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Atlantic Salmon

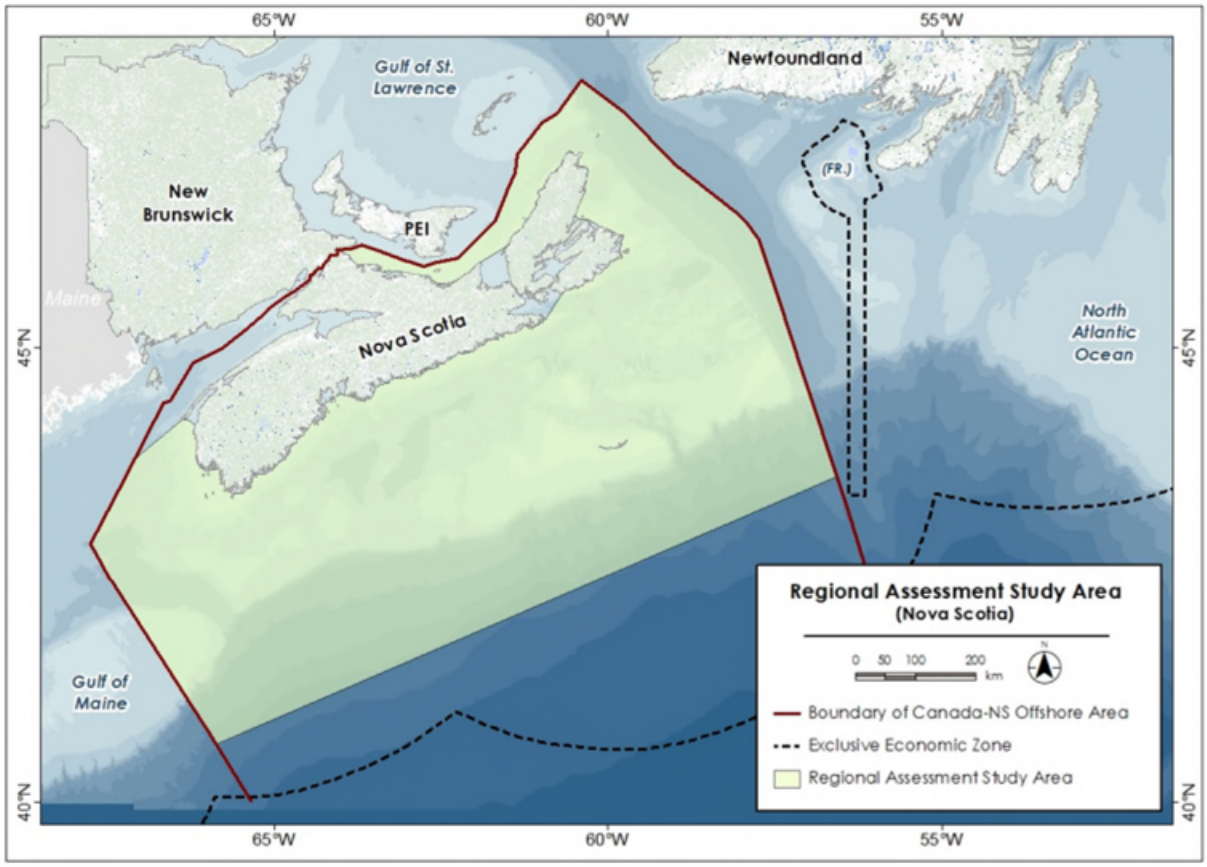

Figure 1. Regional Assessment Study Area (Nova Scotia).

Question/request: Known information and data gaps, and vulnerabilities regarding Atlantic salmon in the Nova Scotia offshore wind development Study Area. If possible, please note the importance of hotspots of activity/abundance, trends, and seasonality.

Canada

Response:

Using this template, please provide brief summaries in tabular or bullet format. Responses should only apply to the 'Study Area' outlined in the figure above. Responses should include the following considerations, but are intended to be brief and drawing upon/pointing to existing data and published reports:

1. **Overview of current knowledge:** A brief summary of key species in the Study Area and their identified areas and/or times of year that are important (e.g., spawning areas, aggregation areas, migration routes).

- Atlantic salmon from all four Maritimes Region Designatable Units (DU) – Outer Bay of Fundy, Inner Bay of Fundy, Southern Upland and Eastern Cape Breton all are known to use the Study Area during their migrations as post-smolts feeding or migrating to feeding grounds, as well as on return migrations to natal rivers to spawn. Eastern Cape Breton salmon would spend the least time in the Study Area during their migrations, where as salmon migrating to and from rivers in the other three DUs would spend more time in the study area.
- The inner Bay of Fundy (iBoF) DU salmon are generally understood to be local migrants and would spend limited time in the Study Area, except for the Gaspereau River population, which is a distant migrant and would migrate through the entire Study Area on the Scotian Shelf.
- Consecutive spawning life histories of salmon would spend most or all of their time at sea in the Study Area. Alternate Spawning life histories would leave the Study Area more quickly and spend less of their time at sea in the Study Area overall – only as they leave as post-smolts and then upon return migrations the following summer.
- All four DUs are designated as Endangered, and the iBoF DU is listed as such under the Species At Risk Act
- Times of year that are important vary by life stage and life history. In general, post-smolt salmon would be present in the Study Area in May and June, although consecutive spawners would remain in the area throughout their time at sea, until they return to natal rivers to spawn in late summer/fall. Out-migrating kelt would be in the study area in April-May.

2. **Gaps in data collection:** Brief summary of data and knowledge gaps related to data collection (e.g., areas that are data-sparse or poorly understood).

- Many telemetry tracking studies of salmon have been undertaken over the past 20 years. In many of those studies, tag/salmon detection equipment was not deployed in the Study Area, because the studies had different goals/questions. However, in most cases the data would exist to be able to perform an analysis of timing of outward migration of smolts and kelts. There would be much less information about the timing and extent of return migration of multi-sea-winter salmon from the waters off Greenland (see below).
- The Atlantic Salmon Federation, and more recently, DFO, have tagged salmon off Greenland using satellite tags for many years. The data exist and an analysis could be

done of the timing and extent of salmon tagged off Greenland back into the Study Area. This analysis (satellite tags) would not be limited by the lack of acoustic receiver infrastructure/different study design/goals that the acoustic studies above would have.
- The Environment Studies Research Fund project (ongoing) tagged many salmon with both types of tags in most Atlantic Canada DUs. Data are still being retrieved and analyzed. The Study Area for the ESRF project was the Grand Banks, so to some extent its utility for the RA Study Area here will be limited. However, there now exists more extensive semi-permanent arrays of receivers on the Scotian shelf (Marine Protected Area Program, Ocean Tracking Network).
- The ESRF research will also employ oceanographic and climate modelling to try to advance understanding contemporary and future oceanographic conditions that will define Atlantic salmon marine habitat use in space and time.

3. **Known vulnerabilities / impacts of climate change:** Brief summary of known vulnerabilities or potential impacts to species (e.g., spawning areas, aggregation areas, migration routes) associated with climate change.

- Changing ocean conditions associated with climate change are the greatest threat to Atlantic salmon throughout most of their range, but especially for the populations at the south of the species' range (i.e. the Study Area).
- Climate change is affecting their spawning areas (rivers warming, droughts/floods).
- Climate change may alter the river environment at a different rate than the marine environment, limiting diadromous species' ability to adapt due to mismatch as they move from one environment to the others.

4. **List any accompanying geo-spatial data / maps:** Provide hyperlinks for, or include as separate attachments, mapping data on spatial or temporal trends, or predictive modelling that would indicate a higher potential for interaction of species with any planned offshore wind development.

- Some data to generate the requested maps exist (acoustic tagging and satellite tracking data) but no specific maps/layers are available without further analysis.
- Predictive modelling to indicate specific times and places of high interaction with salmon is feasible but not currently undertaken for this area. The work is being done for the ESRF project on the Grand Banks, and a similar project has been proposed (CSRF) for the Bay of Fundy. A similar project could be undertaken for the Scotian Shelf, but the robustness of the study using existing tracking data is uncertain (the other projects use/propose contemporary tracking/oceanographic data to inform the models).

5. **List important / references:** Please also include any pertinent references or hyperlinks to CSAS reports, DFO technical reports, and/or primary publications, including hyperlinks to available data and/or reports published on-line that IAAC should be aware of.

DFO. 2020a. Inner Bay of Fundy (iBoF) Returning Adult Atlantic Salmon Population Abundance Estimate. DFO Can. Sci. Advis. Sec. Sci. Advis. Rep. 2020/027.

DFO. 2020b. Stock Status Update of Atlantic Salmon in Salmon Fishing Areas (SFAs) 19-21 and 23. DFO Can. Sci. Advis. Sec. Sci. Resp. 2020/002. 20 p.

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. 7604 2870, 175 p.

Gibson, A.J.F., Bowlby, H.D., Bryan, J.R., and Amiro, P.G. 2009. Population Viability Analysis of Inner Bay of Fundy Atlantic Salmon With and Without Live Gene Banking. DFO Can. Sci. Advis. Sec. Res. Doc. 2008/057.

Gibson, A.J.F., and Bowlby, H.D. 2013. Recovery Potential Assessment for Southern Upland Atlantic Salmon: Population Dynamics and Viability. DFO Can. Sci. Advis. Sec. Res. Doc. 2012/142. iv + 129 p.

Gibson, A.J.F., Horsman, T.L., Ford, J.S., and Halfyard, E.A. 2014. Recovery Potential Assessment for Eastern Cape Breton Atlantic Salmon (*Salmo salar*): Habitat requirements and availability, threats to populations, and feasibility of habitat restoration. DFO Can. Sci. Advis. Sec. Res. Doc. 2014/071.

Levy, A.L., and Gibson, A.J.F. 2014. Recovery Potential Assessment for Eastern Cape Breton Atlantic Salmon (*Salmo salar*): Status, past and present abundance, life history, and trends. DFO Can. Sci. Advis. Sec. Res. Doc. 2014/099. v + 72 p.

Marshall, T.L., Clarke, C.N., Jones, R.A. and Ratelle, S.M. 2014. Assessment of the recovery potential for the Outer Bay of Fundy population of Atlantic Salmon (*Salmo salar*): Habitat considerations. DFO Can. Sci. Advis. Sec. Res. Doc. 2014/007.

Raab, D., Taylor, A.D., Hardie, D.C., and Brunsdon, E.B. 2021. Updated DFO Science information for Atlantic Salmon (*Salmo salar*) populations in the Southern Upland region of Nova Scotia (SFAs 20 and 21) of relevance to the COSEWIC status report. DFO Can. Sci. Advis. Sec. Res. Doc. 2021/nnn. v + 66 p.

Reader, J.M., Hardie, D.C., McWilliam, S., Brunsdon, E.B., Notte, D. and Gautreau, M. 2021a. 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. 2021/nnn. vi + 97 p.

Reader, J.M., Hardie, D.C., McWilliam, S. Brunsdon, E.B. and Gautreau, M. 2021b. 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. 2021/nnn. vi + 95 p.

Taylor, A.D., Raab, D., Hardie, D.C., and Brunsdon, E.B. 2021. Updated information on Atlantic salmon (*Salmo salar*) Eastern Cape Breton populations (ECB; SFA 19) of relevance to the

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development of a 2nd COSEWIC status report. DFO Can. Sci. Advis. Sec. Res. Doc. 2021/nnn. v + 65 p.

SME:	**Approvals:**
David Hardie	