[DELIVERED VIA EMAIL]

October 7, 2020

Re: Comment on the Proposed Bay du Nord Development Project (the "Project")

Woodstock First Nation ("**WFN**") focused its analysis on the impacts to Atlantic Salmon (Outer Bay of Fundy "**OBoF**" and Inner Bay of Fundy "**IBoF**") as it is a resource that is currently on the verge of extinction within Wolastoqey territory and yet new sources of potential mortality are being proposed while access for food, social and ceremonial ("**FSC**") harvest has long been forgone. However, an ecosystem-based analysis within the proposed Project area is likely to provide the most comprehensive understanding of the potential impacts associated with this proposed Project to the ecosystem itself as well as to Atlantic Salmon.

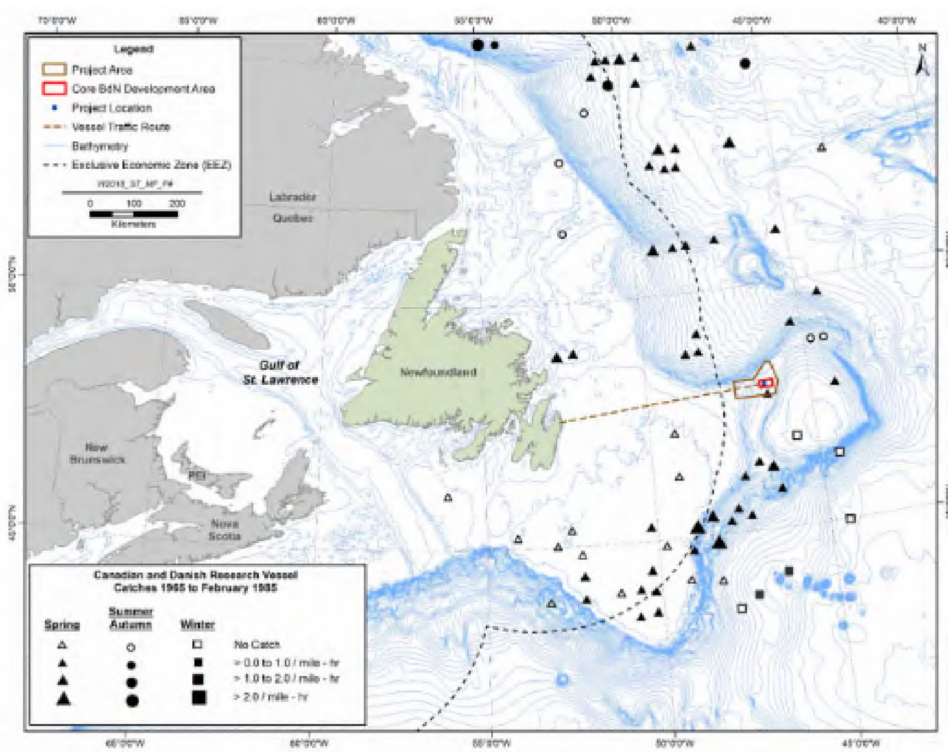

Figure 1. Canadian and Danish research vessel catches of Atlantic Salmon from 1965 to 1985. Original source: Equinor Canada Ltd. (2020) adapted from Reddin and Friedland (1993)

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Section 6.1.9.6 of the Environmental Impact Statement ("**EIS**") report, states that "given the available data, there is likely low interaction with spring migration of adults within and near the Project Area for the insular Newfoundland populations, Gulf of St. Lawrence populations, and eastern-southern Nova Scotia and Outer Bay of Fundy Populations." These statements should be accompanied by a citation documenting exactly what "available data" are being referred to, and the rationale for how this conclusion was reached. Catch data from research vessel surveys (Figure 1) were referred to in Section 6 of the EIS so this may be what "available data" are being used to make this assertion. If this is true, there is a low relative abundance of Salmon in research vessel surveys, especially in the project area, but as this is a migratory species which in some populations are at critically low abundance, then the presence of any Salmon at all should be treated as an indication of suitable habitat and warrant further study. Most publications pertaining to Salmon that are cited throughout the EIS, are from the 1980's & 90's. While these publications represent much of the available literature on Salmon in the marine environment, we would caution that since the date that they were published, there have been substantial declines in Salmon abundance, climate-driven shifts in ecosystem structure and function, and fluctuations in potential marine prey sources. This further necessitates the application of a precautionary approach when it comes to considering Salmon in the potential effects of either routine operations or accidental events and any resulting mitigation or offsetting measures.

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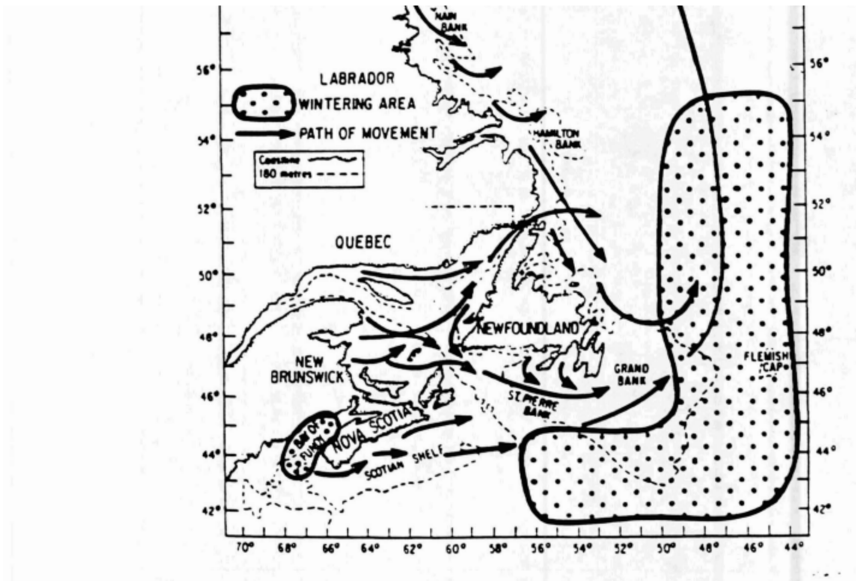

Figure 2. Migration routes for postsmolt Atlantic Salmon originating from rivers throughout the Atlantic provinces. Source: Reddin and Friedland (1993) adapted from Reddin (1988a)

As OBoF Salmon do have the potential to migrate through the project area either as they migrates North as postsmolts or as they migrate South as One-Sea-Winter ("**1SW**") or Multi-Sea-Winter ("**MSW**") Salmon, it is important to examine both life stages in considering potential effects. Postsmolt Salmon are likely to overwinter in the southern Labrador Sea and northern Grand Banks, near the project area (Reddin and Friedland, 1993; Reddin, 2006). However, as stated in Reddin and Friedland (1993), "the corroborative evidence to test this hypothesis from research or commercial vessels fishing during the winter is lacking." Reddin and Friedland (1993) included a map (Figure 2) which shows the potential overwintering area extending from the Southern Labrador Sea down along the eastern slopes of the Grand banks. This area directly overlaps with the project area, but the authors do not specify which life stage(s) are presumed to overwinter here.

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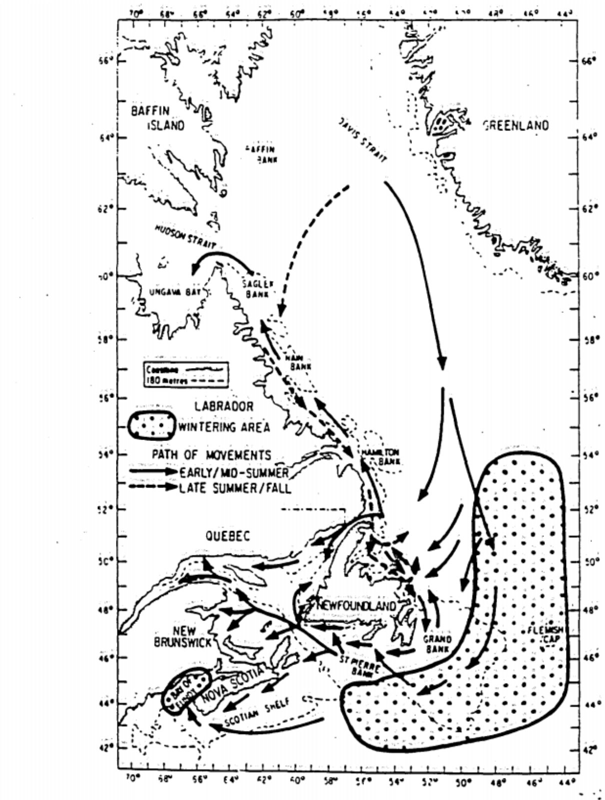

Figure 3. Migration routes for adult Atlantic Salmon returning to rivers throughout the Atlantic provinces. Source: Reddin and Friedland (1993) adapted from Reddin (1988a)

It is important to note that Reddin and Friedland (1993) suggest adult Salmon may also overwinter in the southern Labrador Sea due to catches in that region during Fall and Spring. There remains uncertainty as to preferred overwintering locations as winter surveys were limited to the Grand Banks and were unsuccessful in catching Salmon. However, the authors determined that after overwintering (presumably in the Labrador Sea), Salmon would migrate to the eastern slopes of the Grand Banks, closer to the project area (Figure 3). This appears to be an important region for Spring feeding and is one of two locations where adult Salmon were "found in abundance" (Reddin and Friedland, 1993). It is unknown if a particular food source is concentrated here at this time, however Section 16.7.9.3 admits that, "Migration routes from the overwintering areas to the east Grand Bank are not known and may include areas within and/or near the Project Area, particularly during time periods when sea-surface temperatures are favourable (over 4°C)." Research by Soto et al (2018) demonstrated that Salmon spending either 1 or multiple winters at sea before returning to the Saint John River consistently fed in regions of the North Atlantic (within the Project Area), indicating this region is not just a migratory corridor but also an important foraging and nursery habitat for Atlantic Salmon from the Wolastoq.

While Atlantic Salmon do have specific preferences for certain prey items (capelin, sand lance, squid, etc.), it is also apparent that they will diversify their diet to consume whatever is available and abundant. Given the uncertainty of future trends in prey availability associated with short and longer-term variability in the physical environment of the Labrador Current (Han, G., Ma, Z., & Chen, N., 2019), if the prey distributions were to shift more towards the project area, this could have dire consequences for Salmon in the case of an accidental spill or even routine operations which would normally result in avoidance behaviours. This further necessitates the implementation of monitoring technology that could detect these kinds of migratory events and the decision-making criteria for mitigation measures.

Reddin (2006) recommends that research vessel surveys should continue and be expanded to other areas of the Northwest Atlantic, that satellite tagging experiments be initiated, and that inshore tracking experiments to determine mortality and sources also be initiated. The proponent has deployed acoustic receivers in the project area with the goal of tracking acoustically tagged Salmon, should they pass through the area. They also mention that they provided funding to the Atlantic Salmon Federation (ASF) to purchase acoustic and satellite tags for a kelt tagging program. We requested an update from Equinor on this kelt tagging program. Equinor said they would contact ASF regarding this request, however, we never received a reply on this matter.

Monitoring

The only monitoring measure that is currently proposed for marine fish and fish habitat is surveys to collect data on benthic invertebrates in areas where infrastructure may be placed that were not included in previous surveys. There are currently no planned monitoring measures proposed to determine the presence of Salmon or any of its prey species. There is also no justification as to why additional monitoring is not planned. This is not acceptable. Given the fact that both the federal government and Indigenous groups identified the potential effects to Salmon as an important issue to be addressed in Section 9.1.5.1, we assumed that they would be included the list of "key species in the project area" in Table 9.8. This is also not acceptable. Section 18.4.2 states "Equinor Canada will, in

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accordance with its commitment to ongoing engagement with identified Indigenous groups, also continue to review these inputs and perspectives as the planning and eventual implementation of the Project progress and will consider them in its Project-related planning and decision-making as applicable." We would request that the proponent either commit to establishing their own monitoring program for Atlantic Salmon and/or clearly demonstrate how they will be integrating results from other initiatives such as the Environmental Studies Research Fund ("**ESRF**") into their own monitoring program.

Mitigation

The proponent contradicts itself in its assessment of project effects on species such as Atlantic Salmon. For example, in Section 7.3 where it mentions "migratory species (including fish, birds and mammals) that move through the Flemish Pass may potentially be affected by Project activities and these species may be harvested by Indigenous groups in coastal areas through FSC fishing, commercial-communal fishing or through other harvesting activities" and then in Section 14.4.2, it makes the assertion that "no associated potential effects to….[or] availability of culturally important species in the Indigenous communities". In Section 16.7.4.8 the proponent also states that "Although there is the potential for effects on fish and their habitats in the RSA, these are, with appropriate mitigations ….unlikely that the overall abundance, distribution or health of any [SAR] and its eventual recovery will be negatively affected." There does not appear to be any references cited to support any of these claims. So while there is generally an admission of uncertainty on behalf of the proponent in regards to Salmon migration trajectories and habitat use in and around the project area, this same uncertainty is not shared when it comes to determining the level of risk for the species. While we concede that species-specific mitigation strategies are difficult, we implore the proponent to firstly acknowledge the uncertainty surrounding potential effects of Project activities on Salmon and then through further Indigenous consultation, explore monitoring options that could inform future species-specific mitigation measures for Atlantic Salmon. Data deficiency is not an excuse to ignore the potential for harm that may be caused to this species as a result of negligence.

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Compensation

With regards to compensation, we want to explicitly state that no amount of compensation will adequately account for the loss of a population so vitally intertwined with Wolastoqey existence and culture. However, for further context regarding compensation and how the Fishing Gear Damage or Loss Compensation Program proposed in this report falls short of addressing impacts to Aboriginal and Treaty rights, please refer to the document WNNB submitted for Husky Energy Exploration Project's Information Requirement 58-02 specific to compensation and the inadequacies within the current framework.

Sincerely,

Amanda McIntosh
Resource Development Consultation Coordinator
Woodstock First Nation

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Robin Boychuk – IAAC – Robin.Boychuk@canada.ca

References

Han, G., Ma, Z., and Chen, N. 2019. Ocean climate variability off Newfoundland and Labrador over 1979–2010: A modelling approach. *Ocean Modelling*, *144*, 101505

Reddin, D.G. and K.D. Friedland. 1993. Marine environmental factors influencing the movement and survival of Atlantic salmon. Pp. 79-103. In: D. Mills (ed.) Salmon in the Sea and New Enhancement Strategies. Atlantic Salmon Federation, Fishing New Books/Blackwell Publishing, ON.

Reddin, D.G. 2006. Perspectives on the marine ecology of Atlantic salmon (Salmo salar) in the Northwest Atlantic. Canadian Science Advisory Secretariat Research Document 2006/018, Fisheries and Oceans Canada, Science. http://www.dfo-mpo-gc.ca/csas

Soto, D.X., Trueman, C.N., Samways, K.M., Dadswell, M.J. and Cunjak, R.A., 2018. Ocean warming cannot explain synchronous declines in North American Atlantic salmon populations. *Marine Ecology Progress Series*, *601*, pp.203-213.

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MSES
Management and Solutions in Environmental Science

Technical Review of Equinor's EIS for the Bay du Nord Development Project

Prepared for Woodstock First Nation

September 2020

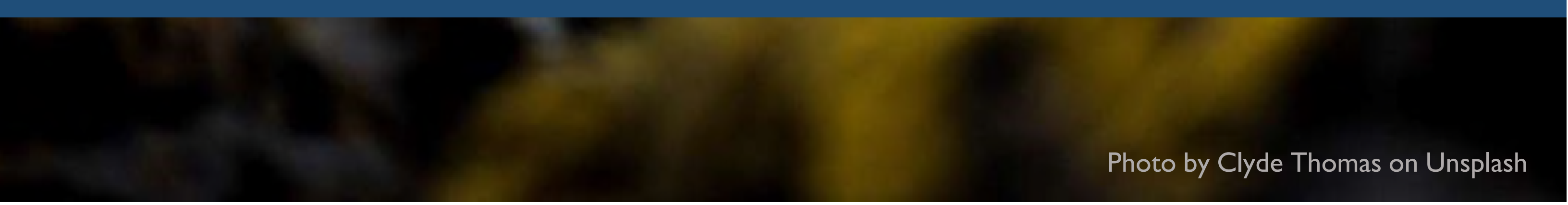

Photo by Clyde Thomas on Unsplash

List of Contributors

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	Derrick deK. Varent, Ph.D. (Fish Ecology)
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ACRONYM LIST

Km^2	Square kilometers
BdN	Bay du Nord
BTEX	benzene, toluene, ethylbenzene, xylenes (monocyclic aromatic hydrocarbons)
CEAA 2012	*Canadian Environmental Assessment Act*
COSEWIC	Committee on the Status of Endangered Wildlife in Canada
DWH	Deepwater Horizon
EIS	Environmental Impact Statement
EL	Exploration License
Equinor	Equinor Canada Limited
EU	European Union
IAA, the Agency	Impact Assessment Agency of Canada
Husky	Husky Oil Operations Limited
OIW	oil in water
OSPAR	Convention for the Protection of the Marine Environment of the North-East Atlantic
MSES	Management and Solutions in Environmental Science
NAFO	Northwest Atlantic Fisheries Organization
NL	Newfoundland
PAH	polycyclic aromatic hydrocarbons
PNEC	predicted no effect concentrations
the Project	Bay du Nord Development
RV	Research Vessel
SAR	species at risk
SBM	synthetic-based muds
SDL	Significant Discovery License
SST	sea surface temperature
WFN	Woodstock First Nation

1.0 Introduction

The Woodstock First Nation (WFN have requested that Management and Solutions in Environmental Science (MSES) conduct a third-party review of Equinor Canada Limited's (Equinor) Environmental Impact Statement (EIS) for the Bay du Nord (BdN) Development (the Project) that was submitted to the Impact Assessment Agency of Canada (IAA, the Agency) in July 2020. In this technical review, MSES evaluated the EIS with the goal of assisting WFN in understanding any gaps and deficiencies in the information provided by Equinor and to develop information requests and recommendations that would address those gaps and deficiencies.

1.1 Background on the Proposed Project

We understand that Equinor, and its partner, Husky Oil Operations Limited (Husky) are proposing to develop the BdN field, which includes Bay du Nord, Bay de Verde, Bay de Verde East and the Baccalieu discovery (collectively the Core BdN Development) offshore of eastern Newfoundland and Labrador (NL). The Project is defined as the development of the Core BdN Development and Project Area Tiebacks. The Core BdN Development will include the offshore construction and installation, hook-up and commissioning, production and maintenance operations, drilling and eventual decommissioning, as well as, associated supporting surveys, field work, and supply and servicing activities. Project Area Tiebacks would occur if ongoing internal assessments of known discoveries and/or exploration activities discover economically recoverable reserves that can be tied-back to the BdN production installation.

The Project is located in the Flemish Pass area of the Canada-Newfoundland Offshore Area, approximately 500 km east-northeast of St. John's. The Core BdN Development will occur primarily within Significant Discovery Licenses (SDLs) 1055, 1056 and 1057 and within Exploration Licenses (ELs) 1143 and 1157. The Project Area is 4,900 km^2 and includes other ELs and SDLs in which Equinor has majority interest.

The proposed Core BdN Development will be a subsea development which may include multiple templates and/or individual satellite wells (combined templates/satellites between 5 and 10) tied back via flowlines to a ship-like floating production storage and offloading installation. The total number of wells for the Core BdN Development (which includes side-tracks and/or pilot wells) is estimated to be between 10 and 40 wells, including 5 to 20 producing wells and 5 to 20 injection wells depending on the outcome of ongoing evaluations. The Project includes all activities, including supporting activities, associated with offshore drilling and production facilities.

The Canadian Environmental Agency (now the IAA) issued the EIS guidelines in September 2018, under the *Canadian Environmental Assessment Act* (CEAA 2012). New federal environmental assessment legislation (Bill C-69) was approved in June 2019, however this will not apply to the project, which will continue under CEAA 2012.

1.2 Review Approach

Our review of the EIS focused on impacts to marine fish, including reviewing Equinor's impact assessment from potential accidental events and malfunctions and how these impacts and proposed mitigations may affect fish health. Sustaining fish resources is a key concern for the WFN as many communities may have commercial licenses within the regional or local Project study area that help support their communities. In addition, there is concern that some fish species may be affected by the Project as they migrate through these areas of high offshore development to areas where traditional harvesting is a priority. Dr. Sarah Alderman reviewed the EIS assessment in light of these concerns, with support from Dr. Derrick deK. Varent.

In this review, MSES experts considered the adequacy of information presented in the EIS in terms of the baseline data, mitigations and follow-up programs presented by Equinor, and the quality of the assessment of potential environmental impacts and/or risks associated with the proposed Project. A key objective of the MSES review process was to identify and highlight any information gaps in the EIS that may impede WNNB's understanding of the potential impacts resulting from the proposed Project.

1.3 Review Document Structure

This report is structured into Overarching Comments and Specific Information Requests. In the overarching comments, each expert provides a plain language summary of the overall findings of their review. The Specific Information Requests include the detailed technical analysis of the EIS and its supporting documents in terms of the potential direct, indirect and cumulative impacts of the proposed Project, with a consideration of WNNB's traditional use practices. Text containing comments, requests or questions directed to Equinor or regulators appears in **bold**. Throughout the whole document, direct quotes from the EIS are in *italics* while quotes from other sources and literature remain in plain text.

2.0 Technical Review of Equinor's Bay du Nord EIS

2.1 Fish and Fish Habitat

2.1.1 Overarching Comments

The distributions for relevant species of interest, including SAR, is summarized by combining survey data from two independent survey efforts (Canadian and European). It is not evident if and how Indigenous Knowledge on species distributions was included. The Canadian Research Vessel (RV) data covers the western side of the Project Area and surrounding area, while the European Union (EU) trawl includes the eastern boundaries of the Project Area. It is not clear what proportion of the Project Area is covered by the combination of these survey efforts, which limits our ability to fully assess the presence of key species within the Project Area and their potential for adverse effects from project activities.

The approach for risk assessment uses predicted no effect concentrations (PNEC) to define a conservative threshold from which to interpret spill modelling results. Emphasis is given to the probability of exceeding the threshold and how long it takes to exceed the threshold, but from a toxicological perspective, it is the actual concentrations that matter. In some cases, the spill models predict lethal concentrations of certain chemicals in water surrounding the Project Area, but the ramifications of these predicted lethal concentrations are not addressed in the EIS.

Some areas of this EIS were found to insufficiently address potential impacts of project activities and operational risks for key species identified by Indigenous Groups including species at risk (SAR). A reoccurring argument was that any localized adverse effects would not influence the regional population; however, this argument is poorly supported and in some cases counter to Committee on the Status of Endangered Wildlife in Canada (COSEWIC) designations for certain species.

Simulations for produced water release scenarios included 6 cases with varied parameters. Outcomes were assessed for several toxic components of produced water using conservative threshold values. Detailed results are presented in Appendix J and interpreted in Chapter 9. Questions regarding the scope of the model, specifically a more substantial justification for selecting only the month of June in the simulations, as well as the source and validity of the chosen threshold values for toxic constituents are raised.

2.1.2 Information Requests

1. Issue: Species distribution survey data and distribution maps	
Reference:	BdN EIS, Chapter 6, Sections 6.1.8 and 6.1.9
Preamble:	Species distribution maps are presented for several relevant finfish species, including species at risk (SAR). Information was retrieved from data generated by Canadian Research Vessel (RV) Surveys and supplemented with data from European Union (EU) trawls to provide better coverage of the Project Area. The survey and trawl data are current and collected over multiple years, which brings confidence to the data. What is not clear for the Canadian RV data is the geographical extent of these surveys. All of the distribution maps generated from the EU trawl data indicate where species are absent either by empty symbols (e.g. Figure 6-12) or shading (e.g. Figure 6-17), which visually indicates the extent of data collection in relation to the Project Area. In contrast, the distribution maps for the Canadian RV data only indicate where one or more individuals of a species were found (e.g. Figure 6-16), and in most cases, the symbols end at or near the continental shelf just prior to the Project Area. The absence of a symbol in the Project Area, therefore, could mean either that the species was not found there, or that no data are available. It is not clear whether the Canadian and EU surveys together offer a complete picture of species distributions in the Project Area. In addition to the survey and trawl data, several literature references are provided to describe the biology (e.g. life history, habitat preferences) and distributions of relevant fish species. These references are summarized in Table 6.31. In some cases, the references provided are considerably outdated, dating as far back as 1968. As stated on page 6-6, "*…the Northwest Atlantic's ecosystem has experienced ecological shifts and remains in a state of flux*", and so it is quite possible that these old references are no longer relevant.
Request:	**a) Please provide a stand-alone Figure that delineates the geographical extents of the Canadian RV survey and EU trawl data in order to demonstrate the total survey coverage within the Project Area.** **b) Please quantify the total area covered within the Project Area boundaries from the combined data sets of the two surveys.**

	c) Alternatively or in addition to (a), include in all Figures showing a species' distribution range according to the Canadian RV Survey, a symbol for 'Species Absent' or a clear delineation for the geographical limits of the Survey. **d) We recommend that a composite image combining data from the two sources within the Project Area would be useful (e.g. a new map that combines Figure 6-16 and 6-17), since the Canadian RV and EU trawl data offer complimentary data on similar species.** **e) Please provide the most recent literature references available to describe the biology and distribution of fish species. If there are data gaps, please identify these and discuss how uncertainty associated with these information gaps was considered in the assessment.** **f) Please make clear if and where Indigenous Knowledge on species distributions/abundances was incorporated into the fish assessment.**
Literature Cited:	Equinor Canada Ltd. (2020). Bay du Nord Development Project – Environmental Impact Statement. Prepared by Wood Environment & Infrastructure Solutions and Stantec Consulting. St. John's, Newfoundland (NL) Canada. July 2020.

2. Issue: Key species identified by Indigenous Groups missing from Chapter 9	
Reference:	BdN EIS, Chapter 9, Section 9.2, page 9-27
Preamble:	Equinor indicates that Indigenous knowledge and interests helped inform the considerations of impact on marine fish and fish habitat for the EIS. Specifically, on page 9-27: "*Key species were identified based, conservation status (SARA schedule 1), and Indigenous social, cultural, commercial, and traditional importance…*". As part of the EIS process, Equinor consulted with Indigenous Groups who identified "*Potential effects to key fish species that are harvested for commercial and/or traditional use purposes (e.g., American eel, Atlantic bluefin tuna, Atlantic salmon, Swordfish)*" in their list of concerns (page 9-17). American eel, Atlantic bluefin tuna, and Atlantic salmon are not listed in Table 9.8 Summary of Key Fish Species in the Project Area.
Request:	**a) Please show where you addressed Indigenous concerns for American eel, Atlantic bluefin tuna, and Atlantic salmon in Section 9.2.** **b) We recommend that the aforementioned species be included in Table 9.8.**
Literature Cited:	Equinor Canada Ltd. (2020). Bay du Nord Development Project – Environmental Impact Statement. Prepared by Wood Environment & Infrastructure Solutions and Stantec Consulting. St. John's, NL Canada. July 2020.

3. Issue: Presentation of Dispersed Oil from Produced Water	
Reference:	BdN EIS, Chapter 9, Figure 9-4, page 9-56
Preamble:	Equinor modeled several Case scenarios to predict the footprint of oil concentrations above a predicted no effects concentration (PNEC) that would result from produce water discharge, using different initial oil in water concentrations, release rates, and mixing effects. The results of these models are presented in Figure 9-4 and discussed in the surrounding text (beginning on page 9-56). There is a disconnect between the figure and descriptive text in terms of scale. The text describes effects within metres of the discharge site, while the

	figure units are kilometers. Given the much larger scale of the Figure, it is not possible to discern the high probabilities that are discussed in the text. The text refers to several specific constituents of oil, but Figure 9-4 does not make clear which of these it is showing.
Request:	**a) Please reduce the scale of Figure 9-4.** **b) Alternatively, provide insets or additional figure panels that zoom in on the affected area and show the impact at a finer scale.** **c) Please identify which of the oil constituents discussed in the text (BTEX, PAH, phenols) is depicted in Figure 9-4.**
Literature Cited:	Equinor Canada Ltd. (2020). Bay du Nord Development Project – Environmental Impact Statement. Prepared by Wood Environment & Infrastructure Solutions and Stantec Consulting. St. John's, NL Canada. July 2020.

4. Issue: Scope and thresholds for produced water plume dispersion modelling	
Reference:	BdN EIS, Chapter 9, Section 9.3.2.4, page 9-55 to 9-57, and Appendix J
Preamble:	The modelling scenarios were generated using DREAM which assumes a set of discharge rates, oil in water (OIW) concentrations, and mixing with cooling water. Simulations were only generated for the month of June, with the justification that this is "*considered the most sensitive month for when biological resources are most vulnerable*." (page 9-55). Appendix J provides further justification for selecting June based on lowest wind speeds, and specifies that the biological resource most vulnerable in June is plankton (Appendix J, page 1: "…*since most plankton* *would be in the water column in Spring, June (with the lowest wind speed of the two Spring months) was selected.*"). It is not clear if and how other environmental factors with seasonal variation (e.g. waves, ice) would affect the model results. It is not clear if and how the sensitivities of other species were considered in selecting the month of June. A threshold of "oil concentrations" of 70.5 ug/L was set as the predicted no effects concentration (PNEC). It is not clear what this threshold concentration specifically refers to (e.g. physical oil per unit water, or total oil including dissolved constituents). The description of results on pages 9-56 and 9-57 includes mention of specific constituents of oil (BTEX, PAHs, phenols) and their predicted concentrations under the various DREAM simulations. It is not readily apparent in the text in Chapter 9, but different PNEC thresholds were considered for each group of toxic constituents. This approach is appropriate because these components have different toxicities, but Chapter 9 gives the impression that there is only one PNEC considered in the simulations. The cited reference for the threshold values of various toxic constituents in produced water is OSPAR 2012. This is a guidelines document that sets the disclaimer that using PNEC for risk assessment "*is valid only for substances causing direct effects. Substances that are both bioaccumulative and persistent might cause postponed effects after accumulation of a certain body burden (due to uptake of food), sometimes at great distance from the discharge point.*" (OSPAR 2012). Many constituents found in produced water are known to carry both direct <u>and indirect</u> effects in fish and can bioaccumulate in certain tissues (e.g. PAH; Kennedy 2015). We were unable to locate specific threshold values in OSPAR 2012, as this document

	presents a standard method for generating threshold values rather than the values themselves.
Request:	**a) Please indicate if and how ocean conditions in a winter month would be expected to alter the results of a DREAM simulation.** **b) Please provide rationale for selecting June for the DREAM simulation for other biological resources (with specific reference to those listed in Table 9.8 Summary of Key Fish Species in the Project Area). Is this considered a vulnerable time for other biological resources listed in Table 9.8?** **c) Please explain in Chapter 9 exactly what the 70.5 ug/L of "oil" refers to (e.g. physical oil, dissolved concentrations of specific constituents).** **d) Please provide valid references for the chosen PNEC values.** **e) Please justify and provide relevant literature citations for using a single PNEC threshold for a constituent across all biological organisms considered in this report.** **f) Please acknowledge and discuss the limitations of using PNEC to set thresholds for biological effects (i.e. indirect effects, bioaccumulation).** **g) We note that it is difficult to assess the validity of Equinor's conclusions from the DREAM simulations given the information provided in Chapter 9. Care should be taken to make this section stand-alone (e.g. discussion of 'threshold' is vague and uncertain in Chapter 9 and only made clear in Appendix J).**
Literature Cited:	Equinor Canada Ltd. (2020). Bay du Nord Development Project – Environmental Impact Statement. Prepared by Wood Environment & Infrastructure Solutions and Stantec Consulting. St. John's, NL Canada. July 2020. Kennedy, C.J., 2015. Multiple effects of oil and its components in Fish. In: Alford, J., Peterson, M., Green, C. (Eds.), Impacts of Oil Spill Disasters on Marine Habitats and Fisheries in North America. CRC Press, pp. 3–34. OSPAR. 2012. OSPAR Guidelines in support of Recommendation 2012/5 for a Risk-based Approach to the Management of Produced Water Discharges from Offshore Installations. OSPAR Agreement 2012-7. OSPAR 12/22/1, Annex19

5. Issue: Predicted impact of produce water discharge on Atlantic salmon	
Reference:	BdN EIS, Chapter 9, page 9-61
Preamble:	There is potential that the residual oil concentrations in produced water may be great enough to cause a change in fish mortality, injury, and/or health. This is discussed for a variety of organisms. It is stated: "*Species like Atlantic salmon do not migrate in large concentrations and preferred sea surface temperatures (SSTs) would likely limit habitat use to temporary movement corridors in the Project Area, limiting potential for interactions with produced water.*" This statement, found on page 9-61, is unclear, speculative, and unsupported.
Request:	**a) Please list which of the relevant species (as per Table 9.8) are considered "*Species like Atlantic salmon*".**

	b) Please explain what is meant by "*migrate in large concentrations and preferred sea surface temperatures*". **c) Please define the "*temporary movement corridors in the Project Area*".** **d) Please provide literature citations or other evidence to support the many assumptions made in this statement.**
Literature Cited:	Equinor Canada Ltd. (2020). Bay du Nord Development Project – Environmental Impact Statement. Prepared by Wood Environment & Infrastructure Solutions and Stantec Consulting. St. John's, NL Canada. July 2020.

6. Issue: Atlantic salmon migration routes	
Reference:	BdN EIS, Chapter 9, section 9.5.5, pages 9-164 to 9-166
Preamble:	Mean sea surface temperatures (SST) are used to predict Atlantic salmon habitat use near the Grand Banks and Flemish Pass. Ranges of SST in the Project Area are provided for 5 to 8-month intervals, using historical data from 1900-2016. A smaller historical window for summarizing SST may be more appropriate given the influence of the climate crisis on ocean temperatures. This information is provided for the Insular Newfoundland Populations, which includes the South NL Population (designated as Threatened under COSEWIC). The information is also relevant for the Gulf of St. Lawrence Populations (Special Concern), as well as, the Eastern-Southern Nova Scotia and Outer Bay of Fundy Populations (Endangered). On page 9-164, Equinor concludes that "…*migration to the east Grand Banks area must occur; however, the exact migration route is not known and may be influenced by SST during the time of migration. For example, the monthly SST values around the Project Area are a general indication that Atlantic salmon would not use the area outside the months July through to November and based on the SST temperatures recorded, if salmon use the area during the summer/autumn period (22 June to 22 December), it would likely be limited.*" It is further suggested (page 9-164) that "*No life stage of Atlantic salmon is dependent upon the Project Area and any utilization is likely restricted to limited migration at low densities in those years when spring water temperatures exceed 3°C.*"
Request:	**a) Please provide references to support the predictive value of SST and Atlantic salmon habitat use.** **b) Please discuss whether the "*limited migration at low densities*" could also be a consequence of an already reduced population size. As well, is further compounded by limited survey efforts as noted in the EIS: "*…surveys of the area are limited and regional variations in abundance have been reported*", (page 9-165).** **c) Please provide a topographical map of the Project Area and surrounding waters that summarizes historical SST for the spring Atlantic salmon migration.** **d) Please discuss how the warming trend in the ocean and the full life of the Project was considered when concluding that migrating Atlantic salmon are not likely to traverse the Project Area in the spring due to cooler SST.** **e) Please summarize mean SST in the Project Area using a more recent date range.**

Literature Cited:	Equinor Canada Ltd. (2020). Bay du Nord Development Project – Environmental Impact Statement. Prepared by Wood Environment & Infrastructure Solutions and Stantec Consulting. St. John's, NL Canada. July 2020.

7. Issue: Impacts to Redfish Species	
Reference:	BdN EIS, Chapter 9, Section 9.5.7, page 9-169
Preamble:	As stated, "*Acadian and deepwater redfish are species with COSEWIC status designations that are well distributed in the Flemish Pass and Flemish Cap.*" The specific status of these two species is Threatened, and these species are distributed in the Project Area (Figure 6-27). Impacts from the Project on these species are largely dismissed because "*areas of relatively high aggregation on the slopes outside the Project Area limits potential regional population effects*". The argument that these species exist elsewhere and therefore individuals in the Project Area do not matter is counter to the COSEWIC designation of these species as Threatened. What evidence is there that affected individuals in the Project Area will not contribute to a regional population effect? How is the regional population defined?
Request:	**a) Please provide evidence, such as a population model, that supports Equinor's conclusion that adverse effects on redfish in the Project Area will not contribute to a population decline of these Threatened species.** **b) Please describe the geographical limits, or other parameter that defines the "regional population" of redfish referred to in this section.**
Literature Cited:	Equinor Canada Ltd. (2020). Bay du Nord Development Project – Environmental Impact Statement. Prepared by Wood Environment & Infrastructure Solutions and Stantec Consulting. St. John's, NL Canada. July 2020.

8. Issue: Figure clarity of seabed deposition and water column concentration maps	
Reference:	BdN EIS, Chapter 16, Figures 16-39 to 16-42, 16-44, and others up to 16-59.
Preamble:	These figures are meant to depict the seabed deposition associated with the accidental release of synthetic-based muds (SBM) under several scenarios. Only the top panel of Figure 16-39 is clear; all other figures showing predicted seabed deposition are blurry. Many of the figures showing predicted water column concentrations are also blurry (e.g. Figure 16-57).
Request:	**a) Please reinsert high-resolution images so that visualizations of results from the SBM release scenarios can be properly assessed.**
Literature Cited:	Equinor Canada Ltd. (2020). Bay du Nord Development Project – Environmental Impact Statement. Prepared by Wood Environment & Infrastructure Solutions and Stantec Consulting. St. John's, NL Canada. July 2020.

9. Issue: Population level effects of a spill	
Reference:	BdN EIS, Chapter 16, Section 16.7.4.3 pgs. 16-138 and 16-141, and Section 16.7.4.8 pg. 16-150
Preamble:	The argument is made that a worst-case scenario spill (with or without chemical dispersants) would likely cause adverse effects on fish in the immediate vicinity of the spill, but the impact on the broader population would be negligible. This conclusion is stated on page 16-150: "…*not likely to result in an overall detectable decline in overall fish abundance or change in the spatial and temporal distribution of fish populations in the overall RSA for multiple generations. Similarly, while any affected individuals could conceivably be part of a species at risk,*

	it is unlikely that the overall abundance, distribution or health of any such species and its eventual recovery will be negatively affected." Support for this conclusion is offered from post-spill monitoring after the Deepwater Horizon (DWH) spill, where (page 16-138) "*impacts on the productivity of the region's fisheries lasted only a few years…*[and]*…was largely influenced by fisheries closures (Murawski et al. 2016)*." This argument implies that adverse effects imposed by an accidental spill, even if great, are irrelevant because fisheries activities also have a great influence on population dynamics. This downplays the cumulative impacts of human activities on natural fish populations and passes the onus to other parties. Additional support for negligible population level effects of a spill is offered from a modelling study on Arctic cod that predicted (page 16-138 and 16-141) "*if large mortalities of Arctic cod juvenile and eggs were to occur due to a hypothetical spill event… the effects on the regional cod population would be insignificant (Gallaway et al. 2017)*." The Gallaway study is useful in demonstrating how data can be integrated to inform risk assessments of populations; however, it does not provide evidence that fish populations are unaffected by large oil spills in the marine environment. As noted by Gallaway et al., "Our predictions <u>have significant uncertainty</u> because relative abundance and density approximation of Arctic cod larvae were based on a single year's observations, as were the vital rate estimates. Multiple years of observations are needed to evaluate the veracity of our results." It is also important to note that the Gallaway study modelled impacts on the most <u>widespread and abundant fish species</u> in their study area, with a population size estimated at tens to hundreds of millions (Gallaway et al. 2017). With a substantial population buffer in its favour, it is not surprising that adverse effects imposed by the hypothetical spill scenarios occurred for only a fraction of the population. Gallaway et al. (2017) did not address a fish species with a smaller population size or more limited distribution, and so one cannot assume that a hypothetical negligible effect of a spill on Arctic cod equates to a hypothetical negligible effect on all fish species in the Project Area. This is especially relevant for SAR, species with considerable year-to-year variations in abundances, and species with long life cycles.
Request:	**a) Please include additional studies that measure the ecosystem effects of the DWH spill to provide a balanced argument for population effects of a spill (see Issue 11 of this report).** **b) Please identify how the spill assessment considers cumulative impacts to fish from other limiting factors such as overharvesting.** **c) Please assess spill scenarios on a fish species whose population is already limited.** **d) Please note on pages 16-138 and 16-141 that results from the hypothetical modelling study of Gallaway et al. (2017) is not sufficient support for concluding that an accidental spill in the Project Area would have negligible population effects on fish, for the reasons noted above. Therefore, provide additional evidence and justification that an accidental spill in the Project Area would have negligible population effects on fish.**
Literature Cited:	Equinor Canada Ltd. (2020). Bay du Nord Development Project – Environmental Impact Statement. Prepared by Wood Environment & Infrastructure Solutions and Stantec Consulting. St. John's, NL Canada. July 2020.

	Gallaway, B.J., W.J. Konkel, and B.L. Norcross. 2017. Some thoughts on estimating change to Arctic cod populations from hypothetical oil spills in the eastern Alaska Beaufort Sea. Arctic Science, 3(4): 716-729.

10. Issue: Spill models and predicted dissolved hydrocarbon concentrations	
Reference:	BdN EIS, Appendix E Section 4.2.2, Chapter 16
Preamble:	The results of the spill scenario simulations indicate that the maximum dissolved hydrocarbon concentrations at any depth in the water column following a subsurface blowout at either Site 1 or Site 2 could exceed 500 ug/L. For example, Figure 4-56 indicates that waters surrounding the Project Area would likely realize minimum concentrations of more than 100 ug/L, and that these high concentrations could extend for hundreds of kilometers from the release site. These concentrations of dissolved hydrocarbons are high enough to cause serious sublethal and lethal effects in many species and life stages of fish (Kennedy 2015; Lee et al. 2015). This fact is not stated in Section 4.2.2, and in fact a more optimistic outlooks is summarized on page 101: "*Elevated concentrations of soluble hydrocarbons within the water column at the trap height may extend for several kilometers, however natural dispersion and degradation would reduce the predicted in-water concentrations rapidly as the distance from the release location increased.*" The interpretation of the spill models, specifically with respect to dissolved hydrocarbon concentrations and the effects on fish, are insufficiently presented in Chapter 16, where figures depict the probability of dissolved hydrocarbon concentrations exceeding a conservative 1 ug/L threshold and the time to threshold exceedance (e.g. Figure 16-4). Such figures obscure the true magnitude and extent of dissolved hydrocarbons that would result from worst-case scenario spills, and this information is essential for understanding the potential for adverse effects on fish.
Request:	**a) Please include figures for dissolved hydrocarbon concentrations in Chapter 16 and then provide an appropriate interpretation of the impacts that these high concentrations would have on fish.** **b) When reporting dissolved hydrocarbon concentrations from the modeling scenarios, please include the range, mean, and median predicted values rather than using less specific language (e.g. "*…reaching or exceeding the ecological threshold*", page 16-144).** **c) Please report the mean dissolved hydrocarbon concentration in the Project Area and the percentage of area exceeding threshold concentrations under the various spill scenarios, and then use this to inform or update conclusions on impacts to SAR.**
Literature Cited:	Equinor Canada Ltd. (2020). Bay du Nord Development Project – Environmental Impact Statement. Prepared by Wood Environment & Infrastructure Solutions and Stantec Consulting. St. John's, NL Canada. July 2020. Kennedy, C.J., 2015. Multiple effects of oil and its components in Fish. In: Alford, J., Peterson, M., Green, C. (Eds.), Impacts of Oil Spill Disasters on Marine Habitats and Fisheries in North America. CRC Press, pp. 3–34.

	Lee, K., M. Boufadel, B. Chen, J. Foght, P. Hodson, S. Swanson, and A. Venosa. 2015. Expert Panel Report on the Behavior and Environmental Impacts of Crude Oil Released into Aqueous Environments. Royal Society of Canada, Ottawa, ON.

11. Issue: Impact assessment of a worst-case scenario spill event	
Reference:	BdN EIS, Chapter 16, Table 16.39
Preamble:	As noted in Issue 10 of this report, the results of the spill scenario simulations indicate that the maximum dissolved hydrocarbon concentrations following a subsurface blowout could exceed lethal levels for fish and other aquatic organisms. In addition, a range of adverse effects may also occur in fish exposed to lower concentrations, as the authors indicate on page 16-137. We note that adverse effects such as immunotoxicity and impaired swimming performance, carry the potential for indirect mortalities in fish from increased disease susceptibility and decreased prey capture/predator avoidance, respectively, as well as food web disruption. Therefore, combined with areas of lethal concentrations, the overall impact of a subsurface blow-out spill could be much greater than suggested by the authors (Table 16.39). We ask Equinor to consider that ecosystem models aimed at detecting the long-term impact of the DWH spill offer mixed perspectives. While some models suggest little lasting effect on fish and shellfish (Ward et al. 2018), others found significant impacts on aquatic organisms including deep-sea corals (Girard and Fisher 2018) as well as large and demersal fish groups (Ainsworth et al. 2018). Moreover, the Ainsworth study highlighted that recovery trajectories for impacted populations are influenced by population growth rates, with slow-growth populations requiring more than 30 years to recover to baseline. In light of these issues, the conclusions presented in Table 16.39 for subsurface blowouts are questioned. Specifically, the assigned medium-high level confidence in the assessment of medium-level, reversible, long-term adverse impacts on fish should be reconsidered.
Request:	**a) Please include additional literature references on the ecosystem effects of the DWH spill to provide a balanced view on the potential impacts of a subsurface blowout.** **b) Please adjust expectations of medium-level impacts to effects on fish and fish habitat given that significant direct and indirect mortalities are likely for the presented spill scenarios.** **c) The concept of Reversibility (return to baseline) does not adequately capture the known and likely cumulative impacts of a spill, commercial harvesting, and climate change on fish. Please indicate how cumulative effects were considered in the assessment of environmental effects of a spill on fish and fish habitat.** **d) Please present and summarize separate outcome scenarios for different fish groups to emphasize the greater likelihood of long-term and irreversible effects on certain species (e.g. demersal slow-growing populations and SAR).**
Literature Cited:	Ainsworth CH, Paris CB, Perlin N, et al. Impacts of the Deepwater Horizon oil spill evaluated using an end-to-end ecosystem model. *PLoS One*. 2018;13(1):e0190840.

	Equinor Canada Ltd. (2020). Bay du Nord Development Project – Environmental Impact Statement. Prepared by Wood Environment & Infrastructure Solutions and Stantec Consulting. St. John's, NL Canada. July 2020. Girard F, Fisher CR. Long-term impact of the Deepwater Horizon oil spill on deep-sea corals detected after seven years of monitoring. *Biological Conservation*. 2018;225:117-127. Ward EJ, Oken KL, Rose KA, et al. Applying spatiotemporal models to monitoring data to quantify fish population responses to the Deepwater Horizon oil spill in the Gulf of Mexico. *Environ Monit Assess*. 2018;190(9):530.

12. Impacts to Roundnose Grenadier within COSEWIC limits	
Reference:	BdN EIS, Chapter 9, Table 9.16, Section 9.5.2
Preamble:	The impacts to the SAR are generally deemed difficult to assess because of insufficient information on critical habitat and existing distributions but remain manageable because other aggregations of the same species exist outside of the Project Area. However, the Roundnose Grenadier does not follow this same logic. The Canadian RV data shows that Roundnoses live in high abundances at the west end of the development area. However, the surveys did not extend far enough into the development area to determine whether those high aggregations continue across the development area (i.e. to the east). For that area we would typically refer to the EU or Northwest Atlantic Fisheries Organization (NAFO) data. Yet the EIS does not provide EU/NAFO data for Roundnose Grenadiers, rather Equinor only provides it for the Roughhead Grenadier (a related species that is not as big of a conservation concern). Equinor should clarify whether this data exists for the Roundnose Grenadier, and if it does, provide it in the EIS. Further, at the time of writing the COSEWIC report for Roundhead Grenadier, it was assumed that there were no subunits to the species distributions (i.e. distinct populations) because there was no evidence of genetic differentiation or local adaptation (DFO 2010). However, more recently, genomic data published in a leading journal has led the authors to suggest that local adaptation is occurring frequently across depths (Gaither et al 2018). Combining this information with the reasonable arguments outlined in the EIS to why the risk to Roundnose Grenadier is "moderate" necessitates a better plan for ensuring the sustainability of the population. In the recovery plan, DFO states that other forms of mortality are acceptable as long as they remain within the magnitude of mortality expected through bycatch (DFO 2010). By this metric, and the possible reductions in fishing, can the proponents estimate quantitatively whether the Project has a potential to exceed this limit?
Request:	**a) Provide distribution maps for the Roundnose Grenadier from other sources of data (e.g. EU / NAFO surveys) which cover the full core development area.** **b) Estimate quantitatively whether the potential impacts of the Project fall within or exceed the bycatch limit provided within the DFO 2010 recovery plan.**

Literature Cited:	DFO. 2010. Recovery Potential Assessment for Roundnose Grenadier, *Coryphaenoides rupestris*. DFO Canadian Science Advisory Secretariat Science Advisory Report 2010/021. Equinor Canada Ltd. (2020). Bay du Nord Development Project – Environmental Impact Statement. Prepared by Wood Environment & Infrastructure Solutions and Stantec Consulting. St. John's, NL Canada. July 2020. Gaither, M.R., Gkafas, G.A., de Jong, M., Sarigol, F. Neat, F. et al. 2018. Genomics of habitat choice and adaptive evolution in a deep-sea fish. Nature Ecology & Evolution volume 2, 680–687.

13. Offsetting area under the Fisheries Act should be higher than 7.0 km^2	
Reference:	BdN EIS, Chapter 9, Section 9.3.3.3 (page 9-80), Appendix O
Preamble:	The EIS provides detailed information on fish habitat offsetting but it is not clear whether Equinor plans to include the possible alterations to the seabed from the drill cuttings in the offsetting plan. It appears from Appendix O that they are only including the roughly 7 km^2 from the subsea infrastructure. However, in Chapter 9, the authors modelled another roughly 2.5 km^2 that could be altered for an indefinite period from the drilling program. This value should be included in the offsetting as lost habitat.
Request:	**a) Discuss whether the 2.5 km^2 from drilling sedimentation will be included in the offsetting plan.**
Literature Cited:	Equinor Canada Ltd. (2020). Bay du Nord Development Project – Environmental Impact Statement. Prepared by Wood Environment & Infrastructure Solutions and Stantec Consulting. St. John's, NL Canada. July 2020.