – Maritimes Region
Sarah Lehnert	DFO Science – NL Region
Scott Douglas	DFO Science – Gulf Region
Scott Roloson	DFO Science – Gulf Region
Shannan May-McNally	DFO Science – National Capital Region
Sherisse McWilliam	DFO Science – Maritimes Region
Stephanie Walsh	Nova Scotia Power
Tammy Rose-Quinn	DFO Resource Management – Maritimes Region
Tara McIntyre	Centre for Science Advice – Maritimes Region
Terry Toner	Nova Scotia Power
Tim Robinson	Fort Folly Habitat Recovery
Wendy Epworth	Fort Folly Habitat Recovery