Newfoundland Orphan Basin Exploration Drilling Program

Response to Information Requirements and Clarification Requirements

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1.0 INFORMATION REQUIREMENTS

1.1 Project Description

1.1.1 Information Requirement: IR-01

External Reviewer ID:

DFO-01; QFN

Reference to EIS:

Section 1.0;
Section 1.2;
Section 4.2.3.4;
Section 8.1.4.1;
Section 9.1.4.1;
Section 12.1.4.1;
Section 13.1.4.1

Context and Rationale:

The Environmental Impact Statement (EIS) Guidelines require that spatial boundaries take into account the appropriate scale and spatial extent of potential environmental effects.

Section 1.2 of the EIS defines the Project Area as encompassing the immediate area in which Project activities and components may occur, including direct physical disturbance to the marine benthic environment (in Exploration Licences 1145, 1146, 1148 and 1149) plus a 20 kilometre buffer (Figure 1.1). However, the Project Area does not include the transit route for vessels and helicopters to and from St. John's which are part of routine operations. No rationale is provided for the Project Area not being inclusive of all routine project activities nor is a rationale is provided for the 20 kilometre buffer from the Exploration Licences for the Project Area.

Section 9.1.4.1 of the EIS defines the Local Assessment Area as "…the Project Area and adjacent areas where Project-related environmental effects are reasonably expected to occur based on available information, including effects thresholds, predictive modelling, and professional judgement." However, it is not clear how the modelling in the EIS (e.g., Appendix B – Drill Cuttings Modelling Report, Appendix C – Underwater Sound Assessment Report, and Appendix D – Oil Spill Trajectory Modelling Report) has been used to define the Local Assessment Area.

Similarly, the Regional Assessment Area is defined as the area within which residual environmental effects from operational activities and accidental events may interact with marine and migratory birds. However, the modelling in Appendix D – Oil Spill Trajectory Modelling Report extends outside the Regional Assessment Area. It is noted that it is possible that effects from larger scale unplanned events (e.g., blowout) could extend beyond the Regional Assessment Area. It is not clear how the Regional Assessment Area encompasses potential environmental effects from operational activities and accidental events.

Specific Question of Information Requirement:

Discuss the rationale for a Project Area that is not inclusive of all Project routine activities and components.

Provide a rationale and purpose for the buffer zone of 20 kilometre around each Exploration License.

Provide rationale for the spatial boundaries of the Local Assessment Area and Regional Assessment Area with respect to the scale and spatial extent of potential environmental effects inclusive of accidents and malfunctions. Clarify whether the predictive modelling completed for the EIS was used to define the extent of the Local Assessment Area and Regional Assessment Area for all valued components.

Response:

The Project Area represents the immediate area within which Project activities may occur and includes Exploration Licences (ELs) 1145, 1146, 1148, and 1149. These ELs are not contiguous, although for the purpose of the environmental assessment, a single Project Area was preferred. The Project Area boundary was therefore drawn to join the ELs in the West Orphan Basin and the East Orphan Basin as a single unit area. The only Project activity not captured within the Project Area is vessel and helicopter transit, which is captured within the Local Assessment Area (LAA) for each Valued Component (VC). Other than vessel and helicopter transportation, which extends beyond the Project Area, all other activities are focused within the Project Area. It is important to note that all potential effects associated with vessel and helicopter transportation along the entirety of predicted transit routes has been assessed.

The 20-km buffer has been used to capture discharges and emissions from routine activities that may extend outside the EL if drilling were to occur near the edge of an EL (versus the middle of an EL).

The LAA is intended to represent the maximum area within which environmental effects from routine Project activities and components can be predicted or measured with a reasonable degree of accuracy and confidence. For most VCs it incorporates the Project Area (which already incorporates a conservative buffer to account for potential discharges and emissions that may potentially extend beyond the ELs within which drilling activity can occur) and the transit routes for vessels and helicopters. The LAA for marine mammals and sea turtles was extended to a 150 km buffer as a very conservative (i.e., precautionary) distance based on the underwater sound modelling (Zykov 2016) conducted for BP Canada Energy Group ULC's (BP) Scotian Basin Exploration Drilling Project (BP 2016), which predicted that sound levels were predicted to decrease to below 120 dB re 1 μPa RMS SPL at distances >150 km from the mobile offshore drilling unit (MODU) during operations in winter (i.e., when sound propagates furthest due to environment conditions). The LAA for marine mammals and sea turtles in the Scotian Basin Exploration Drilling Project EIS assumed a 150 km buffer around the exploration licences and this conservative approach was also adopted for the Newfoundland Orphan Basin Exploration Drilling Program EIS. However, it should be noted that transmission loss modelling conducted for the Newfoundland Orphan Basin Exploration Drilling Program predicted a much smaller radial extent for a 120 dB re 1 μPa RMS SPL threshold of up to 40 km from the MODU. Refer also to the response to IR-23.

The boundaries of the Regional Assessment Area (RAA) were delineated to capture the area within which residual environmental effects from the Project activities and components may interact cumulatively with the residual environmental effects of other past, present, and future (reasonably foreseeable) physical activities. Although the RAA is intended to be much broader than the LAA, it is acknowledged in the EIS that it is possible that effects from larger scale unplanned events (e.g., blowout) could extend beyond the RAA. One of the challenges in delineating an RAA is the need to encompass spatial extents of environmental effects while characterizing the baseline environment on a scale that is meaningful and conducive to assessment. In addition, a large-scale unplanned event is considered an unlikely event. Another challenge is that the RAA boundaries usually form the framework for the assessment and therefore are delineated at an early stage of the EIS before all modelling has been completed. These boundaries are usually drawn based on professional judgement and existing knowledge as well as preliminary modelling results and are similar to project areas defined in other exploration drilling EISs.

The RAA for this EIS encompasses an area of 1,556,245 km^2. In the unlikely event of a well blowout in the West or East Orphan Basin, it is possible that a visible sheen (0.4 μm) or water column oil exceeding a threshold of 58 ppb total hydrocarbon concentration could occur outside the RAA boundaries. As shown in the Oil Spill Trajectory Modelling (Appendix D of the EIS), the prediction of effects is not truncated by the RAA boundaries.

1.1.2 Information Requirement: IR-02

External Reviewer ID:

N/A

Reference to EIS:

Section 2.4.1

Context and Rationale:

Section 2.4.1 of the EIS states that details of the safety zone would be provided to the Marine Communication and Traffic Services for broadcasting and publishing in the Notice to Shipping and Notice to Mariners. However, it is not clear whether this would be applicable to Exploration Licence 1149 which is outside the exclusive economic zone or if additional notifications or communications are required by the international community.

Specific Question of Information Requirement:

Discuss if any additional notifications or communications are required to notify the international community when drilling outside the exclusive economic zone at Exploration Licence 1149.

Response:

BP would provide updates to Notices to Shipping and Notices to Mariners as applicable for activities on its Exploration Licences inside and outside the exclusive economic zone. These publications are not restricted to Canadian use and are accessible by members of the international community who may be navigating in the area. In addition, for Exploration Licence 1149 which is outside the exclusive economic zone, BP would also notify the North Atlantic Fisheries Organization Secretariat.

1.1.3 Information Requirement: IR-03

External Reviewer ID:

N/A

Reference to EIS:

Section 2.4.1

Context and Rationale:

Section 2.4.1 of the EIS states that it will take 60 days to drill a well. No further information is provided in the EIS on the components of the timeframe, nor the factors influencing it. It is noted that other operators in shallower or similar water depths have predicted a longer timeframe (e.g., 80 days) to drill a well.

Specific Question of Information Requirement:

Discuss the components of and the assumptions used to determine the length of time to drill a well, including the estimated drilling time based on best case or average installations. Discuss any efficiencies that the proponent can apply that would allow a well to be drilled faster than other operators.

Response:

The time to drill each well is dependent on a variety of factors including water depth, well design, depth of reservoir, geological formation, physical environment / weather conditions, technical factors, etc. BP estimates that drilling operations as part of this Project would take approximately 60 days (from well spud to well abandonment). This time estimate is consistent with a typical drilling program duration for exploration and delineation wells drilled offshore Newfoundland and Labrador based on a calculated average of 57 days duration for wells drilled between 2010 and 2018. Note that this time estimate does not include completion or drill stem testing.

It is not currently anticipated that well testing will be carried out on the wells drilled in the initial phase of the Project (i.e., one to two wells). In the event of well success in the initial wells, and if the need for well testing is identified, a well test program will be developed and executed on subsequent wells drilled as part of the primary term of the exploration licence. Where it is carried out, it is likely that testing activities could occur over a period of approximately two weeks to one month.

BP would seek to optimize the drilling plan to be as safe and efficient as possible. Aspects that can affect drilling efficiencies can include, for example, drilling bit selection, casing design, and fluid hydraulics. These planning decisions are made during the detailed design phase of the well program, which will be conducted prior to the submission of BP's application to the Canada-Newfoundland and Labrador Offshore Petroleum Board for an Approval to Drill a Well.

1.1.4 Information Requirement: IR-04

External Reviewer ID:

C-NLOPB-10; C-NLOPB-11; KMKNO-02

Reference to EIS:

Section 2.4.1;
Appendix B;
Appendix C

Context and Rationale:

Section 2.4.1 of the EIS does not indicate whether batch drilling or simultaneous drilling may occur over the course of the Project, and if so, whether the effects analysis in the EIS is applicable. This information is required to assess the potential environmental effects of the Project.

Specific Question of Information Requirement:

Provide the following information on the proposed Project and associated environmental effects:

- clarify if batch drilling or simultaneous drilling is being considered for this Project, and if so provide information about its frequency and duration; and
- if so, provide additional information assessing the environmental effects of batch drilling or simultaneous drilling on all valued components, including updating modelling in Appendices B and C if necessary.

Response:

BP does not intend to conduct simultaneous drilling (i.e., multiple mobile offshore drilling units operating at the same time) for this Project. Currently only one well is planned to be drilled in 2020 pending regulatory approval. Depending on results of this initial well, additional wells may be drilled to help identify the presence and commercial viability of potential hydrocarbon resources.

Up to 20 wells may be drilled over the term of the exploration licence, but the number, timing, and location of wells (if applicable) after the initial exploration well will depend on the results of the initial well. BP does not currently plan to conduct batch drilling as part of this Project. However, depending on success of initial well(s) and if a multi-well program is proposed where there may be multiple close proximity wells with similar well designs, then there may be potential operational efficiencies through batch drilling. The option of batch drilling would be considered during detailed design phase for future wells (included in the 20 well count) and would be captured through the Approval to Drill a Well authorization process with the Canada-Newfoundland and Labrador Offshore Petroleum Board. Although batch drilling could potentially offer operational efficiencies, any changes in environmental effects would likely be negligible. The effects assessment in the EIS therefore does not require updating to account for potential batch drilling.

1.1.5 Information Requirement: IR-05

External Reviewer ID:

N/A

Reference to EIS:

Section 2.4.4;
Section 2.7;
Section 8.3.3.1

Context and Rationale:

Section 2.4.4 of the EIS is entitled "Well Abandonment and Decommissioning," however, no decommissioning activities are described within the section. Section 2.7 of the EIS states that wells may be designed for suspension and re-entry, however, no further information is provided on this process in the EIS. A description of all project activities is required to assess potential environmental effects.

Specific Question of Information Requirement:

Clarify whether the exploration wells will be abandoned rather than decommissioned.

Clarify if wells may be suspended and if so, provide further information on which circumstances wells are suspended and the methodology used to suspend an exploration well. Discuss potential environmental effects, as applicable.

Response:

Wells may be temporarily suspended during drilling operations due to weather, ice or other unforeseen circumstances. In these circumstances, well suspension would be conducted in a manner that prevents loss of fluids from the wellbore and enables the safe and efficient resumption of operations. In accordance with the *Newfoundland Offshore Petroleum Drilling and Production Regulations*, BP would also inspect and monitor the suspended well to maintain its continued integrity and to prevent pollution where weather conditions and proximity of the drilling unit allow. The 500-m radius safety zone would remain in place around the drilling unit.

At the end of planned drilling operations at each well, BP will plug and abandon the well. At water depths of 970 m or more (the minimum water depth in BP's exploration licences), BP will seek approval from the Canada-Newfoundland and Labrador Offshore Petroleum Board (C-NLOPB) to abandon the wellhead in place on the seafloor. Leaving the wellhead on the seafloor does not alter the number, type or method of placement and verification of the permanent barriers in the well. Wells abandoned in place are considered to be decommissioned they are not suspended for future re-entry or use.

If the wellheads are not able to be left in place, they will be removed using mechanical means (e.g., cutting). This may be conducted by inspection, maintenance and repair vessels and/or light intervention vessels, as well as the drilling unit. The specific vessels to be employed for this work will be communicated to the appropriate authorities, including the C-NLOPB, during the Operations Authorization process if a vessel other than the drilling unit is to be used. Blasting would not be conducted for wellhead removal. Wellhead removal will result in underwater sound emissions; these effects have been assessed in the EIS.

1.1.6 Information Requirement: IR-06

External Reviewer ID:

C-NLOPB-05

Reference to EIS:

Section 2.5

Context and Rationale:

Section 2.5 of the EIS states that when the blowout preventer (BOP) is initially installed, the remotely operated vehicle (ROV) intervention capability for operating the BOP, if necessary, will also be tested. This is done by physically engaging the ROV control panel to function the controls. However, based on the recent Husky spill in November 2018, the sea state during an accident or malfunction can be such that it is impossible to operate an ROV. The Canada-Newfoundland and Labrador Offshore Petroleum Board (C-NLOPB) advises in such cases the BOP must be equipped to be operated using an acoustic signal from a platform support vessel in case of total loss of the drilling platform. The C-NLOPB advises this technology is readily available (Konsberg ASC500).

Specific Question of Information Requirement:

Confirm that the blowout preventer (BOP) would be equipped so that it can be operated using an acoustic signal from a platform support vessel. If it is not the case, provide a rationale for not using this technology.

Response:

BP has not yet selected a drilling contractor and therefore the mobile offshore drilling unit (MODU) and specific BOP capabilities are not known. BP will adhere to the Drilling and Production Guidelines (Canada-Newfoundland and Labrador Offshore Petroleum Board [C-NLOPB] and Canada-Nova Scotia Offshore Petroleum Board 2017) (refer to section 29.7) which requires consideration of autoshear and deadman systems in addition to the ROV intervention capability. The autoshear and deadman are automated systems which do not require power or control from the MODU to function. BP will also consider the need to implement an acoustic BOP control system and to equip the subsea BOP stacks with two shear rams. The back-up system will be independently operated (separate accumulator). Specific BOP configuration and technology to be employed to undertake an emergency disconnect will be included in BP's application for an Operations Authorization from the C-NLOPB.

References:

C-NLOPB (Canada-Newfoundland and Labrador Offshore Petroleum Board) and Canada-Nova Scotia Offshore Petroleum Board]. 2017. Drilling and Production Guidelines. August 2017. 136 pp.

1.2 Alternative Means

1.2.1 Information Requirement: IR-07

External Reviewer ID:

C-NLOPB-08

Reference to EIS:

Section 2.9.2.3

Context and Rationale:

Section 2.9.2.3 of the EIS refers to the alternative means of drilling waste management. The C-NLOPB advised that compliance with the Offshore Waste Treatment Guidelines (OWTG) represents the minimum performance acceptable to the C-NLOPB. The C-NLOPB advised that various technological approaches to cuttings treatment to reduce the concentration of synthetic-on-cuttings to the lowest achievable concentration have not been considered and that where technically feasible, proponents should strive to outperform the Offshore Waste Treatment Guidelines targets.

Specific Question of Information Requirement:

Discuss approaches for cuttings treatment to reduce synthetic-on-cuttings to the lowest achievable concentration to outperform the Offshore Waste Treatment Guidelines targets.

Response:

The Offshore Waste Treatment Guidelines (OWTG; National Energy Board et al. 2010) were developed with the intention of aiding operators in the management of waste material associated with petroleum drilling and production operations in offshore areas regulated by the Canada-Newfoundland and Labrador Offshore Petroleum Board (C-NLOPB), Canada-Nova Scotia Offshore Petroleum Board, and National Energy Board. However, the performance targets included in the OWTG represent minimum performance expectations. BP's Environmental Protection Plan (EPP), which must be submitted to the C-NLOPB as part of the Operations Authorization process to drill a well and will be used as the conformance standard by the C-NLOPB, will include the waste treatment process and monitoring requirements to be implemented to manage waste from the drilling operation. The EPP will include practices and procedures to reduce the concentrations and volumes of waste materials discharged to the environment.

BP has not yet contracted a mobile offshore drilling unit or muds / solids company, therefore specifics on drilling waste management are not currently known. In general, drilling solids will undergo a series of treatments prior to discharge. This may include the use of shale shakers, solids dryer and centrifuges. Once drilling solids are treated to a level below the 48-hour mass weighted average of 6.9% synthetic-on-cuttings, they are eligible for discharge to the marine environment. The waste treatment process will meet or exceed the expected 48-hour mass weighted average of 6.9% synthetic-on-cuttings OWTG target.

References:

National Energy Board, Canada-Newfoundland and Labrador Offshore Petroleum Board, and Canada-Nova Scotia Offshore Petroleum Board. 2010. Offshore Waste Treatment Guidelines. vi + 28 pp.

1.3 Air Quality

1.3.1 Information Requirement: IR-08

External Reviewer ID:

ECCC-01; NRCan-02; NRCan-03; NRCan-04

Reference to EIS:

Section 2.8.1;
Section 5.3.3

Context and Rationale:

The EIS Guidelines require an estimate of the direct greenhouse gas emissions associated with all phases of the Project. The EIS Guidelines also state that assumptions are clearly identified and justified.

Section 2.8.1 of the EIS provides an estimated total value of daily and annual CO2 equivalent emissions from the fuel combustion of the mobile offshore drilling unit (MODU), helicopter and platform supply vessel. Table 2.5 in Section 2.8.1 of the EIS provides an estimate of NOx, CO, SOX, and PM emissions from MODUs, platform supply vessel, etc. However, some individual Greenhouse Gas (GHG) pollutants (CH4, N2O) are not provided and combustion emission factors of total volatile organic compounds (VOCs) and other NPRI Part 1, 2, and 5 substances are not provided although they are readily available. Clarification is required with respect to the greenhouse gas emission factors and global warming potentials used to determine the final emissions.

Similarly, an estimated total CO_2 equivalent emissions from flaring due to non-routine activities is provided but is not provided by individual pollutant. For a full description of possible emissions resulting from the Project, it is necessary to estimate the potential emissions if any such activities should occur.

Section 2.8.1 of the EIS provides an estimate of the GHG emissions from flaring; however, other than “higher heating value approach”, there are insufficient details provided to assess the estimation techniques and to determine the accuracy of the estimates.

Emission values (total suspended particulates, fine particulates smaller than 2.5 microns, respirable particulates of less than 10 microns, carbon monoxide, Sulphur oxides, nitrogen oxides, volatile organic compounds, hydrogen sulfide and other potentially toxic air pollutants) are compared to current provincial and federal emissions, but not with target values.

Specific Question of Information Requirement:

Provide assumptions and supporting evidence for emission estimates, including specific emission factors used. Provide the greenhouse gas emissions by source (MODU type, well testing, helicopters and platform supply vessel) and individual greenhouse gas pollutants (CH_4, N_2O). Provide an estimate of VOC emissions and other NPRI Part 1, 2 and 5 substances where emission factors are readily available. Update Table 2.5 with information requested above and with CO_2 equivalent per year. Provide the greenhouse gas emission factors used as well as global warming potentials used and sources for information used.

Provide details on the assumed composition being flared, volumes being flared, and emissions factors used to obtain the final total emission rates. Estimate emissions of other pollutants (e.g., NOx, soot, CO, VOCs) from flaring or provide justification for their exclusion.

Similar to the estimate details provided for the other emission sources (i.e., NOx, CO_2 and CO) from the MODU, platform supply vessel, and helicopters, provide details regarding the determination of the CO2 equivalent estimate for flaring.

Compare and assess the level of estimated emissions (total suspended particulates, fine particulates smaller than 2.5 microns, respirable particulates of less than 10 microns, carbon monoxide, sulphur oxides, nitrogen oxides, volatile organic compounds, hydrogen sulfide and other potentially toxic air pollutants) to the regional, provincial and federal emission targets.

Response:

The emission factors used to calculate the emission estimates as provided in Table 2.6 of the EIS were presented in Table 2.5 of the EIS. Table 1 provides an updated EIS Table 2.5 that include the emission factors used to calculate the emissions of individual greenhouse gas (GHG) pollutants (methane [CH_4], N_2O [nitrogen oxide]) and Table 2 provides an undated EIS Table 2.6 that includes the CH_4 and N_2O emission estimates for each routine Project activity.

It is acknowledged that volatile organic compounds (VOCs) and other National Pollutant Release Inventory (NPRI) Part 1, 2 and 5 substances may potentially be released during the Project (likely only during well test flaring); however, these air containments were not included in the emissions inventory for the Project as it is unlikely any material volume would be emitted from regular sources (i.e., rig engines) beyond those already calculated. The quantities of such contaminants released from routine Project activities are expected to be very small and will disperse quickly from the sources at these offshore locations. There are also no ambient air quality standards for these contaminants under the Newfoundland and Labrador *Air Pollution Control Regulations* (Office of the Legislative Counsel Newfoundland and Labrador 2004) or the Canadian Ambient Air Quality Standards (Canadian Council of Ministers of the Environment 2014); therefore, there is no way to represent the significance of emissions.

Table 1 EIS Updated Table 2.5: Gaseous Emissions Factors for Project Activities

Air Contaminant	Emission Factors		
	MODU	Platform Supply Vessels (PSVs)	Helicopters
CO_2	2690 g/l[a]	417 lb/MMBtu[d]	2,560 g/l[a]
CH_4	0.133 g/l[a]	0.003 lb/MMBtu[d]	0.029 g/l[a]
N_2O	0.4 g/l[a]	0.02 lb/MMBtu[d]	0.071 g/l[a]
CO	0.85 lb/MMBtu[b]	0.71 lb/MMBtu[d]	0.95 g/kg fuel[e]
NO_x	3.2 lb/MMBtu[b]	8.52 lb/MMBtu[d]	18 g/kg fuel[e]
SO_x	0.0505 lb/MMBtu[b,c]	2.56 lb/MMBtu[d]	4 g/kg fuel[e,f]
PM	0.1 lb/MMBtu[b]	0.3 lb/MMBtu[d]	0.4 g/kg fuel[e]

[a] Environment and Climate Change Canada. 2015. National Inventory Report 1990-2013: Greenhouse Gases Sources and Sinks Part 2.
[b] United States Environmental Protection Agency (US EPA). 1996. AP-42 Chapter 3.4 Large Stationary Diesel and All Stationary Dual-fuel Engines.
[c] The emission factor for SO_2 in US EPA AP-42 is calculated based on $1.01S^1$, where S^1 is the Sulphur in the fuel oil. The emission factor assumes that all Sulphur in the fuel is converted to SO_2. It has been assumed that the Sulphur content of the fuel oil will be 0.05%. The emission factor for SO_2 is therefore 0.0505.
[d] US EPA. 2009. “Current Methodologies in Preparing Mobile Source Port-Related Emission Inventories.”
[e] Swiss Confederation. 2015. “Guidance on the Determination of Helicopter Emissions.”
[f] Emission factor assuming all Sulphur is converted to SO_2. The Sulphur content of aviation fuel was assumed to be 4,000 ppm, or 4 g/kg.

Table 2 EIS Updated Table 2.6: Estimated Daily Criteria Air Contaminant Emissions for the MODU and Support Vessels and Helicopter

Source	Daily Fuel Consumption (tonnes)	Daily Energy Consumption (MMBtu)	CO_2 (t/d)	CH_4 (t/d)[a]	N_20 (t/d)[b]	CO_{2eq} (t/d)	CO (t/d)	NO_X (t/d)	SO_X (t/d)	PM (t/d)
MODU	76.4	3,248	241	0.012	0.036	252	1.59	3.76	0.23	0.20
PSV (assumes 2)	33.1	1,405	266	0.002	0.01	269	0.45	5.44	1.63	0.19
Helicopter	4.60	192	14.5	0.0002	0.0004	14.7	0.01	0.12	0.04	0.003
TOTAL	**114**	**4,844**	**522**	**0.014**	**0.046**	**535**	**2.05**	**9.31**	**1.9**	**0.40**

a Global Warming Potential, 25
b Global Warming Potential, 298
t/d = tonnes per day

As stated in Section 2.8.1 of the EIS, it is not currently anticipated that well flow testing will be carried out in the wells drilled in the initial phase of the Project (i.e., one to two wells). However, should well flow testing be conducted as part of the Project activities, flaring would occur, but air contaminants would be released over a relatively short time period, and thus the quantities released to the atmosphere are expected to be small (and any calculations would also be quite generic without understanding the fluids being flared). Well flow testing is a non-routine activity that occurs over a short period of time at the end of the drilling program.

The well flow test window is likely to last no more than a month, although it could extend up to three months. Within this operational window, the well flow test process will vary in terms of activity and it is likely that there will be some time periods where flaring is required. Flaring may be for operational purposes, such as flushing or bleeding, and it would be carried out over one to six hours per flaring event, with low flow rates. Flaring may also be required during a series of separate well flow test periods that could last two or three days per period.

GHG emissions resulting from flaring during a well flow test were estimated and presented in EIS Section 2.8.1 of the EIS using guidance published in Section 98.253 of the Code of Federal Regulations Title 40, Protection of Environment and assuming that 10,000 bbl of oil could be flared during a well flow test with a higher heat value of 967,687 Btu/ft³. The emissions of individual GHG and the CO_2 equivalent emissions (CO_2e) from flaring are provided in Table 3. Actual emissions may vary depending on the hydrocarbons encountered in the well and the design of the well test.

Table 3 GHG Emissions from Non-Routine Flaring

Source	CO_2 (t/d)	CH_4 (t/d)[a]	N_2O (t/d)[b]	CO_2e (t/d)
Flaring during Well Flow Testing	3,213	9.70	0.032	3,466
a Global Warming Potential, 25 b Global Warming Potential, 298 t/d – tonnes per day				

Assuming that up to two wells could be tested in any year, it is estimated that up to 6,932 tonnes CO_{2e} could be released from non-routine flaring during well flow testing per year. This represents approximately 0.07% of Newfoundland and Labrador's annual GHG emissions as reported in 2015.

Flaring due to well flow testing, if completed, would be conducted over a short duration (days) and due to the offshore nature of the Project, emissions of other air contaminants (e.g., NO_x, particulate matter, CO, VOCs) are also expected to be small, and not likely to cause ambient standards to be exceeded at sensitive receptors. As a result, these were not included in the assessment.

Levels of estimated emissions for particulate matter, carbon monoxide, sulphur dioxide, nitrogen dioxide have not been compared to regional, provincial, and federal emission targets as exploration drilling is explicitly excluded from NPRI reporting.

References:

Canadian Council of Ministers of the Environment. 2014. Canadian Ambient Air Quality Standards.

Code of Federal Regulation. 2009. Title 40. Projection of Environment, Chapter I. Environmental Protection Agency, Subchapter C. Air Programs, Part 98 Mandatory Greenhouse Gas Reporting, Subpart Y. Petroleum Refineries, Section 98.253 Calculating GHG Emissions.

Environment and Climate Change Canada. 2015. National Inventory Report 1990-2013: Greenhouse Gases Sources and Sinks Part 2.

Office of the Legislative Counsel Newfoundland and Labrador 2004. Newfoundland and Labrador *Air Pollution Control Regulations.*

Swiss Confederation. 2015. Guidance on the Determination of Helicopter Emissions.

US EPA (United States Environmental Protection Agency). 1996. AP-42 Chapter 3.4 Large Stationary Diesel and All Stationary Dual-fuel Engines.

US EPA (United States Environmental Protection Agency). 2009. Current Methodologies in Preparing Mobile Source Port-Related Emission Inventories.

1.4 Physical Environment

1.4.1 Information Requirement: IR-09

External Reviewer ID:

KMKNO-08; NRCan-01

Reference to EIS:

Section 5.1.2

Context and Rationale:

Figure 5.3 of the EIS provides Eastern Newfoundland seabed features information for Exploration Licence 1145. However, this does not extend to Exploration Licences 1146, 1148 and 1149. Natural Resources Canada advised that this map is from an old surficial sediment geology map that used little data in the area and was based mostly on bathymetry, and that it is not reliable for geohazard purposes. Natural Resources Canada has provided references to be reviewed on the geology and potential for geohazards in the Orphan Basin, and advised that if the proponent has collected additional geological information as part of their exploration program, this information could be used to augment the references provided by Natural Resources Canada.

Section 5.1 of the EIS discusses Mass Transport Deposits (MTD), i.e., submarine landslides. However, the EIS does not provide a discussion of the geohazards presented by MTDs. Campbell reports (2005) that the MTDs carry coarser sand and gravel and can be unstable in areas based on the presence of diapiric features. Natural Resources Canada requested the proponent discuss the potential for submarine landslides (and their runouts) to impact drilling activities within the Exploration Licences. Natural Resources Canada provided references to be reviewed to obtain information pertaining to sediment quality, thickness, grainsize and mobility. It is noted that C-NLOPB will require a further geohazard assessment on the Exploration Licences prior to the issuance of any approval to drill a well.

<u>References</u>

Aksu, A.E. and Hiscott, R.N. (1992). Shingled Upper Quaternary debris flow lenses on the NE Newfoundland slope. Sedimentology, 39, 193-206.

Campbell, D.C., (2005). Major Quaternary mass-transport deposits in southern Orphan Basin, offshore Newfoundland and Labrador; Geological Survey of Canada, Current Research 2005-D3, 10 p.

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Lia, Gang, Piper, David J.W., Campbell, D. Calvin and Mosher, David. (2012). Turbidite deposition and the development of canyons through time on an intermittently glaciated continental margin: The Bonanza Canyon system, offshore eastern Canada. Marine and Petroleum Geology 29, (1), 90-103.

Piper, D.J.W., Tripsanas, E., Mosher, D.C., and MacKillop, K., 2019, Paleoseismicity of the continental margin of eastern Canada: Rare regional failures and associated turbidites in Orphan Basin: Geosphere, v. 15, no. 1, p. 85–107, https:// doi.org /10.1130 /GES02001.1.

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Tripsanas, E.K., Piper, D.J.W. and Campbell, D.C. (2008a). Evolution and depositional structure of earthquake-induced mass-movements and gravity flows: southwest Orphan Basin, Labrador Sea. Marine and Petroleum Geology. 25, 7, 645-662.

Tripsanas, E., Piper, D.J.W., Jenner, K.A. and Bryant, W.R., (2008b). Sedimentary characteristics of submarine mass-transport deposits: New perspectives from a core-based facies classification. Sedimentology. 55, 97–136

Specific Question of Information Requirement:

Taking into consideration the provided references, and any additional geological information from the exploration program, discuss the surficial geology within the Exploration Licences and the potential for submarine landslides (and their runouts) to impact drilling activities within the Exploration Licences. Discuss sediment quality, thickness, grain size and mobility in the Project Area.

Response:

The majority of research related to slope failures and the processes that caused the failures have been in the southern part of Orphan Basin on and around the Flemish Pass, Flemish Cap, and Sackville Spur; however, some researchers have extended their work to the north inclusive of the Project Area.

Orphan Basin has been subject to slope failures as evidenced by mass transport deposits (MTDs) observed in geophysical and core data. Campbell (2005) observed that the volume and abundance of MTDs is highest deeper in the sedimentary record and decreases as one moves closer to the seafloor.

Piper et al. (2019) indicate that maximum stable slope angle is greater than 3° in glacial till and up to about 3° in other soils. Tripsanas and Piper (2008) collected a transect of cores along Trinity Slope which sampled glacial tills with shear strengths near the seafloor of up to 80 kPa. Seafloor sediments are expected to grade from glacial tills on the shelf and upper slope, through muddy sands and sandy muds on the lower slope, towards marine silts and clays in the deeper portions of the study area. Sediments in the northwestern portion of the Project Area (EL 1145, EL 1146. and EL 1148) are expected to be muddy sands/sandy muds, while those in the central and southeastern portion of the Project area are likely to be marine clays.

Aksu and Hiscott (1992), Campbell (2005), and Tripsanas et. al (2008) suggest that more recent slope failures have occurred during glacial maxima. During glacial maxima sediments were deposited on the continental shelf and upper slope and failures may have occurred due to wave loading (Aksu and Hiscott 1992). Slope failures can also occur due to over steepening and excess pore pressures which can both occur due to rapid deposition during glacial cycles (Nadim et al. 2005).

Tripsanas et al. (2008) indicated that while failures are most frequent during glacial maxima, some failures have been observed during interglacial periods within the Orphan Basin, most recently identified to have occurred some 7,000 to 8,000 years before present in the Sheridan Canyon System, which extends northward to the southwestern border of the Project Area but lies several 10s of kilometers away from the exploration leases. The researchers suggest that potential triggers may include seismicity and/or dissociation of gas hydrates (causing a weakening of the sediments). However, they discount dissociation of gas hydrates, because pressure (sea level) and temperature have been relatively constant since the last glacial maxima (LGM). Thus, seismicity was the likely trigger for the slope failures observed which is consistent with finding by Nadim et al. (2005).

Li et al. (2012) indicate that during the LGM, the northern extent of shelf edge glaciation was the northern margin of the Trinity Trough. The seafloor and shallow stratigraphy on the slope and abyssal plain seaward of the Trinity Trough (Trinity Mouth Fan) impacts a large portion of the Project Area (including EL 1148 and the southern portion of EL 1145). This area shows evidence of seafloor and shallow subsurface modification by glacially derived debris flows (Tripsanas et al. 2007). Piper et al. (2019) indicate that the most recent identified slope failures occurred 7,000 years before present on Trinity Mouth Fan, which is covered by a variable thickness (up to a few meters) of parallel bedded sediment drape.

The authors further indicate that on the North Slope, which lies to the north of Trinity Trough, the most recent identified failures occur some 37,000 years before present. The age of these failures is consistent with the thickening (>5 m) of seafloor drape north of the Trinity Mouth Fan and the inferred lack of direct glacial influence on the shelf during the LGM. Slope sediments in this portion of the Project Area (including the northern portion of EL 1146 and EL 1145) are more likely to be stable than those in the southern portions of the study area.

Recently collected 3D seismic data suggest that while geomorphologic features indicative of seafloor failures (e.g., headscarps, runout) are present, there appears to be a drape of interpreted marine sediments that supports the assertion that the area has been stable for many 10’s of thousands of years.

The deep-water portions of the Project Area are poorly sampled and while Li et al. (2012) show the extent of glaciogenic debris flows from the Trinity Trough reaching the EL 1149 license area, it is inferred that the area is sufficiently far from sediment sources during glacial and interglacial times that large-scale debris flows are not likely.

The probability of a submarine landslide impacting the Project Area is expected to be relatively low given:

- The correlation of debris flow occurrence and glacial maxima drawn by the cited authors.
- The seafloor on the continental slope to the west is composed of competent glacial tills with high shear strengths near the seafloor.
- Favorable preconditioning due to excess pore water pressures which, if any, may be reduced in the northern project area due to low sedimentation rates and sufficient time for natural dewatering.
- Section 5.2 of the EIS indicates the area has been subject to seismic events. Any typical future seismic events would not be expected to cause a major slope failure as the area has been previously subjected to seismicity. Smaller retrogressive slides on the steepest parts of the slope to the west of the study area are possible but are not expected to travel great distances.

References:

Aksu, A.E. and R.N. Hiscott. 1992. Shingled Upper Quaternary debris flow lenses on the NE Newfoundland slope. Sedimentology, 39, 193-206.

Campbell, D.C. 2005. Major Quaternary mass-transport deposits in southern Orphan Basin, offshore Newfoundland and Labrador; Geological Survey of Canada, Current Research 2005-D3: 10 pp.

Li, G., D.J.W. Piper, D.C. Campbell and D. Mosher. 2012. Turbidite deposition and the development of canyons through time on an intermittently glaciated continental margin: The Bonanza Canyon system, offshore eastern Canada. Marine and Petroleum Geology, 29(1): 90-103.

Nadim, F., T.J. Kvalstad and T. Guttormsen. 2005. Quantification of risks associated with seabed instability at Ormen Lange. Marine and Petroleum Geology, 22: 311-318.

Piper, D.J.W., Tripsanas, E., Mosher, D.C., and MacKillop, K., 2019, Paleoseismicity of the continental margin of eastern Canada: Rare regional failures and associated turbidites in Orphan Basin. Geosphere, 15(1): 85-107, https:// doi .org /10.1130 /GES02001.1.

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Tripsanas, E.K., D.J.W. Piper and D.C. Campbell. 2008. Evolution and depositional structure of earthquake-induced mass-movements and gravity flows: southwest Orphan Basin, Labrador Sea. Marine and Petroleum Geology, 25(7): 645-662.

Tripsanas, E.K., D.J.W. Piper and K.A. Jarret. 2007. Logs of piston cores and interpreted ultra-high resolution seismic profiles, Orphan Basin. Geological Survey of Canada, Open file 5299.

1.4.2 Information Requirement: IR-10

External Reviewer ID:

NRCan-01

Reference to EIS:

Section 16.1.4

Context and Rationale:

Section 5.1 and Section 16.1.4 of the EIS provide information on the geology and geological stability and seismicity on the Orphan Basin. However, there is no mention of the importance of elevated or excess pore pressure in slope stability. Natural Resources Canada recommended that the research by Loloi (2004) and Cameron et al (2014) be consulted to provide additional information. The Storegga slide in Norway is discussed in the EIS as an example of slope stability comparable to the Project; however, Natural Resources Canada advises that data is available for the Orphan Basin.

<u>References</u>

Cameron, G.D.M., Piper, D.J.W. and MacKillop, K., 2014, Sediment failures in northern Flemish Pass; Geological Survey of Canada, Open File 7566. 141 p. doi:10.4095/293680

Loloi, Mehdi, (2004). Slope Instability analysis of a part of Orphan Basin off Newfoundland. Masters of Engineering Thesis, Dalhousie University, 220 p.

Specific Question of Information Requirement:

Review the geotechnical data on slope stability from Loloi (2004) and Cameron et al (2014) related to the Orphan Basin. Discuss the probability of any re-mobilization of the slope failures and present information on the slope stability in the Orphan Basin. Discuss the importance of elevated or excess pore pressure in slope stability in the Orphan Basin.

Response:

Slope failures, identified in southern Orphan Basin and northern Flemish Pass by Cameron et al. (2014), are believed to have occurred 20,500 (two events) and 27,000 (one event) years before present. The researchers speculate that the cause of the failures was seismicity and that the slope may have been more susceptible to failure due to preconditioning from excess pore water pressure caused by rapid loading of sediment by shelf edge glaciers.

Cameron et al (2014) inferred the possibility of excess pore water pressures based on consolidation tests. On the other hand, Loloi (2004) interpreted that samples collected in south Orphan Basin are normally consolidated. Nonetheless, Strout and Tjelta (2005) and Nadim et al. (2005) did measure excess pore water pressures in situ and believe this preconditioned the Storegga slope, on the mid-Norway continental slope, to fail under seismic loading 8,200 years ago.

Cameron et al. (2014) calculated a 10,000-year reoccurrence interval for slope failures based on measurements from a number of slope failures in the south Orphan Basin. For north Orphan Basin, Piper et al. (2019) identified that the last major event occurs some 37,000 years ago.

Li et al. (2012) suggest that the Orphan Basin margin was influenced to varying degrees by glacial activity during the last glacial maximum. The northern portion of the basin is interpreted to have received less sediment input as a result of glaciers not reaching the shelf break, while shelf edge glaciers supplied more sediment to the southern portions of the basin.

Based on inferences from interpreted sediment flux and recurrence intervals, included in the relevant literature, it appears that the northern portion of the Project Area is more stable (less susceptible to slope failures) than the southern and eastern portions of the Project Area. This can be linked to glacial/interglacial cycles or seismic recurrence intervals, but is most likely the interplay between the two, especially with respect to the linkages between seismicity and isostatic loading/unloading during glacial cycles.

References:

Cameron, G.D.M., D.J.W. Piper and K. MacKillop. 2014, Sediment failures in northern Flemish Pass; Geological Survey of Canada, Open File 7566. 141 pp. doi:10.4095/293680

Loloi, M. 2004. Slope Instability Analysis of a part of Orphan Basin off Newfoundland. Masters of Engineering Thesis, Dalhousie University, 220 [p.

Li, G., D.J.W. Piper, D.C. Campbell and D. Mosher. 2012. Turbidite deposition and the development of canyons through time on an intermittently glaciated continental margin: The Bonanza Canyon system, offshore eastern Canada. Marine and Petroleum Geology, 29(1): 90-103.

Nadim, F., T.J. Kvalstad and T. Guttormsen. 2005. Quantification of risks associated with seabed instability at Ormen Lange. Marine and Petroleum Geology, 22: 311-318.

Piper, D.J.W., Tripsanas, E., Mosher, D.C., and MacKillop, K., 2019, Paleoseismicity of the continental margin of eastern Canada: Rare regional failures and associated turbidites in Orphan Basin. Geosphere, 15(1): 85-107, https:// doi .org /10.1130 /GES02001.1.

Strout, J.M. and T.I. Tjelta. 2005. In situ pore pressures: What is their significance and how can they be reliably measured?. Marine and Petroleum Geology, 22: 275-285.

1.5 Fish and Fish Habitat

1.5.1 Information Requirement: IR-11

External Reviewer ID:

DFO-02; WM-22

Reference to EIS:

Section 6.1

Context and Rationale

Section 6.1.3 of the EIS Guidelines require a characterization of fish populations that could potentially be affected by routine project operations or by accidents and malfunctions. Section 6.1.7 of the EIS provides a high level overview of the life history of finfish in the Project Area that relies upon the Eastern Newfoundland Strategic Environmental Assessment. Table 6.4 identifies key fish species within the Regional Assessment Area and Project Area. While there is information on the life history of some key species in Section 6 and Section 7, life history of all key species identified in Table 6.4 has not been provided. Fisheries and Oceans Canada advised that more recent information for fish species is available.

Fisheries and Oceans Canada advised that species harvested in the Regional Assessment Area (RAA) (e.g., Winter Flounder, Toad Crab, Monkfish, *Pandalus montagui*) in Table 7.4 were not described in Section 6.1 of the EIS.

Specific Question of Information Requirement

Describe the life history, with respect to survival, reproduction and growth, of fish (groundfish and pelagic), plankton and invertebrate species that may be present in the Project Area that may be affected by project routine activities and accidental events. Incorporate more recent publications, where available.

Provide revised tables where information where Fisheries and Oceans Canada identified inconsistencies or omissions.

In instances where fish assemblages are discussed, provide a rationale for identification of the representative species.

Update the environmental effects analysis of routine project activities and accidental events on fish and fish habitat in the Project Area based on the revised discussion.

Response

Although the focus of the assessment is on species at risk and species of conservation concern, additional species information can be found throughout Section 6. EIS Section 6.1.4 provides high level information on plankton in the Project Area, while EIS Sections 6.1.5 and 6.1.6 provide high level information on invertebrates. For additional life history information of fish, Table 1 (revised EIS Table 6.4) has been updated (below) to include species information, where available, for non-species at risk and non-species of conservation concern, including commercial species. EIS Figures 6.6 to 6.11 present species distribution within the Project Area for the six most abundant species within the Project Area. EIS Table 6.5 provides data on spawning seasons and areas for fish species with a high potential to be found within the Project Area. Finally, EIS Section 6.1.9 presents further information on species of Indigenous significance.

Table 1 EIS Table 6.4 (revised): Fish Species within the RAA and Project Area

Common Name	Scientific Name	Habitat and Ecology
Acadian redfish[2]	*Sebastes marinus*	• Year-round residents • Primarily along continental slopes and in deep channels, from 150 to 300 m • Larvae prefer surface waters, where they feed on copepods and fish eggs • Slow growth and long lifespan; they can live up to 75 years • Ovoviviparous, females keep their fertilized eggs inside their brood chamber until the larvae have hatched • Larvae are released between the end of spring to early summer
American plaice[1]	*Hippoglossoides platessoides*	• Benthic flatfish that occurs along the continental shelves on both sides of the North Atlantic • Settled juveniles prefer depths of 100 to 200 m • Adults typically prefer depths of 100 to 300 m, but have been found as deep as 1,400 m • Spawning occurs on the Newfoundland Shelf in April or May • Commercially important
Atlantic cod[1]	*Gadus morhua*	• Atlantic cod inhabit all waters overlying the continental shelves of the Northwest and the Northeast Atlantic Ocean • Occurs in offshore waters (typically at depths less than 500 m), can also be found throughout the coastal, inshore waters • Broadcast spawner • Known to spawn extensively throughout the inshore, nearshore, and offshore waters from April to October • Northeast Newfoundland Shelf cod migrate from offshore waters to inshore coastal waters in spring to spawn inshore • Eggs, and then larvae, present in the upper water column (10 to 50 m) • Mature slower in Newfoundland Shelf, eastern Labrador and Barents Sea; mature later than more southern population. • Commercial species harvested by several countries
Atlantic halibut	*Hippoglossus*	• Eggs and larvae are pelagic, while the juveniles move to deeper waters • Distribution of pelagic Atlantic halibut larvae is mostly between 5 and 50 m • Juveniles and adults are closely associated with the seabed. Typically found at depths of 100 to 700 m, though may be present at depths up to 1,000 m • Commercially important

Common Name	Scientific Name	Habitat and Ecology
Atlantic wolffish¹	*Anarhichus lupus*	• The species is widely distributed across the North Atlantic • The centre of its western Atlantic distribution is off the coast of northeast Newfoundland • Inhabits the cold (1.5°C to 4°C), deep (up to 900 m) waters of the continental shelf • Spawn in September, larvae are pelagic while adult Atlantic wolffish are relatively sedentary • Atlantic wolffish can conduct short (few km) seasonal migrations between offshore waters and shallow waters (<120 m deep) for spawning
Blacksmelts	*Bathylagus sp.*	• Deep water species, found at depths ranging from depth range 500 to 3,237 m. • Both eggs and larvae are pelagic. • Blacksmelt feed on small crustaceans.
Blue hake	*Antimora rostrata*	• Blue hake are found in deep waters, sometimes at depths of approximately 3,000 m. • Females typically reach 75 cm, while males may grow to approximately half that length.
Carapine grenadier	*Lionurus carapinus*	• Deep water species found at depths ranging from 384 to 5,610 m. • They feed on polychaete worms, copepods, amphipods, isopods, and mysids.
Common grenadier	*Nezumia bairdi*	• The common grenadier feeds primarily on euphausiids, amphipods, and polychaetes. • Typically found at depths ranging from 90 to 700 m.
Deepwater redfish¹	*Sebastes mentella*	• Generally, live at depths from 350 to 500 m • Larvae prefer surface waters, where they feed on copepods and fish eggs • Slow growth and long lifespan; they can live up to 75 years • Ovoviviparous, females keep their fertilized eggs inside their brood chamber until the larvae have hatched • Larvae are released between the end of spring to early summer
Dragonfish	*Stomias boa ferox*	• This species has been found at depths that range from depth range 20 to 800 m. • They are a mesopelagic species that inhabit deepwater (>500 m) during daylight hours and migrates to shallower waters (<200 m) at night.
Eelpout	*Lycodes sp.*	• Eel-like appearance, with elongated bodies and the dorsal and anal fins continuous with the caudal fin. • Bottom dwelling species.
Greenland halibut	*Reinhardtius hippoglossoides*	• They prefer cold temperatures and softer substrates consisting of mud and sandy mud. • They grow to more than a metre in length and weigh more than 10 kg, and can live more than 20 years.
Hookear sculpin	*Artediellus* sp.	• Hookear sculpins are typically found between 13 and 183 m. • They prefer sand, mud or hard bottom habitats. • Preferred prey is invertebrates.

Common Name	Scientific Name	Habitat and Ecology
Kaup's arrowtooth eel	*Synaphobranchus kaupii*	• Kaup's arrowtooth eel is typically found between 400 and 2,200 m. • They are a deep-water species and prefer temperature ranges between -1°C and 10°C. • They primarily feed on Decapoda, Natantia, amphipods, but also fish, and cephalopods.
Large scale tapirfish	*Notacanthus chemnitzii*	• The large scale tapirfish is typically found at depths ranging from 128 to 1,000 m. • They feed primarily on sea anemones.
Northern wolffish[1]	*Anarhichas denticulatus*	• The Northern wolffish inhabits boreal and subarctic waters on both sides of the North Atlantic and in the Arctic. • It is most abundant on the shelf off northeastern Newfoundland and in the Labrador Sea with highest densities at temperatures between 2°C and 5°C. • Found between 38 to 1,504 m, but mainly between 500 and 1,000 m. • Spawns September through November. • Larvae and young of the year are pelagic. • Project Area overlaps with recently proposed designated critical habitat. This is further discussed in EIS Section 6.1.10.
Ogrefish	Melamphaidae	• Deep-sea family of fishes. • Depending on the species they have a dorsal fin with 1 to 3 weak spines; pelvic fin insertion thoracic or subthoracic with 1 spine; 6 to 8 soft rays; caudal fin with 3 to 4 procurrent spines; cycloid scales often large and deciduous; lateral line absent, or limited to one or two pored scales; and 24 to 31 vertebrae.
Roughhead grenadier[1]	*Macrourus berglax*	• Globally found along the continental shelf and slope in temperate to arctic waters of the North Atlantic. • In Canadian waters distributed along the continental slope and deep shelf; been observed off Newfoundland and the Grand Banks. • In the trawl surveys off Newfoundland, densities tend to be highest at depths of about 500 to 1,500 m although they may inhabit depths between 200 to 2,000 m. • Spawning occurs in winter and early spring and may even extend over an entire year. • Spawning grounds are not certain, but they are thought to lie on the southern and southeastern slopes of the Grand Bank. • Eggs are reported to be pelagic.
Roundnose grenadier[1]	*Coryphaenoides rupestris*	• Globally found along the continental slope and mid-Atlantic ridge of the North Atlantic Ocean. • In Canadian waters, it is most abundant in the northern part of the range (Labrador and Northeast Newfoundland shelves, Davis Strait). • Its range extends beyond the 200-mile limit. • Has been reported at depths between 200 and 2,600 m, most abundant at depths greater than 800 to 1,000 m. • Spawning may occur along the northern Mid-Atlantic Ridge, developing eggs and larvae are transported by currents and the young settle on the continental slopes off Baffin Island, Labrador and eastern Newfoundland.

Common Name	Scientific Name	Habitat and Ecology
Sand Lance	*Ammodytes sp.*	• Size typically ranges from 28 to 30 cm. • Matures between 1 and 3 years and 18 cm in length. • Their eggs are demersal, adhesive, and range from 0.92 and 1.02 mm in diameter. Once they hatch, they are pelagic and float at the water surface.
Shortspine tapirfish	*Polyacanthonotus rissoanus*	• They are typically found at depths between 540 and 2,875 m. • Primarily feeds on coelenterates, worms, and crustaceans.
Silver hake	*Merluccius bilinearis*	• Juvenile and mature hake are associated with water temperatures between 5°C and 12°C and 7°C and 10°C, respectively. • Juvenile silver hake feed primarily on invertebrates, while adult fish are piscivorous and are known to commonly exhibit cannibalism. • The age of maturity is typically 2 years.
Slickhead sp.	*Alepocephalus sp*.	• No species data available.
Smooth skate[1]	*Malacoraja senta.*	• Smooth skate have been recorded at depths ranging from 25 to 1,436 m, however, 90% of survey sets including smooth skate show occurrences between 70 and 480 m. • The densest concentrations and 90% of survey occurrences were found between 2.7°C and 10°C. • Smooth skates prefer soft mud substrates consisting of silt and clay, but they have also been found on sand, shell hash, gravel, and pebble substrates.
Spotted wolffish[1]	*Anarhichas minor*	• Found on both sides of the North Atlantic and in the Arctic. • Eggs are deposited on the bottom, the larvae are pelagic, and the juveniles and adults occupy bottom waters. • Typically occupy depths between 200 and 750 m on the continental shelf or in deep trenches. • Fertilization is internal and mating probably occurs in the summer. • DFO recently proposed designated critical habitat for spotted wolffish, which is located within the Regional Assessment Area (RAA) and further discussed in EIS Section 6.1.10.
Thorny skate[1]	*Amblyraja radiata*	• Globally found on both sides of the North Atlantic. • Distributed continuously from Baffin Bay, Davis Strait, Labrador Shelf, Grand Banks, Gulf of St. Lawrence, Scotian Shelf and Bay of Fundy to Georges Bank, over a wide range of depths. • Inhabit a wide range of depths (primarily 18 to 1,200 m) and typically in water temperatures of 0 to 10 °C. • Spawning appears to occur in the fall and winter. • Egg cases are often deposit deposited on sandy or muddy flats.
Vahl's eelpout	*Lycodes vahlii*	• Deep water species; typically found between 65 and 1,200 m. • Feeds on worms, crustaceans, and molluscs.
Viperfish	*Chauliodus sloani*	• Typically found at depths between usually 494 and 1,000 m. • Feeds primarily on myctophids but also on midwater fishes and crustaceans/.

Common Name	Scientific Name	Habitat and Ecology
White hake[1]	*Urophycis tenuis*	• White Hake are found near the bottom and have been associated with fine sediment substrates such as mud but have also been reported on sand and gravel. • Their ideal temperature range is 4 to 8°C. • Size at 50% maturity in Canadian waters ranges from 40 to 54 cm for females and 37 to 44 cm for males. Generation time is approximately 9 years.
Witch Flounder	*Glyptochepalus cynoglossus*	• Witch flounder prefer depths of 100 to 400 m, although they have at depths up to 1,600 m. • They are a bottom dwelling species and prefer soft substrates (e.g., sand, clay, mud). • Their primary food source is worms, though they do supplement with other benthic invertebrates (e.g., crustaceans, molluscs).
Yellowtail Flounder	*Limanda ferruginea*	• Yellowtail flounder prefer depths of 40 to 70 m. • Adults are 38 to 40 cm long and weigh 0.5 to 0.6 kg. They have been known to live to 12 years of age but rarely make it past 10.
Atlantic salmon[1]	*Salmo salar*	• Atlantic salmon originally occurred in every country whose rivers flow into the North Atlantic Ocean and Baltic Sea. • Canadian range is roughly one-third the area of the total global range. • Life history begins in freshwater and may involve extensive migrations through freshwater and marine environments before returning to fresh water to spawn. • Growth in ocean is rapid relative to that in fresh water. • In spring, adult salmon are generally concentrated in abundance off the eastern slope of the Grand Bank and less abundantly in the southern Labrador Sea and over the Grand Bank. • During summer to early fall, adult, non-maturing salmon are concentrated in the West Greenland area and less abundantly in the northern Labrador Sea. • Culturally significant to Indigenous peoples
Albacore tuna	*Thunnus alalunga*	• Albacore are a relatively fast-growing species, reaching lengths of over 1 m and 40 kg. • They spawn in the spring and summer in subtropical waters from the Atlantic to the Mediterranean Sea. Females release 2 to 3 million eggs per spawning season. • Albacore tuna feed on fish, crustaceans, and squid.
American eel[1]	*Anguilla rostrata*	• Found on the western side of the Atlantic Ocean from the Caribbean Sea north to Greenland and Iceland. • Spawns in the Sargasso Sea and eggs hatch within roughly one week. • Larvae drift passively, and are widely dispersed by surface currents of the Gulf Stream. • Larvae, elvers or mature adults may pass through Project Area during migrations to or from spawning areas. • Culturally significant to Indigenous peoples.

Common Name	Scientific Name	Habitat and Ecology
Atlantic bluefin tuna[1]	*Thunnus thynnus*	• Two discrete and evolutionarily significant populations, Gulf of Mexico (western population) and Mediterranean Sea (eastern population). • Majority of the fish found in Canadian waters are thought to be from the western population. • Specific habitat requirements have not been defined for Atlantic bluefin tuna. • No spawning or rearing occurs within Canadian waters. • Majority of fishery captures are in Gulf of St. Lawrence and off Nova Scotia.
Basking shark[1]	*Cetorhinus maximus*	• Circumglobal, temperate, migratory pelagic species. • Have been observed throughout Atlantic waters including the Gulf of St. Lawrence, Bay of Fundy, Scotian Shelf and Grand Banks, generally during the summer months. • Frequently encountered at the surface during summer months in the Project Area. • May target areas of high zooplankton concentrations. • Speculated individuals hibernated in deep shelf or slope waters during the winter. • Annual southern migration associated with a change in seasons from late summer to winter.
Blue shark	*Prionace glauce*	• Distributed worldwide in temperate and tropical oceans, primarily in surface waters and offshore. • Range in Canada includes Gulf Stream-associated waters off Nova Scotia and Newfoundland. • Found at depths from surface to at least 600 m depth. • Prefers temperatures of 12°C to 20°C, potentially only occurs in the Project Area during summer.
Capelin	*Mallotus villosus*	• Capelin exhibit sexual dimorphism during the spawning season. Males develop darker heads and back and their pectoral, pelvic, and anal fins are well-developed in comparison to females. Males also develop a row of elongated scales just above the lateral line on either side of the body, known as spawning ridges. • Adult capelin range from 13 to 20 cm in length. • Capelin can weigh up to 45 g and their life expectancy is approximately 5 years.
Greenland shark	*Simniosus microcephalus*	• The Greenland shark typically prefers deep waters where it is commonly found at depths greater than 200 m. They can be found closer to the surface during the winter months. • They are a slow growing species, with adults ranging in length from 3.5 to 5 m. • The Greenland shark feeds on fish species such as capelin, char, halibut, herring, lumpfish and salmon as well as marine mammals.
Lanternfish	Myctophidae	• Many species of lanternfish exhibit diurnal migration. During the day they are found at depths between 300 and 1,200 m, while at night they are found between 10 and 100 m. • Common prey species for fish and marine mammals.

Common Name	Scientific Name	Habitat and Ecology
Porbeagle shark[1]	*Lamna nasus*	• Coastal and oceanic shark that lives in cold to temperate waters. • Juveniles most common and continental shelves but can occur well offshore. • Most can be found at temperatures ranging from 5ºC to 10ºC. • Mating occurs in the northwest Atlantic occurs in the Grand Banks, south of Newfoundland and at the mouth of the Gulf of St. Lawrence. • Females give birth to live young outside Canadian waters. • Rarely found between January and June in the RAA. • Potentially only occurs in the Project Area during warm water season.
Shortfin mako shark[1]	*Isurus oxyrinchus*	• Circumglobally distributed in temperate and tropical waters. • Canadian waters represent the northern fringe of the Shortfin Mako range. • Preferred water temperature is between 17-22 °C usually associated with the Gulf Stream. • Appears as if females migrate to latitudes of 20-30 °N to give birth.
Swordfish	*Xiphias gladius*	• Seasonal migrant; found in Canadian waters from spring to fall. • Large species of fish, reaching up to 100 kg.
White shark[1]	*Carcharodon carchias*	• Circumglobally distributed in sub-polar to tropical seas of both hemispheres. • Has been recorded from the Northeast Newfoundland Shelf to the Bay of Fundy. • Canadian waters represent the northern fringe of the white shark's range. • Depth from just below the surface to just above the bottom, down to a depth of at least 1,200 m. • Recorded in water temperatures from 5°C to 27°C, preferred temperature's above 11°C. • Possible white shark pupping areas in the Atlantic Ocean include the Mid-Atlantic Bight.
Northern Shrimp	*Pandalus borealis*	• Northern shrimp are a cold-water species that prefer temperatures between 2°C to 6°C. • They are typically found on soft substrates. • They can grow up to 15 cm, although they are typically smaller.
Crab, Queen / Snow	*Chionoecetes opilio*	• Snow crab are typically found in areas with sand or mud substrates. • They are found at depths ranging from 50 to 600 m. • Males can grow up to a maximum carapace width of approximately 15 cm, while females reach approximately half this size.
Herring, Atlantic	*Clupea harengus*	• Female herring can produce 30,000 to 200,000 eggs per spawning season. • Eggs are deposited on rock, gravel, or sand substrates. They hatch in approximately 7 to 10 days. • They reach sexual maturity at age 4.
Atlantic mackerel	*Scomber scombrus*	• Atlantic mackerel can grow up to 40 cm. • Adults can weigh up to 800 g. • Atlantic mackerel do not have a swim bladder, and therefore need to continuously keep moving in order to breathe.
Striped Shrimp	*Pandalus montagui*	• No species data available.

Common Name	Scientific Name	Habitat and Ecology
Whelk	Buccinidae	• Buccinidae is a large family of sea snails that includes more than 1,500 species. • They typically prefer and a solid substrate, although some inhabit sandy areas.
Winter Flounder	*Pseudopleuronectes americanus*	• Winter flounder have been associated with a variety of substrate types including mud, sand, and pebble. • Typically found at depths of less than 100 m. • Adults reach lengths of 50 cm or greater. • Their preferred temperature range is between 12°C and 15°C.
Crab, Spider / Toad	*Hyas araneus, Hyas coarctatus*	• Two species, *H. araneus* is typically larger and found in shallower water than *H. coarctatus*. • Found at depths ranging from shallow subtidal areas to 1,650 m. • Larvae typically hatch during summer and float at the surface for several months.
Skate	Rajidae	• Skates live on or near the substrate; they are able to bury themselves in mud or sand to ambush prey and avoid predators. • Eggs are internally fertilized and deposited as egg cases. • Embryo development that can last up to 15 months.
American Angler	*Lophius americanus*	• Typically found at depths less than 100 m. • They prefer to live on substrate composed of sand or gravel. • Adults can reach lengths of 1 m and weigh over 20 kg.

Fish in the forgoing table have not been organized by assemblages; therefore, the information request pertaining to representative species is not applicable. The updated species descriptions do not change the predicted environmental effects of the Project on marine fish during routine activities or accidental events. Therefore, the effects assessment, including mitigation, follow-up, and effects significance determination for fish and fish habitat as presented in the EIS remains unchanged.

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1.5.2 Information Requirement: IR-12

External Reviewer ID:

KMKNO-18; KMKNO-21; PNIN-08

Reference to EIS:

Section 6.1

Context and Rationale

Section 6.1 of the EIS states the description of the biological environment presented for the Project is based on the results of previous research and existing scientific literature and environmental assessment. Section 6.1.6 acknowledges the data gap with respect to existing benthic communities that occur on deeper continental shelf environments and in abyssal habitats. In particular, the gap in information is evident in Exploration License 1149.

Section 6.1.6.1 of the EIS describes the presence of corals in Exploration License 1145 and 1146; however, the description of the presence of corals in Exploration Licenses 1148 or 1149 is limited to Table 6.3 of the EIS which indicates that there are corals "…around Exploration License 1148". It is not clear whether international organizations have completed surveys in these areas. Information on the presence and distribution of coral species is required for all Exploration Licenses in the designated project to understand the potential environmental effects of the project.

In addition, Section 6.1.7 of the EIS provides several figures related to fish distribution in the Project Area and Regional Assessment Area; however, the figures showing fish species distributions do not identify fish as occurring in Exploration License 1149. It is not clear if the absence of fish in that Exploration License is due to a lack of data or if there are no fish in that area. An understanding of existing conditions in all Exploration Licenses is required to understand the potential environmental effects of the Project on fish and fish habitat.

Specific Question of Information Requirement

Describe the presence and distribution of coral species in Exploration License 1148 and 1149. Confirm whether there have been surveys conducted in Exploration License 1149 (i.e. Northeast Atlantic Fisheries Organization surveys), and discuss the findings of those surveys.

Provide a rationale for the absence of fish species in Exploration License 1149, as illustrated in figures found in Section 6.1.7 of the EIS, including a discussion of data used and data gaps relevant to the Figures. Alternatively provide a discussion on the fish distribution in Exploration License 1149.

In the absence of biophysical data and information related to existing conditions in Exploration License 1149, discuss how the assessment of environmental effects of exploration drilling on the resources in this exploration was conducted.

Update the effects predictions, and proposed mitigation and follow-up, if required.

Response

A summary of potential occurrences of corals and sponges in the Project area is provided in Table 6.3 of the EIS. Figure 6.5 in the EIS provides the locations of corals and sponges within the Project Area based on Fisheries and Oceans Canada (DFO) surveys from 2014 to 2016; no additional data sources were available for the area. Stony corals were identified just outside the perimeter of Exploration License (EL) 1148. Surveys for corals and fish were not conducted by DFO within EL 1149 as it is outside of Canada's Exclusive Economic Zone. A search of coral and fish species data including the Project Area was conducted, and to BP's knowledge, no biophysical data has been collected in this area. Publicly available Northwest Atlantic Fisheries Organization (NAFO) data are restricted to within the boundary of the NAFO fishing footprint, which is 30 km from the Project Area and 60 km from the nearest EL. In the absence of data, a conservative approach was taken for the assessment of environmental effects of exploration drilling in this area. The following mitigation applies to corals:

- BP will conduct an imagery-based seabed survey at the proposed wellsite(s) to confirm the absence of shipwrecks, debris on the seafloor, unexploded ordnance, and sensitive environmental features, such as habitat-forming corals or species at risk. The survey will be carried out prior to drilling and will encompass an area within a 500-m radius from the wellsite. If any environmental or anthropogenic sensitivities are identified during the survey, BP will notify the Canada-Newfoundland and Labrador Offshore Petroleum Board immediately to discuss an appropriate course of action. This may involve further investigation and/or moving the wellsite if it is feasible to do so. This survey will also provide baseline data for coral and sensitive benthic habitat that may be present and be used to inform discussions on potential follow-up and monitoring with respect to drill waste discharges.
- Selection and screening of chemicals to be discharged, including drill fluids, will be in accordance with the Offshore Chemical Selection Guidelines (National Energy Board [NEB] et al. 2009). Where feasible, lower toxicity drilling muds and biodegradable and environmentally friendly properties within muds and cements will be used. The chemical components of drilling fluids, where feasible, will be those that have been rated as being least hazardous under the Offshore Chemical Notification Scheme and Pose Little or No Risk to the Environment by the Convention for the Protection of the Marine Environment of the North-East Atlantic (refer to Section 2.9 for more information on chemical selection).
- Operational discharges will be treated prior to release in accordance with the Offshore Waste Treatment Guidelines (OWTG; NEB et al. 2010) and other applicable regulations and standards such as MARPOL, of which Canada has incorporated provisions under the *Canada Shipping Act*. Waste discharges that do not meet regulatory requirements will not be discharged and will be brought back to shore for disposal. The development and implementation of a Project-specific environmental protection plan and waste management plan will be designed to prevent unauthorized waste discharges (refer to EIS Section 2.8 for details on waste discharges and management).
- Synthetic-based mud (SBM) drill cuttings will be returned to the mobile offshore drilling unit (MODU) and treated in accordance with the OWTG before being discharged into the marine environment. The concentration of SBM on cuttings will be monitored onboard the MODU, and in accordance with OWTG, no excess or spent SBM will be discharged, and any of this excess or spent SBM that cannot be reused will be brought back to shore for disposal. Water-based mud drill cuttings will be discharged without treatment.

References

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1.5.3 Information Requirement: IR-13

External Reviewer ID:

DFO-17, DFO-CL-44

Reference to EIS:

Section 2.8;
Section 5.3;
Section 5.4.2;
Appendix D, Figures B.1.5 and B.1.6

Context and Rationale:

Section 2.8 of the EIS states that the 5-year hindcast HYCOM (HYbrid Coordinate Ocean Model) current dataset was analyzed and used in the drill waste deposition modelling simulations.

Fisheries and Oceans Canada has advised that with respect to drill waste deposition modelling, the use of a model hindcast current dataset instead of an observed current dataset may not be appropriate unless the model has been validated for representative and extreme current conditions. The extent to which the HYCOM model simulation has been validated with observational currents data is unclear.

It is noted that this is particularly relevant as Section 5.4.2 of the EIS indicates that currents observed at one location are much stronger than indicated from the model. Fisheries and Oceans Canada has noted that displays of current speed in Figures B.1.5-B.1.6 of Appendix D to the EIS indicate that the upper-ocean currents in the HYCOM simulation may be weaker than those indicated by the moored current measurements at the Lona O-50 site in Section 5.4.2.2 of the EIS. As such, Fisheries and Oceans Canada has requested a comparison of the model currents with observed currents.

Specific Question of Information Requirement:

With respect to the drill waste deposition modelling, provide:

- a rationale for the use of model hindcast current dataset as a model input to predict dispersion of disposed drill cuttings;
- a description of how the HYCOM model simulation has been validated through the use of observational and extreme current data; and
- a comparison of the model currents with observed currents, and discuss the effect of using each in the model.

In addition, confirm if the model used for drill waste deposition had been validated for representative and extreme current conditions.

Response:

With respect to the drill waste deposition modelling, provide:

- **a rationale for the use of model hindcast current dataset as a model input to predict dispersion of disposed drill cuttings;**

HYCOM reanalysis is the best publicly available current hindcasts for the offshore Canada region and has been widely used in Atlantic Canada for oil spill trajectory and drill waste dispersion modelling. It includes data assimilation of sea level, SST, and in-situ Argo data, and was found to capture the key current processes well. It also has good temporal resolution (3 hr) as opposed to some other datasets for which only daily snapshots are available. This high temporal resolution allows the model to resolve key extreme current processes (e.g., storm-driven near inertial motions).

Recently, BP commissioned Oceans Ltd to validate HYCOM current profiles against in-situ observations from six moorings in the Orphan Basin covering the time period 2004 to 2013 (Oceans Ltd. 2019). The key findings are summarized below in our response to the following comment.

- **a description of how the HYCOM model simulation has been validated through the use of observational and extreme current data; and**

HYCOM model has been validated against measurements at the following 6 mooring locations (Tables 1 and 2). OB-C and GB-F have two deployments.

Table 1 Position and Time (UTC) Information on the Four Moorings Deployed by the Bedford Institute of Oceanography

Mooring	OB-C-1	OB-E-1	OB-C-2	OB-F-1
BIO #	1517	1519	1552	1550
Deployed	Jun. 4, 2004	Jun. 5, 2004	May 23, 2005	May 24, 2005
Recovered	May 22, 2005	May 22, 2005	May 17, 2006	May 17, 2006
Latitude (N)	48°32.33’	49°17.82’	48°32.24’	49°08.21’
Longitude (W)	47°41.42’	48°18.97’	47°40.11’	46°54.38’
Water Depth (m)	2261	2262	2239	2758

Table 2 Position and Time (UTC) Information on the Three Moorings Deployed by Oceans Ltd. Mooring GB-F-66

Mooring	GB-F-66-1	GB-F-66-2	LN-0-55	MG-A-49
Deployed	Aug. 22, 2006	Sept. 18, 2006	May 29, 2010	Aug. 1, 2013
Recovered	Feb. 23, 2007	Apr. 7, 2007	Sept. 2, 2010	Nov. 27, 2013
Latitude (N)	49°25.43’	49°24.70’	49°04.78’	48°57.41’
Longitude (W)	48°09.87’	48°11.40’	47°22.92’	47°35.85’
Water Depth (m)	2330	2280	2585	2472

Since each OB mooring (OB-C, OB-E and OB-F) deployed by Bedford Institute of Oceanography covers ~1 year period, the validations have been focused at these mooring locations. At each site, Oceans Ltd. (2019) compared up to four different depths (two near surface layers, one mid depth, and one near seabed). The key findings for each site are summarized below (from Oceans Ltd. 2019).

Mooring OB-C-1

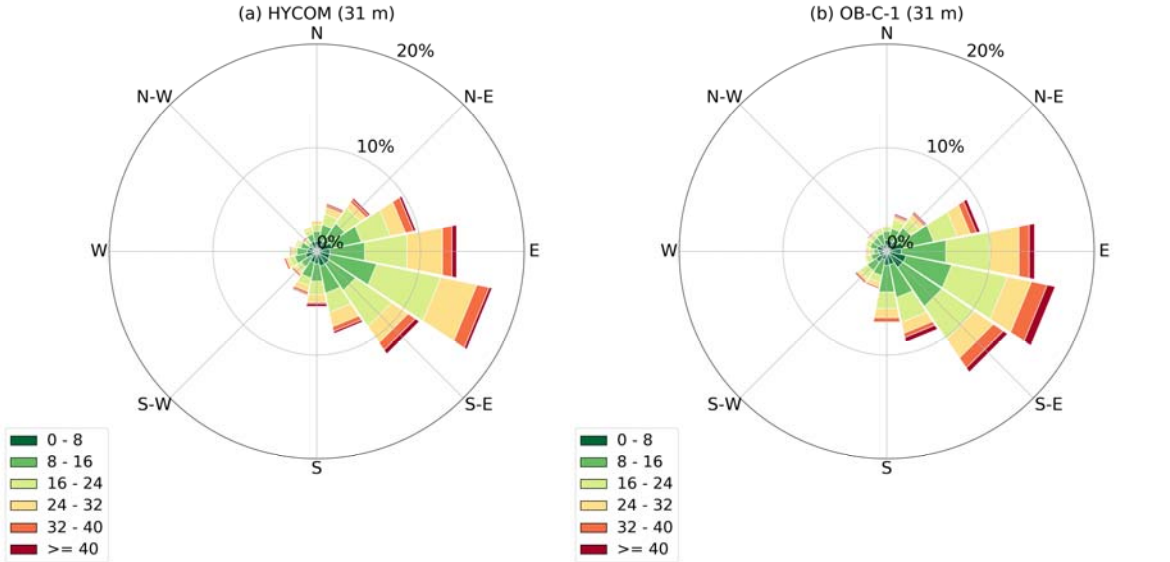
At mooring OB-C location, the dominant flow is towards east-southeast. Vertically, the currents show a coherent structure. HYCOM reanalysis has successfully reproduced both (Figures 1 to 4).

For the maximum current, HYCOM reproduces the surface maximum very well, but is underestimating at depths (Table 3). It is known that HYCOM typically underestimates the currents at depths due to lower vertical resolution in the model grid comparing to the near surface layers.

For the mean current, HYCOM agrees well with the measured values at all four depths.

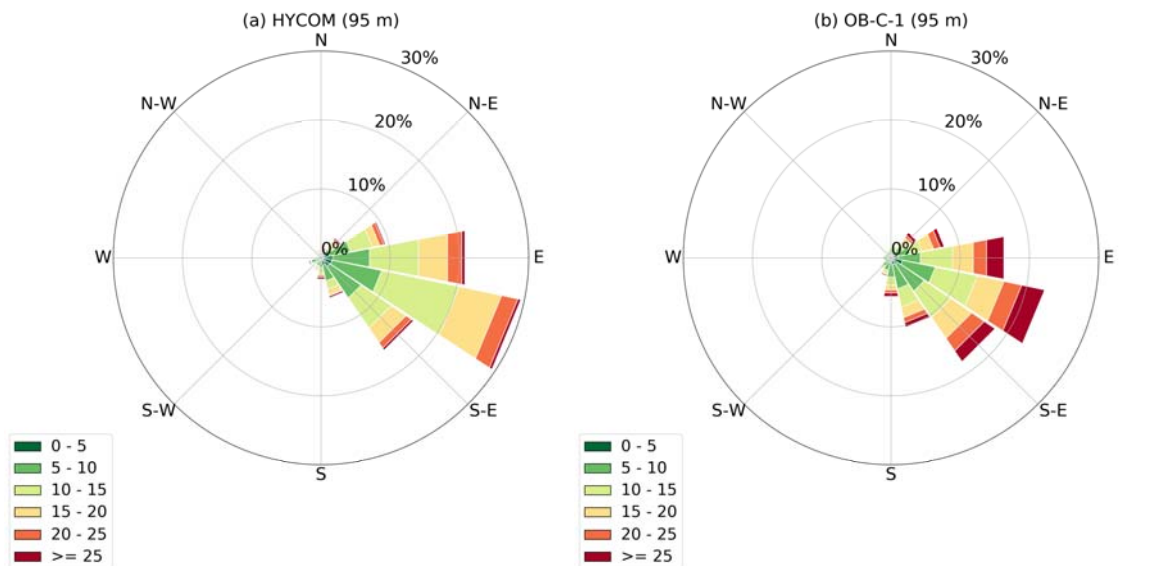
Table 3 Summary Statistics of Current Speed at OB-C-1

	depth m)	mean	std	min	25%	50%	75%	max
HYCOM OB-C-1	31	0.18 0.17	0.10 0.10	0.00 0.00	0.10 0.10	0.17 0.16	0.24 0.23	0.61 0.62
HYCOM OB-C-1	95	0.12 0.14	0.06 0.08	0.00 0.00	0.07 0.07	0.11 0.12	0.16 0.18	0.35 0.54
HYCOM OB-C-1	361	0.09 0.12	0.03 0.06	0.00 0.01	0.07 0.08	0.09 0.11	0.11 0.15	0.20 0.46
HYCOM OB-C-1	1911	0.08 0.09	0.03 0.04	0.00 0.01	0.06 0.06	0.08 0.09	0.10 0.12	0.18 0.30



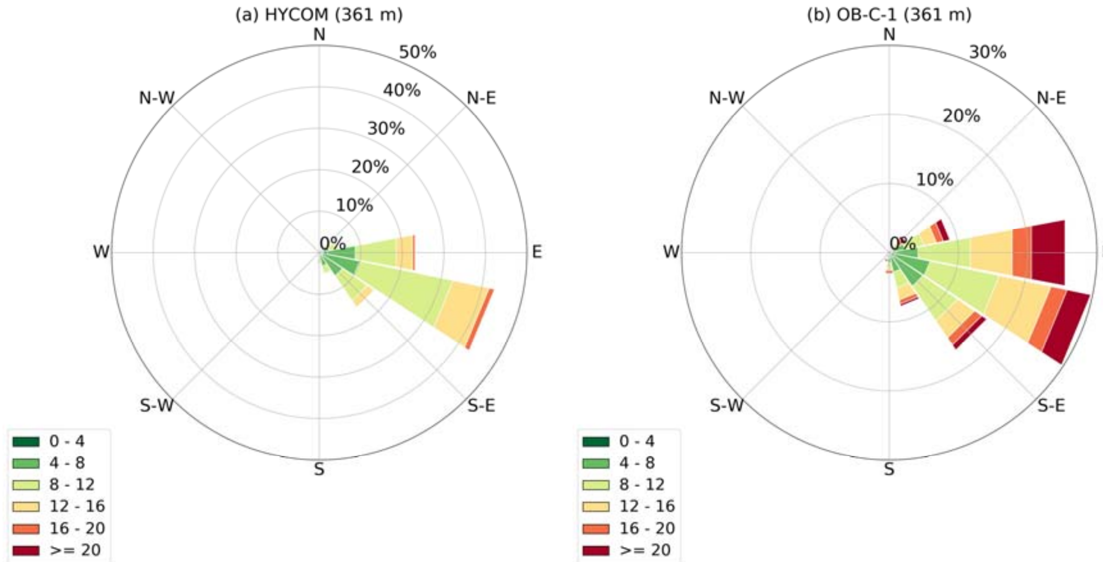
Note: Legend denotes speed categories (cm s^{-1})

Figure 1 Current Rose Plots of HYCOM and Mooring OB-C-1 at the Depth of 31 m during the Entire Measurement Period



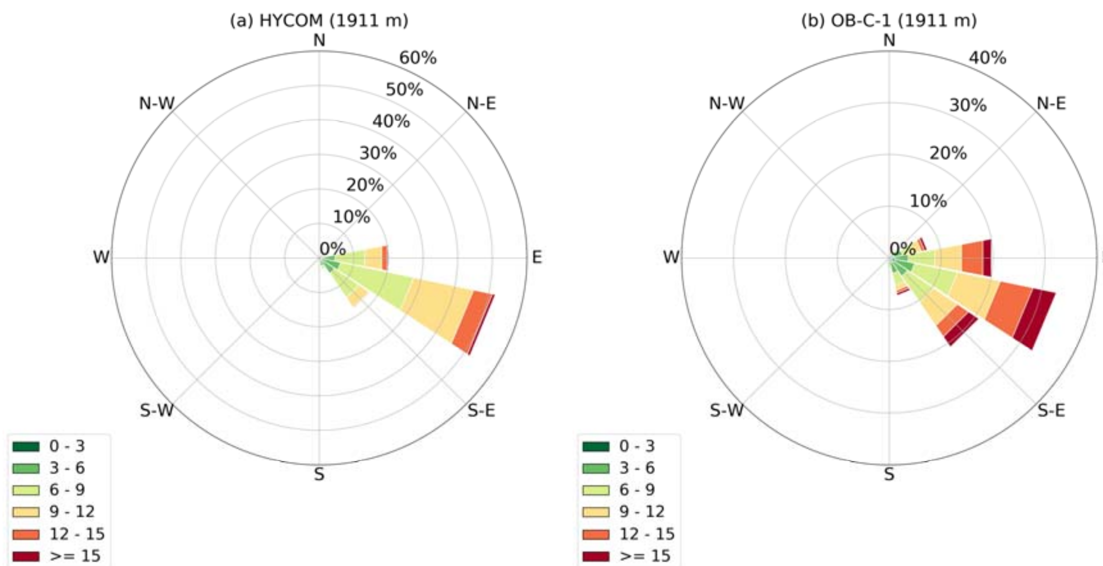
Note: Legend denotes speed categories (cm s^{-1})

Figure 2 Current Rose Plots of HYCOM and Mooring OB-C-1 at the Depth of 95 m during the Entire Measurement Period



Note: Legend denotes speed categories (cm s^{-1})

Figure 3 Current Rose Plots of HYCOM and Mooring OB-C-1 at the Depth of 361 m during the Entire Measurement Period



Note: Legend denotes speed categories (cm s^{-1})

Figure 4 Current Rose Plots of HYCOM and Mooring OB-C-1 at the Depth of 1,911 m during the Entire Measurement Period

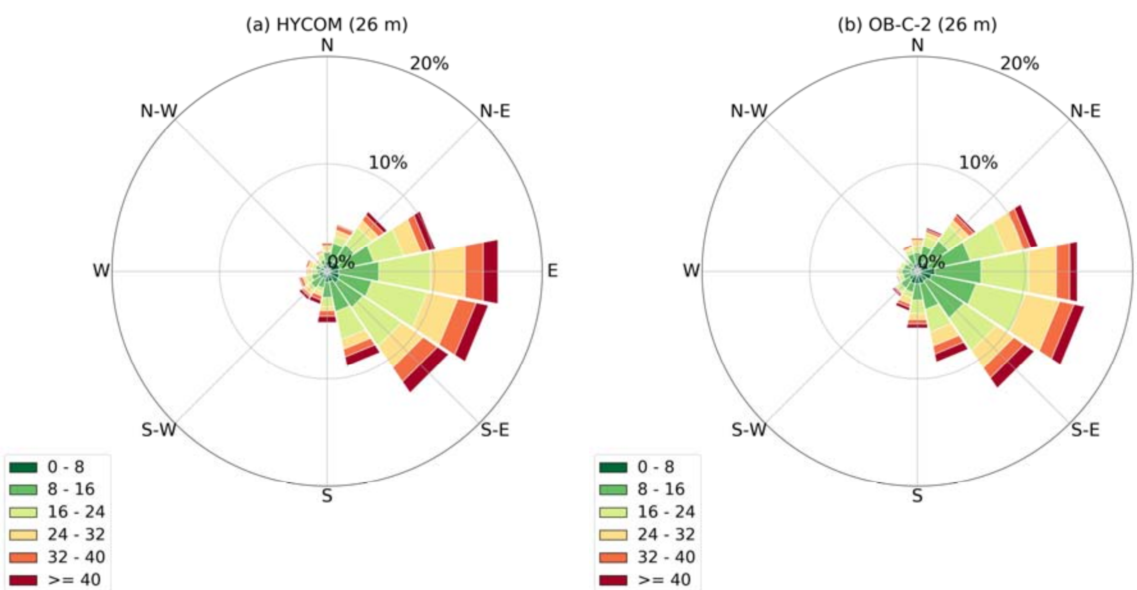
Mooring OB-C-2

Similar to OB-C-1, the speed and direction distributions of HYCOM currents closely resemble those of the measured currents.

For the maximum current, HYCOM is slightly overestimating the surface maximum but is underestimating at depths. For the mean current, HYCOM agrees very well with the measured values at different depths (Table 4 and Figures 5 to 8).

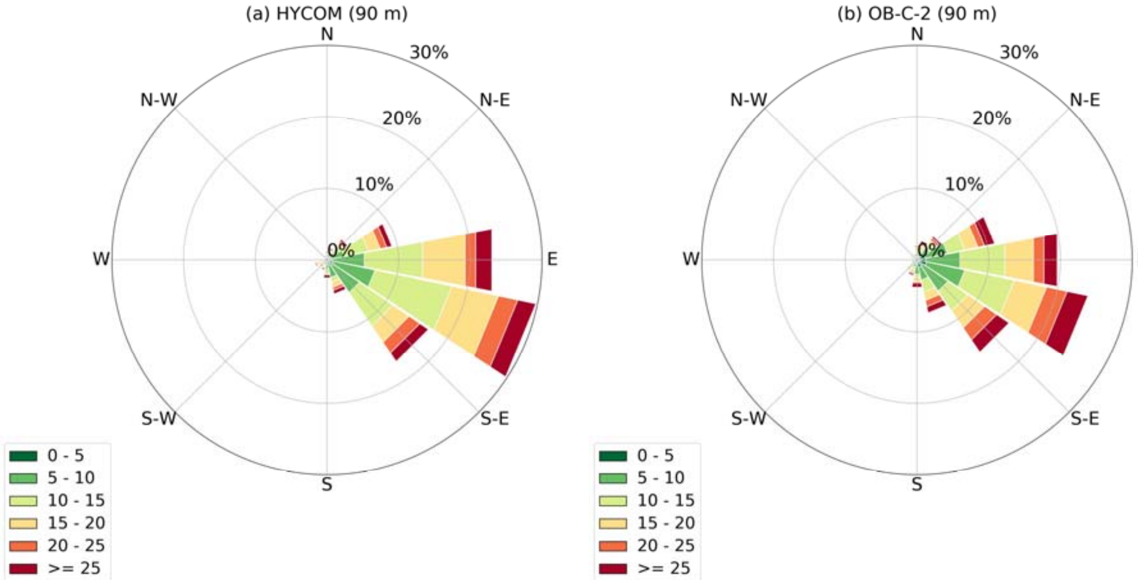
Table 4 Summary Statistics of Current Speed at OB-C-2

	depth (m)	mean	std	min	25%	50%	75%	max
HYCOM	26	0.21	0.13	0.00	0.12	0.19	0.27	1.00
OB-C-2		0.19	0.12	0.00	0.11	0.17	0.25	0.83
HYCOM	90	0.14	0.07	0.00	0.09	0.13	0.18	0.50
OB-C-2		0.14	0.09	0.00	0.08	0.13	0.19	0.69
HYCOM	350	0.12	0.05	0.00	0.09	0.12	0.15	0.28
OB-C-2		0.13	0.07	0.01	0.07	0.12	0.16	0.53
HYCOM	1900	0.10	0.03	0.00	0.08	0.10	0.12	0.23
OB-C-2		0.10	0.05	0.01	0.06	0.09	0.12	0.34



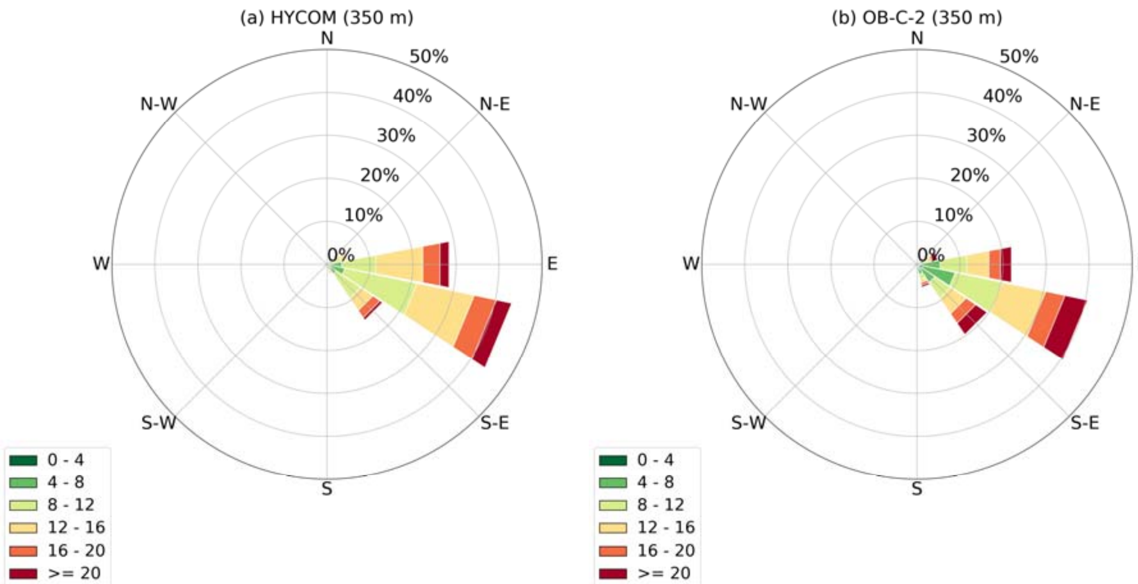
Note: Legend denotes speed categories (cm s^{-1})

Figure 5 Current Rose Plots of HYCOM and Mooring OB-C-2 at the Depth of 31 m during the Entire Measurement Period



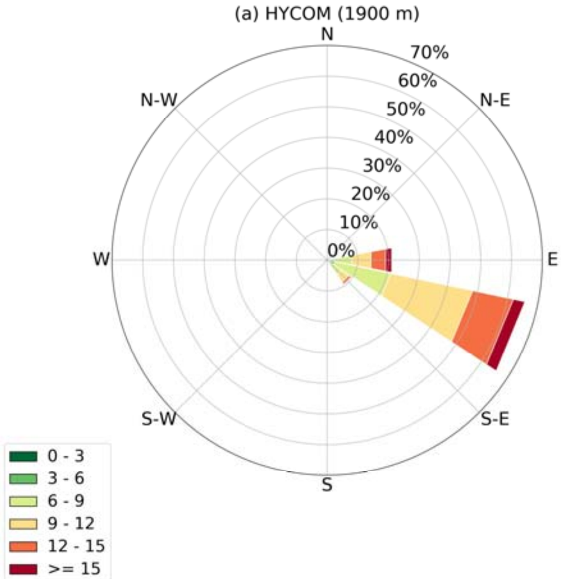
Note: Legend denotes speed categories (cm s^{-1})

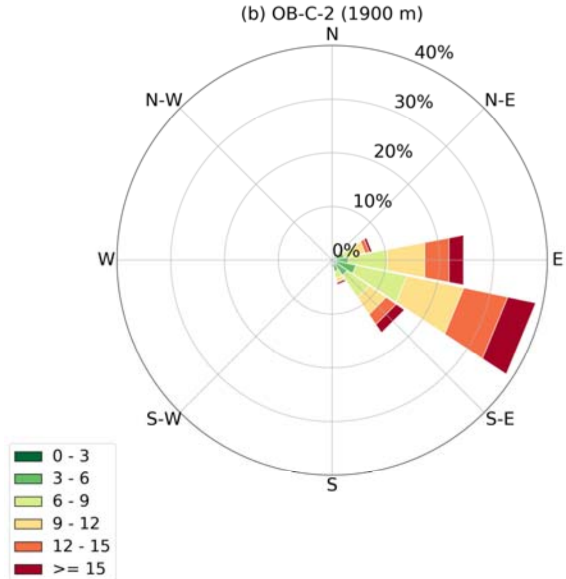
Figure 6 Current Rose Plots of HYCOM and Mooring OB-C-2 at the Depth of 95 m during the Entire Measurement Period



Note: Legend denotes speed categories (cm s^{-1})

Figure 7 Current Rose Plots of HYCOM and Mooring OB-C-2 at the Depth of 361 m during the Entire Measurement Period





Note: Legend denotes speed categories (cm s^{-1})

Figure 8 Current Rose Plots of HYCOM and Mooring OB-C-2 at the Depth of 1,911 m during the Entire Measurement Period

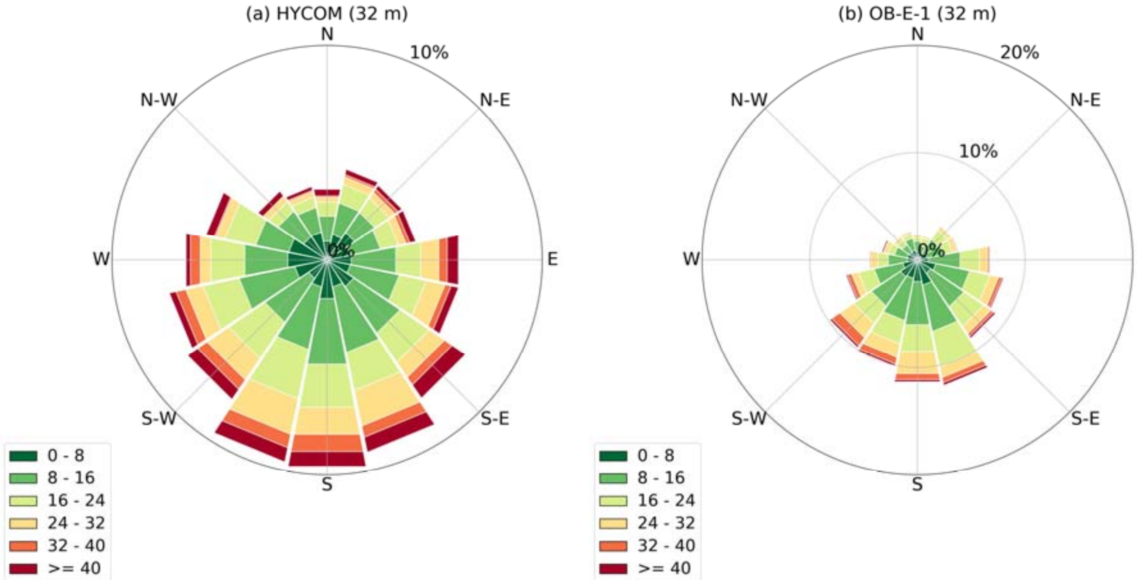
Mooring OB-E-1

The observed currents at OB-E-1 are vertically coherent. The predominant direction of the currents is southward, except that the result of the current at 362 m is inconclusive due to the lack of observational data from January through May.

For the maximum current, HYCOM is overestimating the surface maximum, but agrees well at 96 m below sea surface. HYCOM maximum is lower at the 362 m and 1911 m depths. For the mean current, HYCOM agrees well with the measured values at different depths (Table 5 and Figures 9 to 12).

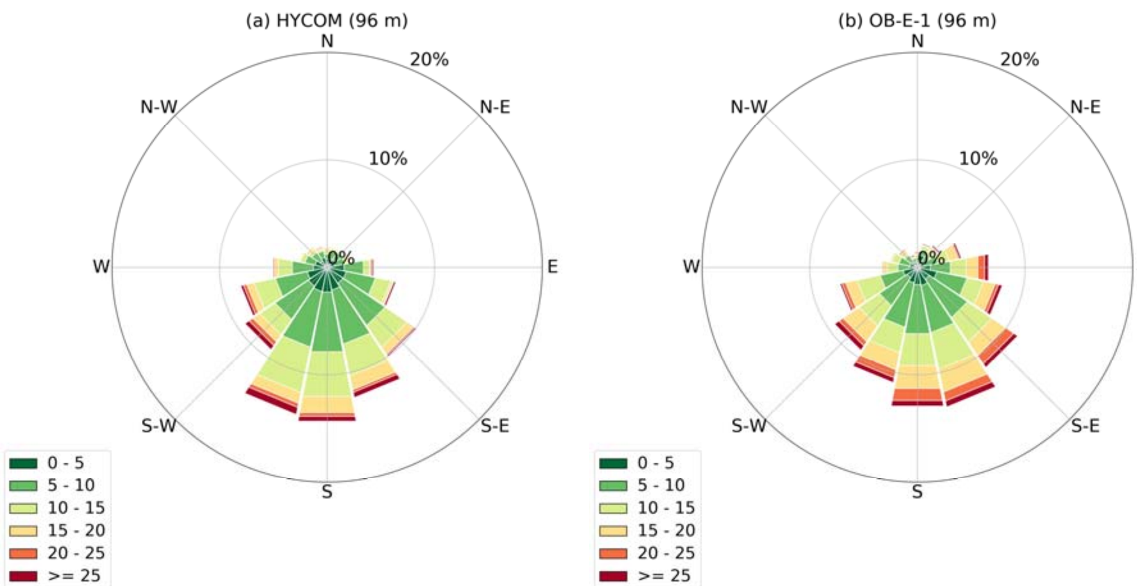
Table 5 Summary Statistics of Current Speed at OB-E-1

	depth (m)	mean	std	min	25%	50%	75%	max
HYCOM OB-E-1	32	0.18 0.16	0.13 0.09	0.00 0.00	0.09 0.09	0.15 0.14	0.24 0.21	0.81 0.55
HYCOM OB-E-1	96	0.09 0.11	0.06 0.07	0.00 0.00	0.05 0.06	0.08 0.10	0.12 0.15	0.44 0.44
HYCOM OB-E-1	362	0.07 0.08	0.03 0.05	0.00 0.01	0.05 0.05	0.07 0.07	0.09 0.11	0.18 0.38
HYCOM OB-E-1	1911	0.06 0.08	0.03 0.04	0.00 0.01	0.04 0.05	0.05 0.07	0.07 0.10	0.16 0.22



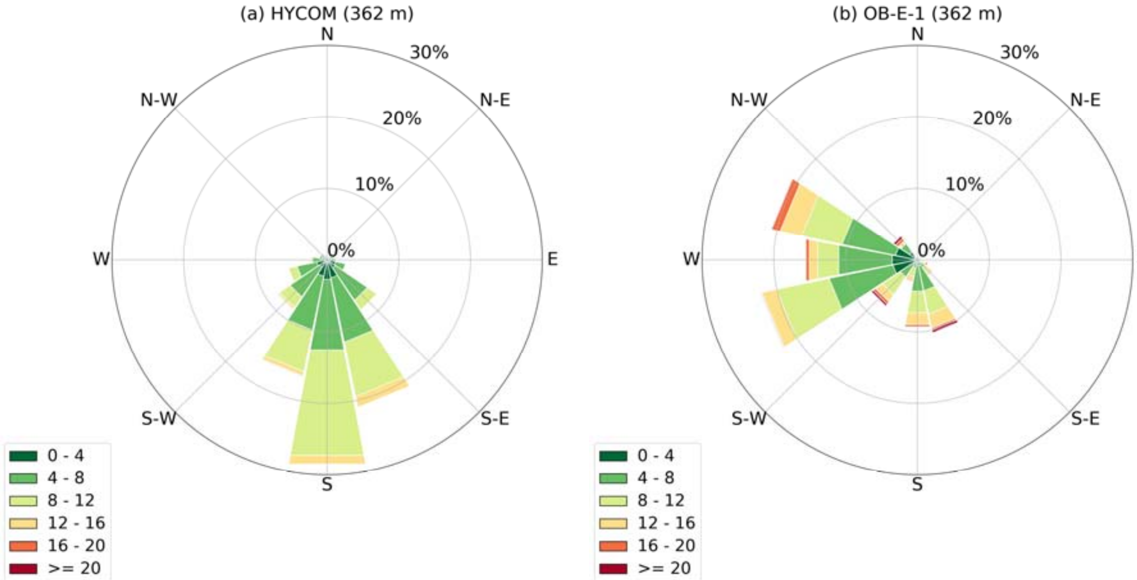
Note: Legend denotes speed categories (cm s^{-1})

Figure 9 Current Rose Plots of HYCOM and Mooring OB-E-1 at the Depth of 31 m during the Entire Measurement Period



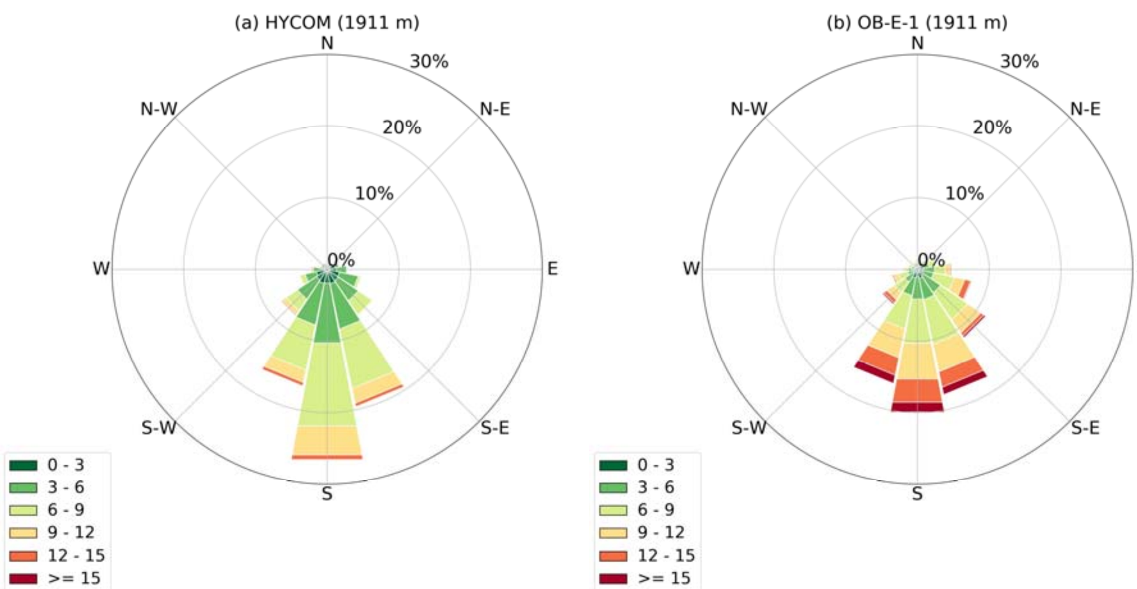
Note: Legend denotes speed categories (cm s^{-1})

Figure 10 Current Rose Plots of HYCOM and Mooring OB-E-1 at the Depth of 95 m during the Entire Measurement Period



Note: Legend denotes speed categories (cm s^{-1})

Figure 11 Current Rose Plots of HYCOM and Mooring OB-E-1 at the Depth of 361 m during the Entire Measurement Period



Note: Legend denotes speed categories (cm s^{-1})

Figure 12 Current Rose Plots of HYCOM and Mooring OB-E-1 at the Depth of 1,911 m during the Entire Measurement Period

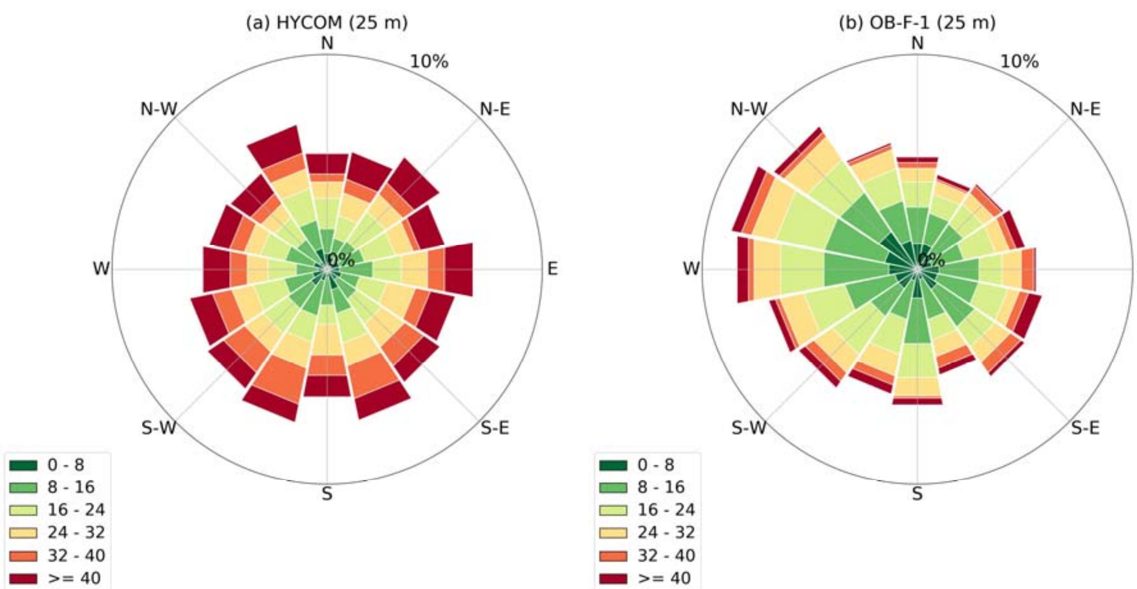
Mooring OB-F-1

The observed currents at OB-F-1 show great variability. The currents at all 4 depths flow in all directions. The predominant current direction at 350 and 2225 m is south-southeast, and the currents in the upper two depths, 25 and 105 m, swing back and forth from east to west for most of the time of the year. HYCOM captures this vast variability in current direction at different depths.

For both the maximum and mean currents, HYCOM is overestimating near the surface, but underestimates at the other three depths (Table 6 and Figures 13 to 16).

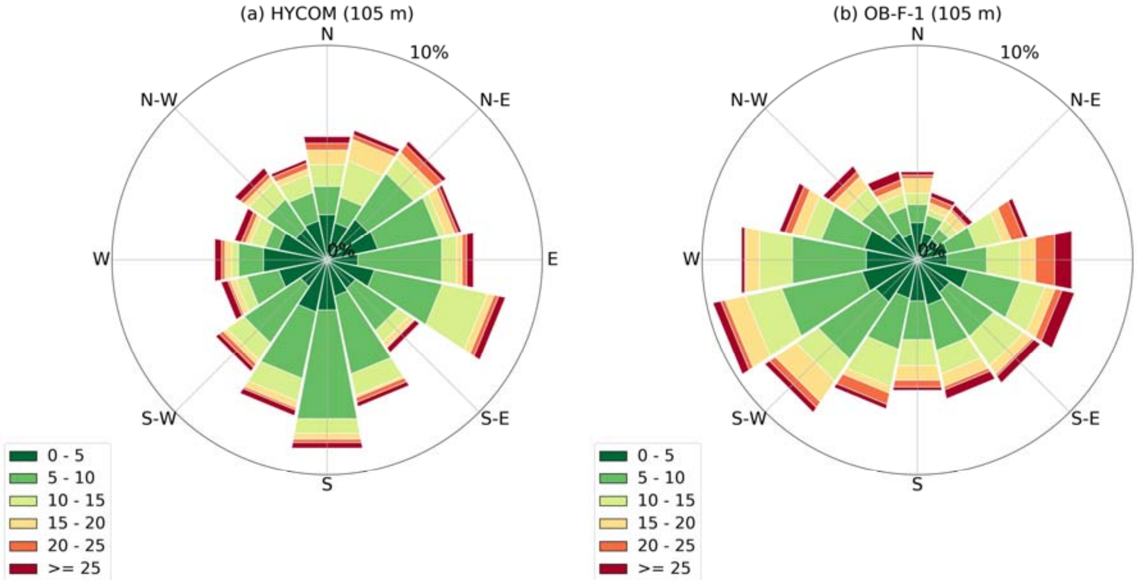
Table 6 Summary Statistics of Current Speed at OB-F-1

	depth (m)	mean	std	min	25%	50%	75%	max
HYCOM OB-F-1	25	0.26 0.18	0.16 0.11	0.01 0.00	0.14 0.10	0.23 0.16	0.35 0.24	1.01 0.73
HYCOM OB-F-1	105	0.09 0.10	0.07 0.08	0.00 0.00	0.04 0.04	0.07 0.08	0.11 0.13	0.44 0.52
HYCOM OB-F-1	350	0.05 0.08	0.03 0.05	0.00 0.01	0.03 0.05	0.05 0.07	0.07 0.11	0.17 0.36
HYCOM OB-F-1	2225	0.04 0.11	0.03 0.05	0.00 0.01	0.03 0.07	0.04 0.11	0.06 0.14	0.17 0.31



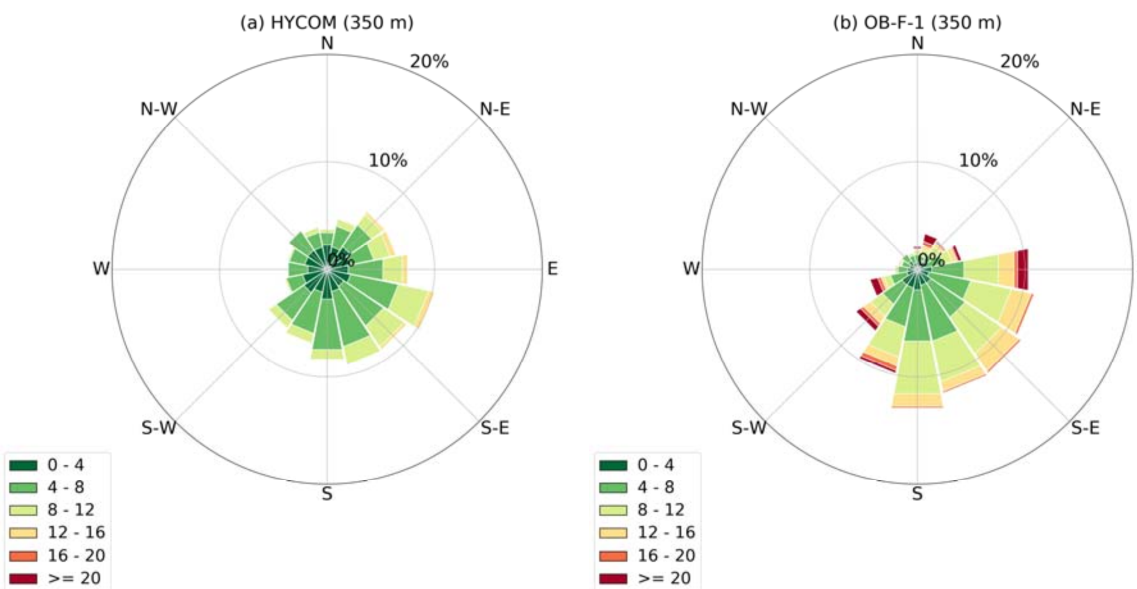
Note: Legend denotes speed categories (cm s^{-1})

Figure 13 Current Rose Plots of HYCOM and Mooring OB-F-1 at the Depth of 31 m during the Entire Measurement Period



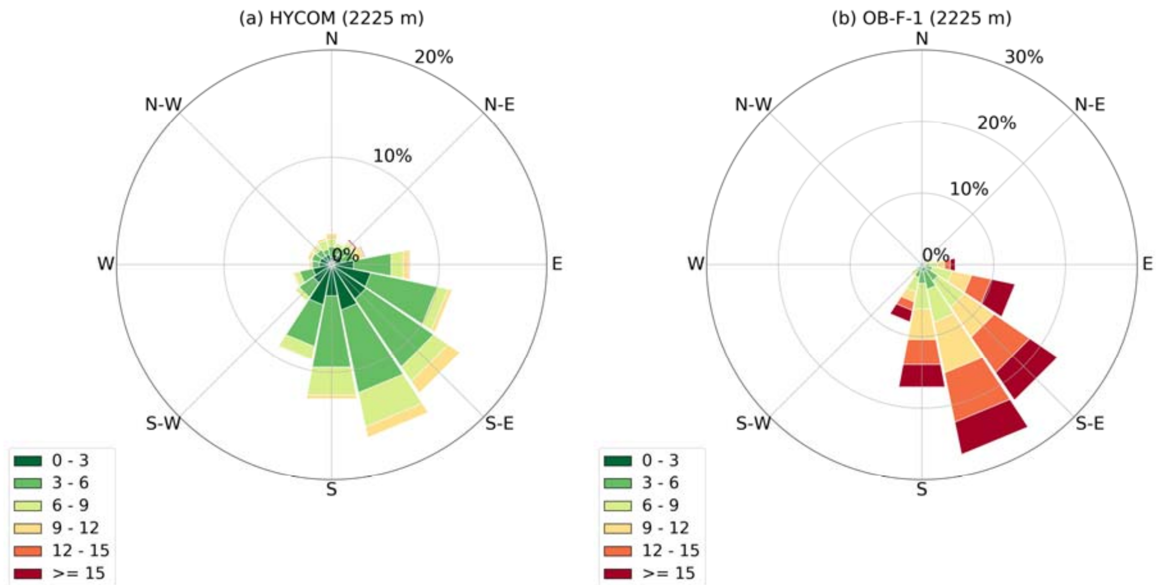
Note: Legend denotes speed categories (cm s^{-1})

Figure 14 Current Rose Plots of HYCOM and Mooring OB-F-1 at the Depth of 95 m during the Entire Measurement Period



Note: Legend denotes speed categories (cm s^{-1})

Figure 15 Current Rose Plots of HYCOM and Mooring OB-F-1 at the Depth of 361 m during the Entire Measurement Period



Note: Legend denotes speed categories (cm s^{-1})

Figure 16 Current Rose Plots of HYCOM and Mooring OB-F-1 at the Depth of 1,911 m during the Entire Measurement Period

- **Comparison of extreme current conditions**

In the Orphan Basin, the extreme near surface currents are near-inertial motions generated by storms or eddies or a combination of both. Since the period of the near-inertial motions is less than 24 hrs at this latitude, it is critical to use 3hrly HYCOM (daily values will not resolve the peaks). Some of the eddies ("tall eddies") can penetrate deep. These eddies have been measured at several mooring locations. The coherent vertical structure shown in HYCOM suggests it captures some of the variability related to the tall eddies as well.

The following figures show comparisons of HYCOM and measured current during extreme events at each mooring location. Overall, HYCOM captures these extreme events reasonably well, although the model misses some of the extreme events.

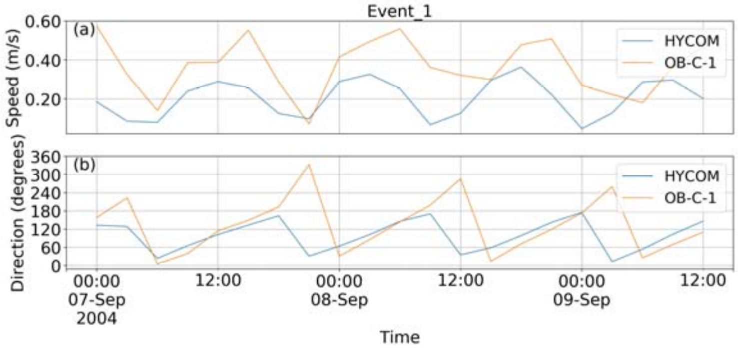


Figure 17 Time Series of Current Speed and Direction of HYCOM and Mooring OB-C-1 during the Extreme Events around Sept. 8, 2004

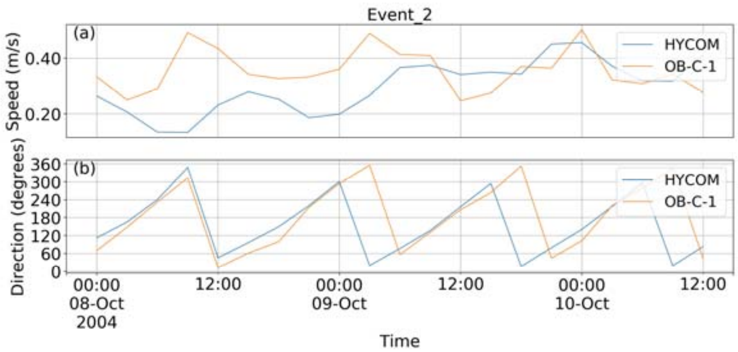


Figure 18 Time Series of Current Speed and Direction of HYCOM and Mooring OB-C-1 during the Extreme Events from Oct. 8, 2004 to Oct. 9, 2004

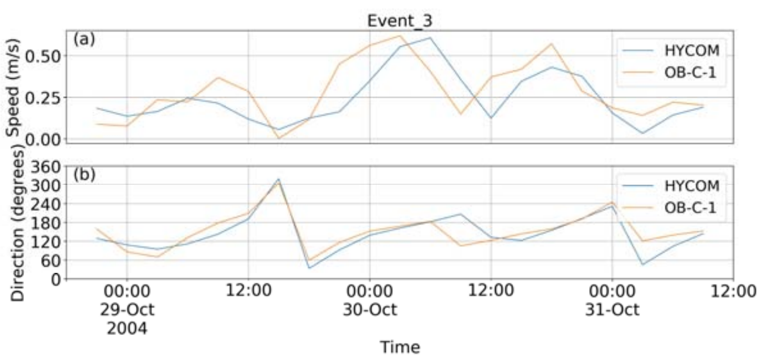


Figure 19 Time Series of Current Speed and Direction of HYCOM and Mooring OB-C-1 during the Extreme Events around Oct. 30, 2004

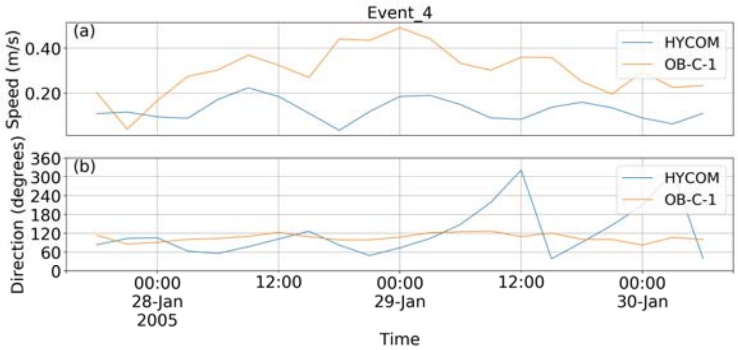


Figure 20 Time Series of Current Speed and Direction of HYCOM and Mooring OB-C-1 during the Extreme Events around Jan. 29, 2005.

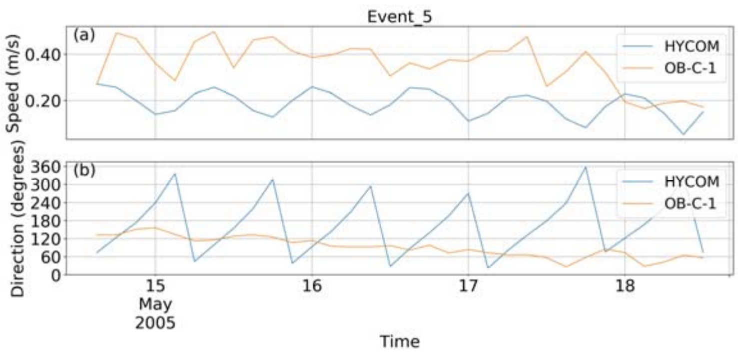


Figure 21 Time Series of Current Speed and Direction of HYCOM and Mooring OB-C-1 during the Extreme Events from May 15, 2005 to May 18, 2005

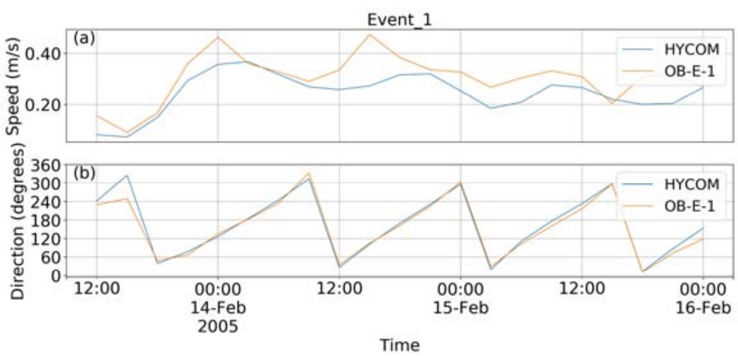


Figure 22 Time Series of Current Speed and Direction of HYCOM and Mooring OB-E-1 during the Extreme Events from Feb. 14, 2005 to Feb. 15, 2005

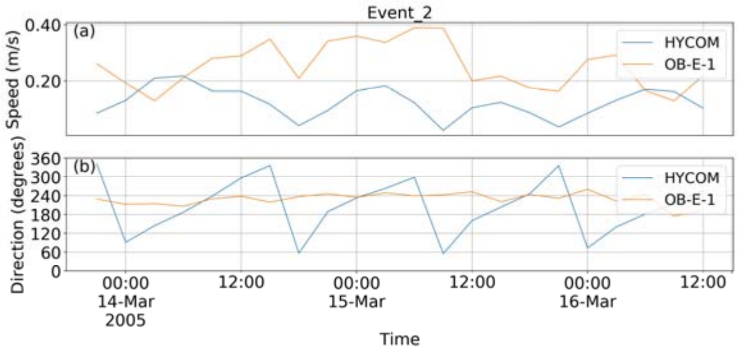


Figure 23 Time Series of Current Speed and Direction of HYCOM and Mooring OB-E-1 during the Extreme Events around Mar. 15, 2005

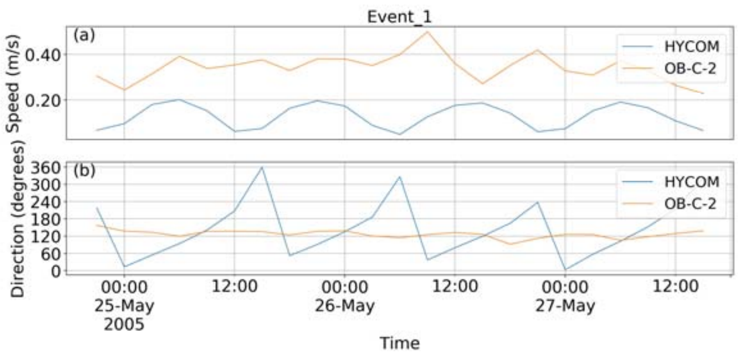


Figure 24 Time Series of Current Speed and Direction of HYCOM and Mooring OB-C-2 during the Extreme Events around May 26, 2005

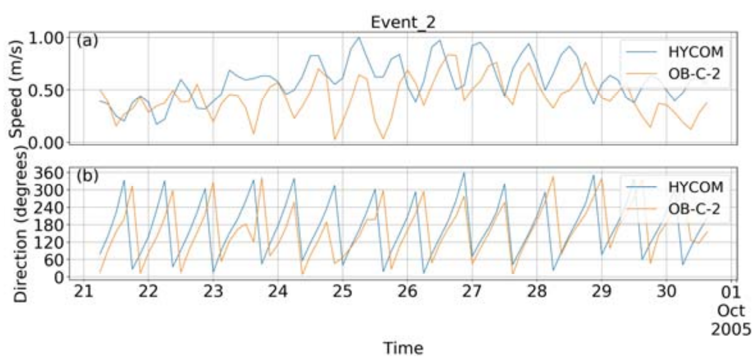


Figure 25 Time Series of Current Speed and Direction of HYCOM and Mooring OB-C-2 during the Extreme Events from Sept. 22, 2005 to Sept. 30, 2005

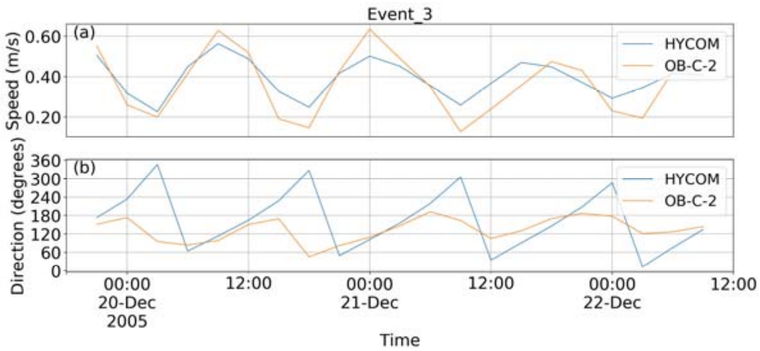


Figure 26 Time Series of Current Speed and Direction of HYCOM and Mooring OB-C-2 during the Extreme Events around Dec. 21, 2005

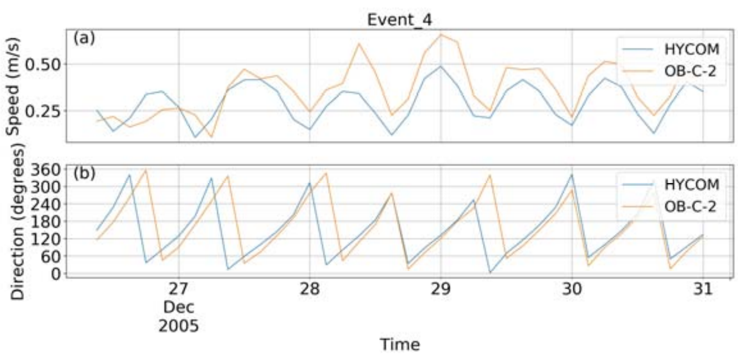


Figure 27 Time Series of Current Speed and Direction of HYCOM and Mooring OB-C-2 during the Extreme Events from Dec. 27, 2005 to Dec. 31, 2005

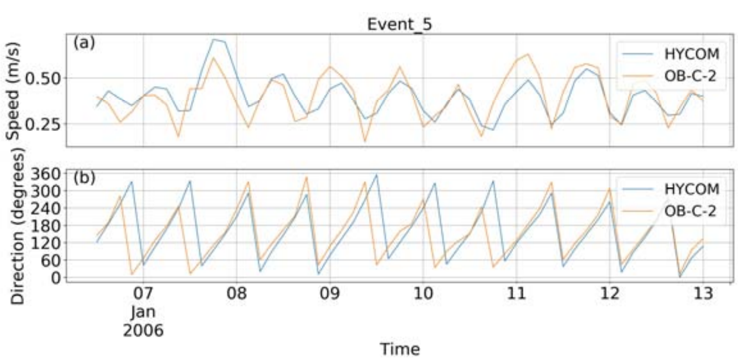


Figure 28 Time Series of Current Speed and Direction of HYCOM and Mooring OB-C-2 during the Extreme Events from Jan. 7, 2006 to Jan. 12, 2006

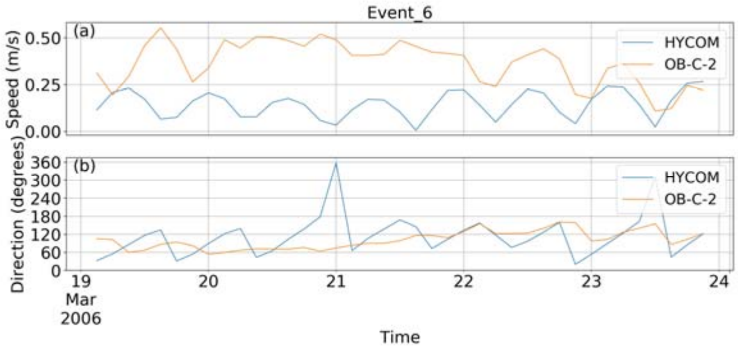


Figure 29 Time Series of Current Speed and Direction of HYCOM and Mooring OB-C-2 during the Extreme Events from Mar. 20, 2006 to Mar. 23, 2006

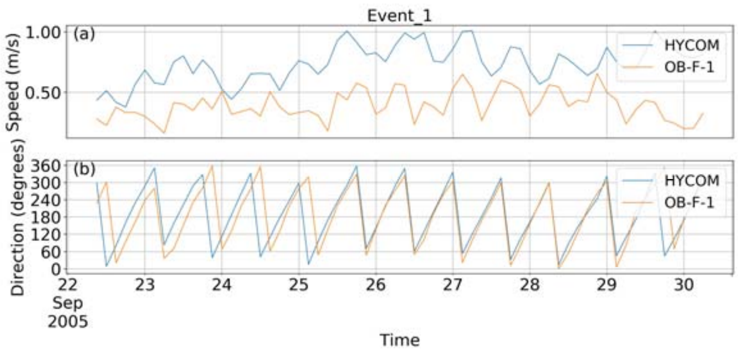


Figure 30 Time Series of Current Speed and Direction of HYCOM and Mooring OB-F-1 during the Extreme Events from Sept. 23, 2005 to Sept. 29, 2005

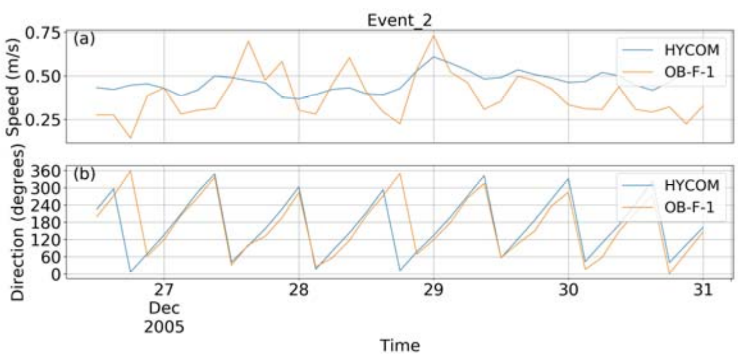


Figure 31 Time Series of Current Speed and Direction of HYCOM and Mooring OB-F-1 during the Extreme Events from Dec. 27, 2005 to Dec. 30, 2005

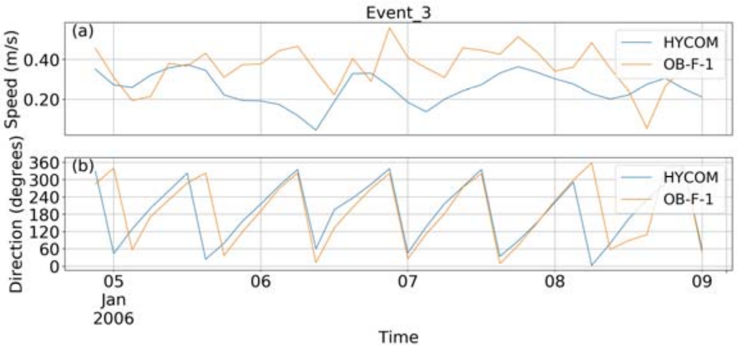


Figure 32 Time Series of Current Speed and Direction of HYCOM and Mooring OB-F-1 during the Extreme Events from Jan. 5, 2005 to Jan. 8, 2006

- **Provide a comparison of the model currents with observed currents, and discuss the effect of using each in the model.**

For detailed information on data and model comparisons, please refer to our response to the above comment.

- The drill waste deposition modelling simulations can be driven by observed currents. However, there are significant limitations using observed currents.
- Observed currents are limited in duration. Three to five years of data is needed for this type of modelling.
- Observations are limited to single point observations that are not close to the well site. For drilling dispersion modelling, the observational data needs to be acquired within 1 km of the wellsite location to be of any relevance.

The data are collected at a single point, so there is no 3D element to the data

Since HYCOM reanalysis has been proven to reproduce the measured current reasonably well, it is preferable to use HYCOM for the drill waste deposition modeling.

- **Fisheries and Oceans Canada has noted that displays of current speed in Figures B.1.5-B.1.6 of Appendix D to the EIS indicate that the upper-ocean currents in the HYCOM simulation may be weaker than those indicated by the moored current measurements at the Lona O-50 site in Section 5.4.2.2 of the EIS.**

The maximum current speed measured during the three-month deployment at Lona O-50 was ~1.6 m/s (~20 m). This is a lot stronger than the maximum currents (less than 1 m/s) measured at nearby mooring locations (OB-C and OB-F, over multiple years). Oceans Ltd took a closer look at the strong current speed measured at Lona O-50 and identified there were significant knock-downs (70 to 120 m) on the ADCP instrument during these events. There was also significant vertical gradient in current speeds above and below 30 m. It is believed these strong current readings near ~20 m are not real. The instrument knock-downs are likely due to “tall eddies” which have been measured at OB-C and OB-F as well.

References:

Oceans Ltd. 2019. Validation of HYCOM Current Profiles Against In-Situ Observations in the Orphan Basin. March 2019.

1.5.4 Information Requirement: IR-14

External Reviewer ID:

DFO-22

Reference to EIS:

Appendix B

Context and Rationale:

Appendix B provides the information related to the completed drilling waste dispersion model. Fisheries and Oceans Canada has advised that information about the drilling waste dispersion modeling is incomplete with respect to the following:

- the models described in the Dose-Related Risk and Effects Assessment Model (DREAM) package relate to the fate and effects of oil and other chemicals associated with liquid discharges (oil spills, produced water etc.) and mostly consider surface effects (currents and winds) rather than dispersion modelling;
- appropriate references for the Particle Tracking (ParTrack) model are not provided;
- the rationale for the selection of the two drilling sites was not provided;
- clarification of if the horizontal diffusion was used in the dispersion modeling is required, and if not a rationale as to why it was not used is required;
- details of the currents in the study area are not adequately presented. This is particularly the case for deep water currents which may affect benthic boundary layers and resuspension. Carter and Schafer (1983) provide an excellent summary of the currents across the study area and of their potential effects on sedimentation and resuspension as well as on the substrates and associated fauna. They also summarize available data on current direction and strength for the larger area which indicates that the deep water currents are also subject to intermittent reversal of direction (Carter and Schafer, 1983). Since the summary figures of the currents used to parameterize the model are not provided it is difficult to determine if these features are adequately represented by the model;
- the rationale for using the top 100 metres of current records to select the low and high current periods is not provided. This depth may be relevant for initial release of SBM cuttings (at 15 metres) but does not capture current behavior for the WBM releases (near bottom) or the later fate of SBM particles.
- the time step for the current inputs was not specified in the 5 years of HYCOM data (2006-2010) in depth bins of 100 metres (40 bins over 5 000 metres) in the model; and
- salinity and temperature needed for water mass density calculations are extracted from the World Ocean Atlas on a monthly basis. It is not clear if this means that one value per depth bin is used for the entire modelled period. Information to address each of the points raised by Fisheries and Oceans Canada is necessary to evaluate the validity of the predicted potential environmental effects.

<u>Reference</u>

Carter, L. and Schafer, C.T, 1983. Interaction of the Western Boundary Undercurrent with the continental margin off Newfoundland. Sedimentology, 30, pp. 751-768.

Specific Question of Information Requirement:

With respect to the drilling waste dispersion model provide the following:

- a discussion on the extent to which the model simulation is representative of the various current components in the Orphan Basin;
- appropriate references for ParTrack model;
- a rationale for selection of the two drilling sites;
- clarification on whether the horizontal diffusion was used in the dispersion modelling, and if it was not used a rationale as to why it was not used;
- a detailed description of currents in the study area in particular deep water currents and how they may affect benthic boundary layers and resuspension, taking into consideration Carter and Schafer (1983);
- a rationale for using the top 100 metres of current records to select the low and high current periods in the modelling;
- the time step for the current inputs regarding the models use 5 years of HYCOM data (2006-2010) in depth bins of 100 metres (40 bins over 5000 metres), and
- a description of how salinity and temperature information were used in the modelling and how these reconciled with the HYCOM data bins.

Response:

With respect to the drilling waste dispersion model provide a discussion on the extent to which the model simulation is representative of the various current components in the Orphan Basin

HYCOM has been widely used in Atlantic Canada for similar modelling studies and provides the best publicly available current hindcast for the region. In the Orphan Basin, the extreme currents are near-inertial motions generated by storms or eddies or a combination of both. Since the period of the near-inertial motions is less than 24 hrs at this latitude, it is critical to use 3-hourly HYCOM (daily values will not resolve the inertial motions). Comparisons of HYCOM and measurements show that HYCOM captures some of the strong inertial motions well. Some of the eddies (“tall eddies”) can penetrate deep. These eddies have been measured at several mooring locations. The coherent vertical structure shown in HYCOM suggests it captures the variability related to these tall eddies. Tidal currents (Bedford Institute Tides) are also superimposed to the HYCOM currents.

BP commissioned Oceans Ltd. to validate HYCOM current profiles against several full-water-column moorings in the Orphan Basin covering the time period 2004 to 2013 (Oceans Ltd. 2019). Refer to the response provided for IR-13 for a discussion on the validation of HYCOM in this region. The validation shows HYCOM reanalysis is able to reproduce the mean deep-water currents at OB-C-1, OB-C-2, OB-E-1, but underestimate the mean currents at OB-F-1. In addition, HYCOM underestimates the extreme near-bed currents at all the sites. This is a known issue to almost all the hydrodynamic models since the vertical resolution of the HYCOM model grid is much lower near sea bed (on the order of several hundred meters) comparing to near surface.

Current modeling is more difficult than modelling waves and winds. HYCOM captures the key current processes and circulation patterns in the region. It resolves certain oceanographic features better than others and consequently will agree better with observations at some locations / depths than others.

Provide appropriate references for ParTrack model

ParTrack is a software tool for modeling and simulating the release of drilling muds, cuttings and chemicals from offshore platforms (Rye et al. 1998, 2006; Rye and Furuholt 2010). Given model inputs such as ambient currents and densities, chemical and physical properties of the effluent, and details of the release scenario, ParTrack simulates the release and spreading of the effluent within a three-dimensional (3D) ocean grid. A ParTrack simulation consists of two sequential steps:

1. Convective descent or ascent in the near-field zone
2. Passive particle transport and spreading in the far-field zone

Step 1 lasts for a few minutes or so; it involves the creation of the 'mud plume'. The density difference between effluent and seawater leads to the initial convective descent of the mud plume. As the plume moves vertically, it entrains ambient water. This often enables the plume to attain a density equal to that of the ambient water before the plume hits the ocean bottom. This neutral buoyancy signals the end of convective movement (for the most part) and the beginning of the spreading in the far-field zone. Particles are released from the plume in accordance with their sizes and densities (and hence sinking velocities). The particles are assumed to sink down on the sea floor as individual particles. The sinking velocities of the particles can be divided into two regimes: the Stokes regime (for smaller particles) and the Constant drag regime (for larger particles) (Rye and Furuholt 2010).

Particles are transported via ambient currents and diffusion. At each time step, ParTrack has an overview of all particle locations. From this data, it computes the mass distribution of the effluent along with its concentrations in both water and sediments.

Provide a rationale for selection of the two drilling sites

Although the precise location of wellsites for the drilling program are not currently known, the drilling mud and cuttings dispersion modelling employed the same representative wellsites for the West Orphan Basin (WOB) and EOB exploration wells used in oil spill modelling and acoustic assessment. These two locations represent viable drilling prospects and were considered representative of various water depths in the Project Area (WOB -1,360 m water depth and EOB - 2,785 m water depth). In the case of cuttings dispersion modelling, the difference in water depth between WOB and EOB well locations sites helped to demonstrate how the cuttings deposition footprint is likely to be affected by the longer particle settling times for discharges at the EOB well location where SBM cuttings discharged at the sea surface are transported over a greater distance before settling on the seabed. This results in a thinner layer of cuttings spread over a larger area, compared to those discharged at the surface from the WOB wellsite, which is located in shallower water.

Clarify whether the horizontal diffusion was used in the dispersion modelling, and if it was not used a rationale as to why it was not used

Particle transport and deposition mechanism follows a mode of movement consisting of advection, diffusion and deposition onto the seabed. The strength of horizontal transport and diffusion is a function of the marine hydrodynamic conditions, such as winds, waves, tidal currents and local eddies.

Advection is simulated as the superposition of a mean local velocity plus a random turbulent component. The mean local velocity is in general the sum of climatological, tidal, and wind-driven plus wave-driven (Stokes) components. The environmental turbulent component w´ is computed as

$$w' = \sqrt{6K}/\Delta t$$

where K is the coefficient of turbulent dispersion, estimated for the horizontal and vertical directions, and t is the time.

The horizontal dispersion coefficient can be approximated from data on dye diffusion studies reported by Okubo (1971, 1974) as reviewed by Bowden (1983):

$$K_x = 0.0027\ t^{1.34}$$

for K in cm²/sec and time t in seconds. As the variance of a cloud increases, the cloud is dispersed by turbulence associated with increasingly larger spatial scales, such that the apparent dispersion coefficient increases with time. Kullenberg (1982) points out that the data supports a maximum at approximately 10^6 cm²/s, or 100 m²/day. This maximum is applied here.

If the model is run with input from a three-dimensional hydrodynamic model in which the horizontal and vertical dispersion coefficients are computed, these values are used in place of the generalized approach described above.

Provide a detailed description of currents in the study area in particular deep water currents and how they may affect benthic boundary layers and resuspension, taking into consideration Carter and Schafer (1983)

Refer to the response provided for IR-13 for details on deepwater currents in the study area. The maximum current speed of 31 cm/s at -2,225m BSL is similar to the maximum current speed of around 32 cm/s measured at 2,500 m water depth for the Northwest Atlantic Bottom Current referenced in Carter and Schaefer (1983).

The physical persistence of drill cuttings on the seafloor depends on the energy of bottom waters and reactivity and biodegradability of the different substances in the drilling fluid and cuttings accumulation in sediments. Strong bottom currents winnow the cuttings particles, resuspending and transporting progressively coarser cuttings particles with increasing current speed, so the median grain size of cuttings in the cuttings pile tends to increase with time after the discharge. Laboratory studies found that the critical current velocity required for erosion of non-aqueous based fluid (NABF) (e.g., synthetic-oil based muds) cuttings ranges from 29 to 40 cm/sec, depending on the wt% NABF on the cuttings (Delvigne 1996). This range of critical current velocities for the most part exceeds the sea floor currents in the Orphan Basin therefore resuspension is likely to be minimal.

Provide a rationale for using the top 100 metres of current records to select the low and high current periods in the modelling

The main purpose of the modelling was to generate results that could be interpreted to assess environmental effects of drill waste discharges on valued components (e.g., Marine Fish and Fish Habitat) for the EIS. Hence, one aim of the modelling was to predict the maximum extent and areal coverage of drill solids on the seafloor resulting from the discharge of mud and cuttings into the marine environment.

Hydrodynamic regimes and cutting characteristics determine the dispersion and deposition patterns of discharged muds and cuttings. Large and coarse cuttings settle quickly onto the seabed and are deposited near to the release location. Fine particles, on the other hand, tend to settle slowly onto the seabed and are more likely to remain suspended longer in the water column and be carried further away from the release location by ocean currents. Hence, in an energetic environment, with strong currents and strong eddies, the concentration of suspended drill solids in the water column will be lower and the cuttings pile heights on the seabed will also be lower. Conversely, in a calm environment, with weak currents and weak eddies, the concentration of suspended drill solids will be higher and the seabed pile heights will also be higher. In addition, any cuttings discharged at the sea surface are likely to be transported further away from the release location than those released at the seabed. This is because they remain suspended in the water column for longer and are therefore carried further away by ocean currents from the release location. Moreover, as current velocities in the upper water column are generally much higher than benthic currents, current records in the top 100 m of the water column were used to select the low and high ambient current periods (45-day period moving-average daily-mean currents) used in the modelling (see EIS Appendix B, Section 5.25, Figures 5.10 and 5.11). This was to maximize and minimize the dispersion footprint of the surface releases (synthetic-based mud cuttings) which are transported further away from the release locations than riserless releases at the seabed.

Figures 1 and 2 show that if the benthic currents are included in the analysis, the start dates for the highest and lowest ambient current periods remains unchanged.

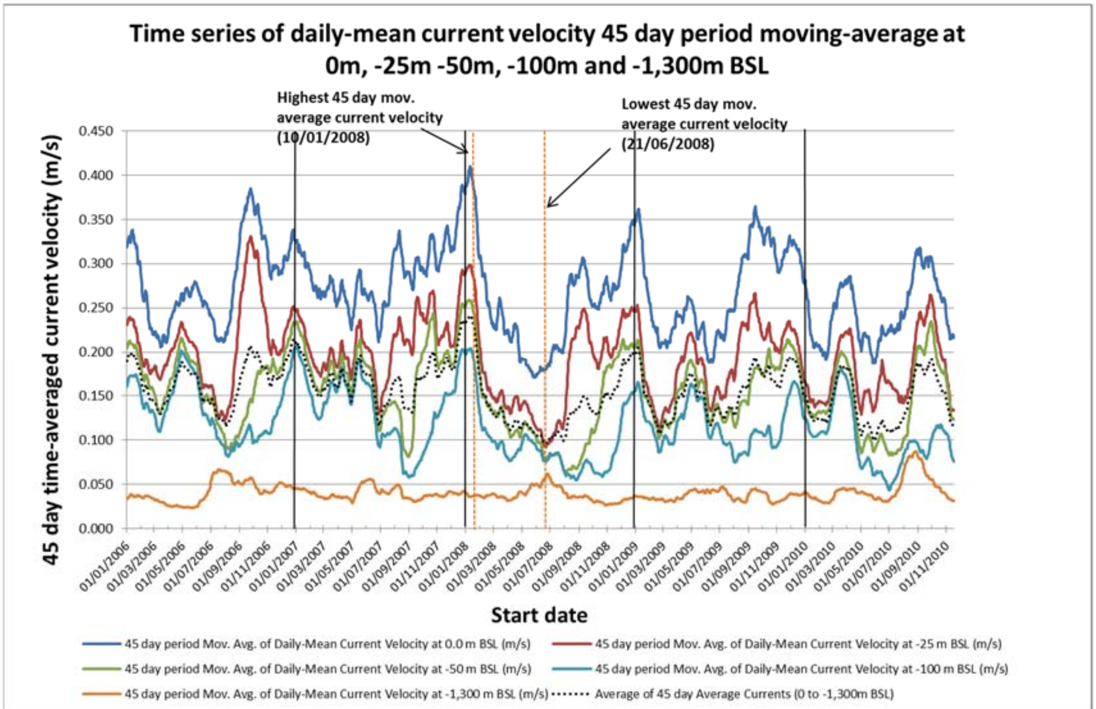


Figure 1 **Time Series of Daily-mean Current Velocity 45-day Period Moving Average at 0 m BSL, -25 m, -50 m, -100 m and -1,300 m BSL Water Depths for the WOB Wellsite Location Between 1st Jan 2006 to 31st Dec 2010**

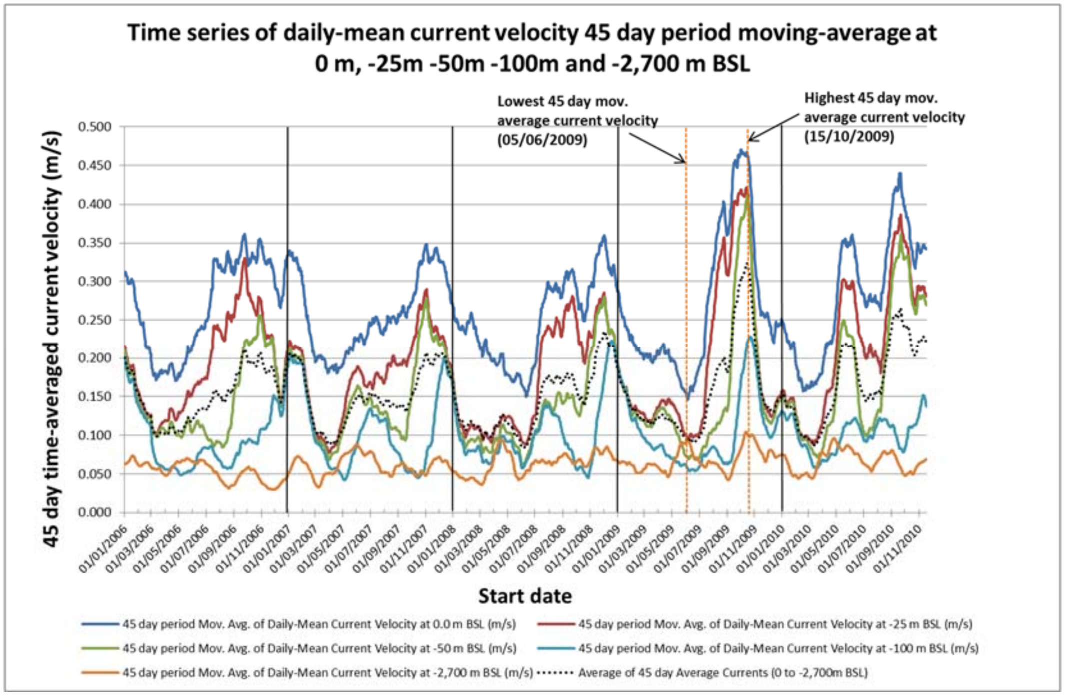


Figure 2 **Time Series of Daily-mean Current Velocity 45 day Period Moving Average at 0 m BSL, -25 m, -50 m, -100 m and -2,700 m BSL Water Depths for the EOB Wellsite Location Between 1st Jan 2006 to 31st Dec 2010**

Provide the time step for the current inputs regarding the models use of 5 years of HYCOM data (2006-2010) in depth bins of 100 metres (40 bins over 5000 metres)

The temporal resolution of HYCOM currents speeds in the hindcast dataset covering the period 1st January 2006 to 31st December 2010 was 3 hours at each of the 40 depth bins.

Provide a description of how salinity and temperature information were used in the modelling and how these reconciled with the HYCOM data bins

The ParTrack model needs a specification of the stratification in the water masses as this affects the buoyance of the near-field mud and cuttings plume. Stratification is accounted for in the model by specifying the vertical variation of temperature and salinity of the ambient water masses. Average monthly temperature and salinity vs. depth profiles for each well location was extracted from the World Ocean Atlas (2013 v. 2). The data was then used to produce hydrographical profiles for each time period employed in the modelling.

References:

Bowden, K.F. 1983. Physical Oceanography of Coastal Waters. Ellis Harwood Ltd, UK. 312 pp.

Carter, L. and C.T. Schafer. 1983. Interaction of the Western Boundary Undercurrent with the continental margin off Newfoundland. Sedimentology, 30: 751-768.

Delvigne, G.A.L. 1996. Laboratory investigations on the fate and physicochemical properties of drill cuttings after discharge into the sea. Paper 3 In: The Physical and Biological Effects of Processed Oily Drill Cuttings. E&P Forum No. 22.61/202. R&P Forum, London, UK.

Kullenberg, G. 1982. Pollutant Transfer and Transport in the Sea. CRC Press, Boca Raton, FL. Vol. I: 227 pp.

Oceans Ltd. 2019. Validation of HYCOM Current Profiles Against In-Situ Observations in the Orphan Basin. February 2019.

Okubo, A. 1971. Oceanic diffusion diagrams. Deep Sea Research, 18: 789-802.

Okubo, A. 1974. Some speculation on oceanic diffusion diagrams. Pp. 77-85. In: G. Kullenberg and Talbot (eds.). Physical Processes Responsible for Dispersal of Pollutants in the Sea. Rapp. Proc. Verb Penn. Cons. Inter. Expl. Mer. 167.

Rye, H. and E. Furuholt. 2010. Validation of numerical model for simulation of drilling discharges to sea. SPE 137348, Abu Dhabi International Petroleum Exhibition & Conference held in Abu Dhabi, UAE, 1-4 November 2010.

Rye, H. M. Reed, and N. Ekrol. 1998. ParTrack model for calculation of the spreading and deposition of drilling mud, chemicals and drill cuttings: Environmental Modelling & Software with Environment Data News, 13(5-6): 431-441.

Rye, H., M. Reed, T.K. Frost, and T.I Roe Utvik. 2006. Comparison of the ParTrack mud/cuttings release model with field data based on use of synthetic-based drilling fluids. Environmental Modelling and Software, 21: 190-203.

World Ocean Atlas. 2013. version 2. Available at: https://www.nodc.noaa.gov/OC5/woa13/.

1.5.5 Information Requirement: IR-15

External Reviewer ID:

DFO-23

Reference to EIS:

Appendix B

Context and Rationale:

Figure 5.4 in Appendix B of the EIS illustrates the particle size distributions for barite, bentonite and drill cuttings used in the drilling mud and cutting dispersion modelling. However, the use of these in the model is not described in the Appendix or EIS.

Fisheries and Oceans Canada has advised that only the largest particles settle out during the modelled period, because fine particles make up the majority of particles, the majority of the drilling wastes are predicted to remain in the water column and advect elsewhere. Appendix B states that approximately 50 percent of the waste material would be transported outside the boundaries of the modelling domain and because it is dispersed would only eventual settle to thicknesses of one μm or less and therefore would not have any significant effects. Fisheries and Oceans Canada stated that the estimate of 50 percent is not supported by either the data provided in Figure 5.4 or the model descriptions (Rye et al. 1998, 2006) and that a figure of close to 75 percent may be more appropriate.

Also, the fate and potential effect of these particulate wastes outside the study boundary is not considered in the assessment.

Specific Question of Information Requirement:

With respect to the drill mud and cuttings dispersion modelling, provide the following:

- a description of the use of particle size distributions for barite, bentonite and drill cuttings in the model;
- supporting evidence showing around 50 percent of waste material that would be transported outside the model domain, or an updated description of the predicted percent of waste material to be transported outside the boundary of the modelling domain; and
- a discussion of the fate and potential effects of particulate waste outside of the study boundary.

Response:

Provide a description of the use of particle size distributions for barite, bentonite and drill cuttings in the model

ParTrack is a software tool for modeling and simulating the release of drilling muds, cuttings and chemicals from offshore platforms (Rye et al. 1998, 2006; Rye and Furuholt 2010). Given model inputs such as ambient currents and densities, chemical and physical properties of the effluent, and details of the release scenario, ParTrack simulates the release and spreading of the effluent within a three-dimensional ocean grid. A ParTrack simulation consists of two sequential steps:

1. Convective descent or ascent in the near-field zone
2. Passive particle transport and spreading in the far- field zone

Step 1 lasts for a few minutes or so; it involves the creation of the 'mud plume'. The density difference between effluent and ambient leads to the initial convective descent of the plume (or ascent in the case of a lighter effluent such as produced water). As the plume moves vertically, it entrains ambient water. This often enables the plume to attain a density equal to that of the ambient before the plume hits the ocean bottom. This neutral buoyancy signals the end of convective movement (for the most part) and the beginning of the spreading in the far-field zone. Particles are released from the plume in accordance with their sizes and densities (and hence sinking velocities). The particles are assumed to sink down on the sea floor as individual particles. The sinking velocities of the particles can be divided into two regimes, the Stokes regime (for smaller particles) and the Constant drag regime (for larger particles) (Rye and Furuholt 2010).

Particles are transported via ambient currents and diffusion and at each time step, ParTrack has an overview of all particle locations. From this data, it computes the mass distribution of the effluent along with its concentrations in both water and sediments.

The size distribution of discharged solids varies as a function of geology, type of drill bit, rate of penetration, type of drilling fluid and solids removal treatment being employed. For this study, a representative size distribution (based on data published by Saga [1994]) was used to characterize the drill cuttings releases. Saga (1994) investigated the particle size distribution (by weight) of drilling mud and cuttings during an exploration drilling in the Barents Sea. These data are summarized in Tables 1 and 2.

Table 1 Drill Cuttings in Drilling Mud: Particle Diameter, Density and Sinking Velocity Distribution

Diameter mm)	Weight (%)	Density (tonnes/m³)	Velocity (m/s)	Velocity (m/day)
0.007	10	2.4	1.90E-05	1.7
0.015	10	2.4	8.80E-05	7.6
0.025	10	2.4	2.50E-04	21.2
0.035	10	2.4	4.80E-04	41.6
0.05	10	2.4	9.80E-04	84.9
0.075	10	2.4	2.20E-03	191.0
0.2	10	2.4	1.60E-02	1,356.5
0.6	10	2.4	5.70E-02	4,898.9
3	10	2.4	2.10E-01	17,988.5
7	10	2.4	3.20E-01	27,483.8
Source: Saga 1994				

Table 2 Barite in Drilling Mud: Particle Diameter, Density and Sinking Velocity Distribution

Diameter (mm)	Weight (%)	Density (tonnes/m³)	Velocity (m/s)	Velocity (m/day)
0.0007	10	4.2	4.40E-07	0.04
0.001	10	4.2	9.10E-07	0.08
0.002	10	4.2	3.60E-06	0.31
0.003	10	4.2	8.20E-06	0.71
0.005	10	4.2	2.30E-05	1.96
0.009	10	4.2	7.40E-05	6.35
0.014	10	4.2	1.80E-04	15.37
0.018	10	4.2	2.90E-04	25.41
0.028	10	4.2	7.10E-04	61.49
0.05	10	4.2	2.30E-03	196.08
Source: Saga 1994				

Provide supporting evidence showing around 50 percent of waste material that would be transported outside the model domain, or an updated description of the predicted percent of waste material to be transported outside the boundary of the modelling domain

Figure 1 provides an example of the mass balance output from one of the drilling discharge simulations. It also shows the final thickness of drill solids deposited at the West Orphan Basin well site, 45 days after the start of drilling. The boundary of the modelling domain is shown by the yellow line. The mass balance chart shows that 49.1% of the total material released while drilling the well has been transported outside the modelling domain boundary. Similar results were found for the other discharge scenarios.

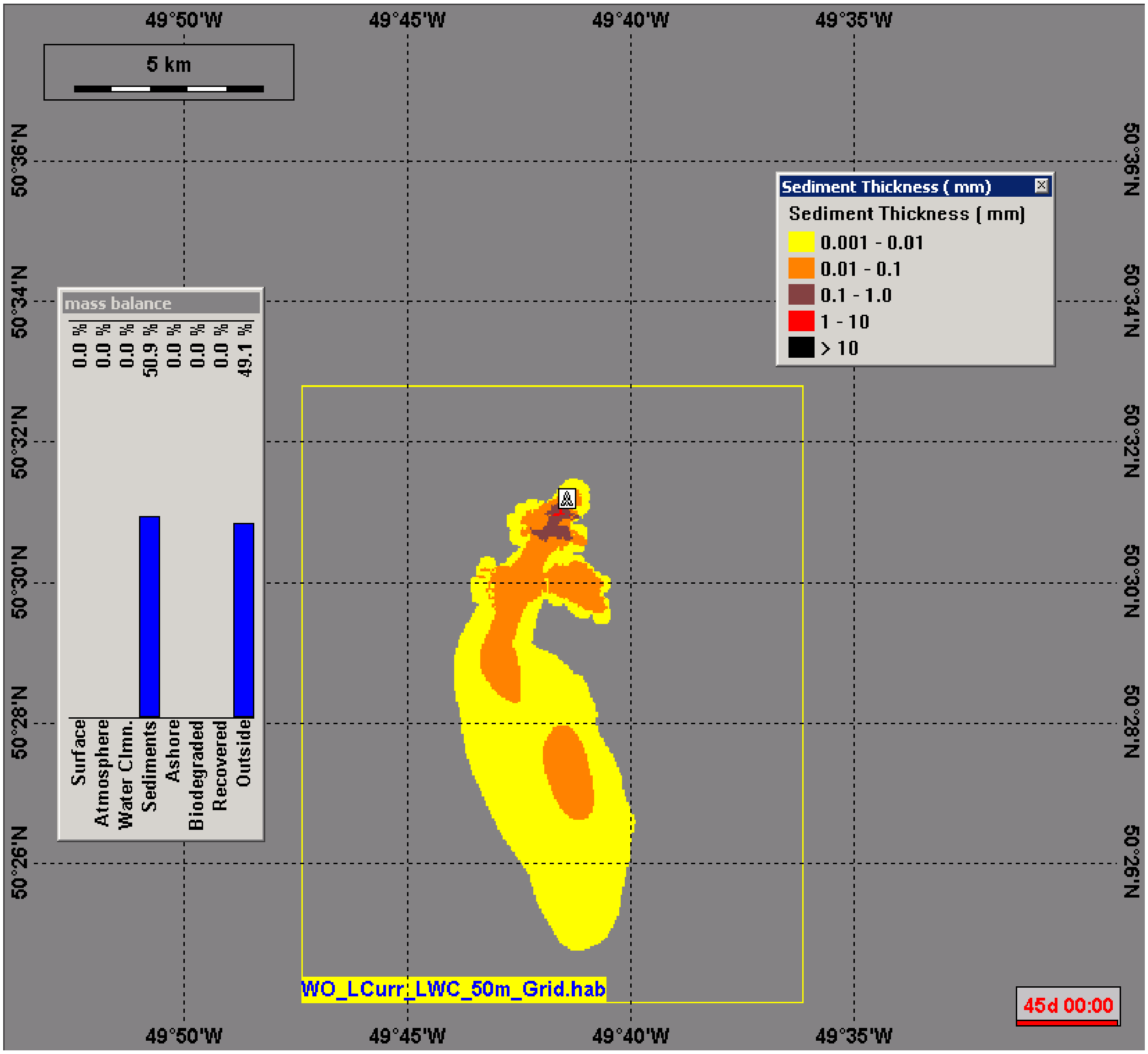


Figure 1. Seabed Deposition Footprint of Total Drill Solids at the West Orphan Basin Well Site under the Lowest Ambient Surface Current Conditions

Provide a discussion of the fate and potential effects of particulate waste outside of the study boundary

The quantity of material transported outside the model domain boundary is extremely small compared with the water volume in which the material is dispersing. Thus, the resulting effect on oceanic suspended particulate matter concentrations is likely to be indistinguishable. In addition, any cuttings deposition thicknesses would be insignificant and undetectable (<0.001 mm, or <1 micron). The deposition area within the 1-micron thickness boundary is shown in yellow and does not extend even beyond the modelling domain.

References:

Rye, H. and E. Furuholt. 2010. Validation of Numerical Model for Simulation of Drilling Discharges to Sea", SPE 137348, Abu Dhabi International Petroleum Exhibition & Conference held in Abu Dhabi, UAE, 1-4 November 2010.

Rye, H., M. Reed and N. Ekrol. 1998. ParTrack model for calculation of the spreading and deposition of drilling mud, chemicals and drill cuttings: Environmental Modelling & Software with Environment Data News, 13(5-6): 431-441.

Rye, H., M. Reed, T.K. Frost and T.I Roe Utvik. 2006. Comparison of the ParTrack mud/cuttings release model with field data based on use of synthetic-based drilling fluids. Environmental Modelling and Software, 21: 190-203.

Saga. 1994. Miljøprogram i forbindelse med brønn 7219/8-1s i Barentshavet. Report from Saga Petroleum a.s. dated 10 March 1994. Saga report R-TIY-0003. Written by J.R. Hasle, H.N. Lie and K. Thorbjørnsen in Norwegian.

1.5.6 Information Requirement: IR-16

External Reviewer ID:

KMKNO-20; WNNB-01; WNNB-02; MTI-01; MTI-04

Reference to EIS:

Section 6.1.4.4;
Section 6.1.9;
Section 8.3.3.1

Context and Rationale:

Several Indigenous groups have expressed concerns about potential effects of the project on Salmon.

Comments from the MTI state that Atlantic salmon are known to exhibit avoidance behaviours to light exposure, infrasound, and surface disturbance. In addition, light and sound stimuli can influence swimming depth and speed. MTI further noted that salmon are sensitive to acoustic particle motion at frequencies below 200 Hz. Infrasound disturbance has short-term effects on fish behaviours and typically return to pre-stimulus states. This may cause flight behaviour to lessen over time to all stimuli, so repeated/extensive exposure can lead to habituation (Bui et al, 2013)[1] The EIS provides little analyses on the behavioural response effects to migrating salmon due to light and sound effects of the Project.

The KMKNO has suggested that since smolt and adult salmon migrations cross the potential vessel route, information should be enhanced through industry supported research opportunities and initiatives.

Section 6.1.9 of the EIS provides information on salmon designated units and the presence in the Project Area. WNNB stated that the conclusions with respect to the sub-populations that utilize New Brunswick and area waters are made despite the findings of Reddin and Frieland (1993), Lacroix (2013) and Soto et al. (2018), which suggest the salmon, at various life stages may utilize the Project Area for feeding.

References:

Lacroix, G.L. 2013. Population-specific ranges of oceanic migration for Atlantic salmon (*Salmo salar)* documented using pop-up satellite archival tags. Can. J. Fish. Aquatic. Sci., 70:1011-1030.

Reddin, D.G. and K.D. Frieland. 1993. Marine environmental factors influencing the movement and survival of Atlantic salmon. International Council for the Exploration of the Sea. Report: C.M 1993/M:42/ Ref. C+H Anadromous and Catadromous Fish Committee

Soto, D.X., C.N. Trueman, K.M. Samways, M.J. Dadswell, and R.A Cunjak. 2018. Ocean warming cannot explain synchronous declines in North American Atlantic salmon populations. Marine Ecology Progress Series. doi: I0.3354/meps12674.

Bui, S., Oppedal, F., Korsøen, Ø. J., Sonny, D., & Dempster, T. (2013). Group behavioural responses of Atlantic Salmon (Salmo salar L.) to light, infrasound and sound stimuli. *PloS one*, *8*(5), e63696.

Specific Question of Information Requirement:

Update the analysis of effects on Atlantic Salmon from routine project activities:

- considering references and WNNB's concerns, provide a rationale for the conclusion that salmon that return to New Brunswick waters are not found in the Project Area;
- the biological and behavioural responses of Atlantic salmon to light and noise; and
- any proponent participation in industry supported research to improve the knowledge of smolt and salmon migrations.

Update the effects predictions, and proposed mitigation and follow-up, if required.

Response:

Regarding the Outer Bay of Fundy population (coastal New Brunswick and Nova Scotia), Section 6.1.9 of the EIS currently states, "…salmon from these Designatable Units (DUs) may be more prevalent in Labrador Sea and eastern Grand Banks feeding areas during the summer/fall feeding season (Reddin and Frieland 1993; Lacroix 2013). Recent work with salmon from the outer Bay of Fundy DU have also suggested that the Project Area may serve as a summer marine feeding area…"

Regarding the Inner Bay of Fundy (IBoF) population (coastal New Brunswick and Nova Scotia), Section 6.1.9 of the EIS currently states," …The existing information suggests that Inner Bay of Fundy salmon are not known to inhabit North Atlantic Ocean waters near the Orphan Basin or the Grand Banks. Thus, with respect to the Project Area, the presence of Inner Bay of Fundy salmon is not expected at any life history stage or season…". Refer to the response to CL-18 for further discussion on the Inner Bay of Funday salmon population, which acknowledges that the IBoF salmon population has the potential to occur in the Project Area; however, the presence of IBoF salmon is considered unlikely. Refer to the response to IR-57 for information on industry-supported research to improve the knowledge of smolt and salmon migrations.

The biological and behavioural response of marine fish to light and noise emissions are discussed in Section 8.3.3.2 of the EIS. These responses, which can be species and/or life-stage specific, can include attraction and/or avoidance behaviours and indirectly may affect risk of predation or reduction of feeding opportunities (Nightingale and Simenstad 2002; Hanson et al. 2003; National Oceanic and Atmospheric Administration 2008). Bui et al. (2013), which specifically studied the response of caged Atlantic salmon to light and sound emissions, concluded responses to stimuli were fairly temporary (returned to original swimming depth and speed within minutes of being exposed to light and sound stimuli). If Atlantic salmon are migrating through the Project Area and exposed to light and sound emissions from Project activities, effects are expected to be low in magnitude (within the range of natural variability), medium term, and reversible, as predicted in the EIS for effects on marine fish in general. Therefore, the effects predictions, and proposed mitigation and follow-up for marine fish and fish habitat as presented in the EIS remain unchanged.

References:

Bui, S., F. Oppedal, Ø.J. Korsøen, D. Sonny and T. Dempster. 2013. Group behavioural responses of Atlantic Salmon (*Salmo salar* L.) to light, infrasound and sound stimuli. *PloS one*, *8*(5), e63696.

Hanson, J., M. Helvey and R. Strach (Editors). 2003. Non-fishing impacts to essential fish habitat and recommended conservation measures. Long Beach (CA): National Marine Fisheries Service (NOAA Fisheries) Southwest Region. Version 1. 75 pp.

Lacroix, G.L. 2013. Population-specific ranges of oceanic migration for Atlantic salmon (*Salmo salar*) documented using pop-up satellite archival tags. Can. J. Fish. Aquatic. Sci., 70:1011-1030.

Nightingale, B. and C. Simenstad. 2002. Artificial night-lighting effects on salmon and other fishes in the Northwest. Ecological Consequences of Artificial Night Lighting conference, February 23, 24, 2002. Sponsored by the Urban Wildlands Group and UCLA Institute of the Environment.

National Oceanic and Atmospheric Administration. 2008. Impacts to Marine Fisheries Habitat from Non-fishing Activities in the Northeastern United States. Northeast Regional Office Gloucester, MA. NOAA Technical Memorandum NMFS-NE-209.

Reddin, D.G. and K.D. Frieland. 1993. Marine environmental factors influencing the movement and survival of Atlantic salmon. International Council for the Exploration of the Sea. Report: C.M 1993/M:42/ Ref. C+H Anadromous and Catadromous Fish Committee.

1.5.7 Information Requirement: IR-17

External Reviewer ID:

DFO-19; DFO-CL-36; DFO-CL-37; KMKNO-16

Reference to EIS:

Section 6.1.7, Table 6.4

Context and Rationale:

Table 6.4 in Section 6.1.7 of the EIS classifies the potential for occurrence of key fish species in the Regional Assessment Area and Project Area. However, no methodology or definition was provided to clarify the basis of the potential for occurrence. This is required to avoid misinterpretation (i.e., does occurrence mean presence or abundance).

In addition, it was noted by Fisheries and Oceans Canada that the fish distribution analysis was based on Fisheries and Oceans Research Vessel data from 2015/2016, and that there are several other sources of information that should have been considered, for example all data collected using Campelean trawl (1995-present) since 2015-2016. This is important as 2015/2016 could potentially be an anomalous year for one or more species

Further, with respect to corals and sponges it was noted by Fisheries and Oceans Canada that the research vessel surveys extend only to the extreme east of the study area and include limited sets in the eastern most Exploration Licences, and that it would have been appropriate to use several years of survey data (e.g. Gullage et al. 2016). As such, the limitations of using the data requires discussion.

In addition, Fisheries and Oceans Canada has advised that information from Spanish, Portuguese, and European Union (EU) Research Vessel Surveys conducted outside of the 200 mile Canadian Economic Exclusion Zone (EEZ) in Northwest Atlantic Fisheries Organization (NAFO) Subdivisions 3L and 3M have not been included, and are readily available from the NAFO Secretariat website (https://www.nafo.int/Publications/General). There was a Canadian Research Vessel Survey conducted on the Flemish Cap from 1978-1985, this was subsequently replaced by an EU-Flemish Cap survey which has occurred annually since 1988. In 2003 the European Union survey was extended to the Flemish Pass in Division 3L. The European Union Surveys include the following: European Union in Division 3M (1988-2017), EU-Spain in Div. 3NO (1995-2017) and European Union-Spain in Division 3L (2003-2017).

Specific Question of Information Requirement:

With respect to the analysis of fish distribution:

- consider data in the sources provided by Fisheries and Oceans Canada, in particular with respect to surveys conducted outside the Economic Exclusion Zone and update Table 6.4 and Figures 6.6-6.11; and
- provide the definition or methodology used to determine potential for occurrence.

Update the effects assessment, and proposed mitigation and follow-up, if required.

Response:

Potential for Occurrence is defined in the footnotes of EIS Table 6.4 as "qualitative characterization is based on expert opinion, and an analysis of understood habitat preferences across life-history stages, available distribution mapping, and catch data for each species within the Project Area". It refers to presence.

With respect to corals and sponges, EIS Table 6.4 and EIS Figures 6.6 to 6.11 are specific to marine fishes. Chapter 6 of the EIS acknowledges the considerable overlap in potential corals and sponges habitat and the Project Area. Specifically, EIS Section 6.1.6 states, "Within the Project Area, corals are present in northwest section of EL 1145 and EL 1146, on the Northeast Newfoundland Shelf and slope, but data on presence in the deeper water areas of the Project Area was unavailable based on DFO Research Vessel (RV) data (Figure 6.5). Of BP's four ELs, EL 1145 appears to contain the highest diversity of corals; within the boundaries of this EL, soft corals, scleractinian stony corals, gorgonians, and sea pens have been recorded." Given the habitat modelling presented in Gullage et al. (2017), EL 1148 is also characterized by this passage in Chapter 6 of the EIS.

Upon the recommendations above regarding research vessel (RV) survey data conducted outside of the 200-mile Canadian Economic Exclusion Zone (EEZ), the Northwest Atlantic Fisheries Organization (NAFO) was researched (NAFO 2017). However, the data reviewed focused primarily on commercial species in the NAFO fishing footprint (approximately 30 km from the Project Area) and did not provide new information on the presence / absence of fish species in the area. Therefore, no updates to the effects assessment and proposed mitigation have been made.

The analysis of fish distribution has been revised to include Fisheries and Oceans Canada (DFO) Research Vessel data from 2007 to 2017. No changes were required to Table 6.4; however, the first page of text in Section 6.1.7 is modified as follows:

6.1.7 Finfish (Demersal and Pelagic Species)

> There are two regulatory regimes with authority over marine fish within the Project Area. The Government of Canada manages fish stocks within the EEZ. Within these areas, the Canadian federal *Fisheries Act* provides protection to commercial, recreational, and Aboriginal fisheries by managing the fish resources and habitats that support these activities. Outside Canada's EEZ, groundfish and benthic invertebrates are managed by NAFO.
>
> The benthic or demersal species which inhabit the continental slope and abyssal habitats in the vicinity of the Project Area are not yet well studied. These species typically have life history traits of late maturation, long life-spans, low reproductive rates, and slow growth which leave them sensitive to habitat and population disturbances (Devine et al. 2006, Baker et al. 2012). Emerging continental slope fisheries for grenadiers, Greenland halibut and redfish are resulting in additional pressures for other continental slope species found within the Project Area such as blue hake, roughhead grenadier, roundnose grenadier, skate species and synaphobranchid eels (Devine et al. 2006).

Pelagic species are generally either: resident pelagic species (capelin and lanternfish) or migratory pelagic species (tunas, swordfish, and several shark species). Resident species generally complete their life histories within the cold northern waters and, in many cases, are well-represented in the DFO research vessel (RV) survey data. In contrast, migratory pelagics in the Project Area are typically large bodied predators that seasonally migrate from temperate areas into northern waters to feed. During their northern migrations, these migratory species typically remain in the waters of the Gulf Stream (Walli et al. 2009; Vandeperre et al. 2014), and therefore would be expected to be at relatively low abundance in the Project Area which is predominantly exposed to the Labrador Current.

Table 6.4 summarizes the species and distribution of finfish of commercial, recreational, or Aboriginal (CRA) value likely to occur in the Project Area. The species list is primarily determined using the DFO RV surveys. The RV survey includes sampling of fish and invertebrates using a bottom otter trawl. These surveys are the primary data source for monitoring trends in species distribution, abundance, of finfish in the region. Finfish SAR and SOCC (which have the potential to be caught in a CRA fishery) are discussed in Section 6.1.8. Additional general life history, diet, and distribution information on these and other species is available within the Eastern Newfoundland SEA (Amec 2014). Figures illustrating the distribution of commercial species are shown in Section 7.2.

DFO RV survey data for 2007 to 2017 was analyzed for the Project Area (DFO 2017). The results of the RV survey indicate deepwater redfish, capelin, Northern sand lance, American plaice, yellowtail flounder, Greenland halibut, and Atlantic cod represent the most abundant species (average number of fish caught from 2007-2017) in the Project Area. The spatial distribution of the seven most abundant fish species in the Project Area are shown in Figures 1 to 7 (Updated EIS Figures 6.6 to 6.12).

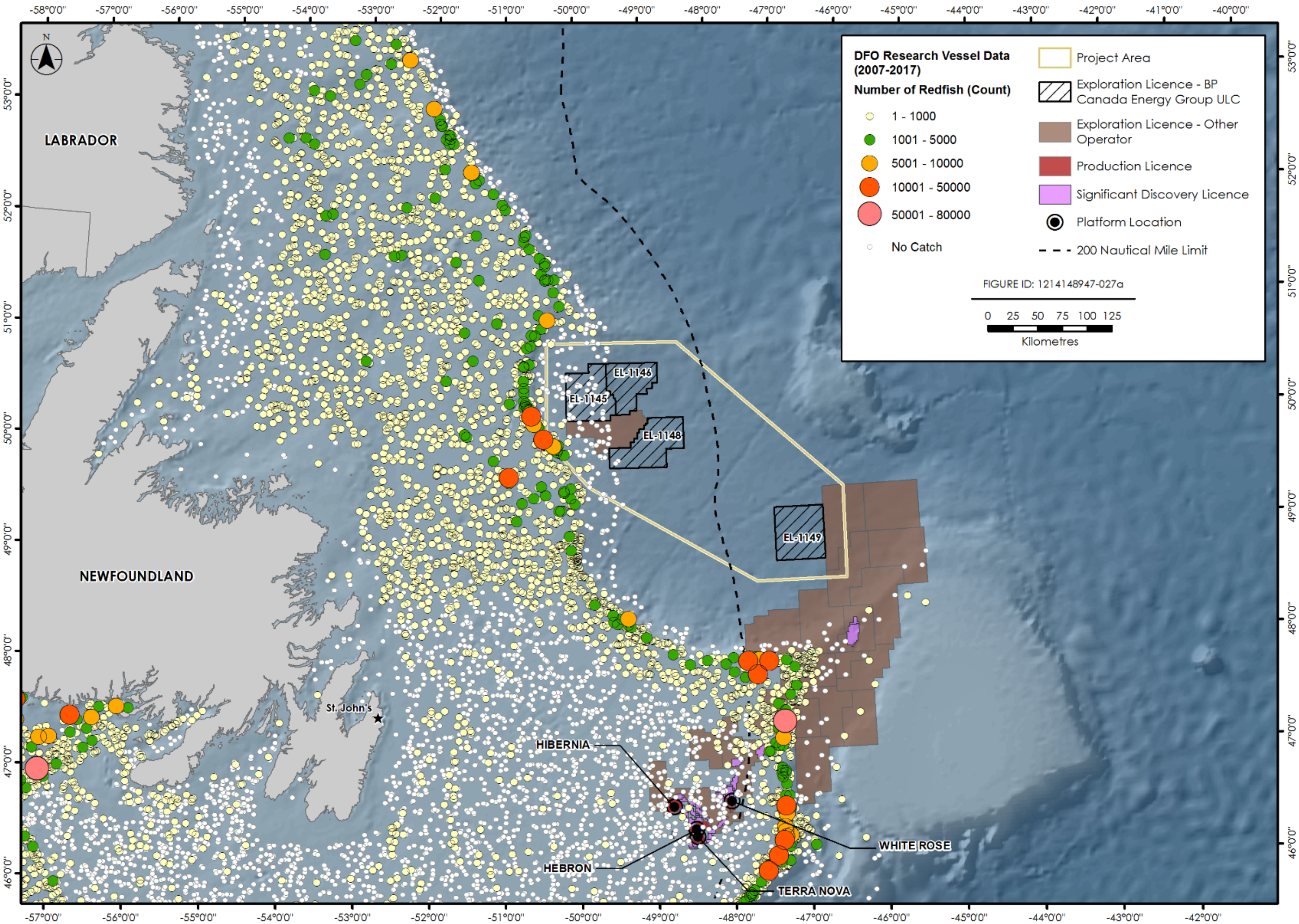


Figure 1 **Figure 6.6 (Updated): DFO Research Vessel Data for Redfish (2007-2017)**

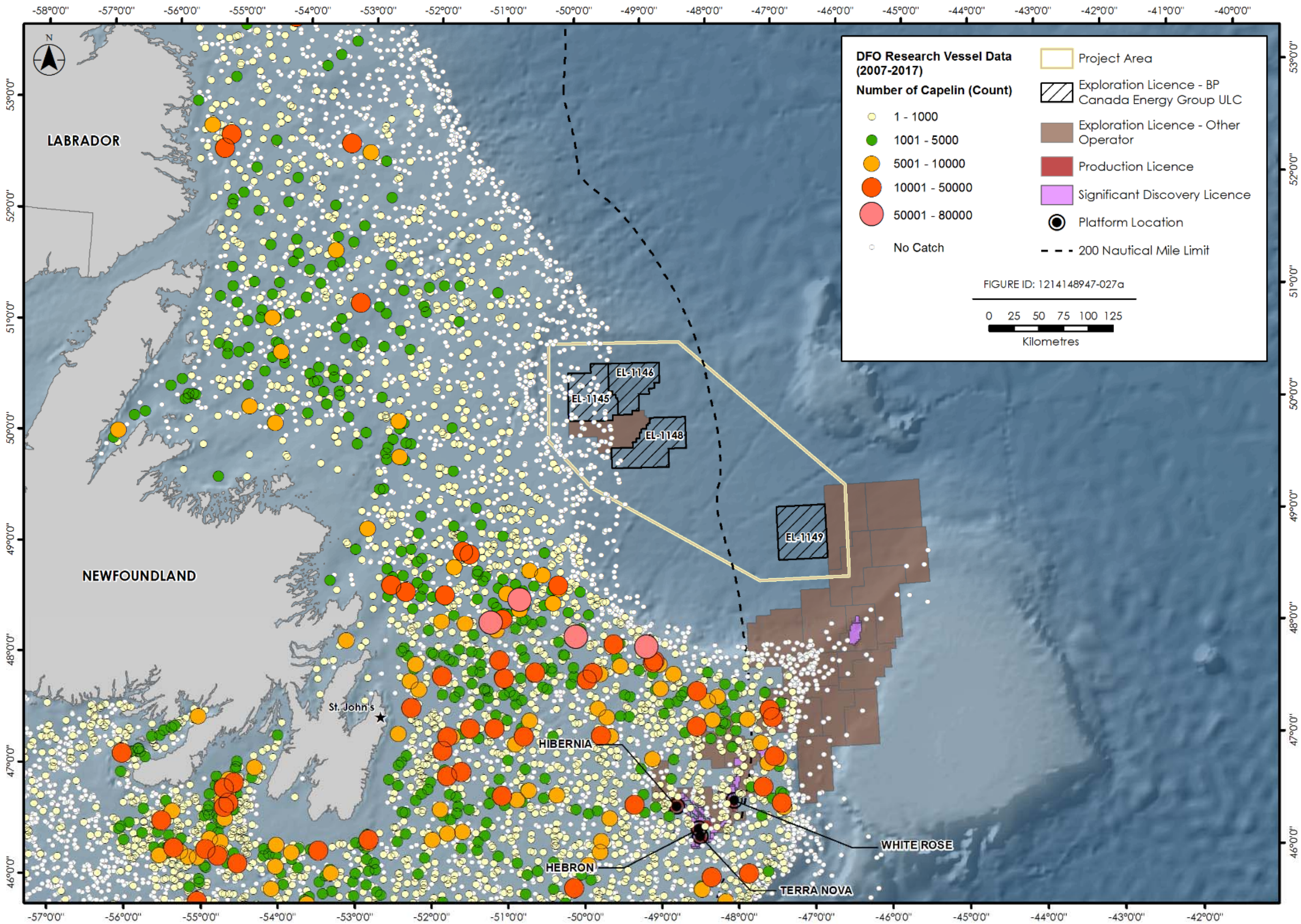


Figure 2 **Figure 6.7 (Updated): DFO Research Vessel Data for Capelin (2007-2017)**

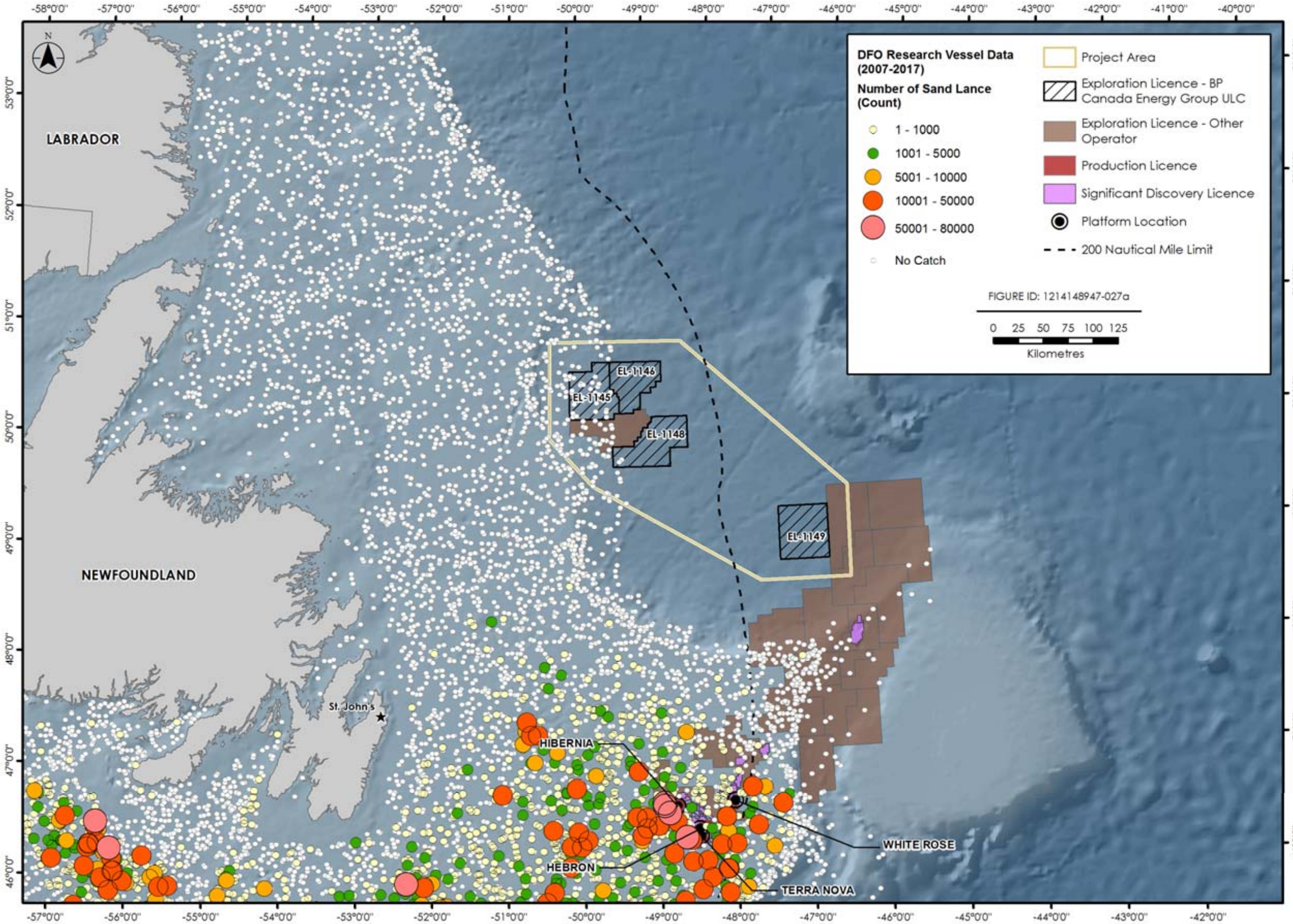


Figure 3 **Figure 6.8 (Updated): DFO Research Vessel Data for Sand Lance (2007-2017)**

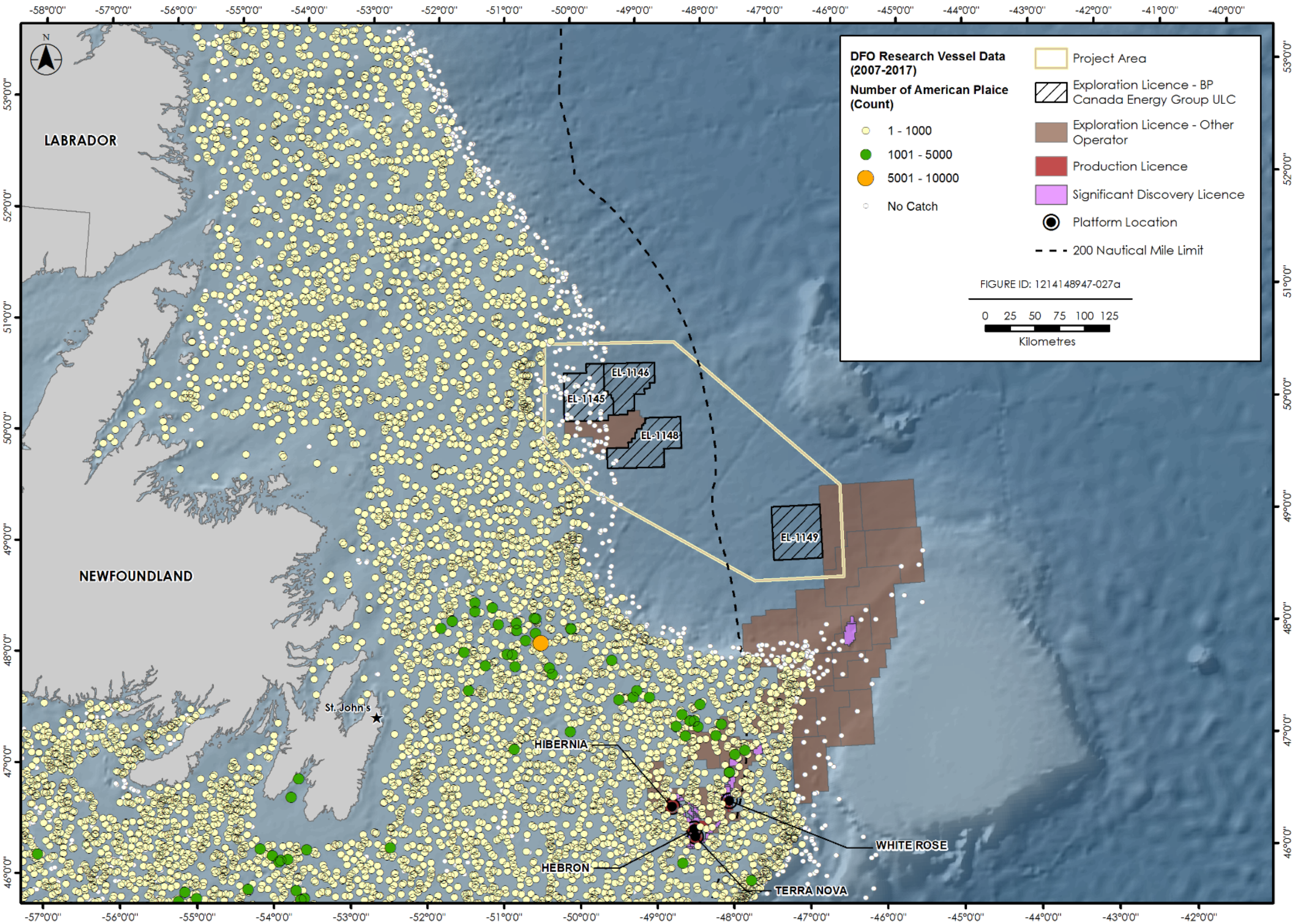


Figure 4 **Figure 6.9 (Updated): DFO Research Vessel Data for American Plaice (2007-2017)**

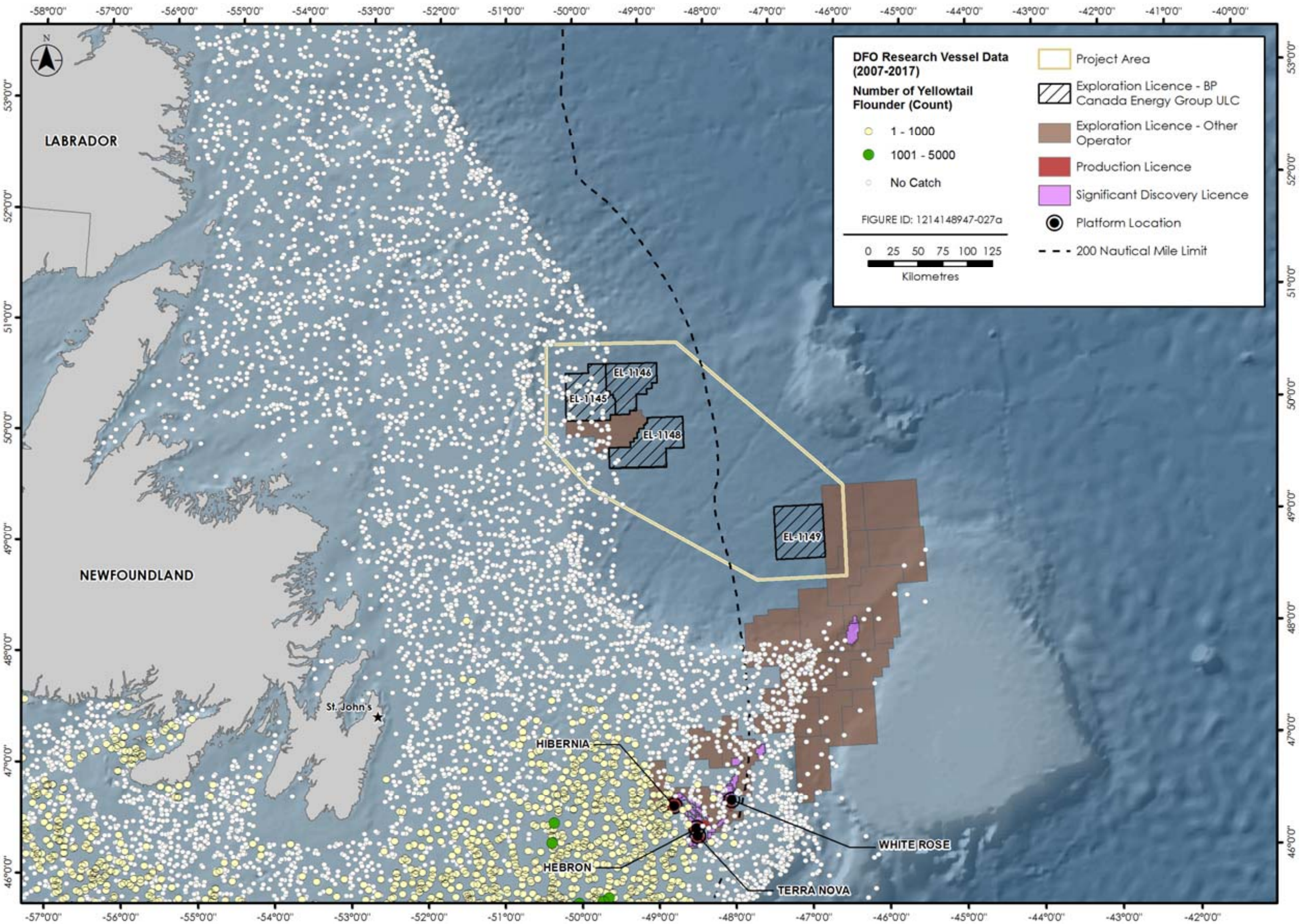


Figure 5 **Figure 6.10 (Updated): DFO Research Vessel Data for Yellowtail Flounder (2007-2017)**

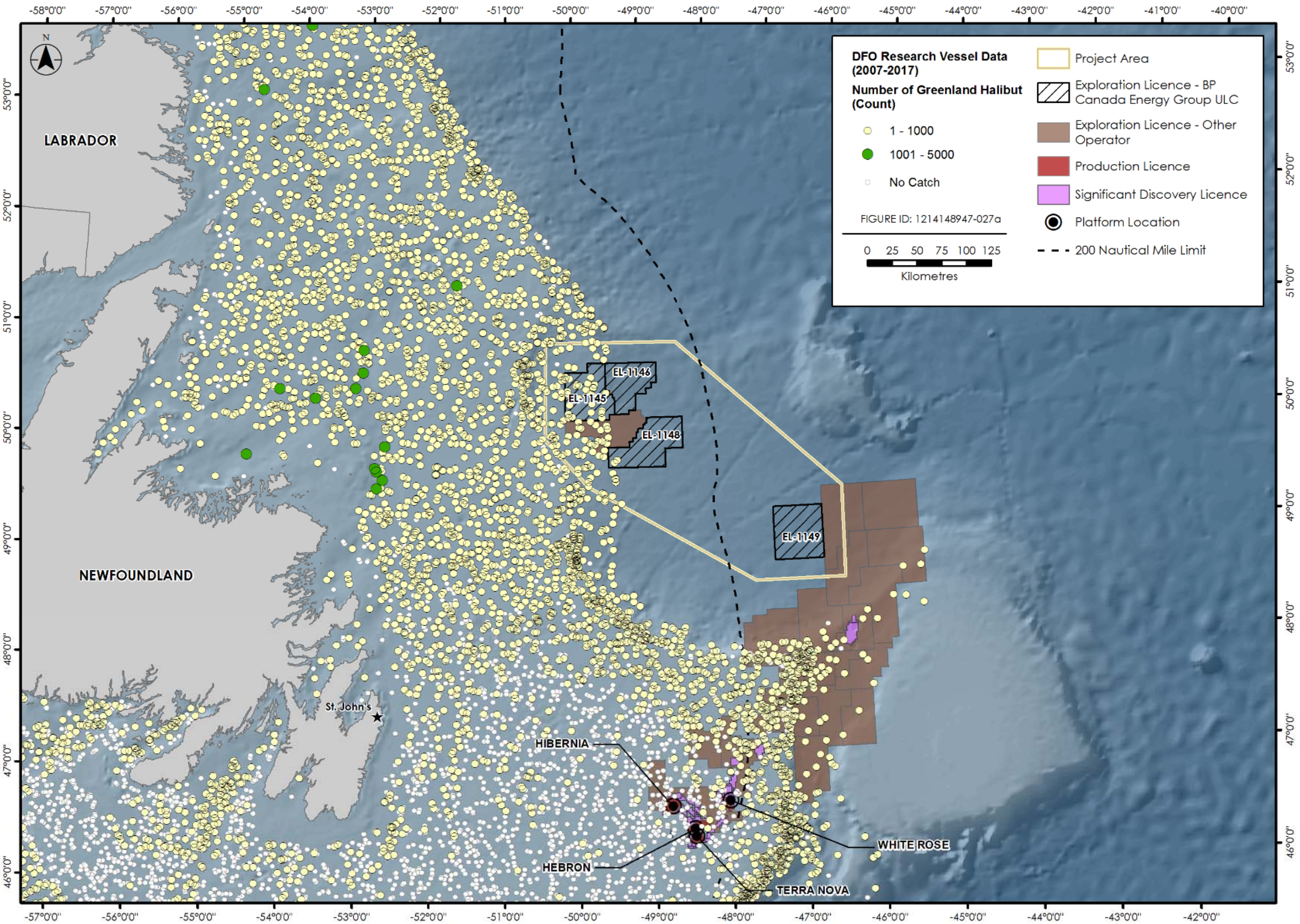


Figure 6 **Figure 6.11 (Updated): DFO Research Vessel Data for Greenland Halibut (2007-2017)**

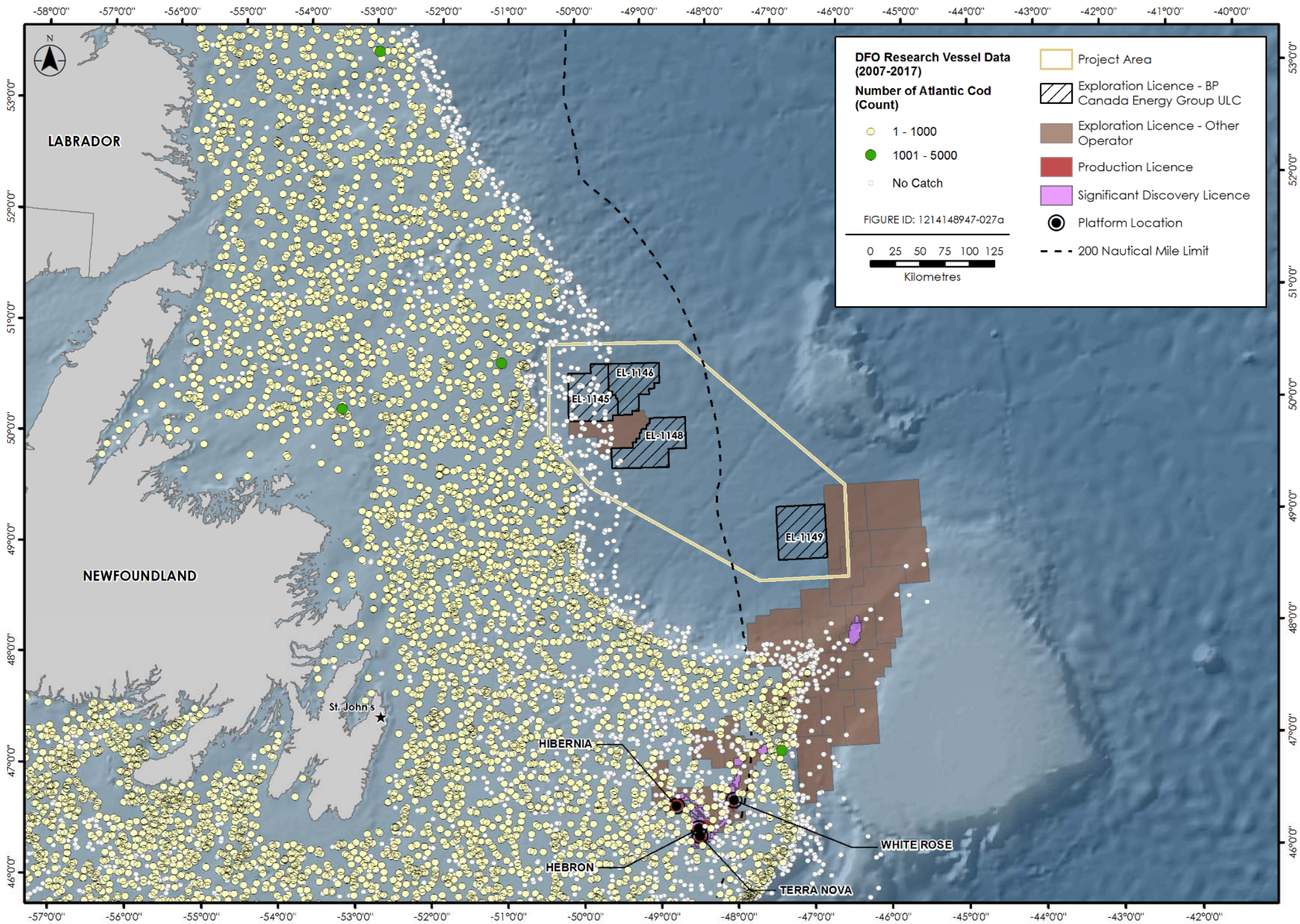


Figure 7 **Figure 6.12 (Updated): DFO Research Vessel Data for Atlantic Cod (2007-2017)**

A variety of spawning strategies are pursued by fish in the Project Area, including broadcast spawning, oviviparous spawning, and depositing eggs in demersal cases. Many resident benthic species are found within and around the Project Area, though several leave the area to spawn in distant places that include freshwater rivers (e.g., Atlantic salmon), beaches (e.g., capelin), or warm temperate or tropical waters (e.g., large pelagics such as tunas and sharks). For poorly studied deep slope or abyssal species, many elements of their reproductive biology are yet to be documented. A summary of spawning seasons and known spawning areas for fish species with a high potential to be found in the Project Area (EIS Table 6.4) is provided in Table 1 (Updated EIS Table 6.5). While a large number of fish species are spring and early summer spawners, a few (such as Greenland halibut) are winter spawners.

Table 1 Table 6.5 (Updated): Spawning Periods and Locations for Fish with High Potential to be Found Within the Project Area

Common Name	Scientific Name	Spawning Time												Known Spawning Locations
		J	F	M	A	M	J	J	A	S	O	N	D	
Deepwater redfish	*Sebastes mentella*			■	■	■								April-May southern Labrador shelf, Newfoundland shelf and Grand Banks, March-April Flemish Cap[1]
Capelin	*Mallotus villosus*					■	■	■	■					Spawns in coastal areas and beaches in Newfoundland and Labrador[2]
Northern sand lance	*Ammodytes dubius*	■	■	■	■							■	■	Spawns in in relatively shallow, sandy bottom offshore environments such as the Grand Banks[3,4]
American plaice	Hippoglossoides platessoides				■	■								Spawning occurs across the species' distribution on sandy benthic habitats that are typically between 100-300 m in depth[5]
Yellowtail flounder	*Limanda ferruginea*					■	■	■						Spawning occurs across the species' distribution on sandy to muddy benthic habitats that are typically between 100-300 m in depth[6]
Greenland halibut	*Reinhardtius hippoglossoides*			■	■	■								Spawning thought to occur in the deep waters (650-1000 m) of the Davis Strait[7,8]

Common Name	Scientific Name	Spawning Time												Known Spawning Locations
		J	F	M	A	M	J	J	A	S	O	N	D	
Atlantic cod	*Gadus morhua*				■	■	■	■	■	■	■			Spawning occurs at depths ranging from 10s to 100s of meters. Cod are known to spawn over a broad distribution of inshore, nearshore, and offshore waters near Newfoundland and Labrador[9]

Note: Shading indicates spawning periods.
Sources: [1]Vaskov 2005; [2]Purchase 2018; [3]Rose 2007; [4]Scott and Scott 1988; [5]Committee on the Status of Endangered Wildlife in Canada (COSEWIC) 2009; [6]Pitt 1970; [7]DFO 1993; [8]Bowering and Nedreaas 2000; [9]COSEWIC 2010

References:

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1.5.8 Information Requirement: IR-18

External Reviewer ID:

KMKNO-23

Reference to EIS:

Section 6.1.6.1; Section 8.3.3.1; Section 11.3.3.1

Context and Rationale

In reference to sensitive benthic habitat-forming species, corals, sponges and sea pens are present in the West Orphan Basin, in particular in Exploration Licence 1145 and 1148. Section 8.3.3.1 of the EIS states as a result of the accumulation of drill solids on the seafloor, it is possible that some species may die from the mass of the discharges crushing them, while others may die because they cannot penetrate through the deposited layer that is burying them.

Section 8.3.3.1 of the EIS states sediment thickness of 6.5 mm could extend 128 m from the discharge point and could cover an area up to 0.69 hectares per well; coral and sponges within this localized area may be affected by the deposition of drilling waste.

The EIS does not discuss the potential for deposited drilling waste discharges to result in permanent habitat change (i.e. hard substrate from concrete discharges where soft substrate may have been previously present or soft substrate from drill cuttings where hard substrate may have been previously present). This potential change in habitat could potentially inhibit the populations from repopulating the area around the wellhead for the area to which cuttings disperse.

Section 8.3.3.1 of the EIS concludes that benthic mortality rates as a result of these discharges are not predicted to result in irreversible changes to local populations, although it is acknowledged that there are fewer data on effects of drilling waste on corals and sponges, and recovery rates for these communities are expected to be longer. No further information is presented on how the habitat changes could be reversed.

Specific Question of Information Requirement

Given the location of the Exploration Licences included in the Project, and noting the special areas, describe the mechanisms by which the changes in habitat for corals and sponges could be reversible around a wellsite after drilling cuttings have settled.

Discuss the potential for permanent habitat loss for corals and sponges in the Project Area.

Response

Larsson and Purser (2011) performed burial studies on *L. pertusa* to compare the sensitivity of the species with established threshold levels for sediment burial outlined by Smit et al. (2008). Smit et al. (2008) set a probable no net effect threshold (PNET) of 6.3 mm in which 95% of species were expected to not be impacted by burial. Larsson and Purser (2011) exposed *L. pertusa* to both 6.5 mm and 19 mm of sedimentation to test the species sensitivity to burial under 6.5 and 19 mm of WBM.

Larsson and Purser (2011) observed that *L. pertusa* may suffer damage from burial of 6.5 mm of drill cuttings, although polyp mortality at this threshold was only 0.5%. However, at this threshold it was also observed that 42% of the coral fragment tissue was smothered resulting in a decrease in proportion skeleton covered by living tissues. Loss of these tissues can be detrimental to the species since fouling organisms can colonize bare skeleton. When *L. pertusa* was exposed to 19 mm of sediment, polyp mortality was observed to be 4%. In the study it was illustrated that *L. pertusa* was able to clear and reject sediment particles from its tissues. These experiments took place in the absence of flow; in a real-life scenario ocean currents would aid corals in the clearing of sediment from their tissues and as a result, effects may be less pronounced.

As discussed in Section 8.3.3.1 of the EIS, in the eastern Newfoundland offshore, the results of Environmental Effects Monitoring (EEM) at three producing oilfields (Hibernia, Terra Nova, White Rose) have shown that sediments have been mostly non-toxic to Microtox, laboratory amphipods, and juvenile polychaetes (Suncor Energy 2011; HMDC 2012; Husky Energy 2013). EEM results at the Hibernia and Terra Nova oilfields have shown no clear association between Microtox toxicity and indices of oil and gas activities, and evidence suggests that any observed Microtox responses were related to natural factors (Suncor Energy 2011; HMDC 2012).

Additionally, EEM programs at production drilling sites offshore Nova Scotia (Deep Panuke and Sable Offshore Energy Project) have consistently observed less adverse effects than predicted. No toxic responses (as demonstrated by amphipod mortality testing) have been observed at any site since 2003 (Canada-Nova Scotia Offshore Petroleum Board [CNSOPB] 2011). Of the 24 metal chemical test parameters monitored in sediment at Sable Offshore Energy Project, elevated concentrations were only detected for total petroleum hydrocarbon and barium (from the drill muds and cuttings piles deposited on the seafloor), and these only extended out to 500 m and returned to baseline concentrations within four years post-drill (CNSOPB 2018). Relative to development drilling, exploratory drilling is generally considered to present less risk of impact to benthic species and habitats, with fewer associated activities, smaller seabed footprints and shorter timeframes.

While the effects are not expected to be permanent, these species are generally slow growing and long lived, and recovery after disturbance may take a decade or more. Drill cuttings sedimentation is estimated to be relatively low for this Project. This, combined with mitigation to reduce potential effects on corals/sponges (see response to IR-12 for details), indicates that effects will not likely result in permanent habitat loss.

Additionally, wellheads that are not removed from the seafloor after plugging and abandonment may provide localized increased habitat structure in a relatively barren and soft bottom habitat. Deep-sea habitats are generally limited by available areas for corals and sponges to colonize and wellhead structures may provide a stepping stone for range expansion.

References

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Husky Energy. 2013. White Rose Environmental Effects Monitoring Program 2012. Prepared by Stantec Consulting Ltd. for Husky Energy, St. John's, NL.

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Suncor Energy. 2011. 2010 Terra Nova Environmental Effects Monitoring Program. Prepared by Stantec Consulting Ltd. for Suncor Energy Inc., St. John's, NL.

1.5.9 Information Requirement: IR-19

External Reviewer ID:

KMKNO-24

Reference to EIS:

Section 8.3.3.2

Context and Rationale:

Section 8.3.3.2 of the EIS states drilling activities and the dynamic positioning activity of the mobile offshore drilling unit may affect the quality of the underwater acoustic environment for marine fish. The potential environmental effects of underwater sound from project activities on marine fish is discussed however, there is no discussion of effects on sedentary or invertebrate or fish species with low motility.

KMKNO identified references that should be considered in an updated effects analysis.

<u>References</u>

Edmonds, N.J., Firnin, C.J., Goldsmith, D., Faulkner, R.C., and Wood, T. 2016. A review of crustacean sensitivity to high amplitude underwater noise: Data needs for effective risk assessment in relation to UK commercial species. Marine Pollution Bulletin, 108(1-2): 5-11. ISSN 0025-326X, doi.org/10.1016/j.marpolbul.2016.05.006.

Griffiths, J.R., Kadin, M., Nascimento, F.J., Tamelander, T., Törnroos, A., Bonaglia, S., Bonsdorff, E., Brüchert, V., Gårdmark, A., and M. Jämström. 2017. The importance of benthic-pelagic coupling for marine ecosystem functioning in a changing world. Global Change Biology 23: 2179-2196. Doi: 10.1111/gcb.13642.

Hawkins, A.D., Pembroke, A.E., and Popper, A.N. 2014. Information gaps in understanding the effects of noise on fishes and invertebrates. Rev. Fish Biol. Fish. 25, 39e64. Doi:10.1007/s11160-014-9369-3.

Popper, A.N., and Hawkins, A.D. 2018. The importance of particle motion to fishes and invertebrates. The Journal of the Acoustical Society of America. 143:470. doi: 10.1121/1.5021594.

Roberts, L., Cheeseman, S., Elliott, M., and Breithaupt, T. 2016. Sensitivity of *Pagurus bernhardus* (L.) to substrate-borne vibration and anthropogenic noise. Journal of Experimental Marine Biology and Ecology, 474: 185-194. ISSN 0022-0981, doi.org/10.1016/j.jembe.2015.09.014.

Specific Question of Information Requirement:

Discuss the potential adverse environmental effects of underwater sound from project activities to sessile/sedentary epifauna and slower moving lower motility invertebrate and fish species.

Update the effects predictions, and proposed mitigation measures and follow-up, if required.

Response:

There is some evidence of physical, behavioural, and physiological effects to lower motility invertebrate species from underwater pressure levels (Carroll et al. 2017; Edmonds et al. 2016), and/or particle motion that accompanies the transmission of sound (Popper and Hawkins 2018). However, there remains substantial gaps in understanding effects of sound pressure levels and/or particle motion on fish and invertebrates. Existing information is not developed to the point that threshold sound exposure levels for sound pressure or particle motion have been developed for these marine fishes (Popper et al. 2014; Popper and Hawkins 2018). Therefore, in absence of more developed scientific information, the EIS assumes the threshold levels for invertebrates are consistent with the existing recommendations for fishes. With respect to organisms with low motility, it is recognized that these organisms are likely to be impacted by sound from vertical seismic profiling, drilling, and dynamic positioning activities to a greater extent than organisms who can behaviourally respond more quickly. However, given the small benthic footprint exposed to these sound stressors, it is not expected that low motility organisms will be affected by the Project at the population level. No changes are required to the effects predictions, proposed mitigation measures or follow-up as presented in the EIS.

References:

Carroll, A.G., R. Pzeslawski, A. Duncan, M. Gunning and B. Bruce. 2017. A critical review of the potential impacts of marine seismic surveys on fish & invertebrates. Marine Pollution Bulletin, 114: 9-24.

Edmonds, N.J., C.J. Firnin, D. Goldsmith, R.C. Faulkner and T. Wood. 2016. A review of crustacean sensitivity to high amplitude underwater noise: Data needs for effective risk assessment in relation to UK commercial species. Marine Pollution Bulletin, 108(1-2): 5-11. ISSN 0025-326X, doi.org/10.1016/j.marpolbul.2016.05.006.

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1.5.10 Information Requirement: IR-20

External Reviewer ID:

N/A

Reference to EIS:

Section 8.1.3

Context and Rationale:

Sections 8.1.3, 9.1.3 and 10.1.3 of the EIS state that the assessment of Project-related effects on marine fish and fish habitat, birds and marine mammals and sea turtles focused on the potential change in risk of mortality or physical injury, and potential change in habitat use or quality.

Section 4.3 of the EIS Guidelines states that in describing and assessing effects to the physical and biological environment, the proponent will take an ecosystem approach. While fish mortality or injury and potential changes in habitat quality are components, the environmental effects analysis did not consider other ecosystem components such as changes in abundance, community structure, or changes in food availability or quantity. The environmental effects of the Project on defined valued components requires an analysis of ecosystem components such as abundance, community structure, and changes in food availability or quantity.

Specific Question of Information Requirement:

Provide the rationale for the selection of a change in risk of mortality or injury and potential change in habitat use or quality as the basis of the effects analysis and how this this is consistent with the ecosystem approach to environmental assessment required described in the Agency's EIS guidelines.

Discuss the applicability of other project-related effects and pathways and why they were excluded, from the effects assessments. Where gaps in the analysis are identified e.g. potential for changes in food availability and quantity for marine fish and fish habitats, migratory birds, and marine mammals and sea turtles, update the analysis.

Response:

It is acknowledged that an environmental effects analysis requires an ecosystem approach. An ecosystem approach is a conceptual framework that promotes environmental effects analysis to consider all components of the ecosystem. The EIS categorizes potential effects as either the potential change in risk of mortality or physical injury, and potential change in habitat use or quality for marine fish, marine and migratory birds, and marine mammals and sea turtles in the ecosystem. At face value, these categories may seem overly simplistic within the context of an ecosystem approach; however, changes to mortality risk and suitable habitat availability form the backbone of assessing potential changes in the community ecology of the entire ecosystem. The goal of an EIS is to define broad categories of Project-related effects that can link Project-related activities to Project-related measurable effects to assist with Project planning and decision-making. In the EIS, the measurable parameters are defined in terms of population-level effects. An analysis focused on the identification and mitigation of population-level effects to all species within the ecosystem based on mortality and habitat availability is inherently considering changes in abundance, community structure, or changes in food availability or quantity. Therefore, an implicit ecosystem approach has been applied to the effects assessment in this EIS.

The measurable parameters related to fish injury as considered in the risk analysis of the potential environmental effect of the project are discussed in the response to CL-05.

1.5.11 Information Requirement: IR-21

External Reviewer ID:

DFO-12

Reference to EIS:

Section 15.5;
Section 15.5.1.3

Context and Rationale:

Section 15.5 of the EIS states that a spill of synthetic-based mud may occur from the mobile offshore drilling unit or the marine riser during the project. Potential effects of a synthetic-based mud spill are discussed in Section 15.5.1.3 of the EIS, which states that change in risk of mortality or physical injury following a spill of synthetic-based mud would likely be restricted to smothering effects on immotile individual and benthic prey species within up to approximately one kilometre from the spill site.

The EIS does not discuss mitigation measures for slow-growing and long-lived species of large benthic organisms, such as sponges and corals with respect to the potential for smothering following a spill of synthetic-based mud. Fisheries and Oceans Canada has advised that adverse effects, such as smothering, can be mitigated or avoided with appropriate set-back distance from sensitive benthic species.

Specific Question of Information Requirement:

Taking into consideration the results of synthetic based muds spill modelling, discuss the potential set back distances of well sites planned to protect benthic habitat from a potential spill of synthetic based mud.

Response:

Setbacks to protect sensitive benthic habitat will be determined in consultation with the C-NLOPB based primarily on predictive modelling of routine discharges and emissions and the proximity of corals and sponges to the proposed wellsite.

The footprint of deposition from a spill of SBM will depend on a variety of factors including the specific spill scenario (e.g., spill volume, number and diameter of release orifices, the rate of release, type of drilling fluid, mud density, depth of release), location of the spill, water depth, and time of year. The EIS referenced SBM spill modelling conducted for the Flemish Pass Exploration Drilling Project (Nexen Energy 2017) which concluded that the maximum spill distance from the drilling site would range from 264 m (in the summer) to 982 m (in the fall). This reference was intended to provide a basis for a semi-quantitative assessment of effects from an SBM spill.

Using an effects threshold of 6.5 mm sediment deposition (Smit et al. 2006), mud cuttings dispersion modelling predicts the maximum extent that these sediment deposition thicknesses could extend is approximately 128 m from a wellsite in West Orphan Basin and 55 m from a wellsite in East Orphan Basin.

BP is adopting a 500 m transect length for pre-drill surveys that will be conducted at each well in the Project Area immediately prior to spud.

On June 22, 2018, while drilling BP's exploration well Aspy D-11 offshore Nova Scotia, approximately 136 m^3 of SBM was discharged from a loose connection in the mud boost line (auxiliary line which pumps drilling mud into the riser to lift drill cuttings from the well). Following this incident, BP initiated an environmental study to determine the extent of environmental effects from the SBM release. Video footage of the seabed and sediment sampling following the unplanned release showed sedimentation on the seafloor which was similar in nature and extent to that predicted in modeling and did not exceed what would be expected from routine drilling discharges. Refer also to the response to IR-84.

References:

Nexen Energy ULC. 2017. Flemish Pass Exploration Drilling Project. Prepared by Amec-Foster Wheeler, St. John's, NL.

Smit, M.G.D., J.E. Tamis, R.G. Jak, C.C Harman, C. Kjelilen, H. Trannum and J. Neff. 2006. Threshold levels and risk functions for non-toxic sediment stressors: burial, grain size changes and hypoxia. Summary, Environmental Risk Management System, Report 9, THO 2006-BH0046/A Open, 2006.

1.5.12 Information Requirement: IR-22

External Reviewer ID:

KMKNO-25

Reference to EIS:

Section 2.10;
Section 8.3.3;
Section 8.5

Context and Rationale:

Sections 2.10, 8.3.3.2 and 8.5 of the EIS provide information on the imagery-based seabed surveys that will be conducted during the project. While the proponent states that there will be pre-drill imagery-based seabed survey, the KMKNO noted that the commitment to conduct a post- drill imagery-based survey is unclear, based on the following:

- Section 2.10 states “A seabed survey will be conducted at the end of the drilling program using an ROV to survey the seabed for debris.”;
- Section 8.5 states that “BP plans to conduct a visual survey of the seafloor using an ROV after drilling activities to assess the visual extent of sediment dispersion and validate drill waste modelling predictions.”; and
- Section 8.3.3.2 states that “BP will conduct an imagery-based seabed survey at the proposed wellsite(s) to confirm the absence of shipwrecks, debris on the seafloor, unexploded ordnance, and sensitive environmental features, such as habitat-forming corals or species at risk… This survey will also serve to provide baseline data for coral and sensitive benthic habitat that may be present and be used to inform discussions on potential follow-up and monitoring with respect to drill waste discharges.”

Clarification is required related to post-drilling follow up and monitoring proposed in the EIS.

Specific Question of Information Requirement:

Provide clarification as the follow-up and monitoring to be conducted post-drilling, including:

- clarify whether the imagery-based survey proposed at the end of the drilling program for debris is the same survey that will be used to assess the extent of sediment dispersion;
- confirm whether the visual survey of the seafloor using a remotely operated vehicle to assess the extent of sediment dispersion will be completed for each wellsite drilled; and
- describe how the extent of sediment dispersion will be measured and how modelling predictions will be validated.

Response:

In accordance with the Drilling and Production Guidelines (Canadian-Newfoundland and Labrador Offshore Petroleum Board [C-NLOPB] and Canada-Nova Scotia Offshore Petroleum Board 2017), following well abandonment, BP will conduct a post-drilling imagery-based survey to confirm that the seafloor is cleared of any material or equipment that could interfere with other commercial uses of the sea. This survey will be conducted using a remotely-operated vehicle. This survey is required for every well that is drilled.

In addition, for the first well in an exploration licence, and for any well where drilling is undertaken in an area determined by coral and sponge surveys to be sensitive benthic habitat, or adjacent to a special area designated as such due to the presence of corals and sponges, BP is proposing to conduct a visual survey using an ROV to assess the extent of sediment deposition relative to predictive modelling. This survey may or may not be conducted concurrently with the post-drilling survey required by the C-NLOPB to confirm clearance of debris. The extent of sediment deposition will be assessed qualitatively, noting changes in visual appearance of the seafloor, including animal tracks if present. This visual approach to determine relative extent of sediment deposition relative to modelling predictions has been used successfully in two recent exploration drilling programs offshore Nova Scotia (the Shelburne Basin Venture Exploration Drilling Project and the Scotian Basin Exploration Project) (Stantec Consulting Ltd. 2016, 2017, 2019). The specific details of the follow-up program will be determined in consultation with the C-NLOPB and Fisheries and Oceans Canada in consideration of the pre-drill survey results.

References:

C-NLOPB (Canadian-Newfoundland and Labrador Offshore Petroleum Board) Canada-Nova Scotia Offshore Petroleum Board. 2017. Drilling and Production Guidelines. 136 pp.

Stantec Consulting Ltd. 2016. Final Report: Shelburne Basin Venture Exploration Drilling Project: Cheshire L-97A Sediment Deposition Survey Report. Prepared for Shell Canada Limited. December 2016. Available at: https://www.cnsopb.ns.ca/sites/default/files/pdfs/shelburnecheshire_sedimentdepositionreport_20161215_final.pdf

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Stantec Consulting Ltd. 2019. Final Report: Scotian Basin Exploration Drilling Project – Aspy D-11A Well Sediment Deposition Survey Report. Prepared for BP Canada Energy Group ULC. February 2019. Available at: https://www.bp.com/content/dam/bp-country/en_ca/canada/documents/NS_Drilling_Pgm/Sediment-Deposition-Survey-Report.pdf

1.6 Marine Mammals and Sea Turtles

1.6.1 Information Requirement: IR-23

Reference to EIS:

Section 10.3.3.2

Context and Rationale:

The Local Area Assessment is defined in the EIS as the Project Area and adjacent areas where Project-related environmental effects are reasonably expected to occur based on available information, including effects thresholds, predictive modelling, and professional judgement. The Local Assessment Area for marine mammals and sea turtles is defined as a 150 kilometre radius around the Exploration Licences as well as the associated vessel and aircraft routes to the Project Area. Figure 10.1 however, shows the 150 kilometre radius buffer to be from the Exploration Licences only. Section 10.3.3.2 of the EIS indicates that sound modelling for the Project shows that behavioural effects could occur for marine mammals up to approximately 47 to 61 kilometres from the MODU, therefore the rationale for application of 150 kilometre radius is not clear.

Specific Question of Information Requirement:

Explain the rationale for applying a 150 kilometre buffer in defining the Local Assessment Area for marine mammals and sea turtles and clarify whether the buffer is only around the Exploration Licences (or also supply vessel and aircraft routes).

Response:

The 150 km buffer used for the Local Assessment Area (LAA) was selected as a very conservative (i.e., precautionary) distance and was based on the underwater sound modelling (Zykov 2016) conducted for BP Canada Energy Group ULC's (BP) Scotian Basin exploration drilling project (BP 2016), which predicted that sound levels were predicted to decrease to below 120 dB re 1 µPa RMS SPL at distances >150 km from the mobile offshore drilling unit (MODU) during operations in winter (i.e., when sound propagates furthest due to environment conditions). The LAA for marine mammals and sea turtles in the Scotian Basin Exploration Drilling Project EIS assumed a 150 km buffer around the exploration licences and this conservative approach was also adopted for the Newfoundland Orphan Basin Exploration Drilling Program EIS. However, it should be noted that transmission loss modelling conducted for the Newfoundland Orphan Basin Exploration Drilling Program predicted a much smaller radial extent for a 120 dB re 1 µPa RMS SPL threshold of up to 40 km from the MODU.

The 150 km buffer was drawn around the exploration licences (ELs) since that is where exploration drilling could occur. However, the LAA also includes the potential vessel and helicopter routes via St. John's and vessel route to Bay Bulls, the area between those routes, and a minimum outer buffer of 10 km.

It is important to realize that sound criteria, particularly for behavioural responses, should only be used as a guide for effects predictions and the 150 km buffer around the ELs to define the LAA for marine mammals and sea turtles represents an ultra-conservative footprint for assessing effects (refer to the response to IR-49 for a more accurately defined zone of influence).

References:

BP Canada Energy Group ULC. 2016. Scotian Basin Exploration Drilling Project Environmental Impact Statement. Volume 1: Environmental Impact Statement. Prepared by Stantec Consulting Ltd., Halifax, NS.

Zykov, M.M. 2016. Modelling Underwater Sound Associated with Scotian Basin Exploration Drilling Project: Acoustic Modelling Report. JASCO Document 01112, Version 2.0. Technical report by JASCO Applied Sciences for Stantec Consulting Ltd. February 2010.

1.6.2 Information Requirement: IR-24

External Reviewer ID:

N/A

Reference to EIS:

Section 6.3.2;
Section 6.3.3;
Section 6.3.4;
Section 6.3.5;
Section 6.3.7

Context and Rationale:

Section 6.3 of the EIS provides baseline information on marine mammals and sea turtles, including species at risk, but does not discuss key habitats or movement corridors within the Project Area. The EIS does not discuss why marine mammal and sea turtle species are using the Project Area and what times of year it is used.

Section 6.3.8 of the EIS states that "based on the Fisheries and Oceans Canada sightings database, the southern portion of the Project Area appears to host a more concentrated proportion of the marine mammals recorded within the Project Area"; however, the EIS does not consider if this is due to habitat or sample bias.

Specific Question of Information Requirement:

Provide information on key habitats or movement corridors for marine mammals and sea turtles found in the Project Area, as well as on the times of year that they are present. Discuss the reasons why these marine mammal and sea turtle species are found in the Project Area (e.g., feeding, migration).

Discuss why the sightings data that is included in the EIS shows that the southern portion of the Project Area hosts a higher concentration of marine mammals than other areas, including whether there is a sample bias in the data.

Update the effects analysis, if required.

Response:

As discussed in EIS Section 6.3.1, information on marine mammals and sea turtle occurrence in the Project Area is based, in part, on a database maintained by DFO. As stated in the EIS: "Therefore, while these data can be used to indicate what species occur in the Project Area and when they occur, they cannot be used to reliably predict species abundance, distribution, or fine-scale habitat use in the area." The database provides information on which species and when they have been sighted in the Project Area and other parts of the Regional Assessment Area. Other studies which extrapolate existing data to model likelihood of species densities (e.g., Mannocci et al. 2017) have also been referenced to estimate seasonal presence of species in the Project Area. In the absence of systematic studies of marine mammal and sea turtle use of the Project Area, more specific information on key habitats and potential migratory corridors cannot be provided. EIS Tables 6.16 and 6.18 provide general habitat information for marine mammals and sea turtles, respectively. As a reminder, based on available information (absence of visual sightings, satellite tagging data; as summarized in EIS Sections 6.3.7.6 and 6.3.7.7), sea turtles are considered rare in the Project Area.

The Fisheries and Oceans Canada database used to map marine mammal sightings in all likelihood is biased; this cannot be verified given that the database does not include information on survey effort and type (e.g., location of vessel, hours on watch, and incidental sightings versus systematic monitoring). It is likely that the majority of the sightings in the southern portion of the Project Area were made during seismic monitoring programs conducted over multiple years (see for example, Moulton et al. 2005, 2006).

As noted in Section 10.4 of the EIS, the effects determination for marine mammals was made with a moderate level of confidence, in part due to limited baseline data on species use of the Project Area and uncertainty as to whether the Project Area is regularly used for foraging, migratory corridors and/or breeding. BP will conduct marine mammal and sea turtle monitoring during vertical seismic profiling surveys which, although are not intended to be systematic surveys to predict species abundance, distribution or habitat use, will provide some additional information on species presence in the Orphan Basin. Updates to the EIS are not required.

References:

Mannocci, L., J.J. Roberts, D.L. Miller and P.N. Halpin. 2017. Extrapolating cetacean densities to quantitatively assess human impacts on populations in the high seas. Conserv. Biol., 31(3): 601-614.

Moulton, V.D., B.D. Mactavish and R.A. Buchanan. 2005. Marine mammal and seabird monitoring of Chevron Canada Resources' 3-D seismic program on the Orphan Basin, 2004. LGL Rep. SA817. Rep. by LGL Limited, St. John's, NL, for Chevron Canada Resources, Calgary, AB, ExxonMobil Canada Ltd., St. John's, NL, and Imperial Oil Resources Ventures Ltd., Calgary, AB. 90 pp. + Appendices.

Moulton, V.D., B.D. Mactavish, R.E. Harris and R.A. Buchanan. 2006. Marine mammal and seabird monitoring of Chevron Canada Limited's 3-D seismic program on the Orphan Basin, 2005. LGL Rep. SA843. Rep. by LGL Limited, St. John's, NL, for Chevron Canada Limited, Calgary, AB, ExxonMobil Canada Ltd., St. John's, NL, and Imperial Oil Resources Ventures Ltd., Calgary, AB. 109 pp. + Appendices.

1.6.3 Information Requirement: IR-25

External Reviewer ID:

BALAENA-01; DFO-03

Reference to EIS:

Section 6.3.2

Context and Rationale:

The Balaena Institute identified the slope of the Orphan Basin and the Sackville Spur as important areas for cetaceans that appear to have significantly important marine biodiversity. It also stated that these areas are located outside Canada's exclusive economic zone and thus have historically not been included in federal science surveys and reports. Although Northern Bottlenose whales are listed as “uncommon” in Table 6.16 of the EIS, Northern Bottlenose whales have been documented in the Project Area. The Balaena Institute indicated that the Orphan Basin and the Sackville Spur represents important habitat for the species recovery and connectivity between Canadian populations of Bottlenose Whales on the Scotian Shelf and northern Labrador Davis Strait. The Balaena Institute advised that it has recent unpublished studies that would provide additional independent information on the density and distribution of cetaceans in the area.

With respect to the overview of marine mammal and sea turtle occurrence presented in Section 6.3.2 of the EIS, Fisheries and Oceans Canada advised that in addition to the sightings database (1947-2015) that was used to provide information on species occurrence in the Regional Assessment and Project Areas, there are other sightings databases that can be found in the Ocean Biogeographic Information System (OBIS).

Specific Question of Information Requirement:

Taking into consideration information available from the Balaena Institute in the Regional Assessment and Project Areas, and other sightings databases that can be found in the Ocean Biogeographic Information System (OBIS), update the effects analysis and proposed mitigation measures and follow-up program, including significance predictions, as applicable.

Response:

Section 6.3.7.4 of the EIS provided information on northern bottlenose whales via a personal communication from L.J. Feyrer, a Ph.D. candidate at Dalhousie University in the Dr. H. Whitehead Research Lab, and member of the Balaena Institute. BP understands that the Balaena Institute data are not yet published nor have these data been uploaded to the OBIS database. A review of the OBIS database did not yield any additional sightings for species at risk in the Project Area. The EIS acknowledges that northern bottlenose whales, as well as other species at risk, occur in and near the Project Area, which has been further corroborated by a recent Environmental Studies Research Fund acoustic monitoring study (Delarue et al. 2018). This acoustic monitoring study involved the collection of marine mammal vocalization data by 20 acoustic recorders deployed at locations extending from northern Labrador to the southwestern Scotian Slope over an approximate two-year period (September 2015 to July 2017). One of the acoustic recorders (Station 15) was located within the Project Area (within Exploration Licence 1146; in approximately 2,000 m water depth) and another acoustic recorder (Station 19) was located in the southern portion of Orphan Basin (either 45 km or 72 km from the Project Area depending on the year, in approximately 1,500 m water depth). In the Project Area, northern bottlenose whale clicks were detected each month but were not as prevalent as at Station 19, south of the Project Area, where clicks were detected almost daily throughout the year. Fin whales were primarily detected from August and April at Stations 15 and 19 but were assumed to be present year-round. Blue whale vocalizations were detected in the Project Area and in southern Orphan Basin in relatively low numbers during September to January; the acoustic analyses were not able to reliably identify blue whale calls during the summer period. Based on these acoustic data, cetacean species at risk do occur in and near the Project Area during winter and in some cases year-round (Delarue et al. 2018). Table 6.16 in the EIS acknowledged the potential presence of several marine species at risk within the Regional Assessment Area and Project Area, including the northern bottlenose whale, fin whale, and blue whale.

As noted in Section 10.4 of the EIS, the effects determination for marine mammals was made with a moderate level of confidence, in part due to limited baseline data on species use of the Project Area. BP will conduct marine mammal and sea turtle monitoring during vertical seismic profiling surveys which, although not intended to be systematic surveys to predict species abundance, distribution or habitat use, will provide some additional information on species presence in the Orphan Basin. Updates to the EIS are not required.

References:

Delarue, J., K.A. Kowarski, E.E. Maxner, J.T. MacDonnell, and S.B. Martin. 2018. Acoustic Monitoring Along Canada’s East Coast: August 2015 to July 2017. Document Number 01279, Environmental Studies Research Funds Report Number 215, Version 1.0. Technical report by JASCO Applied Sciences for Environmental Studies Research Fund, Dartmouth, NS, Canada. 120 pp. + Appendices.

1.6.4 Information Requirement: IR-26

External Reviewer ID:

DFO-08; DFO-CL-19; KMKNO-34

Reference to EIS:

Section 10.3.3.1

Context and Rationale:

Section 10.3.3.1 of the EIS provides information on the potential effects of sound on marine mammals. Tables 11 and 12 from Matthews et al., 2017 are referenced in Section 10.3.3.1 of the EIS. However, Fisheries and Oceans Canada noted that there are no sound pressure level (SPL) peak threshold values identified in Tables 11 and 12 for non-impulsive sound (i.e., from a drilling platform). The columns in Tables 11 and 12 for peak threshold for injury for a drilling platform are listed as “n/a”. However, Table 10.4 in the EIS provides the acoustic threshold levels for permanent threshold shift onset for dB SPL peak levels for non-impulsive sounds. Fisheries and Oceans Canada indicated that there are no peak SPL threshold levels provided for non-impulsive sounds in National Oceanic and Atmospheric Administration’s marine mammals acoustic technical guidance so it is not clear where values in Table 10.4 of the EIS were derived from.

In addition, it is not clear what the radius of 200 metres in the following statement is based on: “Similarly, modelling results indicate that most marine mammals would have to occur and remain within approximately 200 m of the MODU for a 24-hour period to experience sound levels above the thresholds associated with PTS based on the SEL_{cum} injury (see Tables 11 and 12 in Matthews et al. 2017).” The maximum radius for injury after 24 hours is shown in Tables 11 and 12 as being 3.29 kilometres for high-frequency cetaceans and 230 metres for low-frequency cetaceans.

Specific Question of Information Requirement:

Provide the reference for sound pressure level peak threshold for non-impulsive sounds.

Clarify the maximum radius from the MODU that injury could occur in marine mammals after 24 hour exposure to sound from the MODU.

Update the effects assessment, as applicable.

Response:

Sound pressure level (SPL) peak threshold values for permanent threshold shift (PTS) onset were included in Table 10.4 for non-impulsive sounds to be thorough in light of the following statement in National Marine Fisheries Service (NMFS) (2016, 2018; i.e., footnote to Table 4): “*If a non-impulsive sound has the potential of exceeding the peak sound pressure level thresholds associated with impulsive sounds, these thresholds should also be considered.*“ Tables 11 and 12 in Matthews et al. (2017) included n/a (not applicable) notations for peak SPL for the drilling platform (non-impulsive sound source) because the source level from the modelled platform does not exceed the peak SPL thresholds. To clarify the situation, the following footnote should be added to Table 10.4 in reference to peak SPL values for non-impulsive sound: “*As in*

NMFS (2016, 2018), if a non-impulsive sound has the potential of exceeding the peak sound pressure level thresholds associated with impulsive sounds, these thresholds should also be considered." Note that peak SPL is not commonly used in relation to continuous sound.

The EIS statement, "[S]imilarly, modelling results indicate that most marine mammals would have to occur and remain within approximately 200 m of the mobile offshore drilling unit for a 24-hour period to experience sound levels above the thresholds associated with PTS based on the SEL_{cum} injury (see Tables 11 and 12 in Matthews et al. 2017)" is accurate (most marine mammals are all marine mammal hearing groups except high-frequency) (NMFS 2016, 2018). It is important to keep in mind that predicted modelled values are intended to serve as a guide for impact assessment. The EIS also states that "Cetaceans with high-frequency hearing, such as harbour porpoise, are at somewhat higher risk of incurring PTS in the presence of sound within the hearing frequency range based on lower SPL_{peak} and SEL_{cum} threshold values." The estimated R_{max} value for PTS onset for high-frequency cetaceans (i.e., harbour porpoises) from drilling platform sounds was 1.88 km and 3.29 km at Sites A and B, respectively.

Updates to the effects assessment are not required.

References:

Matthews, M.-N., Z. Alavizadeh, L. Horwich M. Zykov. 2017. Underwater Sound Propagation Assessment: Nexen Energy ULC Flemish Pass Exploration Drilling Project (2018-2028). Rep. by JASCO Applied Sciences, Dartmouth, NS for Amec Foster Wheeler, St. John's, NL. 54 pp. + appendices.

NMFS (National Marine Fisheries Service). 2016. Technical guidance for assessing the effects of anthropogenic sound on marine mammal hearing: Underwater acoustic thresholds for onset of permanent and temporary threshold shifts. US Dept. of Commer., NOAA. NOAA Technical Memorandum NMFS-OPR-55: 178 pp.

NMFS (National Marine Fisheries Service). 2018. 2018 Revision to: Technical Guidance for Assessing the Effects of Anthropogenic Sound on Marine Mammal Hearing (Version 2.0): Underwater Acoustic Thresholds for Onset of Permanent and Temporary Threshold Shifts. US Dept. of Commer., NOAA. NOAA Technical Memorandum NMFS-OPR-59: 167 pp.

1.6.5 Information Requirement: IR-27

External Reviewer ID:

N/A

Reference to EIS:

Section 14.4.1

Context and Rationale:

Section 14.4.1 of the EIS states that the Project Area does not overlap with special areas known to be of particular importance to marine mammals; however, the Orphan Spur Ecologically or Biologically Significant Marine Area overlaps with the Project Area and the Fisheries and Oceans Canada report noted below provides information on high concentrations of marine mammals in the Project Area.

<u>Reference</u>

Fisheries and Oceans Canada. 2017. Identification and Descriptions of Ecologically and Biologically Significant Areas in the Newfoundland and Labrador Shelves Bioregion. Canadian Science Advisory Secretariat, Research Document 2017/013.

Specific Question of Information Requirement:

Confirm the overlap of the Project Area with the Orphan Spur Ecologically or Biologically Significant Marine Area. Discuss why the Orphan Spur was designated as an Ecologically or Biologically Significant Area, taking into consideration the importance of the area to marine mammals. Update the effects analysis, as necessary.

Response:

As shown on Figure 6.30 of the EIS, the Project Area does overlap with the Orphan Spur Ecologically and Biologically Significant Area (EBSA). The Orphan Spur EBSA is recognized as having high biodiversity for corals, fish, marine mammals and sea birds, including several fish species at risk and a variety of corals (DFO 2017). Bycatch data has also shown this area to be important to several species of shark. DFO (2017) notes that female hooded seals are found in the Orphan Spur EBSA from August to September and harp seals forage on the edge of the EBSA during the winter; however, no other specific reference of importance of the EBSA to marine mammals is made. Section 6.3.5 of the EIS acknowledged that harp and hooded seals were considered common in the Project Area and this was taken into account for the effects analysis. No updates to the EIS are necessary.

References:

DFO (Fisheries and Oceans Canada). 2017. Identification and descriptions of Ecologically and Biologically Significant Areas in the Newfoundland and Labrador Shelves Bioregion. Canadian Science Advisory Secretariat, Research Document, 2017/013.

1.6.6 Information Requirement: IR-28

External Reviewer ID:

MTI-12; KMKNO-33; WM-63

Reference to EIS:

Section 10.3.2;
Section 10.3.3.1;
Section 10.3.3.2;
Section 13.3.2;
Section 14.4.4

Context and Rationale:

Section 10.3.2 of the EIS states that during transit to/from the Project Area, platform supply vessels will travel at vessel speeds not exceeding 22 kilometres per hour (12 knots), except as needed in the case of an emergency. In the event that a marine mammal or sea turtle is detected in proximity to the vessel, vessel speed will be reduced to avoid the marine mammal or sea turtle. The KMKNO has requested that vessels be required to reduce speeds to 10 knots when a marine mammal or sea turtle is observed or reported in the vicinity.

Section 10.3.3.1 of the EIS states that "vessel crew will keep watch for marine mammals and sea turtles and reduce speed and/or alter course as appropriate to avoid collision." It is not clear however, whether there would be dedicated marine mammal observers on supply vessels or whether observations would be conducted opportunistically by vessel crew.

Section 10.3.3.1 of the EIS states that the International Whaling Commission advocates for reducing the spatial overlap between high numbers of whales and vessels as the best means to mitigate ship strikes, with vessel speed restrictions as an alternate strategy in areas where spatial separation is not possible. However, the EIS does not indicate whether the proponent intends to implement the mitigation suggested by the International Whaling Commission.

Specific Question of Information Requirement:

Provide additional information on mitigation measures that would be implemented related to supply vessels to avoid ship strikes including:

- the distance from the supply vessel that a marine mammal or sea turtle would need to be for vessel speed to be reduced;
- under what circumstances it may not be possible to travel at the defined safe vessel speed;

- whether dedicated marine mammal observers would be employed on supply vessels or whether vessel crew would be trained to monitor for marine mammals and sea turtles. If it is proposed that vessel crew monitor for marine mammals, describe the training that they would receive and procedures that they would follow (such as opportunistic versus systematic observations, dedicated monitoring times, etc.); and
- whether there would be marine mammal observers on all supply vessels.

Clarify whether the proponent intends to reduce the spatial overlap between high numbers of whales and vessels and, if so, whether any systematic monitoring would take place to determine if high numbers of whales are congregating along platform supply vessel routes. If applicable, define what “high numbers” of whales is considered to be.

Response:

Mitigation measures to be implemented to reduce risk of ship strikes with marine mammals and sea turtles include the following:

- Platform supply vessels (PSVs) will use existing shipping lanes as practicable; where these do not exist, PSVs will follow a straight-line approach to and from the Project Area.
- During transit to / from the Project Area, PSVs will travel at vessel speeds not exceeding 22 km/hour (12 knots), except as needed in the case of an emergency.
- Marine mammal and sea turtle sightings will be recorded opportunistically by vessel crew during PSV transit on each Project PSV.
- In the event that a marine mammal or sea turtle is detected in proximity to the vessel (e.g., within 400 m), vessel speed will be reduced to avoid the marine mammal or sea turtle.

These mitigation measures will be included in the Environmental Protection Plan and the Marine Operations Manual for the Project. These measures will be also be communicated as part of Project induction training for marine crews.

Vessel safety will remain a top priority. In any particular circumstance where implementation of the above mitigation measures presents a safety risk to the PSV crew (e.g., if route deviation or vessel speed reduction presents a navigation hazard), the mitigation may not be implemented.

BP does not intend to designate dedicated marine mammal observers on board the PSVs. As part of contractor oversight reviews conducted by BP over the course of the drilling program, BP will confirm observations are being recorded in marine logs as applicable.

If PSV crews are observing congregations of whales along the PSV routes, the captain may use their discretion to change the transit route to avoid congregating whales.

1.6.7 Information Requirement: IR-29

External Reviewer ID:

N/A

Reference to EIS:

Section 10.3.2

Context and Rationale:

Section 10.3.2 of the EIS states that platform supply vessels will use existing shipping lanes as practicable, and where these do not exist, platform supply vessels will follow a straight-line approach to the Project Area.

Given the location of the Exploration Licences included in the Project and species in the area, consider whether any areas could require avoidance/route alteration by platform supply vessels based on potential effects on marine mammals (e.g., breeding grounds, feeding groups, migration routes).

Specific Question of Information Requirement:

Describe the shipping lanes that exist between the supply base (i.e., St. John's, Bay Bulls or alternative site if under consideration) and the Project Area. Describe whether there would be any circumstances under which a straight-line approach would be altered given potential for effects on marine mammals.

Response:

Vessel traffic routes in the Regional Assessment Area, including transatlantic shipping routes, are concentrated primarily to the south of the Project Area, although there is a common vessel route that originates from St. John's Harbour and passes through the southern portion of the Project Area (dissects northwestern point of EL 1149) (refer to Figure 7.38 of the EIS and Koropatnick et al. 2012). Based on existing knowledge, there have been no specific areas along the shipping transit route to the Project Area that have been identified as marine mammal breeding grounds, feeding concentrations, and/or migration routes. In the event that a marine mammal or sea turtle is detected in proximity to the vessel (e.g., within 400 m), vessel speed will be reduced to avoid the marine mammal or sea turtle. If platform supply vessel crews are regularly observing congregations of whales along the PSV routes, the captain may use their discretion to change the transit route to avoid congregating whales.

Refer also to response to IR-28.

References:

Koropatnick, T., S.K. Johnston, S. Coffen-Smout, P. Macnab and A. Szeto. 2012. Development and Applications of Vessel Traffic Maps Based on Long Range Identification and Tracking (LRIT) Data in Atlantic Canada. Can. Tech. Rep. Fish. Aquat. Sci. 2966: 27 pp. http://www.dfo-mpo.gc.ca/Library/345629.pdf

1.6.8 Information Requirement: IR-30

External Reviewer ID:

N/A

Reference to EIS:

Section 10.3.2

Context and Rationale:

Section 10.3.2 of the EIS states that shut down procedures (i.e., shut down of source array) will be implemented if a marine mammal or sea turtle listed on Schedule 1 of SARA is observed within 500 metres of the air gun array. However, it is not clear whether shutdown would occur if any marine mammal or sea turtle species were present or how an observer would be able to distinguish between species taking into consideration distance and visibility in the marine environment.

Specific Question of Information Requirement:

Explain how Schedule 1 SARA species would be identified and distinguished from other species prior to and during vertical seismic profiling. Clarify whether the vertical seismic profiling source array would be shut down as a precaution if there is a question as to the species observed (i.e., whether it is a SARA-listed species).

Response:

The ramp up of the source array would be delayed if any marine mammal or sea turtle species were detected within the 500 m safety zone during the pre-source start watch period. This is more precautionary than current mitigation measures included in the Statement of Canadian Practice (Fisheries and Oceans Canada 2007) but is a common industry practice aligned with various national guidelines and has become standard practice offshore Newfoundland and Labrador.

Marine Mammal Observers (MMO) receive technical training in species identification to allow them to identify marine a mammals and sea turtles to species level, and identification capabilities improve with experience. If an MMO detected a cetacean or sea turtle within the 500 m safety zone that is determined to possibly be a *Species at Risk Act*-listed species based on the expert judgement of the observer or passive acoustic monitoring (PAM) operator, a precautionary shut down of the source array would be implemented independent of a positive species identification.

References:

Fisheries and Oceans Canada. 2007. Statement of Canadian Practice with Respect to the Mitigation of Seismic Sound in the Marine Environment. Fisheries and Oceans Canada. 5 pp.

1.6.9 Information Requirement: IR-31

External Reviewer ID:

KMKNO-34

Reference to EIS:

Section 10.3.3.3

Context and Rationale:

Section 10.3.3.3 of the EIS provides potential distances modelled for various project activities within which environmental effects could occur to marine mammals and sea turtles (e.g., most marine mammals would have to occur and remain within approximately 200 metres of the MODU for a 24-hour period to experience sound levels above the thresholds associated with injury). A follow-up program was not proposed to verify the modelled predictions by monitoring the extent of sound from the project activities.

Specific Question of Information Requirement:

Provide a rationale for not proposing a follow-up program to verify sound predictions taking into consideration uncertainty with respect to extent of sound from project activities and potential effects of underwater sound on marine mammals.

Response:

There have been several recent acoustic monitoring studies conducted to characterize underwater sound levels and/or verify predictive modelling. As described in Matthews et al. (2018) (Appendix C of the EIS), the Environmental Studies Research Fund (ESRF) funded a two-year program aimed at describing the soundscape and the occurrence of marine mammals within the waters off the Canadian Atlantic coast. A total of twenty recorders were deployed in shallow and deep waters in Atlantic Canada and were active for most of 2015–2017. Data from ESRF recorder stations 15 and 19 were located in proximity to the Project Area for the Newfoundland Orphan Basin Exploration Drilling Program and used to characterize existing soundscape in the Project Area (Delarue et al. 2018).

Underwater sound monitoring studies conducted offshore Nova Scotia to measure sound levels associated with the Shelburne Basin Venture Exploration Drilling Project (MacDonnell 2016) which used the *Stena IceMax* drillship and the Scotian Basin Exploration Drilling Project (Kowarski et al. 2019) which used the *West Aquarius* semi-submersible drilling rig also add to the local body of knowledge on underwater sound. Both MacDonnell (2016) and Kowarski et al. (2019) concluded that measured sound levels were within or below predicted sound levels assessed in the respective EIS documents. Although these studies, along with the ESRF study, were not directly related to the Newfoundland Orphan Basin Exploration Drilling Program, they do contribute to an overall understanding of ambient sound levels in the Regional Assessment Area and/or predicted sound levels from exploration drilling programs, thereby reducing uncertainty in effects predictions.

Furthermore, the EIS concluded there is low potential for Project interaction with marine mammal or sea turtle species at risk and effects on marine mammals and sea turtles are expected to be short-term, localized and negligible to low in magnitude. Based on existing studies and low potential for adverse effects on marine mammals and sea turtles due to underwater sound, a follow-up program to verify sound predictions is not proposed.

References:

Delarue, J., K.A. Kowarski, E.E. Maxner, J.T. MacDonnell and S.B. Martin. 2018. Acoustic Monitoring Along Canada's East Coast: August 2015 to July 2017. Document Number 01279, Environmental Studies Research Funds Report Number 215, Version 1.0. Technical report by JASCO Applied Sciences for Environmental Studies Research Fund, Dartmouth, NS, Canada. 120 pp + Appendices.

Kowarski, K.A., E.E. Maxner, C.C. Wilson and S.B. Martin. 2018. Acoustic Monitoring During Scotian Basin Exploration Project: Summer 2018. Document 01687, Version 1.0. Technical report by JASCO Applied Sciences for BP Canada Energy Group ULC

Matthews, M-N, T.J. Deveau, C. Whitt and B. Martin. 2018. Underwater Sound Assessment for Newfoundland Orphan Basin Exploration Drilling Program. Document 01592, Version 4.0. Technical report by JASCO Applied Sciences for Stantec.

MacDonnell, J. 2016. Shelburne Basin Venture Exploration Drilling Project: Sound Source Characterization, 2016 Field Measurements of the Stena IceMAX. Document 01296, Version 3.0. Technical report by JASCO Applied Sciences for Shell Canada Limited.

1.6.10 Information Requirement: IR-32

External Reviewer ID:

DFO-16; DFO-18; DFO-21; WNNB-05; PNIN-06; KMKNO-15

Reference to EIS:

Section 2.10.3;
Section 6.1.6;
Section 8.3.2;
Section 8.3.3.1

Context and Rationale:

Section 8.3.2 the EIS states that an imagery-based seabed survey at proposed well sites will be conducted to confirm the absence of shipwrecks, debris, unexploded ordnance, and sensitive environmental features such as habitat forming coral or species at risk. The Canada Newfoundland & Labrador Offshore Petroleum Board would then be notified to discuss an appropriate course of action if environmental or anthropogenic sensitivities are detected, including potentially moving the wellsite “if it is feasible to do so”. No further information is provided.

From the perspective of planned drilling activities and wellsite locations, the following is not clear:

- what criteria would be considered to determine the feasibility of wellsite relocation to avoid or minimize impact on corals, sponges, and sensitive areas;
- what criteria would be considered to determine relevant and feasible mitigations to avoid and reduce effects on sensitive benthic species and habitat in the event that a wellsite cannot be moved (Fisheries and Oceans Canada advised that the most effective mitigation is avoidance and/or relocation);
- what species of habitat forming corals and sponges would be used to determine the necessity of setback from sensitive benthic species (i.e. corals, sea pens, sponges); and
- whether the density of corals and sponges would also be considered in determining the need for setback.

It is unclear if additional mitigation measures would be proposed if a wellsite is proposed within the Northeast Newfoundland Slope Closure marine refuge or other special areas.

Several Indigenous groups and a member of the public requested that the imagery-based seabed survey be made available to the public.

Specific Question of Information Requirement:

Provide additional information with respect to the detection of environmental or anthropogenic sensitive areas during the pre-drilling imagery-based survey, discussing the following:

- the criteria used to determine the feasibility of wellsite relocation to avoid or minimize impact on corals, sponges, and sensitive areas;

- the species of habitat forming coral and sponges and sensitive habitats that would be used to determine if a wellsite should be relocated;
- whether density of corals and sponges would also be considered in determining the need for wellsite relocation;
- if the information gathered through the imagery-based seabed survey would be made available to the public;
- the potential mitigation measures that would be implemented if wellsite relocation is not possible if sensitive species or habitats were identified in the imagery-based survey.

Discuss if any additional mitigation measures would be proposed and implemented if operating in the Northeast Newfoundland Slope Closure marine refuge or other special areas.

Response:

BP will develop criteria used to determine the feasibility of wellsite relocation to avoid or minimize impact on corals, sponges, and sensitive areas in consultation with Fisheries and Oceans Canada and the C-NLOPB. Potential criteria are expected to focus on habitat forming corals and sponges (of which density may be a factor) rather than presence of individuals of specific species. BP will report the results of the survey to the C-NLOPB and a summary of results of the imagery-based seabed survey would be made available to the public and Indigenous groups. BP will also communicate results during the course of Indigenous and Stakeholder engagement related to the Newfoundland Orphan Basin Exploration Drilling Program.

If any environmental sensitivities are identified during the survey, BP will notify the C-NLOPB immediately to discuss an appropriate course of action or move to an alternate wellsite. This may involve further investigation and/or moving the wellsite if it is feasible to do so. If the survey reveals aggregations of habitat-forming corals and sponges and it is not technically feasible to relocate the wellsite, BP will consult with the C-NLOPB prior to commencing drilling to determine an appropriate course of action, which may include identifying additional mitigation measures. No incremental mitigation measures are proposed to be implemented if operating in the Northeast Newfoundland Slope Closure marine refuge or other special areas, unless the survey reveals aggregations of habitat-forming corals and sponges.

1.6.11 Information Requirement: IR-33

External Reviewer ID:

DFO-15; C-NLOPB-13

Reference to EIS:

Section 2.2, Table 2.23

Context and Rationale:

Section 6.1.3 of the EIS Guidelines requires a description of corals and sponges that could potentially be affected by routine project operations or by accidents and malfunctions. Section 2.2 of the EIS states that the proponent has committed to "..conduct an imagery-based seabed survey at the proposed wellsite(s) to ground-truth the findings of the Geohazard Baseline Review. This includes confirming the absence of … sensitive environmental features, such as habitat-forming corals or species at risk. The survey will be carried out prior to drilling and will encompass an area within a 500-m radius from the wellsite."

Section 2.8.2 of the EIS states that "..the areal coverages for cuttings thicknesses >1 millimetre ("visible" thickness threshold) …extended up to 577 and 635 metres away from the West Orphan Basin wellsite, respectively."

It is not clear why 500 metres was selected as the extent to for the proposed imagery-based seabed survey prior to drilling, rather than a more conservation distance based on the predictions of the completed cutting dispersion modelling.

The EIS does not discuss the inclusion of the location of moorings and chains in the area included in the imagery-based survey.

While there are details included in the EIS regarding the equipment and the function of the imagery-based survey to be conducted prior to drilling, the EIS does not clearly indicate the timeline associated with conducting the pre-drill survey.

Specific Question of Information Requirement:

Provide the rationale for the selection of a 500 metre radius for the proposed imagery-based survey, including its relevance to potential effects from cuttings dispersion, versus a more conservative radius based on completed cuttings deposition modelling. Discuss the relationship between the analysis of the drill waste deposition modelling results and the parameters of the imagery-based survey mitigation measure.

Confirm that the potential location of the moorings and chains would be included in the imagery-based survey.

Describe the timing of the seabed investigation prior to drilling.

Response:

BP will conduct an imagery-based survey using a remotely operated vehicle prior to spudding each well in the drilling program. As discussed in Section 8.3.3 of the EIS, it has been calculated that an average burial depth of 9.6 mm or less is unlikely to cause net adverse effects to benthic organisms attributable to sedimentation (Neff et al. 2004). This is an average value and some species may experience adverse effects at shallower depths (e.g., Smit et al. 2006 references a threshold of 6.5 mm). Drill waste deposition modelling predicted that sediment thicknesses of 6.5 mm could extend up to 128 m from a wellsite in West Orphan Basin and up to 55 m from a wellsite in East Orphan Basin. A 500 m radius transect is therefore considered to be conservative, based on modelling predictions, but was proposed as a standard method employed by BP in other jurisdictions. Furthermore, measurable changes to benthic macrofauna are most often confined to within a 250 m radius and seldom detected beyond 500 m of the drill site (Olsgård and Gray 1995; Bakke et al. 2013).

Although BP has not yet selected a mobile offshore drilling unit (MODU), given the water depths in BP's Exploration Licences, the MODU will not be anchored but instead use dynamic positioning. Therefore, there will be no moorings or chains associated with the drilling program that would require locations to be surveyed.

The timing of the pre-drill survey will be the period before any bottom penetrating activities associated with the well (i.e., spudding the well).

References:

Bakke, T., J. Klungsøyr and S. Sanni. 2013. Environmental impacts of produced water and drilling waste discharges from the Norwegian offshore petroleum industry. Marine Environmental Research, 92: 1154-169.

Neff, J.M., G. Kjeilen-Eilersten, H. Trannum, R. Jak, M. Smit and G. Durell. 2004. Literature Report on Burial: Derivation of PNEC as Component in the MEMW Model Tool. ERMS Report No. 9B. AM 2004/024. 25 pp.

Olsgård, F. and J.S. Gray. 1995. A comprehensive analysis of the effects of offshore oil and gas exploration and production on the benthic communities of the Norwegian Continental Shelf. Mar. Ecol. Prog. Ser., 122: 388-306.

Smit, M.G.D., K.I.E. Holthaus, H.C. Trannum, J.M. Neff, G. Kjeilen-Eilertsen, R.G. Jak, L. Singsaas, A.J. Huijbregts and A.J. Hendriks. 2008. Species sensitivity distributions for suspended clays, sediment burial, and grain-size change in the marine environment. Environ. Toxicol. Chem., 27: 1006-1012.

1.7 Migratory Birds

1.7.1 Information Requirement: IR-34

External Reviewer ID:

WM-156; WM-17; WM-58; WM-64

Reference to EIS:

Section 2.9.2.5

Context and Rationale:

The EIS does not provide baseline information on ambient light in the Project Area. In order to evaluate the effects of lighting from the Project, a discussion of ambient light is required.

Section 2.9.2.5 of the EIS states that "spectral modified lighting has been tested on offshore platforms and has demonstrated a reduced effect on marine birds"; and the proponent "… has not yet made any direct inquiries with vendors regarding the availability of spectral modified lights for use in association with the Project."

However, Table 2.20 states that spectral modified lighting is not technically or economically feasible. However, no justification is provided as to the methodology used to determine the technical and economic feasibility of spectral modified lighting.

Table 2.20 also states that spectral modified lighting has limited capabilities in extreme weather, and there are safety concerns with helicopter approach and landing. However, there has been no consideration of using a hybrid of both spectral modified light and standard MODU lighting (e.g., using standard lighting when helicopters are approaching).

A submission from the public commented that modified green spectral lighting has been found to reduce the attraction of seabirds to platforms at night and has been used successfully off the Dutch coast (See Poot et al. (2008); Marquenie et al (2014); Rodriguez et al. (2017).

<u>References</u>

Poot, H., Ens, B.J., de Vries, H., Donners, M.A.H., Wernand, M.R. & Marquenie, J.M. (2008). Green light for nocturnally migrating birds. *Ecology and Society, 13,* 1-14.

Marquenie, J.M., Wagner, J., Stephenson, M.T., & Lucas, L. 2014. Green lighting the way: Managing impacts from Offshore Platform lighting on migratory birds. Presentation at the Society of Petroleum Engineers International Conference on Health, Safety and the Environment, Long Beach, California, USA, March 17-19, 2014.

Rodríguez, A., Dann, P., & Chiaradia, A. (2017a). Reducing light-induced mortality of seabirds: High pressure sodium lights decrease the fatal attraction of shearwaters. Journal for Nature Conservation, 39, 68-72.

Specific Question of Information Requirement:

Discuss existing ambient light conditions (baseline) in the Project Area and update the effects assessment taking into consideration changes in lighting that would be associated with project activities.

Discuss the availability of spectral modified lighting for use during the Project or explain why spectral modified lighting (or a hybrid approach) is not considered to be technically and/or economically feasible.

Explain whether the MODU under consideration for the Project would have the flexibility to change lights should spectral modified lighting become available and technically and economically feasible over the lifetime of the Project.

Response:

As discussed in Section 2.8.6 of the EIS, the Project Area is assumed to be a dark-sky site given the lack of offshore platforms and low level of existing vessel traffic activity in the area. Artificial lighting from the mobile offshore drilling unit (MODU) and platform supply vessels (PSVs) will result in an increase in night-time light levels. Section 9.3.3 of the EIS describes potential interactions between marine and migratory birds and MODU and PSVs as a result of artificial lighting.

BP will contract existing ("off the shelf") equipment, including a MODU and PSVs, contracted through third-party contractors for the proposed drilling program. Equipment will be selected based on safety considerations and technical capabilities. BP is not currently aware of any MODUs or PSVs with modified lighting (e.g., intensity, spectrum, direction) that have the technical capability to support the Project. Given the potential short duration of each well (approximately 60 days) and therefore potentially the MODU contract, BP will not have the flexibility to change lights should spectral modified lighting become available and technically and economically feasible over the lifetime of the Project. However, artificial lighting will be reduced to the extent that worker safety and safe operations are not compromised. This may include avoiding use of unnecessary lighting, shading and directing lights towards the deck of the MODU and/or PSVs.

In recognition of potential adverse environmental effects related to attraction of birds to artificial lighting, BP has committed to conducting routine checks for stranded birds on the MODU and PSVs using trained personnel in accordance with the *Procedures for Handling and Documenting Stranded Birds Encountered on Infrastructure Offshore Atlantic Canada* (Environment and Climate Change Canada 2016) and associated permit conditions under the *Migratory Birds Convention Act, 1984* authorizing the capture and handling of migratory birds. Results of the monitoring program will be shared publicly to help further improve the understanding of bird strandings and mortality in the Newfoundland and Labrador offshore area.

References:

Environment and Climate Change Canada. 2016. Procedures for Handling and Documenting Stranded Birds Encountered on Infrastructure Offshore Atlantic Canada. 17 pp + Appendices.

1.7.2 Information Requirement: IR-35

External Reviewer ID:

ECCC-05

Reference to EIS:

Section 6.2.1

Context and Rationale:

Section 6.2.1 of the EIS references the Programme intégré de recherches sur les oiseaux pélagiques, the Eastern Canadian Seabirds at Sea database, and Fifield et al. (2009).

Environment and Climate Change Canada has noted that there are a number of additional recent scientific studies of tracking data that reveal the Northwest Atlantic (including the Project Area) as an important area for breeding and over-wintering birds regionally, nationally, and internationally, particularly murres and Dovekies. These references include but are not limited to Fort et al. 2013, Frederiksen et al. 2016, Hedd et al. 2011, Hedd et al. 2018 and McFarlane Tranquilla et al. 2013.

Inclusion of these references would provide a more complete account of the Northwest Atlantic area and inform the effects assessment.

<u>References</u>

Fort, J., Moe, B., Strom, H., Grémillet, D., Welcker, J., Schultner, J., Jerstad, K., Johansen, K.L., Phillips, R.A., and Mosbech, A. (2013). Multicolony tracking reveals potential threats to little auks wintering in the North Atlantic from marine pollution and shrinking sea ice cover. *Diversity Distributions.* **19**: 1322-1332.

Fredericksen, M., Descamps, S., Erikstad, K.E., Gaston, A.J., Gilchrist, H.G., Grémillet, D., Johansen, K.L., Kolbeinsson, Y., Linnebjerg, J.F., Mallory, M.L., McFarlane Tranquilla, L.A., Merkel, F.R., Montevecchi, W.A., Mosbech, A., Reiertsen, T.K., Robertson, G.J., Steen, H., Strom, H., and Thorarinsson, T.L. (2016). Migration and wintering of a declining seabird, the thick-billed murre *Uria lomvia*, on an ocean basin scale: Conservation Implications. *Biological Conservation*. **200**: 26-35.

Hedd, A., Montevecchi, W.A., McFarlane Tranquilla, L.A., Burke, C.M., Fifield, D.A., Robertson, G.J., Phillips, R.A., Gjerdrum, C., and Regular, P.M. (2011). Reducing uncertainty on the Grand Bank: tracking and vessel surveys indicate mortality risks for common murres in the North-West Atlantic. *Animal Conservation.* **14**: 630-641.

Hedd, A., Pollett, I.L., Mauck, R.A., Burke, C.M., Mallory, M.L., McFarlane Tranquilla, L.A., Montevecchi, W.A., Robertson, G.J., Ronconi, R.A., Shutler, D., Wilhelm, S.I., and Burgess, N.M. (2018). Foraging areas, offshore habitat use, and colony overlap by incubating Leach's storm-petrels *Oceanodroma leucorhoa* in the Northwest Atlantic. *PLoS One*. **13**(5): e0194389. https://doi.org/10.1371/journal.pone.0194389

McFarlane Tranquilla, L.A., Montevecchi, W.A., Hedd, A., Fifield, D.A., Burke, C.M., Smith, P.A., Robertson, G.J., Gaston, A.J., Phillips, R.A. (2013). Multiple-colony winter habitat use by murres *Uria* spp. In the Northwest Atlantic Ocean: implications for marine risk assessment. *Marine Ecology Progress Series.* **472**:287-303.

Specific Question of Information Requirement:

Update information on migratory birds in the Project Area taking into consideration references provided by Environment and Climate Change Canada.

Update the effects predictions, potential mitigation and follow-up, as well as significance predictions, as applicable.

Response:

EIS Section 6.2.2.4 (paragraph 3) discusses results of tracking studies showing importance of the Northwest Atlantic as a wintering area to the global dovekie population, to Atlantic populations of thick-billed murre, and to Northwest Atlantic populations of common murres. Fort et al. (2013) is cited in EIS Section 6.2.2.4 where their findings from tracking dovekies from nesting colonies to their wintering areas off Newfoundland are discussed. Frederiksen et al. (2016) is cited in EIS Section 6.2.2.4 in the description of the importance of the RAA as the wintering area for most Atlantic thick-billed murres, and of linkages to the nesting colonies from which they originate. Hedd et al. (2011) is cited in EIS Section 6.2.2.4 in describing the concentration of wintering alcids at the continental shelf slope of the Grand Banks. The common murres tracked by Hedd et al. (2011) were tagged at their Funk Island nesting colony. Within 10 days of abandoning the colony, males moved offshore to the south-southeast, whereas females remained inshore for 10 to 47 days before dispersing offshore. During November and December all tagged birds were in Orphan Basin or “in the vicinity of the oil platforms”. The results of the tracking study by McFarlane Tranquilla et al. (2013) suggests that most of eastern Canada’s population of common murres and approximately one-third of the region’s thick-billed murres overwinter in the waters off eastern Newfoundland. This finding is consistent with the results of later tracking studies of murres, which are summarized in EIS Section 6.2.2.4, citing McFarlane Tranquilla et al. (2015) and Frederiksen et al. (2016).

EIS Section 6.2.2.2 discusses the results of the tracking study by Frederiksen et al. (2012), which suggest that a large majority of black-legged kittiwakes nesting in the Atlantic winter off Newfoundland and Labrador. This section also discusses the importance of the Labrador Sea as a wintering area for some endangered ivory gulls nesting in the Northeast Atlantic revealed by the tracking study of Gilg et al. (2010). The section also discusses the tracking study of the threatened Ross’s gull by Maftei et al. (2015). EIS Section 6.2.2.3 references the study tracking great skuas nesting in Iceland to wintering areas of Canada (Magnusdottir et al. 2012). EIS Section 6.2.2.5 discusses the tracking of sooty shearwaters to the North Atlantic waters off Newfoundland by Hedd et al. (2012).

Tagging Leach’s storm-petrels incubating at nesting colonies in Newfoundland and Nova Scotia nesting colonies with data loggers has shown that this species commutes to deep waters off the continental shelf to forage (Hedd et al. 2018). Return foraging trips from Baccalieu Island and Gull Island, Witless Bay, average 1,757 km and 1,954 km, respectively, in total distance and 3.9 days in duration. The core foraging area of birds nesting on Baccalieu Island includes much of the north-central portion of the Regional Assessment Area (RAA), including most of Orphan Basin and all of the Project Area, whereas the core foraging area of birds at Gull Island covers most of the central portion of the RAA, reaching as far north as the eastern end of the Project Area.

Tracking studies have revealed the importance of the area between Flemish Cap and the mid-Atlantic Ridge is an important staging area for migrating Arctic tern, long-tailed jaeger, and black-legged kittiwake (Egevang et al. 2010; Sittler et al. 2011; Frederiksen et al. 2012; van Bemmelen et al. 2017).

The EIS recognized the importance of the Project Area and RAA to marine and migratory birds, already citing most of the references that Environment and Climate Change Canada has provided, along with additional studies. The effects predictions, mitigation, follow-up and significance predictions as presented in the EIS remain unchanged.

References:

Egevang, C., I.J. Stenhouse, R.A. Phillips, A. Petersen, J.W. Fox and J.R.D. Silk. 2010. Tracking of Arctic terns *Sterna paradisaea* reveals longest animal migration. Proceedings of the National Academy of Sciences, USA, 107: 2078-2081.

Fort, J., B. Moe, H. Strøm, D. Grémillet, J. Welcker, J. Schultner, K. Jerstad, K.L. Johansen, R.A. Phillips and A. Mosbech. 2013. Multi-colony tracking reveals potential threats to little auks wintering in the North Atlantic from marine pollution and shrinking sea ice cover. Diversity and Distributions, 19: 1322-1332.

Frederiksen, M., B. Moe, F. Daunt, R. A. Phillips, R.T. Barrett, M.I. Bogdanova, T. Boulinier, J.W. Chardine, O. Chastel, L.S. Chivers, S. Christensen-Dalsgaard, C. Clément-Chastel, K. Colhoun, R. Freeman, A.J. Gaston, J. González-Solís, A. Goutte, D. Grémillet, T. Guilford, G.H. Jensen, Y. Krasnov, S.-H. Lorentsen, M.L. Mallory, M. Newell, B. Olsen, D. Shaw, H. Steen, H. Strøm, G.H. Systad, T.L. Thórarinsson and T. Anker-Nilssen. 2012. Multi-colony tracking reveals the winter distribution of a pelagic seabird on an ocean basin scale. Diversity and Distributions, 18: 530-542.

Frederiksen, M., S. Descamps, K.E. Erikstad, A.J. Gaston, H.G. Gilchrist, D. Grémillet, K.L. Johansen, Y. Kolbeinsson, J.F. Linnebjerg, M.L. Mallory, L.A. McFarlane Tranquilla, F.R. Merkel, W.A. Montevecchi, A. Mosbech, T.K. Reiertsen, G.J. Robertson, H. Steen, H. Strøm and T.L. Thórarinsson. 2016. Migration and wintering of a declining seabird, the thick-billed murre *Uria lomvia*, on an ocean basin scale: Conservation implications. Biological Conservation, 200: 26-35.

Gilg, O., H. Strøm, A. Aebischer, M.V. Gavrilo, A.E. Volkov, C. Miljeteig and B. Sabard. 2010. Post-breeding movements of northeast Atlantic ivory gull *Pagophila eburnea* populations. Journal of Avian Biology, 41: 532-542.

Hedd, A., W.A. Montevecchi, L.A. McFarlane Tranquilla, C.M. Burke, D.A. Fifield, G.J. Robertson, R.A. Phillips, C. Gjerdrum and P.M. Regular. 2011. Reducing uncertainty on the Grand Bank: tracking and vessel surveys indicate mortality risks for common murres in the North-West Atlantic. Animal Conservation, 14: 630-641.

Hedd, A., W.A. Montevecchi, H. Otley, R.A. Phillips and D A. Fifield. 2012. Trans-equatorial migration and habitat use by sooty shearwaters *Puffinus griseus* from the South Atlantic during the nonbreeding season. Marine Ecology Progress Series, 449: 277-290.

Hedd, A., I.L. Pollet, R.A. Mauck, C.M. Burke, M.L. Mallory, L.A. McFarlane Tranquilla, W.A. Montevecchi, G.J. Robertson, R.A. Ronconi, D. Shutler, S.I. Wilhelm and N.M. Burgess. 2018. Foraging areas, offshore habitat use, and colony overlap by incubating Leach's storm-petrels *Oceanodroma leucorhoa* in the Northwest Atlantic. PLOS ONE, 13: e0194389.

Maftei, M., S.E. Davis and M.L. Mallory. 2015. Confirmation of a wintering ground of Ross's Gull *Rhodostethia rosea* in the northern Labrador Sea. Ibis, 157: 642-647.

Magnusdottir, E., E.H.K. Leat, S. Bourgeon, H. Strom, A.E. Petersen, R.A. Phillips, S.A. Hanssen, J.O. Bustnes, P. Hersteinsson and R.W. Furness. 2012. Wintering areas of Great Skuas *Stercorarius skua* breeding in Scotland, Iceland and Norway. Bird Study, 51: 1-9.

McFarlane Tranquilla, L.A., W.A. Montevecchi, A. Hedd, D.A. Fifield, C.M. Burke, P.A. Smith, P.M. Regular, G.J. Robertson, A.J. Gaston and R.A. Phillips. 2013. Multiple-colony winter habitat use by murres *Uria* spp. in the Northwest Atlantic Ocean: implications for marine risk assessment. Marine Ecology Progress Series, 472: 287-303.

McFarlane Tranquilla, L.A., W.A. Montevecchi, A. Hedd, P.M. Regular, G.J. Robertson, D.A. Fifield and R. Devillers. 2015. Ecological segregation among Thick-billed Murres (*Uria lomvia*) and Common Murres (*Uria aalge*) in the Northwest Atlantic persists through the nonbreeding season. Canadian Journal of Zoology, 93: 447-460.

Sittler, B., A. Aebischer and O. Gilg. 2011. Post-breeding migration of four Long-tailed Skuas (*Stercorarius longicaudus*) from North and East Greenland to West Africa. Journal of Ornithology, 152(2): 375-381.

van Bemmelen, R., B. Moe, S.A. Hanssen, N.M. Schmidt, J. Hansen, J. Lang, B. Sittler, L. Bollache, I. Tulp, R. Klaassen and O. Gilg. 2017. Flexibility in otherwise consistent non-breeding movements of a long-distance migratory seabird, the long-tailed skua. Marine Ecology Progress Series, 578: 197-211.

1.7.3 Information Requirement: IR-36

External Reviewer ID:

ECCC-06; WM-35

Reference to EIS:

Section 6.2.2;
Section 6.2.2.6;
Section 6.2.4,
Table 6.12

Context and Rationale:

Section 6.2.2 of the EIS identifies the Leach's Storm-petrel as designated as Vulnerable by the International Union for the Conservation of Nature (IUCN); however, does not provide further context for the "vulnerable" status of the species.

Environment and Climate Change Canada advised that in addition to the Leach's Storm-petrel colonies in Baccalieu Island, Gull Island, and Green Island, documented population declines at the Great Island colony in Witless Bay should also be referenced in order to provide a more complete account of the populations within the range of the Project. The Great Island Leach's Storm-petrel colony has declined by 55 percent from 300,000 pairs in 1979 to 134,000 pairs in 2011 (Wilhelm et al. 2015).

<u>Reference</u>

Wilhelm, S.I., Mailhiot, J., Arany, J., Chardine, J.W., Robertson, G.J, and Ryan, P.C. (2015). Update and trends of three important seabird populations in the western North Atlantic using a geographic information system approach. *Marine Ornithology*. **43**: 211-212.

Specific Question of Information Requirement:

Provide further analysis on the potential effects of the Project on Leach's Storm-petrels taking into consideration potential threats to the species, population trends, and information provided in Wilhelm et al. 2015.

Review International Union for the Consideration of Nature data to determine if additional marine or migratory bird species of conservation interest, in addition to Leach's Storm-petrel, are likely to occur in the Regional Assessment Area, and update the analysis of effects, as applicable.

Update the effects predictions, potential mitigation and follow-up, as well as significance predictions, as applicable.

Response:

In addition to declines in the numbers of nesting pairs of Leach's storm-petrel at the colonies discussed in EIS Section 6.2.2.6, it is acknowledged that the number of pairs in the colony on Great Island in the Witless Bay Islands Ecological Reserve has also declined. The number of nesting pairs decreased by 55% from 252,910 pairs in 1979 to 134,000 pair in 2011 (Wilhelm et al. 2015). IUCN designates this species as vulnerable on its Red List of threatened species due to a decline in the global population by 30% or more over three generations (BirdLife International 2019). The causes of the decline are unknown but are thought to be due to more than one factor and will need more research to elucidate. Threats to the Leach's storm-petrel population in the western Atlantic listed by BirdLife International (2019) consist of predation by herring gull and other large gull species (Stenhouse et al. 2000), attraction to lights and flares with oil rigs causing mortality from collisions or stranding (Hedd et al. 2018), and the contribution of small spills of hydrocarbons and synthetic drilling fluids to chronic oil pollution in marine waters (BirdLife International 2019). However, large declines in the numbers of herring gulls nesting at various colonies in the Witless Bay Islands Ecological Reserve, and recent high occupancy rates of burrows by Leach's storm-petrel on Great Island, suggest that predation pressure on this Leach's storm-petrel nesting colony is decreasing (Wilhelm et al. 2015).

An additional six species of marine birds are designated at risk on IUCN's Red List (BirdLife International 2019). These are listed in Table 1 with their IUCN Red List status, habitat, and distribution in Newfoundland and Labrador, and their potential to occur in or near the Project Area. Long-tailed duck was designated vulnerable by IUCN because of a decline in the wintering population in the Baltic Sea from the early 1990s to the late 2000s (BirdLife International 2019). In Newfoundland waters this species occurs only along the coast during winter, with the exception of accidental vagrants offshore. Threats to this species are thought to include fisheries bycatch in the Baltic Sea, chronic oil pollution, avian cholera outbreaks, and climate change. Bermuda petrel is designated Endangered by IUCN (BirdLife International 2019). Its population of mature adults in 2011 consisted of 98 pairs nesting on islets off Bermuda (Madeiros 2011). In the non-breeding season, individuals tagged with data loggers have moved north, primarily in Gulf Stream waters, but small numbers have occurred on the Grand Banks and southern Flemish Pass, and therefore have the potential to occur within the Project Area (Madeiros et al. 2014). Current threats to the Bermuda petrel population consist of habitat loss (competition for nesting habitat from white-tailed tropicbird *Phaethon lepturus*, sea level rise, and increased storm activity), predation by rats, and light pollution from the island of Bermuda, which affects nocturnal courtship. Zino's petrel is designated endangered by IUCN due to its very small population size and restricted breeding range (BirdLife International 2019). Its distribution at sea includes the southeast corner of the Regional Assessment Area (RAA) (Ramos et al. 2016). Threats to Zino's petrel have been identified only at the nesting colony on Madeira (fire and predation by cats and rats) (BirdLife International 2019). Desertas (Bugio) petrel is designated vulnerable by IUCN due to its very small population size and a breeding range restricted to Bugio Island in the Desertas Islands off Madeira (BirdLife International 2019). Threats to this species consist of loss of burrows and nesting birds to severe storms and associated erosion, to alien mammal species on Bugio Island, and to predation by large gulls. Studies of birds tagged with data loggers show that this species occasionally passes through the warm waters in the southeast corner of the RAA in spring migration (Ramírez et al. 2013). Black-legged kittiwake is designated vulnerable by IUCN due to rapid population size decline in Europe over the last three generations (BirdLife International 2019). This decline is thought to be caused by declines in its prey abundance as a result of climate change and by commercial fisheries. The number of nesting pairs of kittiwakes at Gull Island, Witless Bay, declined sharply from the early 1970s to the 2000s due to predation by great black-backed gulls and delay in the arrival of prey species (Robertson et al. 2004; Veitch et al. 2016). Threats to black-legged kittiwake include climate change, competition with commercial fisheries, fisheries bycatch, and avian influenza (BirdLife International 2019). Atlantic puffin is designated vulnerable by IUCN because of a rapid decline of 50% to 79% in the size of the European population over the last three generations resulting from shifts in prey distribution, abundance, and quality due to climate change (BirdLife International 2019). The number of puffin nesting pairs at Great Island, Witless Bay, may be declining (Wilhelm et al. 2015). Identified threats to this species are climate change, increasing frequency of extreme weather and storms, fisheries bycatch, invasive mammalian predators (American mink, rats) and anthropogenic disturbance at nesting colonies, hunting, oil spills, and plastic pollution.

Table 1 Marine Bird Species Designated at Risk on the IUCN Red List but not on Federal Provincial Lists or Schedules

Species	Scientific Name	IUCN Red List Status[1]	Habitat and Distribution in Newfoundland	Potential Presence in or Around Project Area
Long-tailed Duck	*Clangula hyemalis*	Vulnerable	Coastal waters	Low
Bermuda Petrel	*Pterodroma cahow*	Endangered	Grand Banks and waters to the south and east[2]	Very Low
Zino's Petrel	*Pterodroma madeira*	Endangered	Warm waters off the continental shelf[3]	Very Low
Desertas (Bugio) Petrel	*Pterodroma deserta*	Vulnerable	Warm waters off the continental shelf[3,4]	Very Low
Leach's Storm-Petrel	*Hydrobates leucorhous* [*Oceanodroma leucorhoa*]	Vulnerable	Continental shelf and adjacent waters	High
Black-legged Kittiwake	*Rissa tridactyla*	Vulnerable	Continental shelf and adjacent waters	High
Atlantic Puffin	*Fratercula arctica*	Vulnerable	Continental shelf	Low

[1] BirdLife International (2019), [2] Madeiros et al. (2014), [3] Ramos et al. 2016, [4] Ramírez et al. 2013.

The assessment of Project effects on Leach's storm-petrel in the EIS took into account the species' declining numbers of nesting pairs at three major colonies, including the largest colony in the world (EIS Section 6.2.2) and its attraction to artificial lighting (EIS Section 9.3.1.3.1). As such, the effects assessment of the presence and operation of the mobile offshore drilling unit remains unchanged.

The Red-Listed gadfly petrels (Bermuda, Zino's, and Desertas) recorded in tracking studies in the RAA were at the northwest periphery of the ranges of each of those species. The locations of these tracked birds were primarily in the southeast corner of the RAA. This reflects these species' preference for the warm waters of the Gulf Stream. As such these three species are very unlikely to encounter Project activities and incur effects. As with other marine bird species, accidental blowouts, large batch spills, and vessel spills could have significant effects on these Red-Listed gadfly petrels, given their small population sizes, if such a spill reached the warm waters south and east of the Grand Banks and Flemish Cap and coincided with presence of individuals of those species. However, a significant effect of such accidental events is unlikely because of the low probability of a large spill and because of the response to mitigate the spill. In addition, spill modelling suggests a very low probability of a surface slick reaching the southeast corner of the RAA, where the gadfly petrels are most likely to occur but are at the edge of their distributions.

No changes to mitigation, follow-up, or significance predictions as presented in the EIS are required.

References:

Birdlife International. 2019. IUCN Red List for Birds. http://www.birdlife.org, Accessed: 21 February 2019.

Madeiros, J. 2011. Cahow Report. Bermuda Audubon Society Newsletter, 22(1): 5-6.

Madeiros, J., B. Flood and K. Zufelt (2014). Conservation and at-sea range of Bermuda Petrel (*Pterodroma cahow*). North American Birds, 67: 547-557.

Ramírez, I., V.H. Paiva, D. Menezes, I. Silva, R.A. Phillips, J.A. Ramos and S. Garthe. 2013. Year-round distribution and habitat preferences of the Bugio petrel. Marine Ecology Progress Series, 476: 269-284.

Ramos, R., I. Ramírez, V.H. Paiva, T. Militão, M. Biscoito, D. Menezes, R.A. Phillips, F. Zino and J. González-Solís. 2016. Global spatial ecology of three closely-related gadfly petrels. Nature Scientific Reports, 6: 23447.

Stenhouse, I.J., G.J. Robertson and W.A. Montevecchi. 2000. Herring Gull *Larus argentatus* predation on Leach's Storm-Petrels *Oceanodroma leucorhoa* breeding on Great Island, Newfoundland. Atlantic Seabirds, 2: 35-44.

Veitch, B.G., G.J. Robertson, I.L. Jones and A.L. Bond. 2016. Great Black-Backed Gull (*Larus marinus*) Predation on Seabird Populations at Two Colonies in Eastern Canada. Waterbirds, 39: 235-245.

Wilhelm, S.I., J. Mailhiot, J. Arany, J.W. Chardine, G.J. Robertson and P.C. Ryan. 2015. Update and trends of three important seabird populations in the western North Atlantic using a geographic information system approach. Marine Ornithology, 43: 211-212.

1.7.4 Information Requirement: IR-37

External Reviewer ID:

WM-34; WM-61

Reference to EIS:

Section 9.3.3.1

Context and Rationale:

Section 9.3.3.1 of the EIS concludes that environmental effects will be localized with respect to the effect of waste discharges on marine birds. However, as noted in a submission from the public, discharge of gray water effluent can have a reefing effect around the platform and, as such, promotes algae growth leading to fish attraction (Wolfson et al. 1979; Baird, 1990). Burke et al (2012) have documented the phenomenon of nocturnal feeding by gulls that take up residency at the base of the Hibernia platform believed to be because of the abundance of food around the platform. Section 9.4 of the EIS provides the significance determination for the effects of the Project on marine and migratory birds. However, the effect of discharges causing a reef effect around platforms attracting birds and associated effects were not explicitly included.

References

Baird, P. H. (1990). Concentrations of seabirds at oil-drilling rigs. Condor 92, 768±771

Burke, C.M., Montevecchi, W.A., & Wiese, F.K. (2012). Inadequate environmental monitoring around offshore oil and gas platforms on the Grand Bank of Eastern Canada: Are marine birds at risk? *Journal of Environmental Management, 104*, 121-127. dx.doi.org/10.1016/j.jenvman.2012.02.012

Morandin, L.A. and O'Hara, P.D. (2016) Offshore oil and gas, and operational sheen occurrence: is there potential harm to migratory birds? Environmental Review 24:285-318

Wolfson, A., Van Blaricom, G., Davis, N. Lewbel, G.S. (1979). The marine life of an offshore oil platform. Marine Ecology Progress Series, 1, 81–89.

Specific Question of Information Requirement:

Confirm the potential for discharges from the Project to result in a reef effect around platforms and associated implications for migratory birds. Update the analysis, mitigation and significance predictions, as applicable.

Update the effects predictions, potential mitigation and follow-up, as well as significance predictions, as applicable.

Response:

As discussed in EIS Sections 9.3.3.1 and 9.3.3.2, "In the Newfoundland and Labrador offshore area, great black-backed gulls congregate in large flocks at MODUs and production platforms during late summer (post-breeding dispersal) and fall (migration) to forage at night on fish, such as Atlantic saury, that attracted to the surface by artificial light emissions from the platforms (Montevecchi et al. 1999; Davis et al. 2017)." This has also been noted by Brown (1986) and Burke et al. (2012). Wolfson et al. (1979) documented the formation of an artificial reef from biological growth on an offshore platform placed on soft sediments. Baird (1990) speculated that seabirds are attracted to these platforms because of this artificial reef effect. Burke et al. (2012) speculated that the biological growth on platforms is enhanced by fertilization of the waters around platforms by human waste discharge from the platforms. As further discussed in EIS Section 9.3.3.2, "The creation of new habitats and increased food availability (of prey species) associated with presence and operation of a MODU will be short-term at a Project drilling location and may result in both positive and negative effects on marine and migratory birds, especially during fall migration when the large pulse of young-of-the-year birds increases population sizes. Enhancement of the local food supply and provision of roosting and resting sites may attract some species to platforms, but the benefits in terms of energy gains for the bird may be offset by increased exposure to risk of various kinds of mortality and energetic costs due to deviation from normal movement and migration patterns."

This neutral net effect on marine and migratory birds of the benefits and costs of a platform reef effect therefore does not change the prediction that the residual environmental effects of the Project on marine and migratory species are not significant.

References:

Baird, P.H. 1990. Concentrations of seabirds at oil-drilling rigs. Condor, 92: 768-771.

Brown, R.G B. 1986. Revised atlas of Eastern Canadian seabirds. 1. Shipboard surveys. Bedford Institute of Oceanography and Canadian Wildlife Service, Dartmouth, NS, and Ottawa, ON. 111 pp.

Burke, C.M., W.A. Montevecchi and F.K. Wiese. 2012. Inadequate environmental monitoring around offshore oil and gas platforms on the Grand Bank of Eastern Canada: Are risks to marine birds known? Journal of Environmental Management, 104: 121-126.

Davis, R.A., A.L. Lang and B. Mactavish. 2017. Study of Seabird Attraction to the Hebron Production Platform: A Proposed Study Approach. Rep. No. SA1190. Rep. by LGL Limited, St. John's, NL, for Hebron Project, ExxonMobil Properties Inc., St. John's, NL. 30 pp. + appendices.

Montevecchi, W A., F.K. Wiese, G.K. Davoren, A.W. Diamond, F. Huettmann and J. Linke. 1999. Seabird attraction to offshore platforms and seabird monitoring from offshore support vessels and other ships: Literature review and monitoring designs. Prepared for the Canadian Association of Petroleum Producers. 56 pp.

Wolfson, A., G. Van Blaricom, N. Davis and G.S. Lewbel. 1979. The marine life of an offshore oil platform. Marine Ecology Progress Series, 1: 81-89.

1.7.5 Information Requirement: IR-38

External Reviewer ID:

ECCC-09; ECCC-10L WM-70

Reference to EIS:

Section 9.3.3;
Section 9.3.3.1;
Section 9.3.5

Context and Rationale:

Section 9.3.1.1 of the EIS acknowledges that the recovery of birds are estimates based on incidental and not systematic observations; however, it is later stated that low mortality rates are anticipated as most stranded birds are successfully released according to previous monitoring.

Environment and Climate Change Canada has advised that although the majority of stranded birds encountered on platforms and vessels are thought to be found alive and released successfully, without a systematic search methodology and documentation of search effort, it is difficult to quantify how many dead individuals may have been undetected during the searches.

Monitoring in previous projects referred to in Section 9.3.3.1 of the EIS was undertaken opportunistically. Therefore, Environment and Climate Change Canada has advised that the information currently available is likely an underrepresentation of the number of individuals coming into contact with MODU and supply vessels. Dead birds may fall into the sea or fall victim to predation by scavengers before they are observed.

Section 9.3.5 of the EIS states that effects on migratory birds are predicted to be low in magnitude and not likely to be significant. Environment and Climate Change Canada has advised that in the absence of systematic searches and documentation of stranded birds (live and dead), additional information is needed to support the conclusion that the project activities' effects will be low in magnitude and uncertainties related to effects predictions require further discussion.

<u>Reference</u>

Bruinzeel, L.W., van Belle, J. and Davids, L. 2009. The Impact of Conventional Illumination of Offshore Platforms in the North Sea on Migratory Bird Populations. A&W-rapport 1227. Alternburg & Wymenga Ecologisch Onderzoek, Feanwalden

Specific Question of Information Requirement:

Determine whether the certainty of effects predictions related to migratory birds requires revision, taking into account advice from Environment and Climate Change Canada. Explain the associated rationale and update the effects predictions accordingly.

Response:

As discussed in EIS Section 9.3.3.1, it is recognized that some of the stranded bird data from bird salvage logs from production and drilling installations in offshore Newfoundland, which were summarized in the EIS, may not have been based on dedicated, systematic searches. However, the data from geophysical exploration programs discussed in the EIS are the product of consistently dedicated, systematic, thorough searches of every deck open to the outside (including airgun and streamer decks) by trained personnel (LGL 2017). Those data suggest that a very high percentage of stranded Leach's storm-petrels are found alive and can be released shortly afterward. EIS Section 9.3.3.1 also acknowledges that an unknown number of storm-petrels may have died from collisions with geophysical exploration vessels and fallen into the sea or have been taken by predators. However, the small percentage of storm-petrels found on geophysical exploration vessels that were dead or injured suggests that collisions, if any, rarely result in mortality. In most cases mortality appeared to have been the result of hypothermia after contact with hydraulic fluids and water on the decks. If this is representative of storm-petrel interactions with vessels and platforms in general, then few individuals may be colliding with vessel hulls, and fewer still may suffer mortality and fall into the sea as a result. In discussing bird mortality from collisions with platforms in the North Sea, Bruinzeel et al. (2009) and Bruinzeel and van Belle (2010) base their mortality estimates on land birds (mostly songbird species) in passage migration. Occasionally large numbers of land birds are found dead on platform. They assume that an additional number of birds die from collision but is undocumented because they fall into the sea or are removed by predators. However, it is not clear that a high mortality rate from collisions is applicable to Leach's storm-petrel. This species flies at wave top height and must gain altitude to the reach the altitude of artificial lighting, thus losing airspeed and potential impact energy in the event of a collision, and gaining maneuverability. In contrast, migrant land birds in passage must descend from migration altitude to the altitude of lighting on offshore facilities, potentially gaining airspeed and impact energy. Further, Bruinzeel et al.'s (2009) and Bruinzeel and van Belle's (2010) assumption that a large proportion of birds colliding with offshore platforms are undocumented has not been tested. In addition, the proportion of birds attracted to North Sea platforms that die may actually be relatively small, but this has not been measured.

Systematic searches of mobile offshore drilling units (MODUs) and Project vessels by Project crew can therefore mitigate strandings effectively to prevent significantly adding to effects caused by other artificial light sources on Leach's storm-petrel populations nesting at Baccalieu and Gull Islands. As discussed in Sections 9.3.2 and 9.5 and the response to IR-39, personnel will be trained to routinely conduct systematic, thorough searches for stranded birds, to document the search effort, to recover and record the condition of birds found, and release live birds in accordance with procedures in Environment and Climate Change Canada (2016).

As defined in this EIS, low magnitude is a detectable change in the mortality, injury, health, or habitat quality compared with existing conditions, but within the range of natural variability. MODUs also typically have lower light emissions than a production facility because they have fewer light sources, and an exploration drilling program is relatively short-term at a given location in comparison with a stationary production facility. In addition, the rate of strandings on geophysical exploration vessels and, to some extent, drilling and production platforms, the rarity and relatively small magnitude of large stranding events, and the high survival rate of recovered birds suggests that relatively few Leach's storm-petrels will be affected by the

Project. Therefore, the conclusion that the Project's adverse effect on marine and migratory birds will be low in magnitude and not likely to be significant is valid. The possibility that the rate of stranding and mortality is an underestimate because of the unknown proportion of birds that collide with an offshore facility but are not documented is reflected in the moderate degree of certainty expressed in this conclusion.

References:

Bruinzeel, L.W. and J. van Belle. 2010. Additional research on the impact of conventional illumination of offshore platforms in the North Sea on migratory bird populations. In: Altenburg & Wymenga ecologisch onderzoek (editor), Feanwâlden, Netherlands, No. 1439, Netherlands Ministry of Public Works, Rijksaterstaat, Water dienst, 27 pp.

Bruinzeel, L.W., J. van Belle and L. Davids. 2009. The impact of conventional illumination of offshore platforms in the North Sea on migratory bird populations. In: Altenburg & Wymenga ecologisch onderzoek (editor), Feanwâlden, Netherlands, No. 1227, Netherlands Ministry of Public Works, Rijksaterstaat, Water dienst, 27 pp.

Environment and Climate Change Canada. 2016. Procedures for Handling and Documenting Stranded Birds Encountered on Infrastructure Offshore Atlantic Canada. 17 pp. + Appendices.

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1.7.6 Information Requirement: IR-39

External Reviewer ID:

ECCC-07; ECCC-08; KMKNO-32; WM-36; WM-39; WM-59; WM-70; MTI-14; MTI-16

Reference to EIS:

Section 9.3.2;
Section 9.5;
Section 14.3.4.1;
Section 18.2

Context and Rationale:

Section 9.5 of the EIS states that, "For the duration of the drilling program for each well, routine systematic checks will be conducted for stranded birds on the MODU and PSVs [platform supply vessel] by trained personnel in accordance with Procedures for Handling and Documenting Stranded Birds Encountered on Infrastructure Offshore Atlantic Canada (ECCC 2016) and associated permit conditions under the MBCA [Migratory Birds Convention Act, 1994] authorizing the capture and handling of migratory birds. Results of the monitoring program will be shared publicly to help further improve the understanding of bird strandings and mortality in the Newfoundland and Labrador offshore area."

Environment and Climate Change Canada has advised that information is lacking concerning how the proponent would implement search protocols and document search effort for stranded migratory birds. The EIS refers to protocols for handling stranded birds, but handling protocols are distinct from systematic searching protocols.

Environment and Climate Change Canada has noted that systematic deck searches for stranded birds undertaken by trained observers are more effective than opportunistic searches. Systematic searches should occur at least daily (preferably at dawn), with search efforts documented and observations recorded (including notes on efforts when no birds are found). Environment and Climate Change Canada has expertise in this area and is available to be consulted in the development of systematic monitoring protocols.

Specific Question of Information Requirement:

Taking into consideration the information provided by Environment and Climate Change Canada, confirm the following (or provide a rationale, in the absence of a confirmation):

- develop a systematic monitoring protocol to search for and document stranded birds on the MODU and the platform supply vessels for the duration of the project activities, including drilling and flaring. Include search efforts and frequency;
- engage Environment and Climate Change Canada in the development of systematic monitoring protocols;
- have its Environmental Observers that would be engaged in seabird observations trained by Environment and Climate Change Canada;

- verify the accuracy of the effect predictions with respect to birds, based on the data collected; and
- annually report monitoring information, including data related to mortality, stranding and injury.

Response:

For the duration of the drilling program for each well, systematic deck searches for stranded and dead birds will be undertaken by trained observers on the MODU and the PSVs during Project operations. These systematic searches will be conducted daily (preferably at dawn) by trained individuals, and in accordance with *Procedures for Handling and Documenting Stranded Birds Encountered on Infrastructure Offshore Atlantic Canada* (Environment ad Climate Change Canada [ECCC] 2016) and associated permit conditions under the *Migratory Birds Convention Act, 1994* authorizing the capture and handling of migratory birds. Search efforts will be documented and observations recorded (including notes of efforts when no birds are found). BP will consult ECCC in the process of preparing the monitoring protocol and permit application. Results of the monitoring program will be shared publicly to help further improve the understanding of bird strandings and mortality in the Newfoundland and Labrador offshore area. BP will also submit a data report to ECCC in accordance with permit conditions under the *Migratory Birds Convention Act, 1994.* These results may also be used to verify effects predictions made in the EIS that residual environmental effects on marine and migratory birds are predicted to be not significant.

References:

ECCC [Environment and Climate Change Canada]. 2016. Procedures for handling and documenting stranded birds encountered on infrastructure offshore Atlantic Canada.

1.7.7 Information Requirement: IR-40

External Reviewer ID:

C-NLOPB-09; MTI-10; KMKNO-31

Reference to EIS:

Section 2.3.3;
Section 2.4.5;
Section 9.3.2;
Appendix B

Context and Rationale:

Section 2.4.5.1 of the EIS estimates that platform supply vessels will make a total of two to three round trips per week between the MODU and the supply base. Figure 4 in Appendix B indicates there is very little traffic in the Project Area at the current time. The EIS Guidelines require the predicted percentage increase in vessel traffic of similar size vessels resulting from the Project. This information, however, is not provided in the EIS. Section 2.4.5.1 states common shipping routes will be used as practicable to reduce incremental marine disturbance, although most common vessel traffic routes are located either to the north or south of the Project Area (refer to Figure 7.34). However, Figure 7.34 is a graph illustrating ground fish harvest within the Regional Assessment Area from 2012 to 2016. Figure 4 in Appendix B illustrates shipping traffic, which shows that Orphan Basin is not located in an area with established shipping routes.

Figure 2.11 (Potential Vessel and Helicopter Routes) of the EIS shows Bay Bulls as a potential supply base port, yet the text only refers to St. John’s as the supply base port. Section 9.3.2 of the EIS states that platform supply vessel routes transiting to and from the MODU will be planned to avoid passing within 300 metres of migratory bird nesting colonies during the nesting period and will comply with provincial Seabird Ecological Reserve Regulations, 2015 and Environment and Climate Change Canada’s Avoidance Guidelines for seabird and waterbird colonies. The Agency notes Environment and Climate Change Canada’s Seabird and Waterbird Colonies: Avoiding Disturbance Guidelines states that a minimum distance of at least 300 metres from all areas of the colony occupied by seabirds and waterbirds would be used.

The KMKNO requested platform supply vessels be required to reduce speeds (10-knot limit) when in the vicinity of a raft of marine birds and to avoid approaching congregations of marine birds.

Specific Question of Information Requirement:

Discuss the expected increase in platform supply vessels in the Project Area due to the Project.

Clarify if Bay Bulls and St. John’s are both potential supply base ports for the Project. If Bay Bulls is under consideration, update the effects analysis, as applicable.

Confirm whether Environment and Climate Change Canada's Seabird and Waterbird Colonies: Avoiding Disturbance Guidelines minimum distance of at least 300 metres would be used for all bird colonies or a specific subset.

Discuss if additional measures are proposed to mitigate potential effects of platform supply vessel speeds on migratory birds, including avoidance or will be reduction of vessel speeds in areas of birded to avoid disturbing congregations of marine birds.

Response:

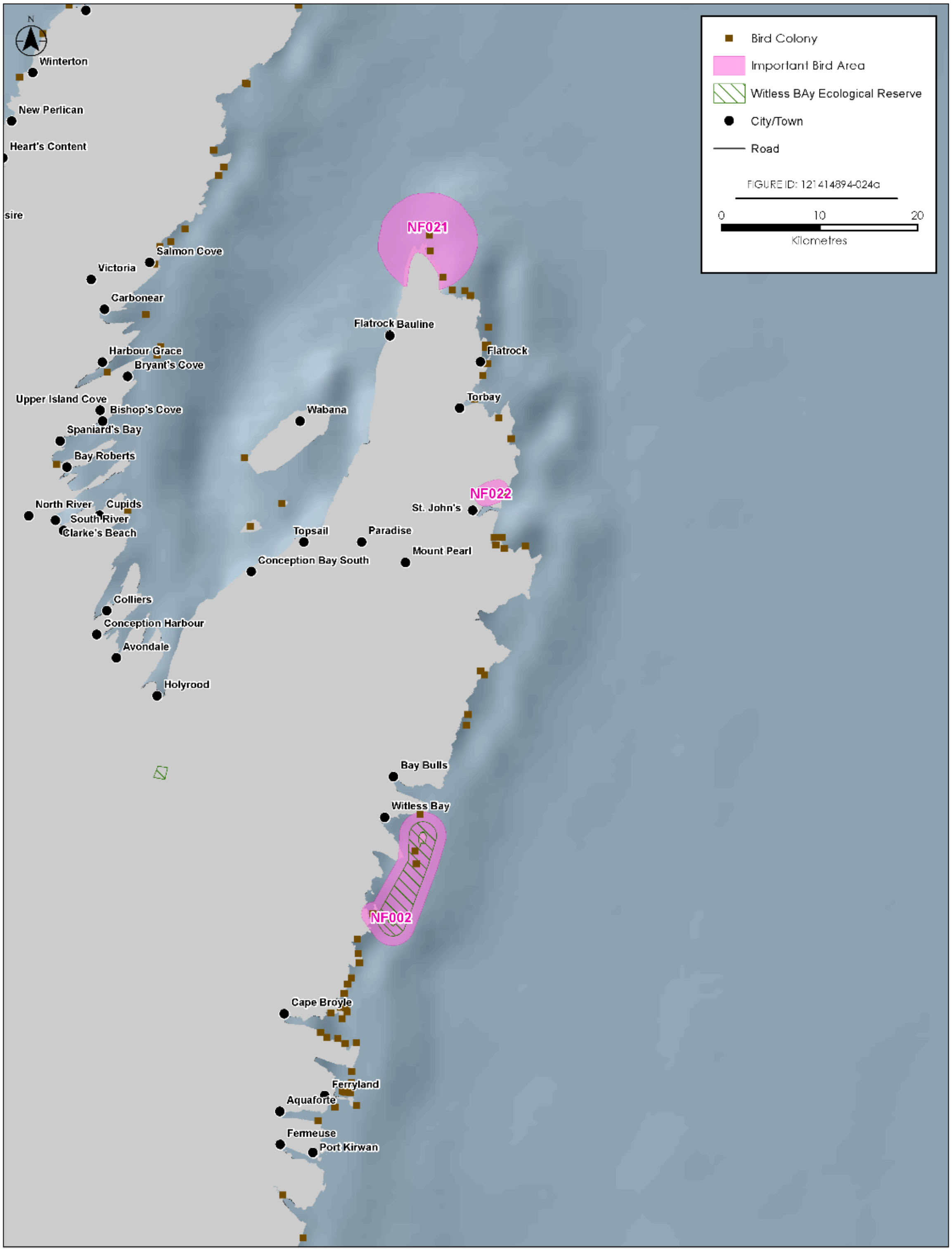
During active exploration, the Project is expected to involve two to three round trips per week by platform supply vessels (PSVs) between the mobile offshore drilling unit and the onshore supply base. As indicated on Figure 7.38 of the EIS (and Koropatnick et al. 2012), the majority of existing vessel traffic off Newfoundland occurs south of the Project Area. Vessel traffic in proximity to the Project Area would primarily be fisheries-related traffic.

BP has not yet selected a supply base for the Project, but it will be an existing facility on the Northeast Avalon Peninsula that could include St. John's or the port of Bay Bulls. From 2010 to 2015, an annual total of approximately 1,300 to 1,600 vessel transits in and out of the Port of St. John's were recorded; the majority of port traffic was offshore energy vessels (R. McCarthy, pers. comm. 2016, in Statoil Canada Ltd. 2017). For a 60-day well program, the increase in vessel traffic due to the Project would be approximately 40 to 60 vessel transits (20 to 30 round trips) per well (approximately 2.5% to 4.6% increase of total vessel traffic). Existing vessel traffic in and around Bay Bulls is considerably lower, although it too has been used to service offshore oil projects.

The option of using Bay Bulls as a supply base port was considered in the EIS and included in the Local Assessment Area boundaries for Valued Components (see EIS Figure 9.1 Marine and Migratory Birds Spatial Boundaries for example) and therefore no update to the effects assessment is required.

PSV routes transiting to and from the mobile offshore drilling unit will avoid transiting near known migratory bird nesting colonies and will comply with provincial *Seabird Ecological Reserve Regulations, 2015* and Environment and Climate Change Canada's (ECCC's) Avoidance Guidelines for seabird and waterbird colonies (ECCC 2017). If Bay Bulls is selected as a supply base port, PSVs entering and exiting Bay Bulls will approach the Witless Bay Ecological Reserve no closer than 2 km (Figure 1).

Although known bird colonies will be avoided, it is recognized that there could potentially be marine birds foraging within potential PSV routes. When travelling to and from the Project Area, PSVs will be travelling at speeds of 12 knots or less and PSV traffic is expected to cause only a brief, temporary displacement of seabirds that could potentially be foraging within the path of PSVs. Commitments regarding buffer zones and vessel speed will be included in the Project Environmental Protection Plan and included in contractor induction training.



Note: Important Bird Area NF022, which appears in close proximity to St. John's harbor is Quidi Vidi Lake and will not have any interaction with PSVs transiting in and out of the harbour.

Figure 1 Important Bird Areas (IBAs) and Bird Colonies along Avalon Peninsula, NL

References:

ECCC (Environment and Climate Change Canada). 2017. Seabird and waterbird Colonies: Avoiding Disturbance. Available at: https://www.canada.ca/en/environment-climate-change/services/avoiding-harm-migratory-birds/seabird-waterbird-colonies-disturbance.html

Koropatnick, T., S.K. Johnston, S. Coffen-Smout, P. Macnab and A. Szeto. 2012. Development and Applications of Vessel Traffic Maps Based on Long Range Identification and Tracking (LRIT) Data in Atlantic Canada. Can. Tech. Rep. Fish. Aquat. Sci. 2966: 27 pp. http://www.dfo-mpo.gc.ca/Library/345629.pdf

Statoil Canada Ltd. 2017. Flemish Pass Exploration Drilling Project Environmental Impact Statement. Prepared by Amec Foster Wheeler and Stantec Consulting Ltd. December 2017.

1.7.8 Information Requirement: IR-41

External Reviewer ID:

KMKNO-01

Reference to EIS:

Section 2.4.3;
Section 2.9.2.5

Context and Rationale:

Section 2.9.2.5 of the EIS states when formation flow testing is carried out, flaring is required to safely dispose of hydrocarbons that may come to surface. An alternative to a formation flow test with flaring is a formation flow testing while tripping, which does not require flaring as part of the well test. However, a formation flow testing while tripping does not provide the same data as formation flow testing with flaring and therefore might not be a suitable alternative in all cases. It is stated that the proponent will consider this test option on a case by case basis to ensure well testing meets C-NLOPB requirements.

Section 9.3.2 of the EIS identifies mitigation measures to reduce potential environmental effects of the Project on marine and migratory birds, including measures with respect to well evaluation and testing. No information is provided on formation flow testing while tripping, which in Section 2.9.2.5 was stated that it would be considered on a case by case basis to ensure it meets well resting requirements of the C-NLOPB.

Specific Question of Information Requirement:

Discuss whether formation flow testing while tripping will be used if well testing is required, if it meets the requirements of the C-NLOPB.

Response:

As indicated in Section 2.4.3 of the EIS, it is not currently anticipated that well testing would be carried out on wells drilled in the initial phase of the Project (e.g., one to two wells). In the event of well success in the initial well(s) and if the need for well testing is identified, a well test program will be developed and executed on subsequent wells.

Formation testing while tripping (FTWT) is an alternative to formation flow testing and can be conducted without the requirement for topside production equipment and flaring. FTWT involves bringing up formation fluids through the wellbore to the mobile offshore drilling unit for testing in a closed casing without interaction with the marine environment. If a well test program is proposed for any well on this Project, BP will require a separate authorization from the Canada-Newfoundland and Labrador Offshore Petroleum Board (C-NLOPB) in accordance with the *Newfoundland Offshore Petroleum Drilling and Production Regulations.* As part of that authorization process, BP will discuss with the C-NLOPB proposed well testing methods, including FTWT, to ensure that testing can be conducted safely and fulfill well information requirements.

1.7.9 Information Requirement: IR-42

External Reviewer ID:

ECCC-04; WM-16; WM-37; WM-40; WM-42; WM-60; MTI-15

Reference to EIS:

Section 2.9.2;
Section 9.3.2;
Section 9.3.3.1

Context and Rationale:

Section 2.9.2 of the EIS discusses planning flaring events such that they do not commence during periods of poor visibility, including at night or during inclement weather. Further, Section 9.3.2 discusses restricting flaring to a minimum required to characterize the well's hydrocarbon potential and as necessary for the safety of the operation, minimizing flaring during periods of migratory bird vulnerability, and the use of a water curtain to deter birds from the general vicinity. It is unclear how the mitigation measures mentioned above would be applied.

Section 9.3.3.1 of the EIS states that 95 percent of strandings of Leach's Storm-petrels occur between 10 September and 13 October.

Environment and Climate Change Canada identified the following mitigation measures that require consideration:

- notification to the C-NLOPB at least 30 days, as per the C-NLOPB's Measures to Protect and Monitor Seabirds in Petroleum-Related Activity in the Canada-Newfoundland and Labrador Offshore Area, in advance of flaring to determine whether the flaring would occur during a period of migratory bird vulnerability along with a description of how the proponent plans to prevent harm to migratory birds; and
- avoiding nighttime flaring (if possible), flaring during peak Storm-petrel fledging (mid-September to mid-October), and during the day when visibility is low due to fog.

Specific Question of Information Requirement:

Provide additional information on the measures to be taken to mitigate the effects of flaring on migratory birds, including:

- describe how flaring would be minimized during nighttime, poor weather conditions, and during periods of bird vulnerability;
- discuss whether it is feasible to schedule flaring outside of 10 September to 13 October;
- confirm if flare shields would be used during all flaring events; and
- confirm if there would be consultation with the C-NLOPB with respect to the timing of routine flaring at least 30 days in advance.

Update proposed mitigation, as applicable.

Response:

BP does not intend to conduct well testing or flaring. However, for the purpose of environmental assessment it is assumed that well testing which could involve short periods of flaring, may be required.

BP will notify the Canada-Newfoundland and Labrador Offshore Petroleum Board (C-NLOPB) at least 30 days in advance of non-emergency flaring to determine whether flaring would occur during a period of migratory bird vulnerability. If a well test program is proposed for any well on this Project, BP will require a separate authorization from the C-NLOPB in accordance with the *Newfoundland Offshore Petroleum Drilling and Production Regulations.* As part of that authorization process, BP will discuss with the C-NLOPB proposed well testing methods, including formation testing while tripping which is an alternative testing method that doesn't require flaring, to ensure that testing can be conducted safely and fulfill well information requirements, while reducing potential adverse environmental effects on migratory birds.

If flaring is required, BP will notify the C-NLOPB in accordance with the "Measures to Protect and Monitor Seabirds in Petroleum-Related Activity in the Canada-NL Offshore Area" and discuss with the C-NLOPB measures it will take to reduce adverse effects on migratory birds. One mitigative option could be to manage the timing of flaring activity. Although BP is unable to commit at this time to avoid scheduling flaring outside of 10 September to 13 October period, flaring could be planned such that it does not commence during periods of poor visibility including at night and during inclement weather to reduce light generated during flaring. However, once the well test with flaring begins, data gathered during the well test could be compromised if the well flow was restricted during this test period (i.e., restricted to certain weather conditions).

Flaring, if required, is expected to be brief and intermittent in nature (lasting two to three days at a time), which could occur multiple times in the well flow test period. When flaring, BP uses a water curtain to protect personnel and equipment on the MODU by limiting the transfer of radiated heat from the flare, thereby mitigating risk of fire. A secondary benefit of a water curtain is potential deterrence of birds from the general vicinity of the flare based on the positioning of the water curtain, therefore this may be considered as a mitigative option to reduce adverse effects on migratory birds.

1.7.10 Information Requirement: IR-43

External Reviewer ID:

WM-30; WM-38

Reference to EIS:

Section 9.3.3.1;
Section 9.4

Context and Rationale:

Section 9.3.3.1 of the EIS states that there is a lack of data on the occurrence of oiling of sea birds around platforms. The data that does exist is lacking on the frequency, likelihood, persistence, fate, and thickness of sheens resulting from discharges. In addition, there is a lack of quantitative studies on the direct effects of sheens on sea birds.

Section 9.4 of the EIS states that the overall determination of effects on birds is made with a moderate level of confidence given uncertainties in predicting the impact of attraction to artificial lighting and flaring on the MODU; however, there is no reference to the lack of data on the occurrence of oiling of sea birds.

Specific Question of Information Requirement:

Given the lack of data related to potential oiling of sea birds around platforms from discharges of operational wastes, discuss the need for follow-up and monitoring of discharges, including potential sheen frequency, as well as associated effects on migratory birds.

Response:

The Offshore Waste Treatment Guidelines (National Energy Board [NEB] et al. 2010) were developed with the intention of aiding operators in the management of waste material associated with petroleum drilling and production operations in offshore areas regulated by the Canada-Newfoundland and Labrador Offshore Petroleum Board (C-NLOPB) Canada-Nova Scotia Offshore Petroleum Board, and NEB. Although performance targets included in the Offshore Waste Treatment Guidelines represent minimum performance expectations, they were developed to be protective of the marine environment.

Although unlikely to occur, the treated discharge of some operational wastes may cause surface sheening, typically under calm conditions; however, the potential for sheen formation is very unlikely with proper treatment and management of operational discharges in accordance with the Offshore Waste Treatment Guidelines and chemical selection in accordance with the Offshore Chemical Selection Guidelines (NEB et al. 2009). As discussed in Section 9.3.3.1 of the EIS, small amounts of oil from sheens has been shown to affect the structure and function of seabird feathers (O'Hara and Morandin 2010), which has the potential to result in water penetrating plumage and displacing the layer of insulating air, resulting in loss of buoyancy and hypothermia. This can in turn cause a heightened metabolic rate (increased energy expenditure), as well as behavioural changes such as increased time spent preening at the expense of foraging and breeding, and potentially death, especially in the winter months when conditions are colder and thermoregulation is most difficult (Morandin and O'Hara 2016).

Morandin and O'Hara (2016) recognize a lack of data on: the occurrence of oiling of seabirds around platforms; the frequency, likelihood, persistence, fate, and thickness of sheens resulting from discharges of drilling muds (and produced water); the direct effects of sheens on seabirds; and the effects of sheens on the abundance of pelagic seabirds in Atlantic Canada.

Although unlikely to occur, if a sheen was observed during normal operating conditions (i.e., discharges within approved operational criteria with no hydrocarbon spill), BP will immediately notify the Canadian Coast Guard and C-NLOPB for informational purposes. Furthermore, for the duration of the drilling program for each well, systematic deck searches for stranded birds will be undertaken by trained observers on the mobile offshore drilling unit and the platform supply vessels during Project operations. These systematic searches will be conducted daily (preferably at dawn) and in accordance with *Procedures for Handling and Documenting Stranded Birds Encountered on Infrastructure Offshore Atlantic Canada* (Environment and Climate Change Canada [ECCC] 2016) and associated permit conditions under the *Migratory Birds Convention Act, 1994* authorizing the capture and handling of migratory birds. Search efforts will be documented and observations recorded (including notes of whether birds show any sign of oiling). BP will consult ECCC (Canadian Wildlife Service) in the process of preparing the monitoring protocol and permit application. Results of the monitoring program will be shared publicly to help further improve the understanding of bird strandings and mortality in the Newfoundland and Labrador offshore area.

References:

ECCC (Environment and Climate Change Canada). 2016. Procedures for Handling and Documenting Stranded Birds Encountered on Infrastructure Offshore Atlantic Canada. 17 pp. + Appendices.

Morandin, L.A. and P.D. O'Hara. 2016. Offshore oil and gas, and operational sheen occurrence: is there potential harm to marine birds? Environmental Reviews, 24(3): 285-318.

NEB (National Energy Board), Canada-Newfoundland and Labrador Offshore Petroleum Board and Canada-Nova Scotia Offshore Petroleum Board. 2009. Offshore Chemical Selection Guidelines for Drilling and Production Activities on Frontier Lands. iii + 13 pp.

NEB (National Energy Board), Canada-Newfoundland and Labrador Offshore Petroleum Board and Canada-Nova Scotia Offshore Petroleum Board. 2010. Offshore Waste Treatment Guidelines. Vi + 28 pp.

O'Hara, P.D. and L.A. Morandin. 2010. Effects of sheens associated with offshore oil and gas development on the feather microstructure of pelagic seabirds. Marine Pollution Bulletin, 60: 672-678.

1.8 Species at Risk

1.8.1 Information Requirement: IR-44

External Reviewer ID:

DFO-06

Reference to EIS:

Section 6.1.7, Table 6.4

Context and Rationale

Table 6.4 in Section 6.1.7 of the EIS has errors regarding the characterization of species at risk. Acadian Redfish, Smooth Skate and White Hake are Species at Risk or Species of Conservation Concern. Atlantic Halibut and Blue Shark are not Species at Risk or Species of Conservation Concern.

There are also inconsistencies between the descriptions of potential occurrence in Table 6.4 and corresponding figures showing species distribution (e.g., Deepwater Redfish, Greenland Halibut, Witch Flounder).

Specific Question of Information Requirement

Update Table 6.4 to correct species at risk and species of conservation concern species characterization. Correct inconsistencies between descriptions of potential occurrence in Section 6.1.7 of the EIS and related figures (Figures 6.6 to 6.11). If figures have errors with species distribution, revise the figure and clearly illustrate the species presence in the Project Area.

Response

Table 1 provides updates that have been made to EIS Table 6.4 to correct the species at risk and species of conservation concern characterizations (as noted above) as well as descriptions of potential occurrence. A review of species distribution presented in EIS Figures 6.6 to 6.11 confirmed that they are accurate based on the available data sets. Based on this review of the figures, the potential for occurrence in the Regional Assessment Area (RAA) was changed from moderate to high for deepwater redfish, Greenland halibut, and witch flounder.

Table 1 EIS Table 6.4 (Updated): Key Fish Species from the 2016-2017 Canadian RV Survey Sets Collected within the RAA and Project Area

Common Name	Scientific Name	Potential for Occurrence in the RAA[1]	Potential for Occurrence in the Project Area[1]	Timing of Presence in Project Area
Demersal				
Acadian redfish[2]	*Sebastes marinus*	High	Moderate	Year-Round
American plaice[2]	*Hippoglossoides platessoides*	High	Low	Year-Round
Atlantic cod[2]	*Gadus morhua*	High	Moderate	Year-Round
Atlantic halibut	*Hippoglossus*	Moderate	Moderate	December to March
Atlantic wolffish[2]	*Anarhichus lupus*	Low	Low	Year-Round
Blacksmelts	*Bathylagus sp.*	Low	Low	Year-Round
Blue hake	*Antimora rostrata*	Moderate	Moderate	Year-Round
Carapine grenadier	*Lionurus carapinus*	Moderate	Moderate	Year-Round
Common grenadier	*Nezumia bairdi*	Moderate	Moderate	Year-Round
Deepwater redfish[2]	*Sebastes mentella*	High	High	Year-Round
Dragonfish	*Stomias boa ferox*	Low	Low	Year-Round
Eelpout	*Lycodes sp.*	Moderate	Moderate	Year-Round
Greenland halibut	*Reinhardtius hippoglossoides*	High	High	Year-Round
Hookear sculpin	*Artediellus* sp.	Low	Low	Year-Round
Kaup's arrowtooth eel	*Synaphobranchus kaupii*	Low	Moderate	Year-Round
Large scale tapirfish	*Notacanthus chemnitzii*	Low	Low	Year-Round
Northern wolffish[2]	*Anarhichas denticulatus*	Moderate	High	Year-Round
Ogrefish	Melamphaidae	Low	Low	Year-Round
Roughhead grenadier[2]	*Macrourus berglax*	High	High	Year-Round
Roundnose grenadier[2]	*Coryphaenoides rupestris*	Moderate	High	Year-Round
Sand lance	*Ammodytes sp.*	Moderate	Low	Year-Round
Shortspine tapirfish	*Polyacanthonotus rissoanus*	Low	Low	Year-Round
Silver hake	*Merluccius bilinearis*	Moderate	Low	Year-Round
Slickhead sp.	*Alepocephalus sp.*	Low	Moderate	Year-Round
Smooth skate[2]	*Malacoraja senta.*	Moderate	Low	Year-Round
Spotted wolffish[2]	*Anarhichas minor*	Low	Moderate	Year-Round
Thorny skate[2]	*Amblyraja radiata*	High	Moderate	Year-Round
Vahl's eelpout	*Lycodes vahlii*	Low	Low	Year-Round
Viperfish	*Chauliodus sloani*	Low	Low	Year-Round
White hake[2]	*Urophycis tenuis*	Moderate	Low	Year-Round

Common Name	Scientific Name	Potential for Occurrence in the RAA[1]	Potential for Occurrence in the Project Area[1]	Timing of Presence in Project Area
Witch Flounder	*Glyptochepalus cynoglossus*	High	High	Year-Round
Yellowtail Flounder	*Limanda ferruginea*	High	Low	Year-Round
Pelagic				
Atlantic salmon[2]	*Salmo salar*	Migratory/Transient	Migratory/Transient	
Albacore tuna	*Thunnus alalunga*	Moderate	Low	September to December
American eel[2]	*Anguilla rostrata*	Migratory/Transient	Migratory/Transient	March to November
Atlantic bluefin tuna[2]	*Thunnus thynnus*	Moderate	Low	July to September
Basking shark[2]	*Cetorhinus maximus*	Moderate	Moderate	Year-Round
Blue shark	*Prionace glauce*	Low	Low	June to October
Capelin	*Mallotus villosus*	Moderate	Low	Year-round
Greenland shark	*Simniosus microcephalus*	Moderate	Low	June to October
Lanternfish	Myctophidae	Moderate	High	Year-Round
Porbeagle shark[2]	*Lamna nasus*	Moderate	Moderate	Year-round
Shortfin mako shark[2]	*Isurus oxyrinchus*	Low	Low	July to October
Swordfish	*Xiphias gladius*	Low	Low	July to October
White shark[2]	*Carcharodon carchias*	Low	Low	July to October

Source: Amec 2014; Baker et al. 2012; COSEWIC 2006a, 2006b, 2007, 2008, 2009a, 2009b, 2010a, 2010b, 2012a, 2012b, 2014, 2017, DFO 2017; Druon et al. 2016; Fossen and Bergstad. 2006; Lehodey et al. 2014.
Notes:
1) This qualitative characterization is based on expert opinion, and an analysis of understood habitat preferences across life-history stages, available distribution mapping, and catch data for each species within the Project Area.
2) Species at risk or species of conservation concern.

References

Amec (Amec Environment and Infrastructure). 2014. Eastern Newfoundland and Labrador Offshore Area Strategic Environmental Assessment. Final Report. Submitted to Canada-Newfoundland and Labrador Offshore Petroleum Board, St. John's, NL. 527 pp. + appendices.

Baker, K.D., R.L. Haedrich, P.V.R. Snelgrove, V.E. Wareham, E. Edinger and K. Gilkinson. 2012. Small-scale patterns of deep-sea fish distributions and assemblages of the Grand Banks, Newfoundland continental slope. Deep-Sea Research Part I: Oceanographic Research Papers, 65: 171-188.

COSEWIC (Committee on the Status of Endangered Wildlife in Canada). 2006a. COSEWIC assessment and status report on the blue shark *Prionace glauca* (Atlantic and Pacific populations) in Canada. Committee on the Status of Endangered Wildlife in Canada. Ottawa, ON. vii + 46 pp.

COSEWIC (Committee on the Status of Endangered Wildlife in Canada). 2006b. COSEWIC assessment and status report on the White Shark *Carcharodon carcharia* (Atlantic and Pacific populations) in Canada. Committee on the Status of Endangered Wildlife in Canada. Ottawa, ON. vii + 31 pp.

COSEWIC (Committee on the Status of Endangered Wildlife in Canada). 2007. COSEWIC assessment and status report on the Roughhead Grenadier *Macrourus berglax* in Canada. Committee on the Status of Endangered Wildlife in Canada. Ottawa, ON. ix + 75 pp.

COSEWIC (Committee on the Status of Endangered Wildlife in Canada). 2008. COSEWIC assessment and status report on the Roundnose Grenadier *Coryphaenoides rupestris* in Canada. Committee on the Status of Endangered Wildlife in Canada. Ottawa, ON. vii + 42 pp.

COSEWIC (Committee on the Status of Endangered Wildlife in Canada). 2009a. COSEWIC assessment and status report on the American Plaice *Hippoglossoides platessoides*, Maritime population, Newfoundland and Labrador population and Arctic population, in Canada. Committee on the Status of Endangered Wildlife in Canada. Ottawa, ON. x + 74 pp.

COSEWIC (Committee on the Status of Endangered Wildlife in Canada). 2009b. COSEWIC assessment and status report on the Basking Shark *Cetorhinus maximus*, Atlantic population, in Canada. Committee on the Status of Endangered Wildlife in Canada Ottawa, ON. viii + 56 pp.

COSEWIC (Committee on the Status of Endangered Wildlife in Canada). 2010a. 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

COSEWIC (Committee on the Status of Endangered Wildlife in Canada). 2010b. COSEWIC assessment and status report on the Atlantic Cod *Gadus morhua* in Canada. Committee on the Status of Endangered Wildlife in Canada. Ottawa. xiii + 105 pp.

COSEWIC (Committee on the Status of Endangered Wildlife in Canada). 2012a. COSEWIC assessment and status report on the American Eel *Anguilla rostrata* in Canada. Committee on the Status of Endangered Wildlife in Canada. Ottawa, ON. xii + 109 pp.

COSEWIC (Committee on the Status of Endangered Wildlife in Canada). 2012b. COSEWIC assessment and status report on the Atlantic Wolffish *Anarhichas* lupus in Canada. Committee on the Status of Endangered Wildlife in Canada. Ottawa, ON. ix + 56 pp.

COSEWIC (Committee on the Status of Endangered Wildlife in Canada). 2014. COSEWIC assessment and status report on the Porbeagle *Lamna nasus* in Canada. Committee on the Status of Endangered Wildlife in Canada. Ottawa, ON. xi + 40 pp.

COSEWIC (Committee on the Status of Endangered Wildlife in Canada). 2017. COSEWIC assessment and status report on the Shortfin Mako *Isurus oxyrinchus*, Atlantic population, in Canada. Committee on the Status of Endangered Wildlife in Canada. Ottawa, ON. xii + 34 pp.

DFO (Fisheries and Oceans Canada). 2017. Aquatic Species at Risk. Accessed at: http://www.dfo-mpo.gc.ca/species-especes/sara-lep/identify-eng.html on April 10, 2018.

Druon J-N, J-M. Fromentin, A.R. Hanke, H. Arrizabalag, D. Damalas, V. Tičina, G. Quílez-Badia, K. Ramirez, I. Arregui, G. Tserpes, P. Reglero, M. Deflorio, I. Oray, S. Karakulak, P. Megalofonou, T. Ceyhan, L. Grubišić, B.R. MacKenzie, J. Lamkin, P. Afonso and P. Addis. Habitat suitability of the Atlantic bluefin tuna by size class: An ecological niche approach, Progress in Oceanography, 142.

Fossen, I. and O.A. Bergstad. 2006. Distribution and biology of blue hake, *Antimora rostrata* (Pisces: Moridae), along the mid-Atlantic Ridge and off Greenland. Fisheries Research, 82(1-3): 19-29.

Lehodey, P., I. Senina, A.-C. Dragon and H. Arrizabalaga. 2014. Spatially explicit estimates of stock size, structure and biomass of North Atlantic albacore Tuna (*Thunnus alalunga*). Earth System Science Data, 6: 317-329.

1.8.2 Information Requirement: IR-45

External Reviewer ID:

N/A

Reference to EIS:

Section 6.2.4

Context and Rationale:

The Agency is the responsible authority for the environmental assessment of the Project and therefore must identify the adverse effects of the Project on listed wildlife species and their critical habitats under the *Species at Risk Act* and, if the Project is carried out, must ensure that specific measures are taken to avoid or lessen those effects and to monitor them. The measures must be consistent with any applicable recovery strategy and action plan. Furthermore, in recognition of the potential risks to species assessed by the COSEWIC, the Agency requires an assessment of effects on these species as well as an accounting of measures that could be taken to avoid or lessen effects and to monitor them. The EIS Guidelines require direct and indirect effects on the survival or recovery of federally listed species to be described (Section 6.3.6).

The EIS does not explain how the mitigation measures for general valued components are consistent with applicable recovery strategies and action plans. In some cases management plans, recovery strategies, or action plans have not been referenced (e.g., Piping Plover, Red Knot and Ivory Gull are listed under the *Species at Risk Act* as endangered and the Ross's Gull is listed as threatened).

Specific Question of Information Requirement:

Update information related to species at risk taking into consideration the management plans, recovery strategies or actions plans for Piping Plover, Red Knot, Ivory Gull Ross's Gull, and Red-necked Phalarope, as necessary.

Provide a description of key threats to species at risk as included in applicable recovery strategies and action plans as relevant to the Project, as well as the potential contribution of project activities to these threats.

Update the effects assessment, potential mitigation and follow-up, as appropriate, including a description of how mitigation measures are consistent with applicable recovery strategies and action plans.

Response:

Red-necked phalarope is assessed by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) as special concern but was proposed to be added to the *Species at Risk Act* (SARA) Schedule 1, Part 4 (Special Concern), on 29 December 2018 (Environment and Climate Change Canada [ECCC] 2018). This proposed order to amend SARA Schedule 1 to include the red-necked phalarope is due to the species' decline over the last 40 years in an important staging area and potential threats on its breeding grounds including habitat degradation associated with climate change. Red-necked phalarope is also susceptible to pollutants and oil exposure on migration and during the winter (ECCC 2018). No recovery strategy or action plans for this species have been prepared yet. Threats on Arctic nesting grounds may include build-up of contaminants, increased industrial development, and denuding of vegetation by growing snow goose (*Anser caerulescens*) populations. In the non-breeding season threats may include changes in ocean temperature, salinity, and currents due to climate change, decline in the availability of prey at traditional staging areas and over-wintering sites, increased disturbance from shipping traffic, change in water quality, chronic oil pollution, point-source oil spills, and ingestion of microplastics (COSEWIC 2014).

Identified threats to piping plover, *melodus* subspecies, that cause a high level of concern, have a high level of severity, and a high causal certainty consist of predation of adults, eggs, and young, disturbance or harm from recreational beach use and vehicle operation on beaches, habitat loss or degradation from human disturbance, and coastal development (Environment Canada 2012). Threats causing a medium level of concern, with a moderate to high level of severity and a high causal certainty consist of habitat loss or degradation due to oil or contaminant spills, flooding and extreme weather events, and pollution due to oil spills.

Identified threats to red knot, *rufa* subspecies, consist of: harvesting of horseshoe crab (*Limulus polyphemus*) in Delaware Bay, the eggs of which are critical to meet the energetic requirements of the final leg of the *rufa* subspecies' spring migration, and industrial and military effluents (ECCC 2017).

Threats to ivory gull causing a high level of concern, high severity, and medium to high causal certainty consist of illegal shooting and predation on nests (Environment Canada 2014). Threats of a medium level of concern, medium severity, and low to medium level of certainty are industrial activities and contaminant pollution. Climate change is anticipated to become a threat to ivory gull.

Threats to Ross's gull that have been identified consist of: human disturbance at nests at Churchill, Manitoba; predation by gulls, jaegers, Arctic fox, weasels and polar bears; habitat loss and destruction from flooding on nesting grounds; and from oil drilling and waste disposal at fall migration stopover sites (Environment Canada 2007b).

Threats to buff-breasted sandpiper include habitat loss, fragmentation and degradation on the nesting grounds due to climate change and mineral and energy resource development (COSEWIC 2012). Threats at migration staging areas and wintering grounds consist of agriculture. Other threats may include agrochemicals, changing agricultural practices, wind energy developments, more frequent and intense storms during fall migration, and more frequent and severe droughts on the Prairies resulting in decreased food availability during spring migration.

Threats to harlequin duck (eastern population) are thought to include chronic oil pollution in marine waters from illegal oil discharge, insect control programs adjacent to breeding rivers, breeding habitat loss or degradation from hydroelectric development, forestry, mineral resource extraction, gillnet bycatch on the Greenland coast (one of the wintering areas), aquaculture operations in overwintering areas, human disturbance via shipping, recreational boating and angling, and illegal hunting (Environment Canada 2007a).

Threats to Barrow's goldeneye (eastern population), that are of a high level of concern and a medium to high causal certainty consist of: logging and fish stocking, but the severity of these threats is unknown (Environment Canada 2013). Hydrocarbon spills are of a medium level of concern and medium causal certainty, but the severity of this threat is unknown. Hunting causes a medium level of concern but low causal certainty and has an unknown severity.

The Project will not contribute to vessel traffic disturbance of these species at risk since platform supply vessel routes do not pass through traditional concentration areas of these species. For many of these species, exposure to hydrocarbons in marine waters is a key threat. Project discharges and emissions will be managed in accordance with the Offshore Waste Treatment Guidelines (National Energy Board [NEB] et al. 2009) and/or the International Convention for the Prevention of Pollution from Ships (MARPOL). Also, any chemicals intended for discharge to the marine environment will be selected for use in accordance with the Offshore Chemical Selection Guidelines (NEB et al. 2009). Adherence to these guidelines will reduce risk of marine pollution threats faced by these species at risk.

Because these species at risk are sensitive to hydrocarbons in marine waters or shorelines, they could be negatively affected by accidental events such as a blowout or large fuel spill. The risk of such incidents occurring will be managed and the potential consequences mitigated through multiple preventative and response barriers as discussed in the accidental events chapter (refer to EIS Section 15.5.2.2).

The only potential for interaction between these species at risk is through operational discharges or accidental hydrocarbon releases. The proposed mitigation measures outlined above will be included in the Environmental Protection Plan for the Project and are consistent with the management plans, recovery strategies, or action plans prepared for these species.

References:

COSEWIC (Committee on the Status of Endangered Wildlife in Canada). 2012. COSEWIC Assessment and Status Report on the Buff-breasted Sandpiper *Tryngites subruficollis* in Canada. Committee on the Status of Endangered Wildlife in Canada, Ottawa, ON. x + 44 pp.

COSEWIC (Committee on the Status of Endangered Wildlife in Canada). 2014. COSEWIC Assessment and Status Report on the Red-necked Phalarope (*Phalaropus lobatus*) in Canada. Committee on the Status of Endangered Wildlife in Canada, Ottawa, ON. x + 52 pp.

ECCC (Environment and Climate Change Canada). 2017. Recovery Strategy and Management Plan for the Red Knot (*Calidris canutus*) in Canada. Environment and Climate Change Canada *Species at Risk Act* Recovery Strategy Series, Ottawa, ON. ix + 67 pp.

ECCC (Environment and Climate Change Canada). 2018. Canada Gazette, Part I, Volume 152, Number 52: Order Amending Schedule 1 to the *Species at Risk Act*. Available at: http://gazette.gc.ca/rp-pr/p1/2018/2018-12-29/html/reg1-eng.html.

Environment Canada. 2007a. Management Plan for the Harlequin Duck (*Histrionicus histrionicus*) Eastern Population, in Atlantic Canada and Québec. Environment Canada, *Species at Risk Act* Management Plan Series, Ottawa, ON. vii + 32 pp.

Environment Canada. 2007b. Recovery Strategy for the Ross's Gull (*Rhodostethia rosea*) in Canada. *Species at Risk Act* Recovery Strategy Series, Environment Canada, Ottawa, ON. iv + 18 pp.

Environment Canada. 2012. Recovery Strategy for the Piping Plover (*Charadrius melodus melodus*) in Canada. Environment Canada Species at Risk Act Recovery Strategy Series, Ottawa, ON. v + 29 pp.

Environment Canada. 2013. Management Plan for the Barrow's Goldeneye (*Bucephala islandica*), Eastern Population, in Canada. Environment Canada *Species at Risk Act* Management Plan Series, Ottawa, ON. iv + 16 pp.

Environment Canada. 2014. Recovery Strategy for the Ivory Gull (*Pagophila eburnea*) in Canada. *Species at Risk Act* Recovery Strategy Series, Environment Canada, Ottawa, ON. iv + 21 pp.

NEB (National Energy Board), Canada-Newfoundland and Labrador Offshore Petroleum Board and Canada-Nova Scotia Offshore Petroleum Board). 2009. Offshore Chemical Selection Guidelines for Drilling and Production Activities on Frontier Lands. iii+13 pp.

NEB (National Energy Board), Canada-Newfoundland and Labrador Offshore Petroleum Board and Canada-Nova Scotia Offshore Petroleum Board). 2010. Offshore Waste Treatment Guidelines. vi + 28 pp.

1.8.3 Information Requirement: IR-46

External Reviewer ID:

DFO-04

Reference to EIS:

Section 6.3.7

Context and Rationale:

Section 6.1.5 of the EIS Guidelines requires inclusion of all potential or known federally listed species at risk and species designated by the *Committee on the Status of Endangered Wildlife in Canada* (COSEWIC), and their habitat within the areas that could be affected by routine Project operations or accidents and malfunctions. Section 6.1.5 of the EIS Guidelines further requires a discussion of the residences, seasonal movements, movement corridors, habitat requirements, key habitat areas, identified and proposed critical habitat and/or recovery habitat (where applicable) and general life history of species at risk that may occur in the Project Area, or be affected by the Project.

Section 6 of the EIS provides species descriptions for species at risk; however, Section 6 does not provide the life history of species at risk, in particular for wolffish species, in the context of the characteristics of the Project Area/Local Assessment Area. The link between the various life history stages of the species and whether the ELs, Project Area or Local Assessment Area have the features that would support the noted life history stages/requirements are not clearly stated in the EIS.

Specific Question of Information Requirement:

Discuss the link between the habitat within the Exploration Licences, Project Area and Local Assessment Area, and the life history requirements or stages of the fish and marine mammal species at risk, including wolffish, identified in Section 6 of the EIS.

Update the effects assessment and cumulative effects assessment, as necessary.

Response:

Fish

Section 6.3.7 of the EIS focuses only on marine mammal and sea turtle Species at Risk that are currently listed under Schedule 1 of the *Species at Risk Act*. Species of conservation interest, including species assessed by the Committee on the Status of Endangered Wildlife in Canada are discussed in EIS Sections 6.1.7 and 6.1.8. In particular, EIS Tables 6.5 and 6.7 provide information on the distribution, habitat, spawning time, life history, and ecology of species of conservation interest and species with a high probability to spawn within the Project Area. EIS Table 6.7 acknowledges proposed critical habitat designations for northern wolffish and spotted wolffish which occur in the Regional Assessment Area (RAA), and, in the case of the northern wolffish, overlaps the Project Area. Refer also to CL-16 for a map showing these proposed areas. No update to the effects assessment, including the cumulative effects assessment is necessary.

Marine Mammals

Section 4.2.3 of the EIS Guidelines (Agency 2018) encourages proponents to make use of existing information and allows for cross-referencing of existing documents when this information is being used to fulfill requirements of the EIS Guidelines. Section 6.3 of the EIS noted that descriptions of marine mammals in the eastern Newfoundland offshore area were presented in the Eastern Newfoundland Strategic Environmental Assessment (Section 4.2.3 of Amec 2014) and project-specific seismic and exploration drilling EISs off Newfoundland's east coast (Section 4.5 of LGL 2015, 2016; and Section 6.3 of Statoil 2017 and ExxonMobil 2017). As such, BP's EIS did not provide detailed descriptions of life histories for marine mammals. Instead, the EIS focused on potential for occurrence within the RAA and Project Area based on habitat preferences, sightings data, and modelling studies.

With regards to marine mammals, no critical habitat has proposed or designated in or near the Project Area. There are data gaps that preclude identifying which life history stages of various cetacean species at risk occur within the Project Area. Generally, it is assumed the cetaceans that occur there during the summer period would engage in foraging activity. It is unknown if the area serves as a migratory route or breeding area for cetacean species at risk. Based on the Fisheries and Oceans Canada sightings database (see Table 6.17 in the EIS), cetacean species at risk that have been observed in the Project Area (i.e., northern bottlenose whales, Sowerby's beaked whale, and fin whales) occurred there during late spring to early fall. However, the absence of visual sightings during other times of the year is likely related to a lack of survey effort. Since the BP EIS was submitted, an Environmental Studies Research Fund acoustic monitoring study has become publicly available (Delarue et al. 2018). This study involved the collection of marine mammal vocalization data by 20 acoustic recorders deployed at locations extending from northern Labrador to the southwestern Scotian Slope over an approximate two-year period (September 2015 to July 2017). One of the acoustic recorders (Station 15) was located within the Project Area (within EL 1146; in approximately 2,000 m water depth) and another acoustic recorder (Station 19) was located in the southern portion of Orphan Basin (either 45 km or 72 km from the Project Area depending on the year, in approximately 1,500 m water depth) (Delarue et al. 2018).

In the Project Area, northern bottlenose whale clicks were detected each month but were not as prevalent as at Station 19, south of the Project Area, where clicks were detected almost daily throughout the year. Fin whales were primarily detected from August and April at Stations 15 and 19, but were assumed to be present year-round. Blue whale vocalizations were detected in the Project Area and in southern Orphan Basin in relatively low numbers during September to January; the acoustic analyses were not able to reliably identify blue whale calls during the summer period (Delarue et al. 2018). Based on these acoustic data, cetacean species at risk do occur in and near the Project Area during winter and in some cases year-round. The EIS assumed that these species could be present within the RAA and Project year-round (see EIS Table 6.16). It is unknown if these cetacean species at risk undertake important life history functions (i.e., breeding, calf rearing) in and near the Project Area but it is possible.

As noted in Section 10.4 of the EIS, the effects determination for marine mammals was made with a moderate level of confidence, in part due to limited baseline data on species use of the Project Area and uncertainty as to whether the Project Area is regularly used for foraging, migratory corridors and/or breeding. No update to the effects assessment, including the cumulative effects assessment, is necessary.

References:

Amec (Amec Environment and Infrastructure). 2014. Eastern Newfoundland and Labrador Offshore Area Strategic Environmental Assessment. Final Report. Submitted to Canada-Newfoundland and Labrador Offshore Petroleum Board, St. John's, NL. 527 pp. + appendices.

Delarue, J., K.A. Kowarski, E.E. Maxner, J.T. MacDonnell and S.B. Martin. 2018. Acoustic Monitoring Along Canada's East Coast: August 2015 to July 2017. Document Number 01279, Environmental Studies Research Funds Report Number 215, Version 1.0. Technical report by JASCO Applied Sciences for Environmental Studies Research Fund, Dartmouth, NS, Canada. 120 pp + Appendices.

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Statoil Canada Ltd. 2017. Flemish Pass Exploration Drilling Program – Environmental Impact Statement. Prepared by Amec Foster Wheeler and Stantec Consulting Ltd., St. John's, NL Canada. 1378 pp.

1.8.4 Information Requirement: IR-47

External Reviewer ID:

DFO-07

Reference to EIS:

Section 10.0

Section 15.5.3

Context and Rationale:

Section 6.3.6 of the EIS Guidelines state that potential adverse effects of the Project on species at risk and their critical habitat must be included in the EIS. Fisheries and Oceans Canada has noted that the EIS states that no identified critical habitat is present in the Project Area, Local Assessment Area, or Regional Assessment Area. However, spill trajectory modelling indicates a small probability that oil could reach the Gully Marine Protected Area and Sable Island National Park Reserve. The EIS does not discuss marine mammals and critical habitat in these areas that could be affected.

Specific Question of Information Requirement:

Describe marine mammal species at risk and their critical habitat in the Gully Marine Protected Area and Sable Island National Park Reserve area that could be affected by an accidental event. Update the effects assessment, as necessary.

Response:

Stochastic modelling of unmitigated well blowout scenarios in West Orphan Basin and East Orphan Basin in winter and summer conditions predicted minimal interaction with Sable Island and the Gully Marine Protected Area (MPA) (refer to Appendix D of the EIS, see Table 1 for a summary of results). The probability of surface oil exceeding a threshold of 0.4 μm (visible sheen) in the Gully or adjacent waters to Sable Island was ≤5% depending on the spill location and response scenario. In-water column oiling at a total hydrocarbon concentration of 58 ppb was not predicted to occur for the Gully or waters surrounding Sable Island and stranded oil (at a concentration of 1 g/m^2) was not predicted to reach Sable Island in any modelled scenario.

Marine mammal species at risk known to frequent the Gully and waters surrounding Sable Island include the northern bottlenose whale (Scotian Shelf population - endangered), blue whale (Atlantic Ocean population - endangered), fin whale (Atlantic Ocean population - special concern), and Sowerby's beaked whale (Atlantic Ocean population - special concern). Zone 1 of the Gully MPA, and adjacent Shortland and Haldimand Canyons are designated as critical habitat for the northern bottlenose whale. The continental shelf edge of Nova Scotia has been identified as important habitat for the Atlantic Ocean population of the blue whale (Fisheries and Oceans Canada 2018). The North Atlantic right whale (endangered) is also expected to be present in the vicinity of the Gully and waters surrounding Sable Island, although critical habitat for this species has been designated on the western Scotian Shelf (i.e., Roseway Basin) and Bay of Fundy (Grand Manan Basin).

Section 15.5.3 of the EIS assesses effects of accidental spills on marine mammals including the above listed species at risk. However, critical habitat on the Scotian Shelf in the vicinity of the Gully MPA and Sable Island was not specifically assessed. The presence of a visible sheen for one to three days (see Table 1) is not expected to alter the valued habitat of Sable Island or the Gully MPA such that there is a decline in abundance lasting more than one generation of key species or a change in community structure beyond which natural recruitment would not sustain the population or community in the special area. It is also therefore not predicted to result in permanent or irreversible loss of critical habitat.

The conclusions and effects determination in Section 15.5.3 of the EIS (no significant adverse environmental effects on marine mammals and sea turtles) remain valid.

References:

DFO (Fisheries and Oceans Canada). 2018. Identification of habitats important to the blue whale in the western North Atlantic. DFO Can. Sci. Advis. Sec. Sci. Advis. Rep., 2018/003.

Table 1 Summary of Predicted Intersection of Oil with Sable Island and the Gully in the Event of a Well Blowout in the Orphan Basin

Modelled Scenario	Sable Island									The Gully								
	Stranded Oil (1 g/m^2)			Surface Oiling (0.4 µm)			Water Column Dispersed and Dissolved Oil (58 ppb THC)			Stranded Oil (1 g/m^2)			Surface Oiling (0.4 µm)			Water Column Dispersed and Dissolved Oil (58 ppb THC)		
	Average Probability of Intersection (%)	Average of Minimal Arrival Time (days)	Average of Maximum Exposure Time (days)	Average Probability of Intersection (%)	Average of Minimal Arrival Time (days)	Average of Maximum Exposure Time (days)	Average Probability of Intersection (%)	Average of Minimal Arrival Time (days)	Average of Maximum Exposure Time (days)	Average Probability of Intersection (%)	Average of Minimal Arrival Time (days)	Average of Maximum Exposure Time (days)	Average Probability of Intersection (%)	Average of Minimal Arrival Time (days)	Average of Maximum Exposure Time (days)	Average Probability of Intersection (%)	Average of Minimal Arrival Time (days)	Average of Maximum Exposure Time (days)
West Orphan Well Blowout Relief Well Scenario (120 days) Summer	-	-	-	-	-	-	-	-	-	-	-	-	2.4	107	1	-	-	-
West Orphan Well Blowout Relief Well Scenario (120 days) Winter	-	-	-	0.9	139	1	-	-	-	-	-	-	5.1	96	3	-	-	-
West Orphan Well Blowout Capping Stack Scenario (30 days) Summer	-	-	-	-	-	-	-	-	-	-	-	-	1	82	1	-	-	-
West Orphan Well Blowout Capping Stack Scenario (30 days) Winter	-	-	-	-	-	-	-	-	-	-	-	-	1.5	75	2	-	-	-

Modelled Scenario	Sable Island									The Gully								
	Stranded Oil (1 g/m²)			Surface Oiling (0.4 µm)			Water Column Dispersed and Dissolved Oil (58 ppb THC)			Stranded Oil (1 g/m²)			Surface Oiling (0.4 µm)			Water Column Dispersed and Dissolved Oil (58 ppb THC)		
	Average Probability of Intersection (%)	Average of Minimal Arrival Time (days)	Average of Maximum Exposure Time (days)	Average Probability of Intersection (%)	Average of Minimal Arrival Time (days)	Average of Maximum Exposure Time (days)	Average Probability of Intersection (%)	Average of Minimal Arrival Time (days)	Average of Maximum Exposure Time (days)	Average Probability of Intersection (%)	Average of Minimal Arrival Time (days)	Average of Maximum Exposure Time (days)	Average Probability of Intersection (%)	Average of Minimal Arrival Time (days)	Average of Maximum Exposure Time (days)	Average Probability of Intersection (%)	Average of Minimal Arrival Time (days)	Average of Maximum Exposure Time (days)
East Orphan Well Blowout Relief Well Scenario (120 days) Summer	-	-	-	-	-	-	-	-	-	-	-	-	0.9	117	1	-	-	-
East Orphan Well Blowout Relief Well Scenario (120 days) Winter	-	-	-	-	-	-	-	-	-	-	-	-	1	148	1	-	-	-
East Orphan Well Blowout Capping Stack Scenario (3o days) Summer	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
East Orphan Well Blowout Capping Stack Scenario (30 days) Winter	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

1.9 Special Areas

1.9.1 Information Requirement: IR-48

External Reviewer ID:

DFO-20; DFO-CL-09; DFO-CL-35

Reference to EIS:

Section 6.4, Figure 6.30

Context and Rationale:

Section 6.4 of the EIS provides information on several special areas that may occur in the regional assessment area and that overlap with the Project Area. The Agency and Fisheries and Oceans Canada noted that:

- additional Ecologically and Biologically Significant Areas (EBSAs) identified by the Conference of the Parties to the Convention on Biological Diversity located outside Canada's exclusive economic zone in the Northwest Atlantic, some of which overlap the assessment areas, have not been included in the EIS (https://www.cbd.int/ebsa/) (e.g. Seabird Foraging Zone in the Southern Labrador Sea EBSA);
- Table 6.24 gives the distance to the Project Area for the Eastern Avalon Coast EBSAs as 303 kilometers. However, the Eastern Avalon Coast EBSAs is within the Local Assessment Area, which includes the platform supply vessel route. Therefore, routine project activities (platform supply vessels) would be expected to intersect with the special area; and
- the Bonavista Cod Box is not a recognized closure area and should be removed.

Specific Question of Information Requirement:

Update Figure 6.30 with appropriate resolution to include all special areas by type (e.g. Ecologically and Biologically Significant Areas identified by the Conference of the Parties to the Convention of Biological Diversity) that could be affected by the Project. Update Table 6.24 with the distance from each identified special area to nearest ELs and where there is the potential for platform supply vessels to intersect with the special area. The figure should include the following:

- all special areas that occur within the Regional Assessment Area including those previously not identified in the EIS; and
- removal of the Bonavista Cod Box.

With respect to special areas that have not been included in the EIS, provide a description of the ecosystem and conduct an assessment of potential effects of the additional special areas. Identify proposed mitigation and follow-up, for routine activities and potential accidental events, as applicable.

Response:

The Bonavista Cod Box has been removed from consideration of Special Areas (see Figure 1).

There are five ocean habitat areas identified off Eastern Newfoundland and Labrador that are designated as Ecologically and Biologically Significant Areas (EBSAs) through the Convention on Biological Diversity (CBD). Four of these areas are located within the Regional Assessment Area and have been identified on Figure 1; all five are described in Table 1; the total area and nearest distance from the Project Area for each CBD EBSA is also provided. The Project Area overlaps with the Orphan Spur EBSA (designated by Fisheries and Oceans Canada), and Seabird Foraging Zone in the Southern Labrador Sea and Slopes of the Flemish Cap and Grand Bank CBD EBSAs. The Eastern Avalon Coast EBSA (designated by Fisheries and Oceans Canada and included in Table 6.25 of the EIS) overlaps with the Local Assessment Area within which Project platform supply vessels (PSVs) would transit.

The EIS assesses potential environmental effects on marine fish (including corals and sponges), marine and migratory birds, and marine mammals and sea turtles that could be inhabiting these EBSAs and relying upon the EBSA habitat for important ecological functions.

Routine Project activities are not expected to interact with EBSAs (designed by DFO or CBD) outside the Project Area or Local Assessment Area. Standard mitigation as described already in the EIS will be used to reduce potential adverse environmental effects on these EBSAs and the species which may be inhabiting them. Accidental events (e.g., well blowout, PSV spill in transit through the EBSA) could potentially affect the habitat quality of an EBSA that is intersected by hydrocarbons. BP will implement multiple preventative and response barriers to manage risk of incidents from occurring and mitigate potential consequences. Section 15.3 of the EIS provides an overview of BP's contingency planning and emergency response measures. As indicated in Section 15.3, BP will undertake a Spill Impact Mitigation Assessment (SIMA) which will consider potential resources at risk and inform the selection of an overall spill response strategy for the Project.

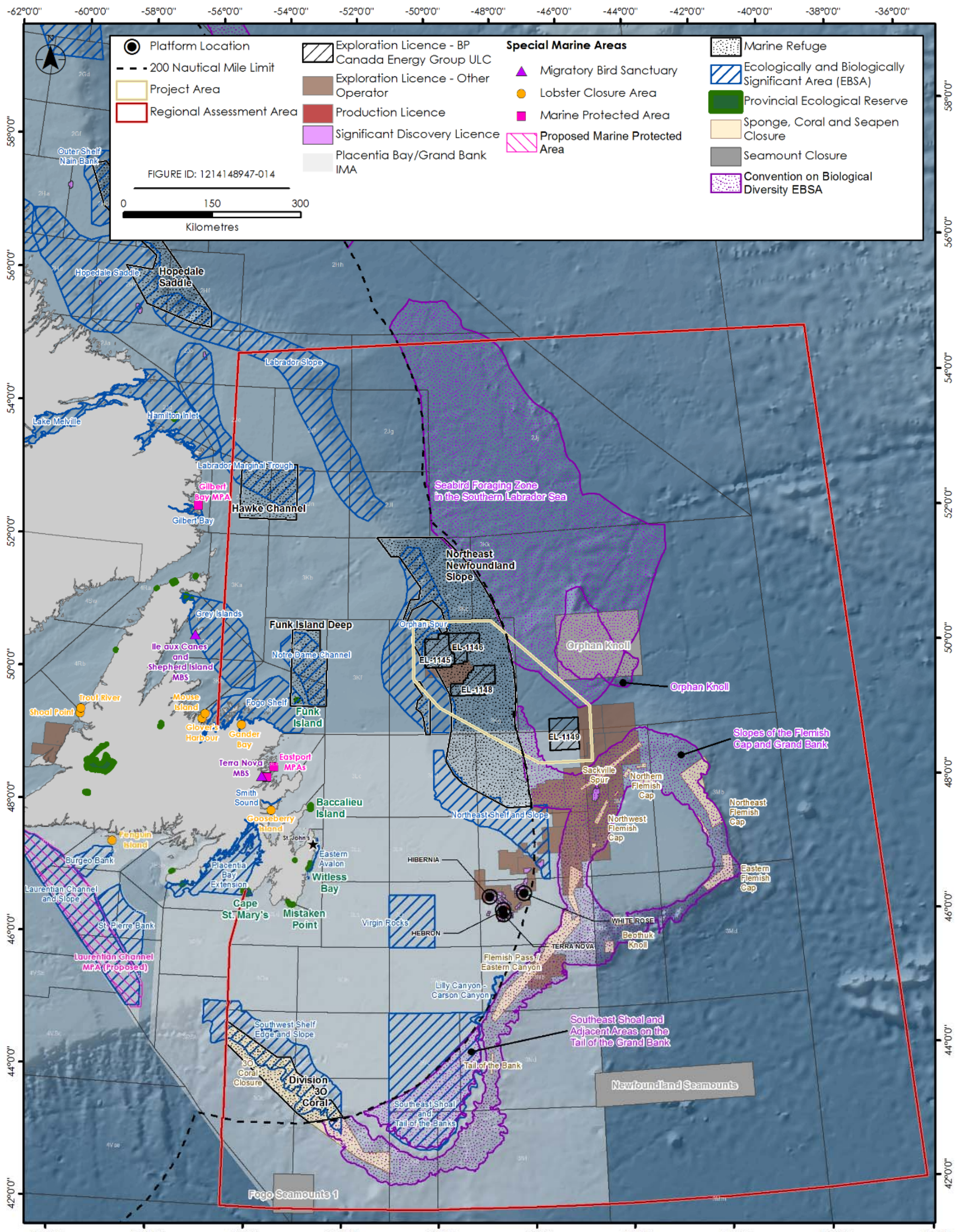


Figure 1 **EIS Figure 6.30 (Updated) Special Marine Areas in the Regional Assessment Area**

Table 1 CBD EBSAs off Newfoundland and Labrador and their Rationale for Designation and Proximity to the Project Area

CBD EBSA	Rationale for Identification/Designation	Total Area (km²)	Nearest Distance to Project Area (km)	Within RAA
Seabird Foraging Zone in the Southern Labrador Sea	Supports globally important populations of marine vertebrates, including an estimated 40 million seabirds annually. Important foraging habitat for seabirds, including 20 populations of over-wintering black-legged kittiwakes (*Rissa tridactyla*), thick-billed murres (*Uria lombia*) and breeding Leach's storm-petrels (*Oceanodroma leucorhoa*). Encompasses the pelagic zone of the Orphan Basin, continental shelf, slope and offshore waters inside and outside the Canadian EEZ.	152,929	Within	Yes
Orphan Knoll	Seamounts typically support endemic populations and unique faunal assemblages. This seamount is an island of hard substratum with uniquely complex habitats that rise from the seafloor of the surrounding deep, soft sediments of the Orphan Basin. Although close to the adjacent continental slopes, Orphan Knoll is much deeper and appears to have distinctive fauna. Fragile and long-lived corals and sponges have been observed and a Taylor Cone circulation provides a mechanism for retention of larvae.	12,776	24	Yes
Southeast Shoal and Adjacent Areas on the Tail of the Grand Bank	The Southeast Shoal is an ancient beach relic that provides a shallow, relatively warm, sandy habitat with a unique offshore capelin-spawning ground. The area supports a nursery ground for yellowtail flounder, as well spawning areas for American plaice, Atlantic cod and Atlantic wolffish (listed as a species of special concern by Canada's federal *Species at Risk Act* – SARA). Unique populations of blue mussels and wedge clams are also found here. The area is an important feeding area for a number of cetaceans, including humpback and fin whales, and is frequented by large numbers of seabirds, including species that travel over 15,000 km from breeding sites in the South Atlantic to feed in the area during the non-breeding season.	16,333	457	Yes
Slopes of the Flemish Cap and Grand Bank	Contains most of the aggregations of indicator species for vulnerable marine ecosystems (VMEs) in the NAFO Regulatory Area. Includes NAFO closures to protect corals and sponges and a component of Greenland halibut fishery grounds in international waters. A high diversity of marine taxa, including threatened and listed species, are found within the EBSA.	87,932	Within	Yes

CBD EBSA	Rationale for Identification/Designation	Total Area (km^2)	Nearest Distance to Project Area (km)	Within RAA
Labrador Sea Deep Convection Area	The only Northwest Atlantic site where winter convection exchanges surface and deep ocean waters. Provides mid-water overwintering refuge for pre-adult *Calanus finmarchicus*, a key species for zooplankton populations of the Labrador Shelf and downstream areas. Annual variability in convection results in significant yearly change through ecosystems of the North-West Atlantic.	43,016	650	No
Source: CBD 2019				

References:

CBD (Convention on Biological Diversity). 2019. Ecological and Biologically Significant Area. Available at: https://www.cbd.int/ebsa/

1.9.2 Information Requirement: IR-49

External Reviewer ID:

KMKNO-27; KMKNO-28

Reference to EIS:

Section 6.4.1.4;
Section 11.1.3;
Section 11.1.4.2;
Section 11.3;
Section 11.3.3.1

Context and Rationale:

Section 6.1.9.1 of the EIS Guidelines requires that the EIS describe special areas. Section 6.4 of the EIS identifies various types of special areas within the Project Area and Regional Assessment Area, including marine refuges and lobster closure areas, ecologically and biologically significant areas, and valued marine ecosystems.

Section 6.4.1.4 of the EIS states that 44 percent of the Northeast Newfoundland Slope Closure marine refuge falls within the Project Area. However, 100 percent of Exploration Licences 1145, 1146 and 1148 fall within the marine refuge. Table 6.21 in the EIS provides the rationale for its designation as an area of high density of corals and sponges with high biodiversity and that it is closed to bottom fishing activities.

No further descriptions of the Northeast Newfoundland Slope Closure are provided. Additional information with respect to the ecosystem (e.g. oceanographic patterns, habitats critical to ecological processes, structural complexity, connectivity of habitats, etc.) and how that relates to the Northeast Newfoundland Slope Closure is required to assess the potential effects of Project activities which may occur directly within the Northeast Newfoundland Slope Closure. The potential effects should be assessed for each of the valued components present (fish, fish habitat, migratory birds, marine mammals, sea turtles, and commercial fish).

Figure 11.1 in Section 11.1.4.2 of the EIS illustrates the special area spatial boundaries; however, the potential zone of influence of project effects are not shown. The figure should illustrate the predicted areal extent of habitat degradation and loss resulting from drill muds and cuttings deposition based on Appendix B of the EIS, the extent of sound effects based on Appendix C, and potential spills based on Appendix D as well as the potential area over which light may affect the Northeast Newfoundland Slope Closure. Sections 11.2 and 11.3 of the EIS do not include a discussion of habitat loss or degradation, including a discussion of environmental effects from Project activities (drill cuttings deposition, sound, spills and light) could affect the baseline conditions described above that resulted in the special area being designated. Using this information update the effects analysis and describe how the Project activities could result in habitat loss or degradation to the Northeast Newfoundland Slope Closure.

Section 11.5 of the EIS states that a follow-up program to address the uncertainty regarding residual effects of drill waste discharges on the marine benthic environment is proposed and would consist of a visual survey of the seafloor using a ROV after drilling activities to assesses the visual extent of sediment dispersion and validate drill waste modelling predictions. The KMKNO have suggested a benthic sampling program to determine infaunal recolonization rates following drilling.

Specific Question of Information Requirement:

Provide information regarding the ecosystem (e.g. oceanographic patterns, habitats critical to ecological processes, structural complexity, connectivity of habitats, etc.) within Northeast Newfoundland Slope Closure marine refuge and how it relates to its special area designation. Update the effects analysis for each of the valued components present (fish, fish habitat, migratory birds, marine mammals, sea turtles, and commercial fish) to describe how Project activities could result in habitat loss or degradation to the Northeast Newfoundland Slope Closure.

Revise Figure 11.1 to illustrate the overlap between the Northeast Newfoundland Slope Closure and the zone of influence of project activities. Provide a discussion of habitat degradation and loss resulting from Project activities (drill cuttings deposition, sound, spills and light) that could affect the baseline conditions described above that resulted in the special area being designated.

Discuss the need for and feasibility of a benthic sampling program to determine infaunal recolonization rates following drilling.

Response:

<u>Northeast Newfoundland Slope Marine Refuge</u>

The Northeast Newfoundland Slope Marine Refuge is a 55, 266 km² area that extends along the Outer Shelf of the Newfoundland Slopes. Along the Newfoundland Slopes, the cold Labrador current coming form the north mixes with the warm Gulf Stream coming from the South to create and upwelling of nutrients. This upwelling creates a highly productive area with rich primary productivity and high species diversity, as discussed in Appendix B Section 5.2.2 of the EIS.

The Northeast Newfoundland Slope Marine Refuge overlaps with the Orphan Spur and Northeast Shelf and Slopes Ecologically and Biologically Significant Areas (EBSAs) designated by Fisheries and Oceans Canada (DFO) and is adjacent to the Seabird Foraging Zone in the Southern Labrador Sea, and the Significant Benthic Area for sea pens and critical habitat for wolffish. The Marine Refuge extends from approximately 400 to 2,000 m depth. The area is high in species diversity and contains corals, fish, marine mammals and seabirds. Several rare or endangered fish species (spotted, northern and Atlantic wolffish, skates, and roundnose grenadier) are found throughout the marine refuge. Several marine mammal and seabird species (e.g., thick-billed murre, storm petrels, black-legged kittiwake, skuas and jaegers, northern fulmar, greater shearwater, dovekie) also frequent this area.

<u>Zone of Influence</u>

<u>Drill Cuttings</u>

Drill waste dispersion modelling (refer to Appendix B of the EIS) predicted, for a well drilled in West Orphan Basin, that the maximum extent deposition at a visible threshold (1 mm deposition thickness) would be 577 to 625 m from the discharge point, with a cumulative footprint of approximately 5.7 to 8.0 hectare per well. Considering an effects threshold of 6.5 mm deposition thickness, the zone of influence is reduced to 128 m or 0.69 hectare per well.

Underwater Sound

As discussed in Section 10.3.3 of the EIS, underwater sound from the mobile offshore drilling unit (MODU) and vertical seismic profiling (VSP) was assessed (see Appendix C in the EIS) and the effects analysis also considered acoustic modelling results for other drilling programs. It was concluded that marine mammals were unlikely to be exposed to sound levels from the MODU that would result in auditory injury. For VSP, the assessment determined that most marine mammal groups would have to occur within 400 m of the seismic source array and remain there for 24 h to possibly incur auditory injury (permanent threshold shift [PTS]). Modelling results suggest that if a baleen whale occurs within approximately 5 to 6 km of the VSP source array for a 24-hour period (i.e., the full duration of the VSP survey) there is risk of auditory injury (PTS). Once again, this is considered an unlikely scenario because baleen whales will likely exhibit localized avoidance of the VSP source array.

Avoidance response of underwater sound by marine mammals (of Project activities) would likely be quite variable (see EIS Section 10.3.3) but the maximum distance was estimated at approximately 40 km for the MODU based on the precautionary 120 dB rms behavioural criterion for non-impulsive sound (see response provided for IR-23).

Light

As discussed in Section 2.8.6. of the EIS, light emissions will be generated from lights on the MODU and platform supply vessel (PSV), which operate 24 hours per day. A typical offshore platform emits 30 kW of artificial lighting. Lighting sources include pilot warning and obstruction avoidance lighting, navigation lights, strobe lights, and lighting for the safety of the employees. Light (and heat) is also generated during flaring. Lighting attraction effects are anticipated to be confined to within approximately 5 km (Poot et al. 2008) to 16 km (Rodríguez et al. 2014, 2015) from the source (for further information, see response to IR-34).

Summary of Zone of Influence

The zone of influence for underwater sound (behavioural response for marine mammals), light and dispersion of drill cuttings is approximately 40 km, 16 km, and ,1 km, respectively. Conservatively, the zone of influence of 40 km for underwater sound (marine mammals) has been applied around as a buffer around the exploration licences as shown in Figure 1 (updated Figure 11.1 from the EIS).

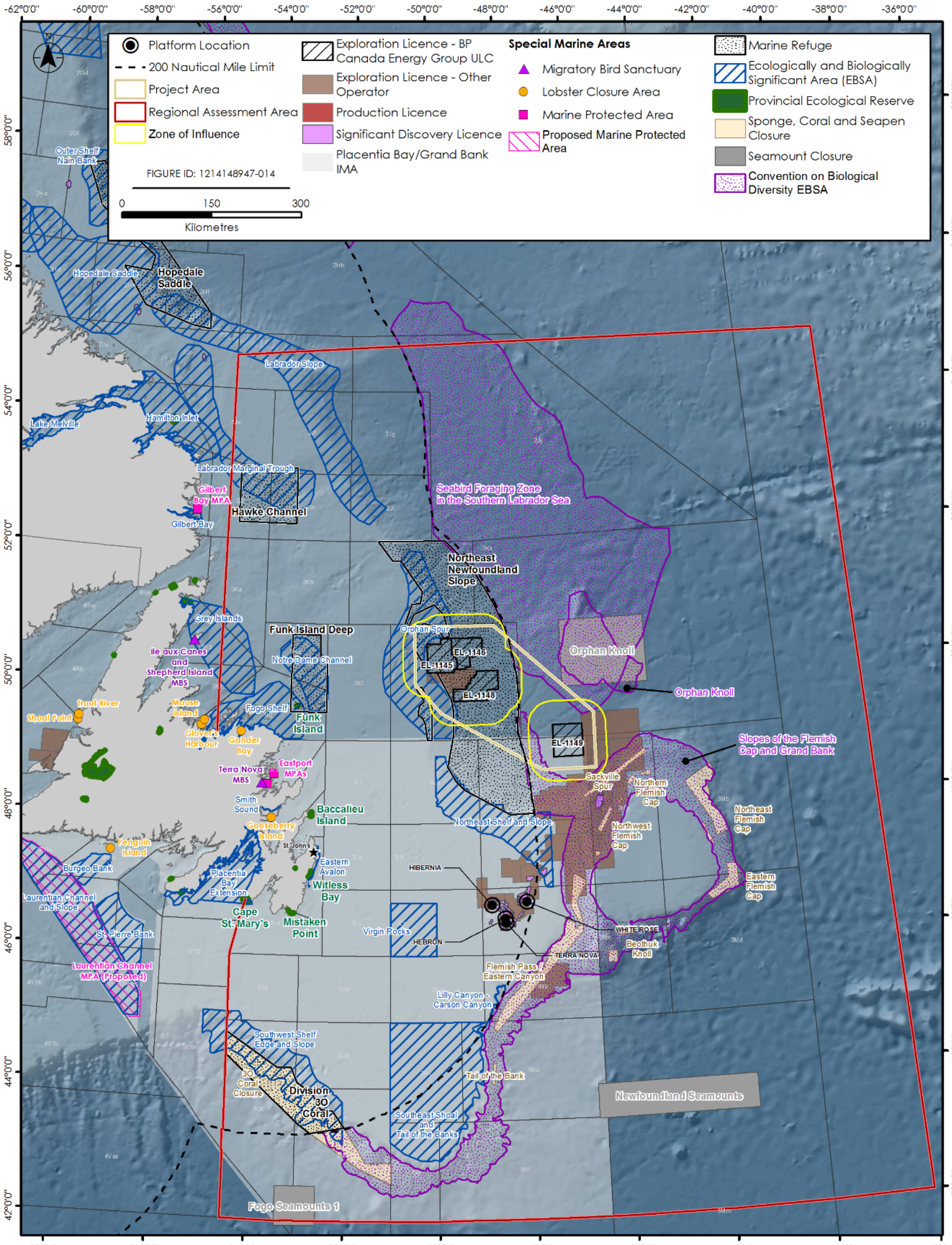


Figure 1 **EIS Figure 11.1 (Updated): Special Areas Spatial Boundaries**

Residual environmental effects resulting in a change in habitat quality within special areas are reversible because although the recovery rate of corals is slow (see response to IR-8), the benthic ecosystems are expected to recover. Drill cuttings sedimentation is estimated to be relatively low for this Project. This, combined with mitigation to reduce potential effects on corals/sponges (see response to IR-12 for details), indicates that effects will not likely result in permanent habitat loss. This is supported by the environmental effects monitoring programs conducted in the Newfoundland offshore area (Hibernia Management and Development Company Limited 2017; Suncor Energy 2017; Husky Energy 2019). Biological recovery (biodegradation by the microbial community) is typically complete in a matter of a few years. Lab-based studies suggest that modern WBM and SBM have low toxicity to benthic organisms due in part to low bioavailability (Trannum et al. 2011). This information suggests that beyond the pre-drill and post-drill wellsite surveys to be conducted, EEM for recovery rates for infaunal organisms is typically not required for exploration drilling programs.

References:

Hibernia Management and Development Company Limited. 2017. Hibernia Production Phase Environmental Effects Monitoring Program – Year Nine (2014) Volume 1 – Interpretation. Prepared by Stantec Consulting Ltd. for Hibernia Management and Development Company Limited, St. John’s, NL.

Husky Energy. 2019. White Rose 2016 Environmental Effects Monitoring Program. Prepared by Stantec Consulting Ltd. for Husky Energy, St. John’s, NL.

International Association of Oil & Gas Producers. 2016. Environmental fates and effects of ocean discharge of drill cuttings and associated drilling fluids from offshore oil and gas operations. Report 543, Version 1, March 2016. 145 pp.

Poot, H., B.J. Ens, H. de Vries, M.A.H. Donners, M.R. Wernand and J.M. Marquenie. 2008. Green light for nocturnally migrating birds. Ecology and Society, 13: 1-14.

Rodríguez, A., G. Burgan, P. Dann, R. Jessop, J.J. Negro and A. Chiaradia. 2014. Fatal Attraction of Short-Tailed Shearwaters to Artificial Lights. PLoS ONE, 9: e110114.

Rodríguez, A., B. Rodríguez and J.J. Negro. 2015. GPS tracking for mapping seabird mortality induced by light pollution. Scientific Reports (Nature), 5: 10670. https://doi.org/10.1038/srep10670

Suncor Energy. 2017. Terra Nova Environmental Effects Monitoring Program (2014). Prepared by Stantec Consulting Ltd. for Suncor Energy Inc., St. John’s, NL.

Trannum, H.C., H.C. Nilsson, M.T. Schaanning and K. Norling. 2011. Biological and biogeochemical effects of organic matter and drilling discharges in two sediment communities. Marine Ecological Progress series. 442: 233-36.

1.9.3 Information Requirement: IR-50

External Reviewer ID:

KMKNO-16

Reference to EIS:

Section 6.4.1.6;
Section 6.4.3.2;
Section 11.3.3.1

Context and Rationale:

Section 6.4.1.6 and Section 6.4.3.2 of the EIS states that 22 percent of the total area of the Orphan Spur Ecologically and Biologically Significant Area and 0.5 percent of the Orphan Knoll Seamount Closure Vulnerable Marine Ecosystem falls within the Project Area, respectively. However, no additional information is provided on the Orphan Knoll Seamount Closure Vulnerable Marine Ecosystem.

Table 6.25 in the EIS states that the rationale for the designation of the Orphan Spur Ecologically and Biologically Significant Area relates to high concentrations of corals, densities of sharks and species of conservation concern (e.g. Northern, Spotted and Striped Wolffish, skates, Roundnose Grenadier, American Plaice, Redfish). However, based on Fisheries and Oceans Canada (2013) referenced below, the information provided in the EIS is incomplete and does not discuss the Orphan Spur's importance to marine mammals and sea birds. Therefore, additional details are required in order to assess the potential effects from Project Activities.

The environmental effects assessment for each valued component should be updated based on the additional information above to describe how Project activities could affect the Ecologically and Biologically Significant Areas and Vulnerable Marine Ecosystems within the predicted zones of influence from various project activities such as drill cuttings deposition, sound, and light.

Tables 6.24 and 6.29 of the EIS indicate the proximity of several special areas to the Project Area. However, the EIS does not indicate which special areas are within the predicted zones of influence from various project activities such as drill cuttings deposition, sound, and light.

As with the IR above, Figure 11.1 in Section 11.1.4.2 of the EIS should be updated to illustrate the overlap of the potential zone of influence from Project activities (e.g. drill cuttings deposition, sound, spills and light) with the special areas. The EIS does not contain a discussion of the potential degradation and loss of habitat for the specific valued components that resulted in the special area designation.

Reference

Department of Fisheries and Oceans Canada (2013). Identification of Additional Ecologically and Biologically Significant Areas (EBSAs) within the Newfoundland and Labrador Shelves Bioregion. Canadian Science Advisory Secretariat Science Advisory Report 2013/048.

Specific Question of Information Requirement:

Provide additional information on the importance of the Orphan Spur Ecologically and Biologically Significant Area to marine mammals and seabirds.

Provide information on why Orphan Knoll was designated as a vulnerable marine ecosystem.

Provide an updated environmental effects assessment for each valued component to describe how Project activities such as drill cuttings deposition, sound, and light could affect the following:

- the Orphan Spur Ecologically and Biologically Significant Area;
- the Orphan Knoll Seamount Closure Vulnerable Marine Ecosystem; and
- special areas that are within the predicted zones of influence from various project activities such as drill cuttings deposition, sound, and light.

Update Figure 11.1 to illustrate the overlap between special areas and the zone of influence of project activities. Provide a discussion of potential degradation and loss of habitat for the specific valued components that resulted in the special area designation.

Response:

Additional information on the importance of the Orphan Spur Ecologically and Biologically Significant Area (EBSA) and surrounding environment, including the Northeast Newfoundland Slopes Marine refuge, is discussed in the response to IR-49. It is acknowledged that the importance of these areas and their reasons for designation go beyond the description presented in the original EIS and would also apply to marine mammals and seabirds. Additional Convention on Biological Diversity (CBD) EBSAs have been added to Figure 1 in the response to IR-48 and their descriptions are provided in Table 1 in that response.

The Orphan Knoll is a single peak, with no depths shallower than 1,800 m. Mounds are found at depths of between 1,800 to 2,300 m. Physical properties indicate that mid-depth waters above Orphan Knoll are in a boundary region between outflow from the Labrador Sea (subpolar gyre) and northward flow of the North Atlantic Current (subtropical gyre). Near-bottom current measurements provide evidence for anti-cyclonic (clockwise) circulation around the knoll. A west-east gradient in nutrients was observed and is likely related to water mass differences between Orphan Basin and the region east of Orphan Knoll. The Orphan Basin-Orphan Knoll region is biologically rich and complex, and strongly influenced by local current regimes, as discussed above. Coral, including stony coral, and sponges have been observed on the flanks using a remote operated vehicle and near-bottom anti-cyclonic circulation could have important implications for the benthic community (Food and Agriculture Organization of the United Nations 2017).

There are no additional special areas that overlap with the 40 km zone of influence (ZOI) (see the response to IR-40 for further detail) that do not already overlap with the Project Area and are discussed in the original EIS or in response to IR-48. The special areas that overlap with the ZOI are listed in the Table 1. The ZOI and special areas are shown on Figure 1 in the response to IR-49.

Table 1 Special Areas that Overlap with the Predicted Zone of Influence (inclusive of predicted effects of noise, light and drill cuttings deposition)

Special Area Name	Jurisdiction
Orphan Knoll	Seamount Closure and Vulnerable Marine Ecosystem (Northwest Atlantic Fisheries Organization)
Orphan Knoll	EBSA (CBD)
Seabird Foraging Zone in the Southern Labrador Sea	EBSA (CBD)
Slopes of the Flemish Cap and Grand Bank	EBSA (CBD)
Orphan Spur	EBSA (Fisheries and Oceans Canada [DFO])
Eastern Avalon	EBSA (DFO)
Northeast Newfoundland Slope	Marine Refuge (DFO)

References:

Food and Agriculture Organization of the United Nations. 2017. Orphan Knoll. Vulnerable Marine Ecosystems Database. Available at: http://www.fao.org/fishery/vme/23600/171186/en.

1.9.4 Information Requirement: IR-51

External Reviewer ID:

N/A

Reference to EIS:

Section 8.3.3.2

Context and Rationale

Section 8.3.3.2 of the EIS states that there is a Significant Benthic Area for sea pens at the edge of the Northeast Newfoundland Slope, that encompasses exploration license 1145 and a small portion of Exploration Licences 1146 and 1148. The proponent states that given the overlap with the sea pen area there could be a change in habitat quality or use for habitat provided by sea pens in these areas. However, the proponent does not describe sea pen habitat, the features and parameters of habitat that could change, the importance of the habitat in an ecological context to benthic species or the benthos assimilative capacity from discharges and waste disposal.

Specific Question of Information Requirement

Describe sea pen habitat with respect to ecological processes that govern their presence.

Describe potential effects of change in habitat quality or use by benthic animals from discharges and emissions.

Response

Greathead et al. (2015) studied the environmental requirements of three sea pen species: *Virgularia mirabilis*, *Pennatula phosphorea*, and *Funiculina quadrangularis*. Four habitat variables have been found to be important in predicting the presence of the three species studied: mud; minimum salinity; depth; and gravel. Habitat suitability increased with the amount of mud that was present in an area. It was also found to decrease with increases in gravel presence. Minimum salinity was found to be highly variable, although the three species studied were shown to have peak habitat suitability at salinities of 27 parts per thousand. Depth requirements varied between the species that were studied. In the Project Area two species of sea pens were recorded, *Anthoptilum grandiflorum* and *Distichoptilum gracile.* Wareham and Edinger (2007) studied the distribution of deep-sea corals in the Newfoundland and Labrador region and found *Distichoptilum gracile* at depths ranging from 346 m to 1,244 m, while *Anthoptilum grandiflorum* was found from 171 to 1,433 m. No other life history information was available for the species found within the Project Area.

Burial by sediment from drill cuttings is a potential effect to sea pens and benthic species in general. Toxic responses to emissions from drilling activities are also possible. Refer to the response to IR-18 for general effects of change in habitat quality or use and the response to IR-12 for proposed mitigation.

References

Greathead, C., J.M. González-Irusta, J. Clarke, P. Boulcott, L. Blackadder, A. Weetman and P. J. Wright. 2015. Environmental requirements for three sea pen species: relevance to distribution and conservation. ICES Journal of Marine Science, 72: 576-586.

Wareham, V.E. and E.N. Edinger. 2007. Distributions of deep-sea corals in the Newfoundland and Labrador region, Northwest Atlantic Ocean. Pp. 289-313. In: R. Y. George and S. D. Cairns (eds.). Conservation and Adaptive Management of Seamount and Deep-sea Coral Ecosystems. Rosenstiel School of Marine and Atmospheric Science, University of Miami. Miami, FL. 324 pp.

1.9.5 Information Requirement: IR-52

External Reviewer ID:

DFO-24; WM-51

Reference to EIS:

Appendix B

Context and Rationale:

Appendix B of the EIS presents the environmental effects assessment for benthic effects of drilling waste deposition, which considers smothering as a significant and short-term effect over the threshold of 6.5 millimetres. Fisheries and Oceans Canada noted that it does not take into account the more recent literature on effects on sensitive benthic species and the potential for interference with feeding etc. or the recent studies of Trannum et al. (2010) where benthic communities were affected by 3 millimetres of water based mud.

Similar exploration drilling projects in the Newfoundland offshore have noted that some species may be more susceptible to shallower burial depths and a more conservative probable no effect threshold of 1.5 millimetres has been applied.

<u>Reference</u>

Trannum, Hilde & C. Nilsson, Hans & Schaanning, Morten & Øxnevad, Sigurd. (2010). Effects of sedimentation from water-based drill cuttings and natural sediment on benthic macrofaunal community structure and ecosystem process. Journal of Experimental Marine Biology and Ecology. 383. 111-121.

Specific Question of Information Requirement:

Taking the Trannum, et al. (2010) reference into consideration, provide a discussion of the potential effects of drilling waste deposition, other than smothering, on benthic species, including benthic species in special areas.

Discuss the rationale for burial threshold of 6.5 millimetres versus the more conservative 3.0 or 1.5 millimetres thresholds.

Response:

The effects of drilling waste accumulation in sediments are typically minor and localized. Further, biological recovery (biodegradation by the microbial community) is typically complete in a matter of a few years. Drilling waste accumulation on the benthic environment may affect benthic fauna through:

- Burial
- Short-term elevations in suspended particulate matter and turbidity
- Changes in benthic topography and texture

- Direct toxicity
- Oxygen depletion
- Sediment organic enrichment (Trannum et al. 2010, 2011; IOGP 2016)

The environmental effects assessment for benthic effects of drilling waste deposition is based on the biological impact at the population level. A key factor in assessing the biological impact at the population level is estimating the habitat area effected by drilling waste accumulation in sediments. Based upon the modelling results presented in the Appendix B of the EIS, drilling waste accumulation even at a thickness of 1.5 mm will cover a relatively small area (extending approximately 125 to 540 m from the discharge point). Therefore, it is not expected that the effects of drilling waste accumulation will affect benthic species at the population level even if the referenced thresholds for smothering (1.5 mm, 3.5 mm versus the 6.5 mm referenced in the EIS) are applied.

BP will survey a 500 m radius during pre-drill survey (see responses to IR-22, IR-32, and IR-33). The pre-drill survey will identify potential corals and sponges which may be sensitive to drilling with a focus on coral / sponge density and habitat-forming corals / sponges.

References:

IOGP (International Association of Oil & Gas Producers). 2016. Environmental fates and effects of ocean discharge of drill cuttings and associated drilling fluids from offshore oil and gas operations. Report 543, Version 1, March 2016. 145 pp.

Trannum, H.C., H.C. Nilsson, M.T. Schaanning and K. Norling. 2011. Biological and biogeochemical effects of organic matter and drilling discharges in two sediment communities. Marine Ecological Progress Series, 442: 233-36.

Trannum, H.C., H.C. Nilsson, M.T. Schaanning and S. Øxnevad. 2010. Effects of sedimentation from water-based drill cuttings and natural sediment on benthic macrofaunal community structure and ecosystem process. Journal of Experimental Marine Biology and Ecology, 383: 111-121.

1.9.6 Information Requirement: IR-53

External Reviewer ID:

WM-24

Reference to EIS:

Section 11.3.4

Context and Rationale:

Section 11.3.4 of the EIS concludes that the Project has the potential to result in residual adverse environmental effects from a change in habitat quality in special areas that exist within the Project Area and along the vessel transit routes in the Local Assessment Area. Table 11.5 in Section 11.3.4 of the EIS states that the residual effects of discharges are reversible on special areas. However, it is not explained in the EIS how the effects of drill mud and cuttings on corals is reversible taking into account ecological considerations such as: slow recovery rates for corals and sponges, restoration process of anoxic sediments from bacteria degradation of drill wastes; recolonization processes, the presence of source subpopulations, population dynamics, oceanographic regime, and habitat requirements.

Specific Question of Information Requirement:

Discuss how the residual adverse environmental effects resulting in a change in habitat quality within the special areas would be reversible taking into account ecological considerations. Update the predicted effects analysis, as required.

Response:

Residual environmental effects resulting in a change in habitat quality within that special areas are reversible because although the recovery rate of corals is slow (see response to IR-8), the benthic ecosystems are expected to recover.

Drill cuttings sedimentation is estimated to be relatively low for this Project. This, combined with mitigation to reduce potential effects on corals/sponges (see response to IR-12 for details), indicates that effects will not likely result in permanent habitat loss. As noted in the response to CL-08 and IR-18, the effects of water-based mud (WBM) cuttings and synthetic-based mud (SBM) cuttings accumulation in sediments are typically minor and localized (International Association of Oil & Gas Producers 2016); borne out by the environmental effects monitoring programs conducted in the Newfoundland offshore area (Hibernia Management and Development Company Limited 2017; Suncor Energy 2017; Husky Energy 2016). Further, biological recovery (biodegradation by the microbial community) is typically complete in a matter of a few years. Lab-based studies suggest that modern WBM and SBM have low toxicity to benthic organisms due in part to low bioavailability (Trannum et al. 2011).

Table 11.5 has been updated in Table 1 in response to IR-54, in which the duration of the residual environmental effect characterization was changed.

References:

Hibernia Management and Development Company Limited. 2017. Hibernia Production Phase Environmental Effects Monitoring Program – Year Nine (2014) Volume 1 – Interpretation. Prepared by Stantec Consulting Ltd. for Hibernia Management and Development Company Limited, St. John's, NL.

Husky Energy. 2019. White Rose 2016 Environmental Effects Monitoring Program. Prepared by Stantec Consulting Ltd. for Husky Energy, St. John's, NL.

International Association of Oil & Gas Producers. 2016. Environmental fates and effects of ocean discharge of drill cuttings and associated drilling fluids from offshore oil and gas operations. Report 543, Version 1, March 2016. 145 pp.

Suncor Energy. 2017. Terra Nova Environmental Effects Monitoring Program (2014). Prepared by Stantec Consulting Ltd. for Suncor Energy Inc., St. John's, NL.

Trannum, H.C., H.C. Nilsson, M.T. Schaanning and K. Norling. 2011. Biological and biogeochemical effects of organic matter and drilling discharges in two sediment communities. Marine Ecological Progress series. 442: 233-36.

1.9.7 Information Requirement: IR-54

External Reviewer ID:

N/A

Reference to EIS:

Section 11.3;
Section 11.3.3.1;
Section 11.3.4

Context and Rationale:

Section 11.3 of the EIS shows that the residual effects summary with respect to special areas is contradictory in some places. Examples include:

- Table 8.5, Table 9.5, Table 10.5 are inconsistent with the magnitude, geographic extent, duration, and frequency residual environmental effects with those determined in Table 11.5 for Special Areas. Clarification is required as to why the residual effects would be considered different for fish, birds and marine mammals as a whole compared with a special area which is designated to protect these species.
- Section 11.3.3.1 describes the changes in habitat quality from well abandonment and decommissioning. This section states that the residual effects are predicted to be low in magnitude, localized to the wellsite, long-term in duration, irregular, and will be reversible as the wellhead, if left in place, would remain there in perpetuity and provide colonization opportunities for benthic species. This is inconsistent as if the wellhead remains in place for perpetuity it means that it is not reversible.

Specific Question of Information Requirement:

Provide clarifications and corrections to the residual effects conclusions with respect to special areas by updating Table 11.5 or provide a rationale for the difference in the residual effects analysis.

Response:

Differences in residual effects characterization can theoretically occur between effects on special areas and the species that inhabit these special areas, particularly when considering potential behavioral effects of species that can extend longer than physical effects on habitat quality of a special area. However, some updates are appropriate in this case, taking into consideration conservative predictions for Marine Fish and Fish Habitat, Marine and Migratory Birds, and/or Marine Mammals and Sea Turtles. Proposed revisions to the Summary of Residual Effects for Special Areas are shown in an updated Table 11.5 below (updates shown in bold font).

The geographic extent of effects on a Change in Habitat Quality for Special Areas due to the presence and operation of a Mobile Offshore Drilling Unit (MODU) has been updated from Project Area to the larger Regional Assessment Area in recognition of underwater sound propagation that can extend outside the Project Area and Local Assessment Area affecting underwater sound levels (and habitat quality) in Special

Areas designated as providing habitat for marine mammals (e.g., Northeast Shelf and Slope Ecologically and Biologically Significant Area [EBSA]).

Residual effects of discharges on a Change in Habitat Quality and Use for Marine Fish and Fish Habitat were characterized as having a medium-term to long-term residual effect. The summary of residual effects on Special Areas presented in Table 11.5 has been updated below to be consistent with the effects duration predicted for Marine Fish and Fish Habitat in recognition of effects of discharges on special areas with benthic conservation objectives (e.g., Northeast Newfoundland Slope Closure marine refuge).

With respect to well abandonment and decommissioning, effects on other Valued Components (VCs) were characterized as being reversible, in acknowledgement of potential colonization of the hard substrate of the wellhead structure and temporary effects on biological species use of the wellsite and Project Area. However, it is acknowledged that although effects on biological VCs may be reversible, the wellhead, if abandoned in place, would represent a permanent change in habitat within a Special Area for those Special Areas in which drilling may occur (e.g., Northeast Newfoundland Slope Closure marine refuge).

With respect to supply and servicing, operations, the residual effects characterization for Special Areas is consistent with other applicable VCs, with the exception of Marine Fish and Fish Habitat which characterized duration of effect to be medium-term. BP believes the medium-term duration rating for Marine Fish and Fish Habitat to be an error and that the effect should be characterized as short-term as has been done for the other biological VCs.

The changes noted below in Table 1 (updated EIS Table 11.5) do not affect the proposed mitigation, follow-up or overall effects significance determination for Special Areas as presented in the EIS.

Table 1 EIS Table 11.5 (Updated): Summary of Residual Environmental Effects on Special Areas

Residual Effect	Residual Environmental Effects Characterization						
	Direction	Magnitude	Geographic Extent	Duration	Frequency	Reversibility	Ecological and Socio-economic Context
Change in Habitat Quality							
Presence and operation of a MODU	A	L-M	**RAA**	**ST-MT**	IR	R	D
VSP operations	A	L	PA	ST	IR	R	D
Discharges	A	L-M	PA	**ST-LT**	IR	R	D
Well abandonment and decommissioning	A	L	PA	ST-LT	IR	**I**	D
Supply and servicing operations	A	L	LAA	ST	IR	R	D

KEY:
See Table 11.3 for detailed definitions
N/A: Not Applicable

Direction:
P: Positive
A: Adverse

Magnitude:
N: Negligible
L: Low
M: Moderate
H: High

Geographic Extent:
PA: Project Area
LAA: Local Assessment Area
RAA: Regional Assessment Area

Duration:
ST: Short-term
MT: Medium-term
LT: Long-term
P: Permanent

Frequency:
UL: Unlikely
S: Single event
IR: Irregular event
R: Regular event
C: Continuous

Reversibility:
R: Reversible
I: Irreversible

Ecological / Socio-Economic Context:
D: Disturbed
U: Undisturbed

1.10 Indigenous Peoples

1.10.1 Information Requirement: IR-55

External Reviewer ID:

N/A

Reference to EIS:

Section 10.1.2

Context and Rationale:

Section 5 of the EIS Guidelines requires "changes made to the project design and implementation directly as a result of discussion with potentially affected groups."

Section 10.1.2 of the EIS indicates that during consultations with Indigenous groups the following concerns were raised: potential Project-related effects on marine mammals, particularly on SARA-listed species including the Blue Whale and the North Atlantic Right Whale; and potential effects on seals which are harvested as a country food. No information is provided on whether changes may have been made to the project design and implementation as a result of discussions with Indigenous groups.

Specific Question of Information Requirement:

Confirm if any changes were made to the proposed project design and implementation to address the concerns Indigenous groups identified with respect to marine mammals (including SARA-listed) and seals and if so, describe the changes.

Response:

There have been no changes made to the proposed Project design and implementation to address concerns Indigenous groups identified with respect to marine mammals (including *Species at Risk Act*-listed) and seals. As described in Chapter 10 of the EIS, the magnitude of effects on marine mammals and sea turtles (including species at risk) is predicted to be negligible to low. With respect to the blue whale and North Atlantic right whale in particular, given their geographic distribution, the Project is expected to have a low potential for interaction with these species. Harp and hooded seals may be common in the Project Area, although Project effects are not predicted to cause measurable effects which would impact their potential to be harvested as a country food.

Mitigation proposed in the EIS (Section 10.3.2) to reduce potential effects on marine mammals (and sea turtles) include the following:

- As required in the Geophysical, Geological, Environmental and Geotechnical Program Guidelines (Canada-Newfoundland and Labrador Offshore Petroleum Board 2017), mitigation measures applied during vertical seismic profiling (VSP) surveys will be consistent with those outlined in the Statement of

Canadian Practice with respect to the Mitigation of Seismic Sound in the Marine Environment (Fisheries and Oceans Canada 2007).
- Platform supply vessels (PSVs) will use existing shipping lanes as practicable; where these do not exist, PSVs will follow a straight-line approach to and from the Project Area.
- During transit to / from the Project Area, PSVs will travel at vessel speeds not exceeding 22 km/hour (12 knots), except as needed in the case of an emergency. In the event that a marine mammal or sea turtle is detected in proximity to the vessel, vessel speed will be reduced to avoid the marine mammal or sea turtle.
- Selection and screening of chemicals to be discharged, including drill fluids, will be in accordance with the Offshore Chemical Selection Guidelines (National Energy Board [NEB] et al. 2009). Where feasible, lower toxicity drilling muds and biodegradable and environmentally friendly properties within muds and cements will be used. The chemical components of drilling fluids, where feasible, will be those that have been rated as being least hazardous under the Offshore Chemical Notification Scheme and Pose Little or No Risk to the Environment by the Convention for the Protection of the Marine Environment of the North-East Atlantic.
- Operational discharges will be treated prior to release in accordance with the Offshore Waste Treatment Guidelines (NEB et al. 2010) and other applicable regulations and standards such as MARPOL, of which Canada has incorporated provisions under the *Canada Shipping Act*. Waste discharges that do not meet regulatory requirements will not be discharged and will be brought back to shore for disposal. The development and implementation of a Project-specific environmental protection plan and waste management plan will be designed to prevent unauthorized waste discharges.

Given the implementation of these mitigative measures, the low likelihood of Project interaction with marine mammal species at risk identified as species of concern by Indigenous groups, and low magnitude effects predicted to occur on seals, no changes are proposed for Project design and implementation to address these Indigenous concerns.

References:

Canada-Newfoundland and Labrador Offshore Petroleum Board. 2017. Geophysical, Geological, Environmental and Geotechnical Program Guidelines, September 2017. 44 pp. + appendices.

Fisheries and Oceans Canada. 2007. Statement of Canadian Practice with respect to the Mitigation of Seismic Sound in the Marine Environment. 5 pp.

NEB (National Energy Board), Canada-Newfoundland and Labrador Offshore Petroleum Board and Canada-Nova Scotia Offshore Petroleum Board]. 2009. Offshore Chemical Selection Guidelines for Drilling and Production Activities on Frontier Lands. 18 pp.

NEB (National Energy Board), Canada-Newfoundland and Labrador Offshore Petroleum Board and Canada-Nova Scotia Offshore Petroleum Board]. 2010. Offshore Waste Treatment Guidelines. 35 pp.

1.10.2 Information Requirement: IR-56

External Reviewer ID:

KMKNO-35, KMKNO-36; MTI-07, MTI-08, MTI-09, MTI-19, MTI-21

Reference to EIS:

Section 3.2;
Section 4

Context and Rationale:

Section 4.3 of the EIS Guidelines state that the proponent will consider the use of both primary and secondary sources of information regarding baseline information, changes to the environment and the corresponding effect on health, socio-economics, physical and cultural heritage and the current use of lands and resources for traditional purposes.

The KMKNO identified primary sources of information as including traditional land use studies, socio-economic studies, heritage surveys or other relevant studies conducted specifically for the Project and its EIS. Often these studies and other types of relevant information are obtained directly from Indigenous groups. Secondary sources of information could include previously documented information on the area, not collected specifically for the purposes of the project, or desktop literature based information.

Several Indigenous groups have indicated that the EIS does not use Indigenous Knowledge in its valued components baseline information or environmental effects analysis (e.g., in conclusions on interactions with Atlantic Salmon, Bluefin Tuna, and swordfish in the project area). Indigenous groups advise that traditional knowledge should be used to assist in developing mitigation, environmental protection plans, and Project monitoring.

Specific Question of Information Requirement:

Clarify whether any primary information was used in preparing the EIS and if so, describe the primary information used. If not, provide a rationale for only using secondary sources of information, particularly related to land and resources use, fishing activity, health and socio-economic issues. Include consideration of additional information obtained during proponent workshops held in St. John's (October 10, 2018), Quebec City (October 15, 2018), and Moncton (October 18, 2018), as applicable.

Discuss whether the proponent is considering collecting further Indigenous knowledge from Indigenous communities and if funding an Indigenous Knowledge study is being considered. If so, advise when this information would be available, and how it would be utilized, including how it could be used in the current assessment, the design and implementation of follow-up and monitoring programs, and further mitigations. If no additional Indigenous knowledge is planned to be collected, provide a rationale for why this would not be necessary.

Response:

As required in the EIS guidelines, BP has incorporated into the EIS, the community knowledge and Aboriginal traditional knowledge to which it has access or that which was acquired through engagement with Indigenous groups on this and similar projects. Primary sources of information include information shared by Indigenous Groups in face-to-face meetings (including the April and October 2018 workshops), in correspondence, and through their comments submitted on the public record during the EIS process of four other proposed offshore exploration drilling programs that have undergone a federal environmental assessment in the past year.

Information related to Indigenous Knowledge (IK) was provided to BP (and other operators) through a series of in-person workshops in both April and October 2018. At both workshops, Indigenous representatives shared their concerns regarding potential impacts of the proposed activities on migrating Atlantic salmon (as well as American eel, swordfish and tuna) that may migrate through the Project Area. However, no additional or new information not previously considered was provided to BP by Indigenous groups at the October workshops. EIS submissions by Indigenous groups on various offshore exploration drilling programs contained similar information related to the importance of, and reliance on Atlantic salmon (and other species) as a food source, in cultural and traditional medicine practices, and as a keystone biological component that contributes to the overall health of a sustainable ecosystem (Denny 2018). Atlantic salmon is integral to Indigenous culture as a means for cultural expression. The continuation of the practice of salmon fishing through traditional means creates opportunities for knowledge sharing, transmission, and adaptation, expression of values of sharing catches to provide for the community, and other uses specific to salmon that cannot be replaced by fishing other species (Denny et al. 2013; Denny and Fanning 2016). While Atlantic salmon was emphasized as a key issue, Indigenous groups have also noted it is important to recognize the interconnectedness of species within ecosystems and overall ecosystem health.

BP provided a number of opportunities for Indigenous groups to share IK, either in writing, or in person. In addition, and at the request of one First Nation, BP agreed to co-fund an IK study with other operators. However, the First Nation chose not to pursue the IK study.

Given the location of the Project, and the absence of potential impacts to human health, socio-economic conditions or resource use, BP does not anticipate undertaking any additional traditional land use studies, socio-economic studies, or heritage surveys. However, should such knowledge be provided to BP by Indigenous groups now or in the future, the company will consider and integrate Indigenous knowledge, where appropriate in exploration activities.

References:

Denny, S. 2018. Review of the Overview of Salmon populations in support of Statoil Canada Ltd. – Flemish Pass Exploration Drilling Project (CEAR 80129). Unama'ki Institute of Natural Resources.

Denny, S.K. and L.M. Fanning. 2016. A Mi'kmaw Perspective on Advancing Salmon Governance in Nova Scotia, Canada: Setting the Stage for Collaborative Co-Existence. The International Indigenous Policy Journal, 7(3) Available at: https://ir.lib.uwo.ca/cgi/viewcontent.cgi?referer=https://www.google.com/&httpsredir=1&article=1294&context=iipj.

Denny, S., A. Denny, K. Christmas, and T. Paul. 2013. Plamu Mi'kmaq Ecological Knowledge: Atlantic salmon in Unama'ki. Unama'ki Institute of Natural Resources.

1.10.3 Information Requirement: IR-57

External Reviewer ID:

CIE-01

Reference to EIS:

Section 6.1.9

Context and Rationale:

Section 6.1.9 indicates that there is limited information on Atlantic Salmon Designable Units, including their ocean distribution and migration." Where data does exist, it is based on tagging studies of salmon from a limited sample of river systems (Hedger et al. 2009; Jacobs 2011; Lefévre et al. 2012; Lacroix 2013; Strøm et al. 2017) or it is inferred from the genetic composition of commercial fisheries catch data (Bradbury et al. 2015; Bradbury et al. 2016a, Bradbury et al. 2016b)…This information is subject to change as future studies are completed."

It is unclear whether future studies refers to specific work contemplated by the proponent. Table 3.6 in the EIS indicates that the proponent in collaboration with other Newfoundland operators, is working with communities to identify potential industry-funded research opportunities including Indigenous knowledge and research studies related to Atlantic Salmon.

Specific Question of Information Requirement:

Provide an update on research collaborations that have been identified, and agreements that are in place, if any to improve understanding of Atlantic Salmon, American Eel or other migratory species in the marine environment and their potential interaction with oil and gas activity in the offshore of Newfoundland. Elaborate on the research areas that are being studied, by whom, how this data will/may improve certainty with respect to impact predictions, for the current and future projects, and how Indigenous groups may be engaged in developing research plans. Indicate how data will be disseminated, including whether results of research initiatives will be shared with other operators in the Newfoundland offshore, Indigenous communities, and the public.

Response:

BP (and other offshore operators) contributes to a mandatory industry-wide research fund (Environmental Science Research Fund [ESRF]) that is managed by the federal government. In response to concerns expressed by Indigenous groups regarding the lack of data related to migratory patterns, abundance and behavior of Atlantic salmon, and the declining numbers of some species, BP and the other operators that are seeking to explore offshore have recommended to the federal government that priority be placed on designating ESRF funds for Atlantic salmon research offshore Eastern Newfoundland, and that Indigenous representatives be involved in the design and implementation of that research. As decision-making regarding research areas to be studied, by whom, how the data will/may improve certainty with respect to impact predictions, and how Indigenous groups may be engaged in developing research plans are yet to be determined by the ESRF Board, BP is unable to provide any specific detail until those decisions have been made.

BP is also aware of other research initiatives related to Atlantic salmon migration that are being proposed or already underway, including a salmon tagging program conducted by the Atlantic Salmon Federation and the placement of additional acoustic receivers (to detect signals from tags) in the Flemish Pass and/or the Grand Banks. It is BP's understanding that this data will be publicly available and will also contribute to the body of knowledge regarding salmon migration in the area.

1.10.4 Information Requirement: IR-58

External Reviewer ID:

KMKNO-38; MTI-18; NG-01

Reference to EIS:

Section 12.3

Context and Rationale:

Section 12. of the EIS states that a Fisheries Communication Plan (FCP) will be used to facilitate coordination with fishers and an Indigenous Fisheries Communication Plan (IFCP) will be used to facilitate coordinated communication with Indigenous fishers. Details of the safety zone will also be communicated during ongoing engagement with commercial and Indigenous fishers. The proponent also plans to engage Indigenous communities to share Project details as applicable and facilitate coordination of information sharing. The Indigenous Fisheries Communication Plan will include procedures for informing fishers of an accidental event and appropriate response, however the following information is unclear in the EIS:

- whether the Indigenous Fisheries Communication Plan differs from the Fisheries Communication Plan;
- whether Indigenous groups would be able to raise issues and concerns to the proponent;
- whether an adaptive approach would be used to allow for harvester feedback;
- the frequency of updates to Indigenous fishers on planned project activities; and
- which Indigenous fishers would be included in the development of the Indigenous Fisheries Communication Plan and their role in monitoring and follow up planning.

Specific Question of Information Requirement:

Provide additional information on the Indigenous Fisheries Communication Plan, including a discussion of the following:

- how the Indigenous Fisheries Communication Plan differs from the Fisheries Communication Plan;
- whether the Indigenous Fisheries Communication Plan would include measures to ensure that issues and concerns can be raised by Indigenous groups during the life of the Project and how this could occur, and if so, describe those measures;
- whether the proponent would consider an adaptive approach to allow for harvester feedback over the life of the Project and how this could occur;
- the frequency of updates to Indigenous communities about planned activities given potential for changes in operations, and the potential need for frequent communication over the life of the Project, for example monthly updates throughout Project execution to fishers; and
- the role of Indigenous fishers in the development of the Indigenous Fisheries Communications Plan and the on-going role of Indigenous fishers in monitoring and follow-up plans, including for accidents and malfunctions. Provide information regarding whether reporting and results of monitoring and follow-up programs would be available to Indigenous fishers.

Response:

Engagement with Indigenous groups and fisheries stakeholders will continue through the life of the Project and will be guided by Indigenous and Fisheries Communication Plans. BP will develop draft communication plans for discussion with Indigenous groups and fisheries stakeholders. BP will model its draft Indigenous Communications Plan on previous work undertaken for the Scotian Basin Exploration Project in Nova Scotia, as this method is already known and accepted by Indigenous groups.

These plans are essentially identical in their intent; both describe a proposed system for communications during Project operations, and in the unlikely event of an emergency. Both plans will also include a section outlining the process for conflict resolution and claims management. BP contacts for communication with Indigenous groups and fisheries stakeholders will be provided in the plans. The Indigenous Communication Plan may also contain an outline of consultation and/or engagement responsibilities as a result of conditions included with the Decision Statement to be issued under the *Canadian Environmental Assessment Act, 2012*. During the development of the plans, Indigenous groups and fisheries stakeholders will be consulted on the frequency and format of communications, as well as preferred organization contacts for communication.

Results of monitoring and follow-up programs for fish and fish habitat, marine mammals and sea turtles, and migratory birds will be published on the Internet and BP will notify Indigenous groups and One Ocean of the availability of these documents.

1.10.5 Information Requirement: IR-59

External Reviewer ID:

KMKNO-29; NG-01

Reference to EIS:

Section 13.3.2

Context and Rationale:

Section 13.3.2 of the EIS states that the proponent will develop and implement a compensation program for damages resulting from Project activities, and that the compensation program will be developed in consideration of C-NLOPB guidelines, including the *Compensation Guidelines Respecting Damages Relating to Offshore Petroleum Activities*.

However, it is unclear in the EIS how the proponent intends to develop the compensation program in collaboration with potentially-impacted parties, including commercial and communal commercial fishers.

- In addition, it is not evident how or if the proponent will include members of the international fishing community and Northwest Atlantic Fisheries Organization (NAFO) authorities in the development of the compensation plan.

Specific Question of Information Requirement:

Discuss if, and how, commercial, international and communal commercial fishers will be engaged in the development of the proposed compensation program.

- In addition, discuss how the proponent would ensure that potentially impacted parties are aware of the C-NLOPB guidelines and the proposed compensation program and know how to raise compensation claims.

Response:

During ongoing engagement with Indigenous groups and fisheries stakeholders, including during the development of the Indigenous Fisheries Communication Plan and the Fisheries Communication Plan, BP will communicate its planned approach to compensation claims.

In the event where a claim for compensation is brought forward to BP, BP will adhere to the *Compensation Guidelines with Respect to Damages Relating to Offshore Petroleum Activity* (Canada-Newfoundland and Labrador Offshore Petroleum Board and Canada-Nova Scotia Offshore Petroleum Board 2017). A single point of contact will be designated to which grievances and/or claims for compensation can be directed. If the event involves an accidental spill where BP's Oil Spill Response Plan is activated, an emergency response claims process will be activated. This claims management process will include establishing a Claims Call Centre, with a toll-free claims reporting telephone number, to manage claims reporting.

References:

Canada-Newfoundland and Labrador Offshore Petroleum Board and Canada-Nova Scotia Offshore Petroleum Board. 2017. Compensation Guidelines Respecting Damages Relating to Offshore Petroleum Activity. November 2017. Available at: http://www.cnlopb.ca/pdfs/guidelines/compgle.pdf?lbisphpreq=1.

1.10.6 Information Requirement: IR-60

External Reviewer ID:

MTI-02; MTI-18; MTI-20; MTI-22; MTI-23; MTI-24; KMKNO-43; NORPEN-06

Reference to EIS:

Section 3.2.9;
Section 15.3.1;
Section 15.3.3

Context and Rationale:

Section 3.2.9 of the EIS states that the proponent "… will continue to notify, communicate with, and engage the Indigenous groups … about key steps in the environmental assessment process including opportunities to provide comment on key documents and/or information to be provided regarding their community." MTI expressed an interest in having a role in the development and implementation of oil spill response plans, other contingency plans, exercises and training.

MTI noted that it would be beneficial implementing an Indigenous advisory committee and Indigenous Guardian-type program whereby Indigenous communities, including MTI, can be involved in monitoring oversight in addition to emergency response readiness (including provisions for training capacity). The mechanisms by which Indigenous groups will continue to be notified, communicated with and engaged should be described.

Section 15.3.3.3 of the EIS states that stakeholder and Indigenous input, including traditional knowledge and input on ecological and socio-economic priorities for response, would be coordinated through the Incident Command System process.

The KMKNO stated that it is not clear in the EIS how the proponent would involve Indigenous groups, not only fishers, in the development and implementation of contingency plans.

Similarly, specifically with respect to the Spill Response Plan, Section 15.3.1 of the EIS states that "Information about environmental and socio-economic sensitivities and potentially affected Indigenous groups and stakeholders will also be included in the plan." However, there is no indication on how the information will be collected, or how Indigenous groups and stakeholders will contribute to the process.

Specific Question of Information Requirement:

Confirm the role of Indigenous groups in the development and implementation of oil spill response plans and other contingency plans, exercises and training. Confirm if Indigenous groups will be provided with versions of these plans when they are finalized.

Discuss the potential to implement Indigenous advisory committee and/or Indigenous Guardian programs for the Project. Describe mechanisms by which Indigenous groups will continue to be notified, communicated with and engaged.

Confirm and describe the role of outside parties, including but not limited to Indigenous groups (not only fishers) and stakeholders, in the development, review and implementation of the Spill Response Plan and other emergency response and contingency plans, including emergency response and preparedness planning, exercises and training.

In addition, confirm if Indigenous groups will be provided with the approved versions of contingency and response plans.

Response:

Since 2016, BP and other operators in the Atlantic region have worked with Indigenous groups to build knowledge and understanding of well containment measures, and emergency preparedness and response in the very unlikely event of an emergency, through numerous face-to-face meetings, information bulletins, workshops, the sharing of plans, and other means of communication. BP will continue to help build knowledge and understanding through these methods of information sharing.

Participation in emergency response is a highly-specialized field that requires considerable advance training. Given the short-term nature of the proposed exploration drilling program, BP does not anticipate creating any new layers for emergency response. Rather, BP will utilize existing emergency response structures that are already in place to serve the industry in Atlantic Canada. Response exercises are conducted to confirm readiness and for these exercises to be effective, they are conducted by personnel who will be involved in emergency response.

As part of ongoing Indigenous and stakeholder engagement efforts, during the development of the Indigenous and Fisheries Communication Plans and the Oil Spill Response Plan, BP will consult with Indigenous groups and fisheries stakeholders to determine appropriate communication protocols to be implemented in the unlikely event of an emergency. BP will also meet with Indigenous groups and fisheries stakeholders to discuss emergency preparedness and response measures that will be included in the Oil Spill Response Plan. Once the Oil Spill Response Plan has been accepted by the Canada-Newfoundland and Labrador Offshore Petroleum Board, BP will post a copy on the Internet and inform Indigenous groups and fisheries stakeholders of its availability.

1.10.7 Information Requirement: IR-61

External Reviewer ID:

N/A

Reference to EIS:

Context and Rationale:

Section 6.3.7 of the EIS Guidelines requires a description and analysis of how changes to the environment caused by the Project would affect current use of resources by Indigenous peoples for traditional purposes. IR-11, -12, -16 and -17 requested an update of the effects assessment, the effects analysis on current use of resources by Indigenous peoples for traditional purposes should also be updated.

Specific Question of Information Requirement:

Utilizing the updated effects analysis required in IR-11, IR-12, IR-16, and IR-17, update the effects assessment on current use of resources by Indigenous peoples for traditional purposes.

Response:

As there is no change to the effects analysis or planned mitigation associated with the Project as per responses to IR-11, IR-12, IR-16, and IR-17, there is no change to the assessment of effects on current use of resources by Indigenous peoples for traditional purposes.

1.11 Commercial Fisheries

1.11.1 Information Requirement: IR-62

External Reviewer ID:

N/A

Reference to EIS:

Section 13.3.3.1

Context and Rationale:

Section 7.2.6 of the EIS presents data related to the harvest weight and species composition of international fisheries occurring in NAFO Divisions 2J+3KLMNO. While the location of domestic harvest is illustrated (Figures 7.19, 7.23, and 7.26-32), there is no discussion of the level of activity of international harvest within the project area or the Exploration Licence outside the exclusive economic zone. Likewise, Section 13.3.3.1 of the EIS states Exploration Licence 1149 is in an area where there is little domestic harvesting activity. However, a discussion of international harvest occurring in Exploration Licence 1149 is not provided.

Specific Question of Information Requirement:

Discuss the location, harvested weight and species of international harvest occurring within the project area outside the exclusive economic zone, specifically in Exploration Licence 1149.

Response:

Exploration Licence (EL) 1149 is on the border of the divide between Northwest Atlantic Fisheries Organization (NAFO) Unit Area 3K and 3L and incorporates a portion of each. The best publicly available dataset from NAFO (NAFO Statlant A dataset) indicates species catch by weight for each NAFO unit Area, but does not specify the exact location of the catch. Based on analysis of the NAFO Statlant B dataset, the only species fished in NAFO unit area 3K between 2012-2017 was Atlantic cod by the Greenland Fleet. The percent breakdown of species catch weight in NAFO 3L is shown in Figure 1 (for more details on international fish, please see response to IR-64). The main species fished in NAFO 3L are Greenland halibut, Atlantic redfish, and northern prawn. It is expected that these catches recorded in NAFO 3L are largely within the NAFO fishing footprint area, which is approximately 50 km south of EL 1149.

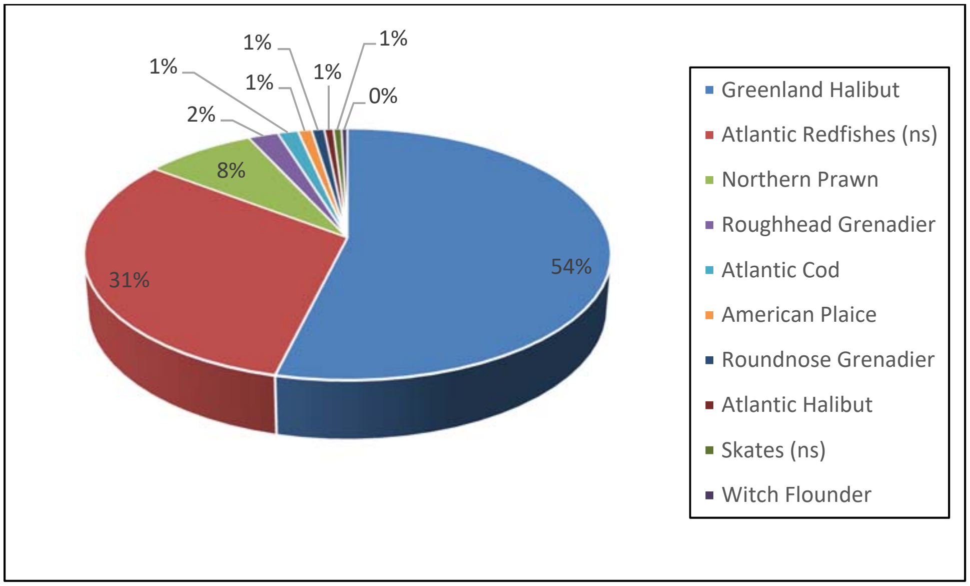


Figure 1 Percent Harvest Weight by Species for International fleets in NAFO Unit Area 3L, 2012-2017

1.11.2 Information Requirement: IR-63

External Reviewer ID:

N/A

Reference to EIS:

Section 7.2.3.1

Context and Rationale:

Section 7.2.3.1 of the EIS describes domestic fishing activity within the Project Area and states that the Project Area falls within the Northeast Newfoundland Slope Closure marine refuge that is closed to all bottom contact fishing activity. However, the EIS does not discuss if fisheries utilizing non-bottom contact gear are active within the marine refuge particularly in the portion that overlaps with the Project Area.

Specific Question of Information Requirement:

Provide clarification on if there are active fisheries in the Northeast Newfoundland Slope Closure marine refuge that use gear other than that used for bottom contact fishing. If there is fishing utilizing non-bottom contact gear, within the marine refuge that overlaps with the Project Area, provide a discussion of the fishery and the potential environmental effects of the project and mitigation and follow-up, as necessary.

Response:

The prohibition of bottom contact fishing with he Northeast Newfoundland Slope marine refuge came into effect in 2018 and the most recently available data on commercial fisheries from Fisheries and Oceans Canada (DFO) are 2016, so there is a delay in the overlap of data which should be considered.

Referring specifically to the areas of overlap between the Northeast Newfoundland Slope marine refuge and the Project area, based on analyses of the most recently available DFO commercial fish data (2016) there are two active fisheries that use gear other than for bottom contact fishing within the Northeast Newfoundland Slope Closure: the snow crab fishery, which uses pots and the Greenland halibut fishery, which uses gill nets. There is also a small amount of redfish caught by gillnet in the area of overlap between the Northeast Newfoundland Slope marine refuge and the Project Area.

For a discussion on the crab fishery, refer to Section 7.2.7.2 of the EIS. For a discussion on the groundfish fishery, including Greenland halibut and redfish, refer to Section 7.2.7.3 of the EIS. Figures 7.29 and 7.30 in the EIS indicate the overlap of the Greenland halibut and redfish fishery with the Project Area, respectively.

Section 13.3 of the EIS assesses the effects of the Project on commercial fisheries, including invertebrate (crab), groundfish (halibut and redfish), and pelagic fisheries. The effects, mitigation, follow-up and significance predictions as presented in Section 13 of the EIS remain unchanged.

1.11.3 Information Requirement: IR-64

External Reviewer ID:

DFO-05

Reference to EIS:

Section 7.2.1.2;
Section 7.2.6, Figure 7.13, Table 7.7

Context and Rationale:

Section 7.2.1.2 of the EIS states that "[o]utside the exclusive economic zone, data on international harvesting activity were obtained using the STATLANT 21A and 21B datasets from NAFO. These datasets present harvesting information in metric tonnes and are available up to 2017. This information captures information on harvesting activities for both Canadian and non-Canadian vessels actively fishing outside the exclusive economic zone and within the NRA [NAFO Regulatory Area]."

Fisheries and Oceans Canada noted that the STATLANT21A and 21B database contains domestic catch data from NAFO areas both inside and outside the exclusive economic zone, i.e., STALANT data is not restricted to harvest data from outside the exclusive economic zone. It is not clear if the data presented in the EIS includes domestic catch harvested outside the exclusive economic zone as indicated.

Further, Fisheries and Oceans Canada noted that Figures 7.13 to 7.16 and Table 7.7 appear to have used an interpretation of STATLANT data as harvest data completely from outside the exclusive economic zone.

Specific Question of Information Requirement:

Clarify whether the Canadian harvest data presented in the EIS as being from outside the exclusive economic included harvest from within the exclusive economic zone. If Canadian harvest data from within the exclusive economic zone was included indicate the percent or quantity of harvest that was within the exclusive economic zone, revise statements, tables and figures as necessary.

Based on the reanalysis of the data, update effects analysis, proposed mitigation and follow-up as well as significance predictions, as applicable.

Response:

Further review of the Northwest Atlantic Fisheries Organization (NAFO) STATLANT 21A and 21B datasets and the NAFO annual compliance review (NAFO 2018), revealed that incorrect assumptions were made regarding the spatial extent of the data set. As a result, data from both inside and outside the Exclusive Economic Zone (EEZ) were included in the discussion of international fisheries, as indicated in Section 7.2.6 of the EIS.

Table 1 updates EIS Table 7.7 to indicate the percent of total landings for each country for 2012 to 2016 in NAFO Unit Area 2J and 3KLMNO. Canadian fleets (Canada Newfoundland and Canada Scotia-Fundy) account for 73% of the total catch weight. However, this portion would be considered domestic fishing and is covered in Section 7.2.3.1 of the EIS.

Table 1 EIS Table 7.7 (Updated) Catch Weight by Country in NAFO Unit Area 2J and 3KLMNO, 2012-2016

Country	Catch weight (tonnes) by year					Total (tonnes)	Total (%)
	2012	2013	2014	2015	2016		
Canada Newfoundland	152213	159900	142193	145243	85514	685063	69.7
Portugal	16111	18011	19149	16901	18221	88393	9.0
Spain	24976	22853	18174	14414	0	80417	8.2
Russia	7002	8679	7762	8460	8737	40640	4.1
Canada Scotia - Fundy	6532	7313	7560	5717	5738	32860	3.3
Faroe Islands	3530	4195	3977	3674	3462	18838	1.9
Estonia	1902	4529	3307	3149	3284	16171	1.6
Norway	820	1343	1358	1307	1350	6178	0.6
United Kingdom	875	1346	0	0	1209	3430	0.3
United States of America	298	1010	976	659	0	2943	0.3
France St. Pierre et Miquelon	1224	436	214	564	324	2762	0.3
Japan	0	0	0	0	2409	2409	0.2
Cuba	961	0	0	0	0	961	0.1
Lithuania	753	0	7	0	0	760	0.1
Poland	0	0	414	0	0	414	0.0
Latvia	137	0	0	0	0	137	0.0
Iceland	0	92	0	0	0	92	0.0
Denmark Greenland	10	0	0	3	2	15	0.0

To prevent duplicate information from being presented and to focus solely on international fisheries, data from the NAFO STATLANT databases pertaining to Canadian fishers has been removed. The following section replaces Section 7.2.6 (International Fisheries) as presented in the EIS. The modifications to this section do not impact the conclusion made in the environmental effects analysis and proposed mitigation and follow-up, as well as significance predications, as presented in Section 13 of the EIS.

Updated EIS Section 7.2.6

A portion of the Project Area and Regional Assessment Area is located outside the Canadian EEZ, and in international waters. NAFO holds jurisdiction over commercial fish harvesting for multiple species and provides data on harvesting activities outside of the EEZ. Commercial harvest landings data, in metric tonnes, from NAFO's STATLANT 21A and 21B datasets for NAFO Divisions 2J + 3KLMNO from 2012 to 2017 are shown in Table 2 (EIS Table 7.6 (updated)). Based on the data provided, most of the international fishing occurs in unit area 3M, followed by 3L, then 3N. This is an expected outcome as these areas overlap with the NAFO fishing footprint (see EIS Figure 7.17).

Table 2 EIS Table 7.6 (Updated): International Harvest (Non-Canadian) by Weight (t), NAFO Divisions 2J+3KLMNO, 2012 to 2017

NAFO Unit Area	Year					
	2012	2013	2014	2015	2016	2017
2J	171	121	0	155	119	117
3K	0	0	0	3	0	0
3L	11687	10659	10068	9824	7676	8144
3M	25885	27596	25795	21930	18071	14951
3N	12899	13704	8617	6345	4831	6653
3O	7957	10414	10858	10874	8301	6443

Figure 1 (EIS Figure 7.13 (updated)) illustrates the quantity of harvest from 2012 to 2017 of vessels from other NAFO member nations harvesting outside of the EEZ. Over this span of time, Spain, Portugal, and Russia were the nations that harvested the most.

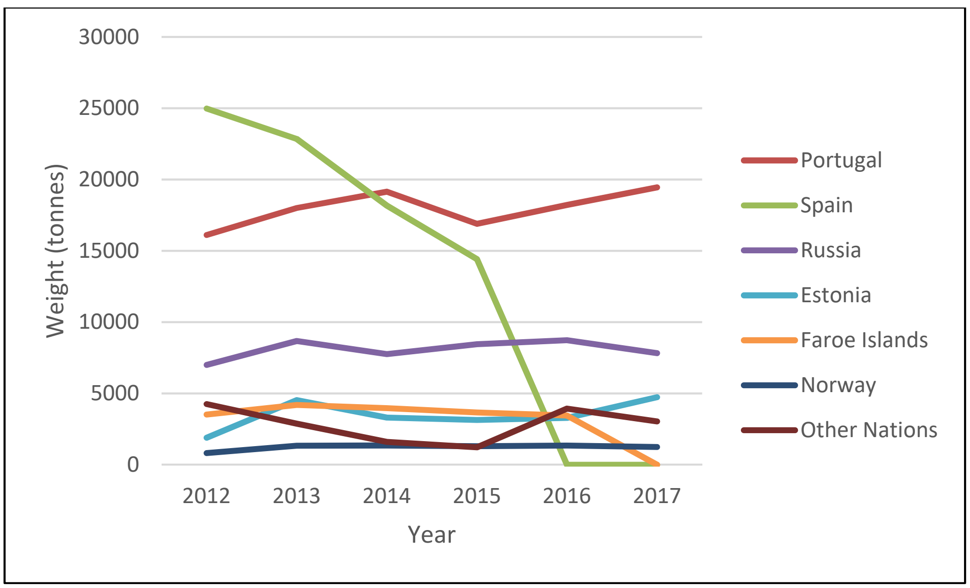


Figure 1 Figure 7.13 (Updated): Harvest from NAFO Divisions 2J+3KLMNO, International Fleets, NAFO Managed Stocks, 2012 to 2017

The top 10 species fished by international fleets in NAFO 3LMNO are presented below. Catches by international fleets in Unit Area 2J and 3K account for less then 0.5% of the total weight caught within each year and therefore are not displayed in graphic form below. For NAFO unit Area 3L (Figure 2), Greenland halibut (54%), Atlantic redfish (31%), and northern shrimp (8%) account for 93% of the total catch weight. In NAFO unit area 3M (Figure 3) Atlantic cod (54%), Atlantic redfish (27%), great blue shark (8%), and Greenland halibut (7%) make up 96% of the total catch weight. NAFO unit area 3N (Figure 4) is a bit more diverse in the number of species that account for the majority of the catch weight, but still heavily focused on groundfish, with skates (27%), Atlantic redfish (23%), and yellowtail flounder (19%) being the top three most fished species (by weight). In NAFO unit area 3O (Figure 5), the majority (77%) of the catch by weight is Atlantic redfish.

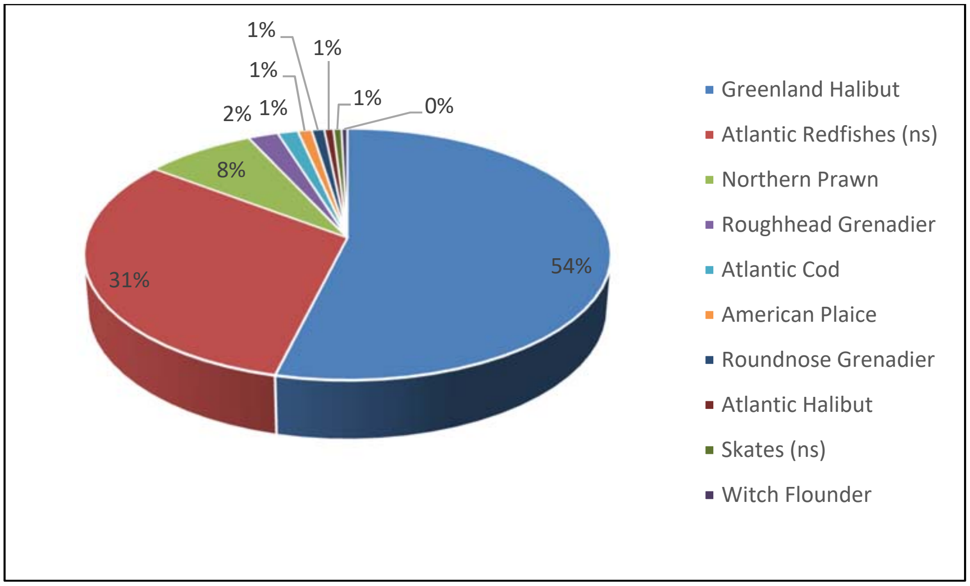


Figure 2 Harvest by Species for International Fleets in NAFO 3L, 2012-2017

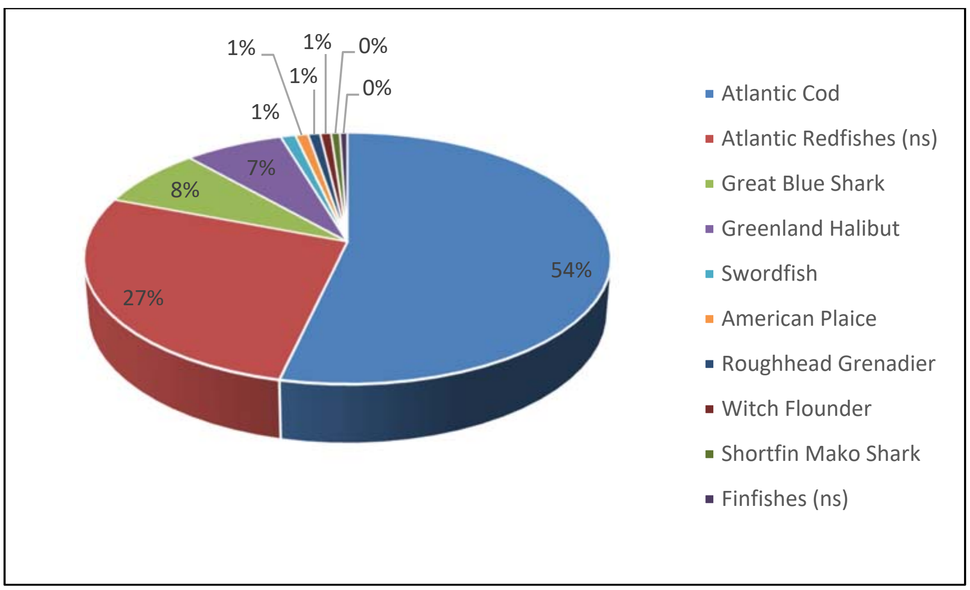


Figure 3 Harvest by Species for International Fleets in NAFO 3M, 2012-2017

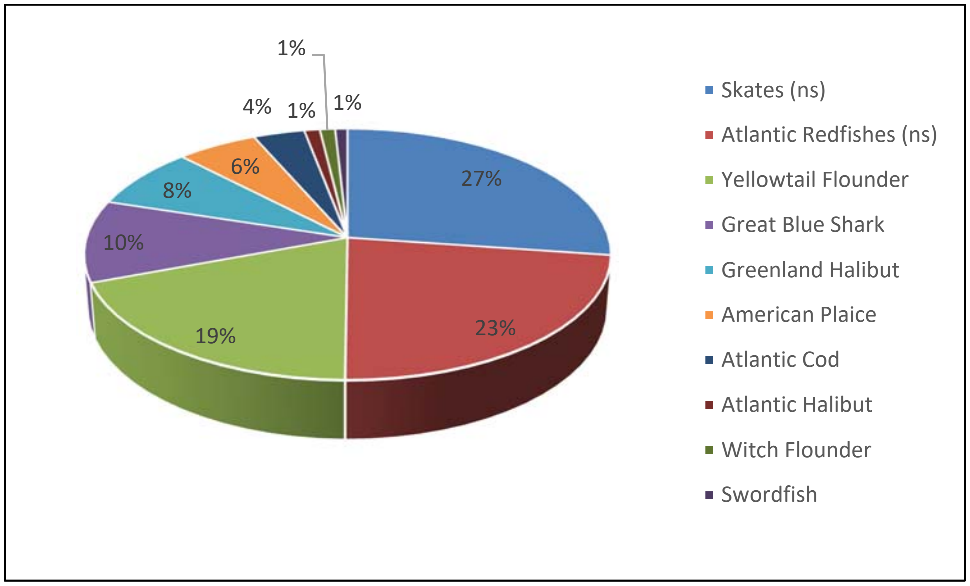


Figure 4 Harvest by Species for International Fleets in NAFO 3N, 2012-2017

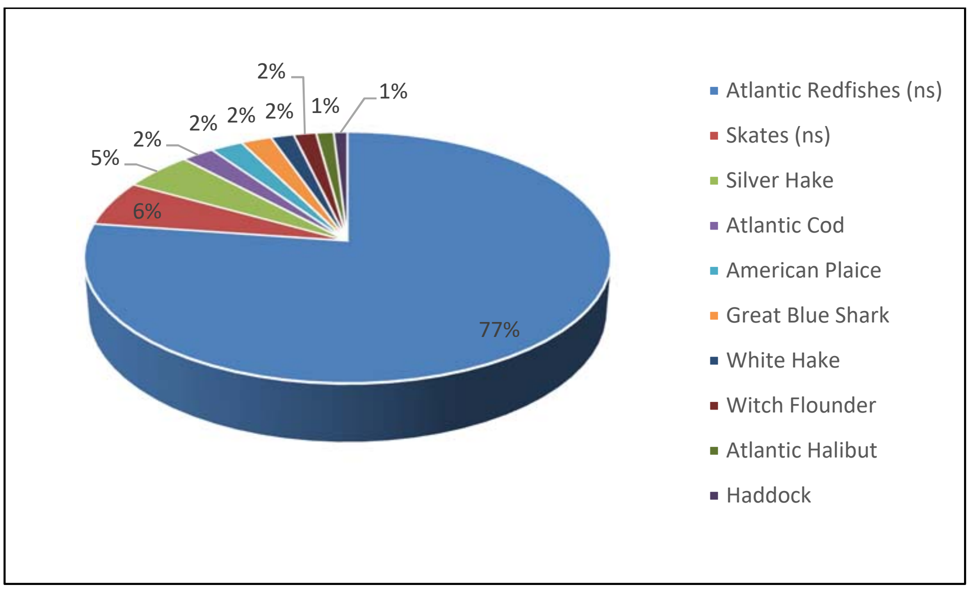


Figure 5 Harvest by Species for International Fleets in NAFO 3O, 2012-2017

The seasonality of international fishing activity is similar to that of domestic harvesting, and is illustrated in Figure 6 (EIS Figure 7.14 (updated)), using data extracted from the STATLANT 21b data set from 2010 to 2015 (the most recent year available in the dataset). It provides an overall total weight harvested throughout the year, and then further breaks this total down by NAFO Unit Area. Figure 6 shows that while commercial harvesting activity occurs year-round, March and July are the months when the majority of international harvesting activities takes place. Additionally, NAFO Subdivisions 3M and 3L are the areas in which the highest weight of landings is harvested.

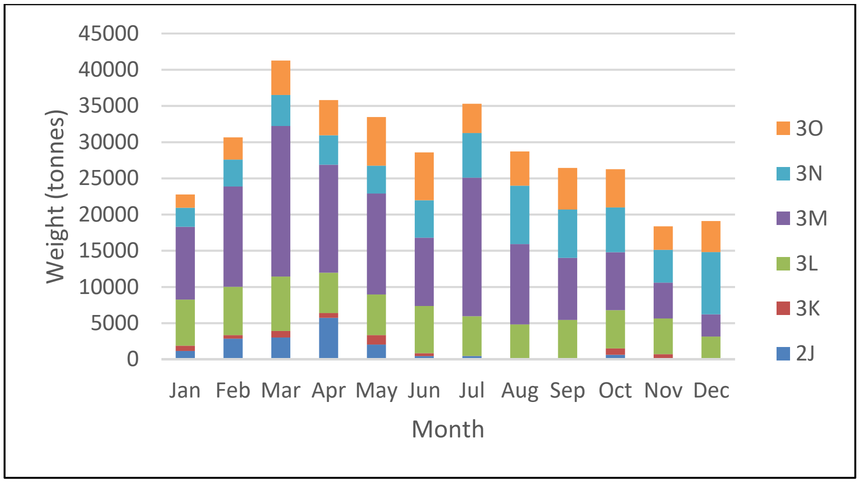


Figure 6 Figure 7.14 (updated): International Harvest by Month and NAFO Subdivision, Total, All Species, 2010 to 2015

References:

NAFO (Northwest Atlantic Fisheries Organization). 2018. Annual Compliance Review. Available at: https://www.nafo.int/Portals/0/PDFs/COM/2018/comdoc18-19.pdf

1.12 Accidents and Malfunctions – Spill Scenarios

1.12.1 Information Requirement: IR-65

External Reviewer ID:

C-NLOPB-15

Reference to EIS:

Section 15.2.2.2

Context and Rationale:

Section 15.2.2.2 of the EIS discussed the probability of a blowout incident based on an analysis of historical data. The Canada-Newfoundland & Labrador Offshore Petroleum Board has advised that the probability of a blowout is not properly calculated. The Canada Newfoundland & Labrador Offshore Petroleum Board stated that the probability can be modelled as a binomial distribution to obtain a probability or expressed as likely number of blowouts if one multiplies the probability per-well by the number of wells to be drilled.

Specific Question of Information Requirement:

Discuss the approach taken for determining the probability of a blowout over the life of the project and provide a revised probability of a blowout over the life of the project, if applicable.

Response:

As indicated in Section 15.2.2.2 of the EIS, historical data indicate that the probability of a blowout incident is extremely low. Between 1980 and 2011, there were 12,429 exploration wells drilled in the United States Federal Outer Continental Shelf (OCS) region; there were 45 blowouts from exploration drilling in this same period. The blowout frequency is therefore calculated to be 3.62×10^{-3} or one blowout for every 276 wells drilled (SL Ross 2017). As of June 2018, there have been 382 exploration wells drilled offshore Nova Scotia and Newfoundland and Labrador since drilling began in 1968. Based on the one well blowout incident (*Uniacke* G-72) offshore Nova Scotia in 1984, the historic frequency of exploration well blowouts for Atlantic Canada is calculated to be 2.6×10^{-3} or 1 blowout for every 382 exploration wells.

Estimates for the probability of a particular exploratory well having a blowout over its productive lifespan can vary per well depending on factors such as depth, well pressure, location, and blowout cause (Statoil 2017). In consideration of drilling technology advancements (calculated blowout frequencies in the United States do not account for improvements in safety and blowout prevention) and Canadian drilling standards which are consistent with North Sea standards (e.g., deep-water drilling is performed with a blowout preventer installed, including shear ram and two-barrier principle) where a lower rate of blowouts has occurred, SL Ross (2017) calculated the probability of an exploration blowout for the Nexen Flemish Pass exploration drilling project to be 3.1×10^{-4} per well. Applying this probability rate to the Newfoundland Orphan Basin Exploration Drilling Program, the likely number of blowouts over the life of the Program (assuming up to 20 exploration wells may be drilled) is calculated to be 0.0062. This probability does not imply the release would be a worst-case blowout scenario, only that there would be a release as a result of a blowout.

References:

SL Ross Environmental Research Ltd. 2017. Spill Probability Assessment for Nexen Energy ULC Flemish Pass Exploration Drilling Environmental Assessment. Prepared for Nexen Energy ULC. November 2017.

Statoil Canada Ltd. 2017. Flemish Pass Exploration Drilling Program – Environmental Impact Statement. December 2017. Prepared by Amec Foster Wheeler and Stantec Consulting Ltd., St. John's, NL.

1.13 Accidents and Malfunctions – Model Inputs

1.13.1 Information Requirement: IR-66

External Reviewer ID:

ECCC-20

Accidents and Malfunctions – Model Inputs

Reference to EIS:

Section 15.4.5, Table 15.8;
Appendix D, Table 5.6

Context and Rationale:

Section 15.4.5 of the EIS states that currents, winds, sea ice, as well as other metocean factors, influence the fate and behavior of oil following a spill. The EIS states that metocean data, available from a number of sources, is formatted to work in the OSCAR model. Section 15.4.5 of the EIS provides the information related to the metocean data parameters inputs for the spill model (OSCAR), however, there was no information presented on how the data was used from these sources.

Environment and Climate Change Canada indicated that in order to have confidence in the input parameters used in the OSCAR model, an understanding of the calculations undertaken in OSCAR to produce wave heights and wind induced current, is necessary.

Specific Question of Information Requirement:

With respect to the OSCAR model inputs, provide the following:

- information on how wave height were calculated; and
- information on how wind induced currents were calculated.

Response:

Wave dynamics are computed through the Oil Spill Contingency and Response (OSCAR) model as a function of wind and ocean characteristics. Within OSCAR, Equations 2 and 3 (illustrated below) are used to compute wave height (H) and period (T) as functions of wind speed (U), water depth (d), fetch (F), and gravitational acceleration (g). These equations are taken from the U.S. Army Corps of Engineers Shore Protection Manual (1984).

$$\frac{gH}{U_A^2} = 0.283 \tanh\left[0.530\left(\frac{gd}{U_A^2}\right)^{3/4}\right]\tanh\left\{\frac{0.00565\left(\frac{gF}{U_A^2}\right)^{1/2}}{\tanh\left[0.530\left(\frac{gd}{U_A^2}\right)^{3/4}\right]}\right\} \quad 2$$

$$\frac{gT}{U_A} = 7.54 \tanh\left[0.833\left(\frac{gd}{U_A^2}\right)^{3/8}\right]\tanh\left\{\frac{0.0379\left(\frac{gF}{U_A^2}\right)^{1/3}}{\tanh\left[0.833\left(\frac{gd}{U_A^2}\right)^{3/8}\right]}\right\} \quad 3$$

Hindcast wind data (in BP’s simulations derived from National Centre for Atmospheric Research (NCAR) / National Centre for Environmental Protection (NCEP) Climate Forecast System Reanalysis (CFSR)) and local water depth and fetch are computed internally in the model from the grid data. At an open grid boundary, a fetch of 100 km (i.e., virtually non- limiting) is assumed.

Wave height and period are computed and stored on a rectangular grid matching that used to define land and water. On startup, a set of four fetch grids is computed and stored, one grid for each major compass point. (A direction variance of + 45 0 is used to select the appropriate fetch grid.) At each change in the wind speed or direction, a new pair of wave height and period grids is calculated. This procedure allows for variations in wave height due to changes in fetch, such that “shadows” downwind of islands are achieved. However, the approach does not include wave shoaling, diffraction, reflection, or wave-current interactions.

Additionally, OSCAR can calculate a wind induced (Ekman) current profile, but in this modelling study it is provided by the 3-dimensional hydrodynamic dataset. Oil on the sea surface is also subjected to wind stress (“Surface drift factor”), and will be driven downwind, at least as long as the wind speed is under 6 or 7 m/s, when breaking waves will begin to mix oil into the water column, when, both Stokes drift and entrainment are involved in the transport.

References:

U.S. Army Corps of Engineers.1984. Shore Protection Manual. Coastal Engineering Research Center, Vicksburg, Missippi. 2 vols.

1.13.2 Information Requirement: IR-67

External Reviewer ID:

N/A

Reference to EIS:

Section 15.5.1.3

Context and Rationale:

Section 15.5.1.3 of the EIS provides an effects analysis of a synthetic-based mud spill from the mobile offshore drilling unit or marine riser based on modelling conducted by for Nexen Energy's Flemish Pass Exploration Project in Exploration Licence 1144 located to the south of the Project Area.

Section 15.5 of the EIS states that the modelling results from the Nexen Energy synthetic-based mud model were applicable based on the wellsite location similar water depth to the West Orphan Basin wellsite. However, other environmental parameters that may influence the model results require consideration as the modelled area has different oceanographic conditions than oceanic conditions found in this Project's Area.

Synthetic-based mud modelling conducted by Nexen Energy for their Flemish Pass Exploration Drilling project was based on an accidental surface release of synthetic-based mud; Nexen did not consider a wellhead release at the seafloor when modelling a spill of synthetic-based mud.

The potential environmental effects of a release of synthetic-based mud at the seafloor is required given the overlap of the Project Area with special areas that are designated to protect coral and sponge habitat.

Specific Question of Information Requirement:

Describe the applicability of Nexen Energy's Flemish Pass Exploration Project synthetic-based mud spill modelling for the current Project given the differences in oceanographic conditions. Discuss the potential environmental effects that the oceanographic conditions in the Project Area may have on the synthetic-based mud spill modelling.

Describe how the predicted effects would change if a synthetic-based mud spill occurred at the wellhead rather than at the surface.

Response:

The transport of mud particles away from the release location is primarily determined by ambient current speeds at the time of the release. The monthly current statistics for modelled surface and bottom currents at West Orphan Basin well location are shown in Table 1.

Table 1 West Orphan Basin Well Location, Monthly Current Statistics

		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Water Depth (0m BSL)	Min (cm/s)	8	7	7	6	7	4	6	8	9	8	10	8
	Mean (cm/s)	34	29	23	25	24	22	21	23	32	32	29	28
	Max (cm/s)	86	69	53	68	54	52	49	58	73	75	61	62
Water Depth (-25 m BSL)	Min (cm/s)	5	6	4	3	4	3	5	1	2	7	4	4
	Mean (cm/s)	24	19	15	19	18	18	14	15	23	25	22	20
	Max (cm/s)	58	54	32	41	48	51	36	47	54	72	52	41
Water Depth (-100 m BSL)	Min (cm/s)	7	3	3	2	2	2	1	2	1	2	1	3
	Mean (cm/s)	17	14	11	14	13	14	9	9	8	9	10	13
	Max (cm/s)	40	39	27	30	36	38	24	36	26	31	31	32
Water Depth (-1,300 m BSL)	Min (cm/s)	1.1	1.2	1.1	1.1	1.0	1.1	1.1	1.3	1.0	1.3	0.7	1.1
	Mean (cm/s)	4	4	3	4	4	4	4	5	5	5	3	4
	Max (cm/s)	8	8	7	12	9	12	12	20	20	13	8	10

Although the Nexen Energy EL 1144 wellsite is located at a water depth of 1,137 m, similar to the water depth at the West Orphan Basin wellsite (1,360 m), the ambient currents at the West Orphan location appear to be more variable and stronger, with mean surface currents an order of magnitude greater and near-bottom currents up to 5 times larger than at the EL 1144 well site.

The implication is that the SBM will be transported over a greater distance before settling on the seabed, resulting in a thinner layer of drill solids spread over a larger area, compared to those discharged at the EL 1144 wellsite. Hence, as was demonstrated in the Drill Cuttings Modeling Report (EIS Appendix B), higher ambient currents are likely to reduce the maximum distance from the wellsite location where benthic burial affects occur.

If the synthetic-based mud spill was to occur at the wellhead, then the SBM drill solids deposition will be localized around the wellhead, resulting in thicker sediments spread over a smaller area than if the SBM spill release was to occur at the surface.

1.13.3 Information Requirement: IR-68

External Reviewer ID:

NRCan-06

Reference to EIS:

Appendix D

Context and Rationale:

Natural Resources Canada advised that the oil spill trajectory modelling appears to assume that oil pour point temperature is below the deep-water temperature; however, this is not necessarily the case. As such, Natural Resources Canada advises that there is a strong potential that the oil from the test region would have pour points above the deep water temperatures of the area. The impact of this is that the crudes may not disperse as the proponent suggests, but may instead solidify into solid particles on their way to the surface. This would change the predicted behaviors modelled results.

Specific Question of Information Requirement:

Provide the rationale for the selection of crude oil characteristics input into the model, considering the estimated fluid properties of the reservoir and the water temperatures. Confirm whether there is an error in the modeling related to oil pour point temperatures specific to this region. If this was not an error, discuss the implications of the pour point being above the deep-water temperature on the modelled results. Update the effects assessment, as required.

Response:

During a subsea oil blowout, the turbulent mixing from entrained seawater into the oil plume causes droplets to shed from the continuous oil phase. Droplet formation happens in several stages, where initially separated oil becomes subsequently broken down into smaller and smaller droplets (Gorokhovski and Herrman 2008). Droplet formation occurs at a highest rate close to the discharge point, where turbulence is highest, and ceases at some distance from the wellhead where turbulence is no longer strong enough to separate oil into smaller fractions. During successive rounds of break-up, the oil's temperature will gradually decrease as the oil at 94°C encounters water at 3°C to 4°C, which means that the different stages of breakup will occur at different temperatures.

Knowing the oil's temperature during droplet formation is important for the modelling of subsea blowouts because the temperature affects viscosity which in turn affects the size of the generated droplets (Johansen et al. 2013).

Within OSCAR a module has been developed that determines the average temperature during droplet size formation using a regression model that depends on the variables of outlet velocity, volume flux, oil temperature, water temperature and orifice diameter. This temperature (rather than the ambient temperature) is then used to estimate the oil's viscosity during droplet formation. The temperature adjusted viscosity allows for a better prediction of the oil droplet size distribution.

As oil droplets rise in the water column, horizontal and vertical advection and dispersion of entrained and dissolved hydrocarbons are simulated in OSCAR by random walk procedures. The algorithms used to simulate these processes controlling physical fates of substances are described in Aamo et al. (1993) and Reed et al. (1995). OSCAR employs surface spreading, advection, entrainment, emulsification, and volatilization algorithms to determine transport and fate at the surface.

Processes such as advection, spreading, entrainment and vertical mixing in the water column are not directly dependent on oil composition, although all tend to be linked through macro-characteristics such as viscosity and density. Other processes, such as evaporation, dissolution, and degradation are directly dependent on oil composition.

Four oil properties are predicted in the model. These are pour point, flash point, density and viscosity of water-free oil. These properties vary as curve fits with laboratory-measured (Daling et al. 1990) values and fraction evaporated as described by Johansen (1991). The pour point is a function of the wax and asphaltene content of the oil. As an oil cools, it will reach a temperature, the so called “cloud point” at which the wax components begin to form crystalline structures and the viscosity of the oil increases hindering its flow.

Once oil is spilled it is impossible to talk about a single pour point value when modelling the weathering behavior of oil. This is because the evaporation and dissolution of volatile/low molecular weight oil pseudo components increases the relative concentration of high molecular weight waxes, thereby increasing the cloud and pour points the oil. In OSCAR the pour point is described by the equation:

Pour point (°C): $P = e^{(a+bf)}$ - 273

where f is the fraction evaporated (or dissolved) (%), and the a's and b's are regression factors derived from laboratory weathering studies on the oil. Figure 1 shows an example of the predicted change in pour point of water free VARG 2004 oil (West Orphan oil analogue) at a sea temperature of 2°C following a surface oil spill.

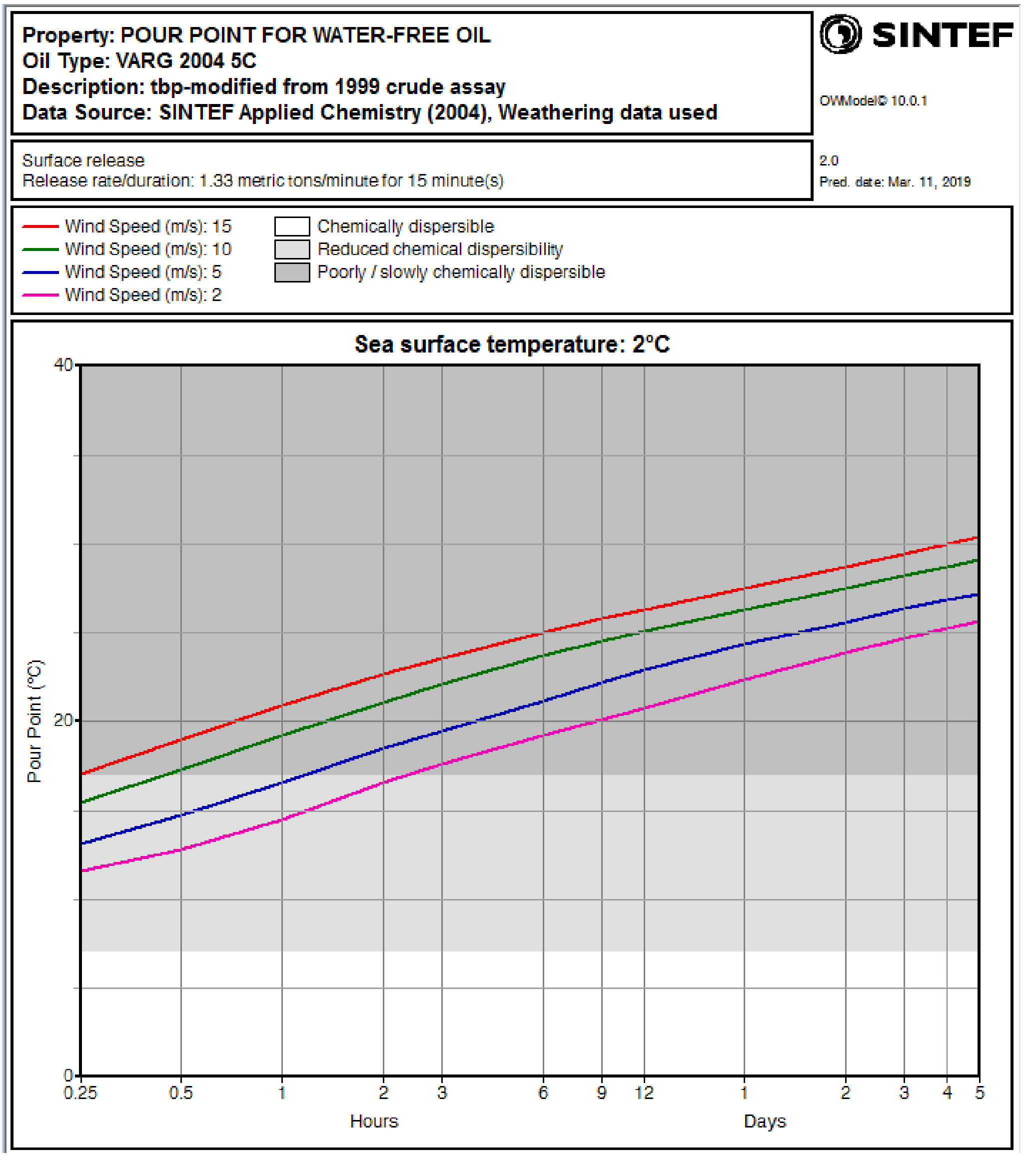


Figure 1 **Example of the Predicted Change in Pour Point of Water-free VARG 2004 oil (West Orphan oil analogue) at a Sea Temperature of 2°C**

References:

Aamo, O.M., M. Reed, P.S. Daling and Ø. Johansen. 1993. A Laboratory-Based Weathering Model: PC Version for Coupling to Transport Models. Pp. 617-626. In: Proceedings of the 1993 Arctic and Marine Oil Spill Program (AMOP) Technical Seminar.

Daling, P.S., P.J. Brandvik, D. Mackay and Ø. Johansen. 1990: Characterization of Crude Oils for Environmental Purposes. Oil and Chemical Pollution, 7: 199-224.

Gorokhovski, M. and M. Herrman. 2008. Modelling primary atomization. Annual Review of Fluid Mechanics, 40(1): 343-366.

Johansen, Ø. 1991. Numerical Modelling of Physical Properties of Weathered North Sea Crude Oils. Report No. 02.0786.00/15/91. IKU, Trondheim, Norway. 18 pp.

Johansen, Ø., P.J. Branvik and U. Farooq. 2013. Droplet breakup in sunsea oil releases - Part 2: Predictions of droplet size distributions with and without injection of dispersants. Marine Pollution Bulletin, 73(1): 327-335.

Reed, M., O.M. Aamo and P.S. Daling. 1995a. OSCAR, a model system for quantitative analysis of oil spill response strategies. Pp. 815-835. In: Proceedings 1995 AMOP Seminar, Edmonton, Alberta, Canada.

Reed, M., O.M. Aamo and P.S. Daling. 1995b. Quantitative analysis of alternate oil spill response strategies using OSCAR. Spill Science and Technology, 2(1): 67-74.

Reed, M., O.M. Aamo and P.S. Daling. 1995c. Strategic analysis of oil spill response alternatives. Pp. 514-831. In: Proceedings of Second International Oil Spill R&D Forum, London, England.

1.14 Information Requirement: IR-69

External Reviewer ID:

NRCan-08

Reference to EIS:

Appendix D

Context and Rationale:

Natural Resources Canada stated that standard gas chromatography instruments cannot measure heavy ends contents so the proponent residue contents beyond Boiling Point > 380°C are not quantitative representations of residue contents for the crudes. Natural Resources Canada indicated that information on the techniques used to quantify heavier ends with boiling points greater than 380°C are applicable to assess the fate of hydrocarbons in a potential spill.

Specific Question of Information Requirement:

Discuss the techniques used to quantify heavier ends with boiling points >380°C in the analysis, providing information on how true boiling point data, wax and asphaltene contents were used.

Response:

The chemical characterization includes GC-MS quantification of selected “environmentally” relevant compounds in the crude: semi-volatile hydrocarbons (SVOC, including polycyclic hydrocarbons (PAH) and alkyl phenols) and volatile hydrocarbons (VOC, including benzene, toluene, ethylbenzene and xylenes (BTEX)). The chemical characterization of the oil implies quantification of more than 80 single compounds. These data are grouped into 25 component groups mainly based on boiling point and dissolution. The 25 individual groups form the OSCAR oil profile (see Table 1) and is a fundamental input to the OSCAR model.

SINTEF have led the industry in developing and refining a systematic, step-wise procedure to characterize the weathering of oils, thereby isolating the influence of different weathering processes (i.e., evaporative loss, photolysis and w/o-emulsification). These laboratory methods have been described by Daling et al. (1990, 1997).

The first step involves the sequential distillation (topping) of the fresh oil into 150°C, 200°C and 250°C (vapour temperature) residues, which approximately (depending on weather conditions) simulates the evaporative loss corresponding to 0.5 to 1 hour, 0-5 to 1 day and 2 to 5 days evaporative loss at sea, respectively. Secondly, a sample of fresh crude is photolyzed (using artificial sunlight) for 20 hours. This causes an evaporative loss of the lightest components similar to the 250°C+ topped oil samples. Finally, the topped and the photolyzed (water-free) oil samples are emulsified with 50% and 75% sea water by using the rotating flask apparatus (Mackay and Zagorski 1982). Thus, 12 weathered oil samples are prepared from the fresh crude and each sample is then subjected to physico-chemical analysis to measure oil properties like specific gravity, flash point, pour point and viscosity as well as maximum water uptake, w/o-emulsification studies and chemical dispersibility tests.

Table 1 Pseudo-components Used to Specify Oil Composition in SINTEF'S OSCAR Model (averaged properties are given for each pseudo-component)

PK	Chemical name	Formula	Mol. Weight	Density (gm/cc)	Boiling point (°C)
1	C1-C4 gasses (dissolved in oil)	C1-C4	37	0.615	-80
2	C5-saturates (n-/iso-/cyclo)	C5-sat	66	0.673	38
3	C6-saturates (n-/iso-/cyclo)	C6-sat	80.5	0.697	70
4	C7-saturates (n-/iso-/cyclo)	C7-sat	99	0.7115	90
5	C8-saturates (n-/iso-/cyclo)	C8-sat	113	0.753	117
6	C9-saturates (n-/iso-/cyclo)	C9-sat	127	0.764	147
7	Benzene	Bezene	78	0.884	80
8	C1-Benzene (Toluene) et. B	C1-Ben	92	0.88	110
9	C2-Benzene (xylenes; using O-xylene)	C2-Ben	106	0.8745	140
10	C3-Benzene	C3-Ben	120	0.875	160
11	C4 and C4 Benzenes	C4-Ben	141.5	0.8795	187
12	C10-saturates (n-/iso-/cyclo)	C10-sat	140.5	0.7725	180
13	C11-C12 (total sat + aro)	C11-C12	156.5	0.8095	205
14	C13-C14 (total sat + aro)	C13-C14	185.5	0.8155	245
15	C15-C16 (total sat + aro)	C15-C16	215.5	0.8225	280
16	C17-C18 (total sat + aro)	C17-C18	238	0.8275	310
17	C19-C20 (total sat + aro)	C19-C20	273	0.8175	337
18	C21-C25 (total sat + aro)	C21-C22	317.5	0.8225	370
19	C25+ (total)	C25+	465	0.95	405
20	Naphthalenes 1 (C0-C1-alkylated)	Napth.1	135	1.015	232
21	Naphthalenes 2 (C2-C3-alkylated)	Napth.2	163	1.016	272
22	PAH 1 (Medium soluble polyaromatic hydrocarbons (3 rings-non-alkyltd;<4 rings)	PAH-1	177	0.98	295
23	PAH 2 (Low soluble polyaromatic hydrocarbons (3 rings-alkylated; 4-5+ rings)	PAH-2	222.5	0.98	400
24	Phenols (C0-C4 alkylated)	Phenols	130	0.986	215
25	Unresolved Chromatographic Materials (UCM: C10 to C36)	UCM	215	1.015	350

Thus, the resulting laboratory weathering data consists of measurements of fraction evaporated and each of the oil properties mentioned above at three different stages of weathering. A non-linear curve fitting scheme is then applied to the weathering data to establish formulas which describe each property as a function of the fraction evaporated (Johanssen 1991). These algorithms are incorporated into OSCAR to simulate the weathering processes.

A link between the laboratory data and weathering properties under field conditions is established on the basis of computations of evaporative loss and w/o-emulsion formation, with the assumption that:

- The product remaining after a given fraction is topped by distillation corresponds to the product remaining after an equal amount is removed by evaporation at sea
- The w/o-emulsification process studied in the laboratory corresponds to the process taking place at sea

Over the last 25 years, SINTEF have collected experimental weathering data on a wide range of oils incorporated into the SINTEF oil database used by OSCAR. By matching limited crude assay data for a new oil (e.g. true boiling point curves, density, pour point, wax and asphaltene content) with the same properties of oils already characterized in the SINTEF oil database, suitable analogue oils can be selected from the database to provide reliable predictions of oil weathering properties during oil trajectory modelling using OSCAR.

References:

Daling, P.S., O.M. Aamo, A. Lewis and T. Strøm-Kristiansen. 1997. SINTEF Oil Weathering Model: Predicting Oil's Properties at Sea. Pp. 297-307. In: 1997 International Oil Spill Conference. Fort Lauderdale, FL, 2-10 April.

Daling, P.S., P.J. Brandvik, D. Mackay and Ø. Johansen. 1990. Characterization of crude oils for environmental purposes. Oil and Chemical Pollution, 7: 199-224.

Johansen, Ø., 1991. Numerical Modelling of Physical Properties of Weathered North Sea Crude Oils. Report No. 02.0786.00/15/91. IKU, Trondheim, Norway. 18 pp.

Mackay, D. and W. Zagorski. 1982. Studies of water-in-oil emulsions. Report EE-34: Environment Canada, Ottawa, ON.

1.14.1 Information Requirement: IR-70

External Reviewer ID:

NRCan-05; NRCam-07

Reference to EIS:

Section 15.2.2.2;

Appendix D

Context and Rationale:

Appendix D of the EIS presents the results of the oil spill trajectory modelling. The presentation of the mass balance results illustrated a sunken oil component. However, there was no discussion on the origin of the sunken oil components or the potential environmental effect of sunken oil on sensitive areas.

In addition, Natural Resources Canada advised it was not clear how the heavy ends of the crude oil were accounted for in the model.

Specific Question of Information Requirement:

Provide an explanation of the sunken oil, including a description of how it formed and the potential environmental effects of sinking oil on sensitive areas.

Discuss how the model accounted for the heavy ends of the hydrocarbons, and how this fraction is related to the proportion of the oil that sank.

Response:

Very few oils naturally sink in the marine environment as oil is less dense than water. There are three different routes that may lead oil to sink and be incorporated into bottom sediments. When oil on the water surface or in the water column comes into contact with sediment suspended in the water column, the oil and sediment may bind together which in turn increases the density of the oil droplet, thereby causing it to sink. Sediment binding is particularly common in shallow waters where the concentration of suspended sediment through the water column is generally higher than in offshore environments. Sedimentation can also occur as oil naturally weathers. As weathering occurs, the lighter compounds in the oil evaporate and the oil density increases making it less buoyant and more likely to sink if it becomes attached to more dense sediment or organic particles (Muschenheim and Lee 2002; Bandara et al. 2011; Sørensen et al. 2014). Dissolved oil in the water column may become partitioned into suspended material (Chao 2003).

Within OSCAR, sedimentation calculations for oil are deactivated in stochastic mode, so there is no stochastic output for the seafloor. Sedimentation is only accounted for in deterministic simulations.

The mass balance outputs from deterministic simulations of the maximum oil on shoreline trajectories selected from West Orphan and East Orphan stochastic subsea blowout relief well scenarios indicated that at 2.4% and 2.1% of the respective total amounts of oil released might became entrained in the sediment at the end of the 160-day simulations (EIA Appendix D, Sections 7.2.1.2 and 7.2.2.2.)

OSCAR reports oil contamination on the seafloor as tonnes/m² for each grid cell and time step and is calculated in the model once an oil droplet passes into a cell identified as a sediment cell. Sediment cells are generated in the model using the bathymetry data and so it is only considered to occur once oil falls onto the seafloor. Sedimentation may occur both in the nearshore and offshore environments; however, it is likely to be largely concentrated in shallow waters where high turbulence can increase the concentration of suspended mineral fines in the water column enhancing oil droplet /particulate collision frequencies.

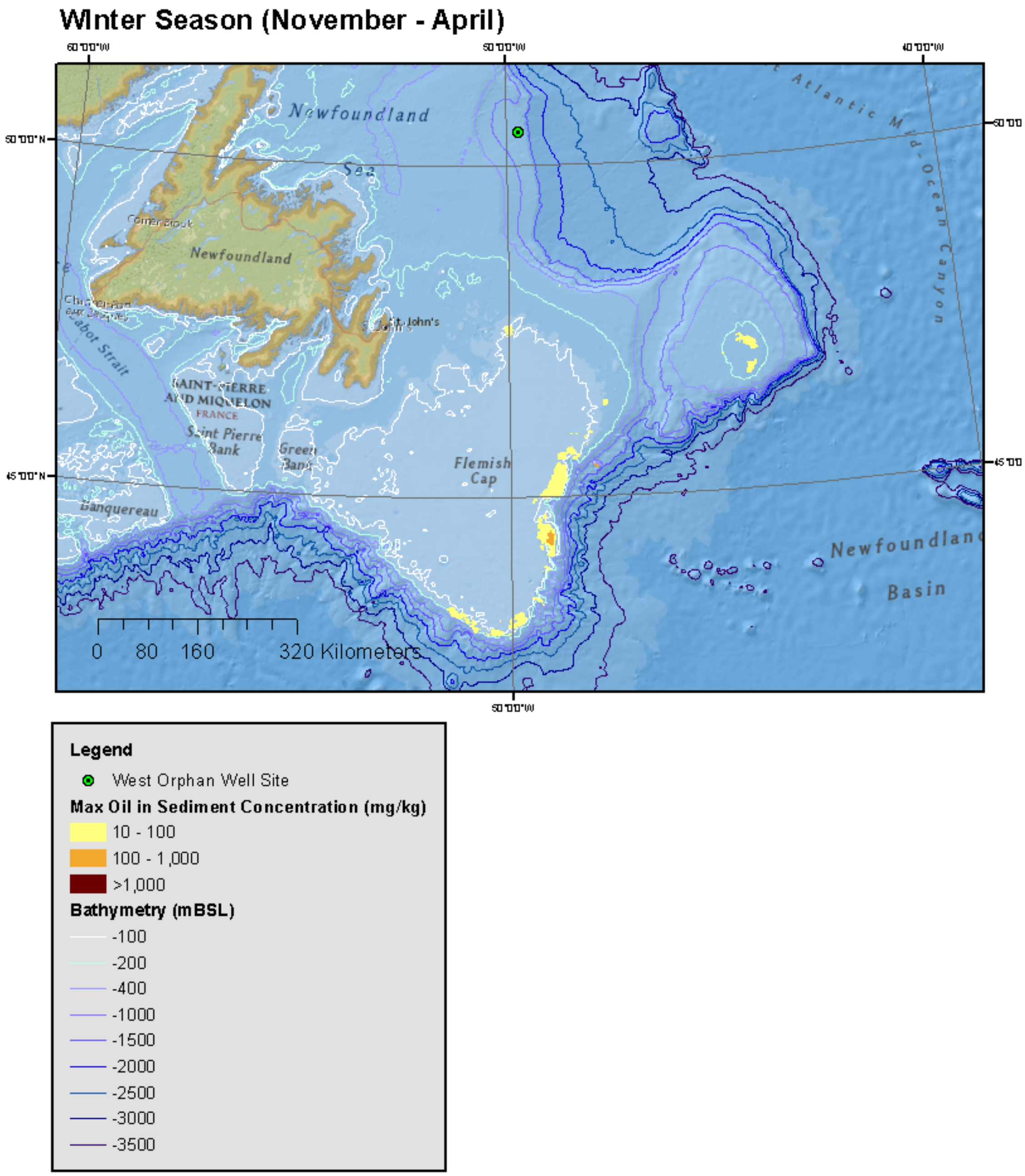
Using data on the concentration of oil hydrocarbons in the upper layer of bottom sediments collected from different regions around the world, Patin (1999) has derived approximate oil concentration in sediment thresholds that might cause effects in benthic biota. A threshold representing the upper limit for no observed effect concentrations (NOECs) was defined as 10 mg/kg, with sub-lethal and acute effects occurring above oil in sediment concentrations of 100 mg/kg and 1,000 mg/kg respectively.

The screening regime recommended in OPSAR 2006/5 for assessing the persistence of oil contamination in cuttings piles arising from the discharge of organic phase drilling fluid contaminated cuttings is 50 mg/kg.

To compare OSCAR oil in sediment outputs with these threshold limits it is necessary to assume a mixing depth in the sediment. During the Braer spill in 1993, 85,000 tons of Gullfaks crude oil was spilled off the coast of Shetland. The rough weather conditions with heavy wind made the oil quickly disperse completely into the water column. No oil was stranded, but it was estimated that approximately 35% of the oil ended up in sediments, with oil mixed to 4 to 10 cm in about 3 months (Royal Society of Edinburgh 1997). Several studies of the environmental impact concluded that ecosystems received little impact and were restored to normal within a year of the release.

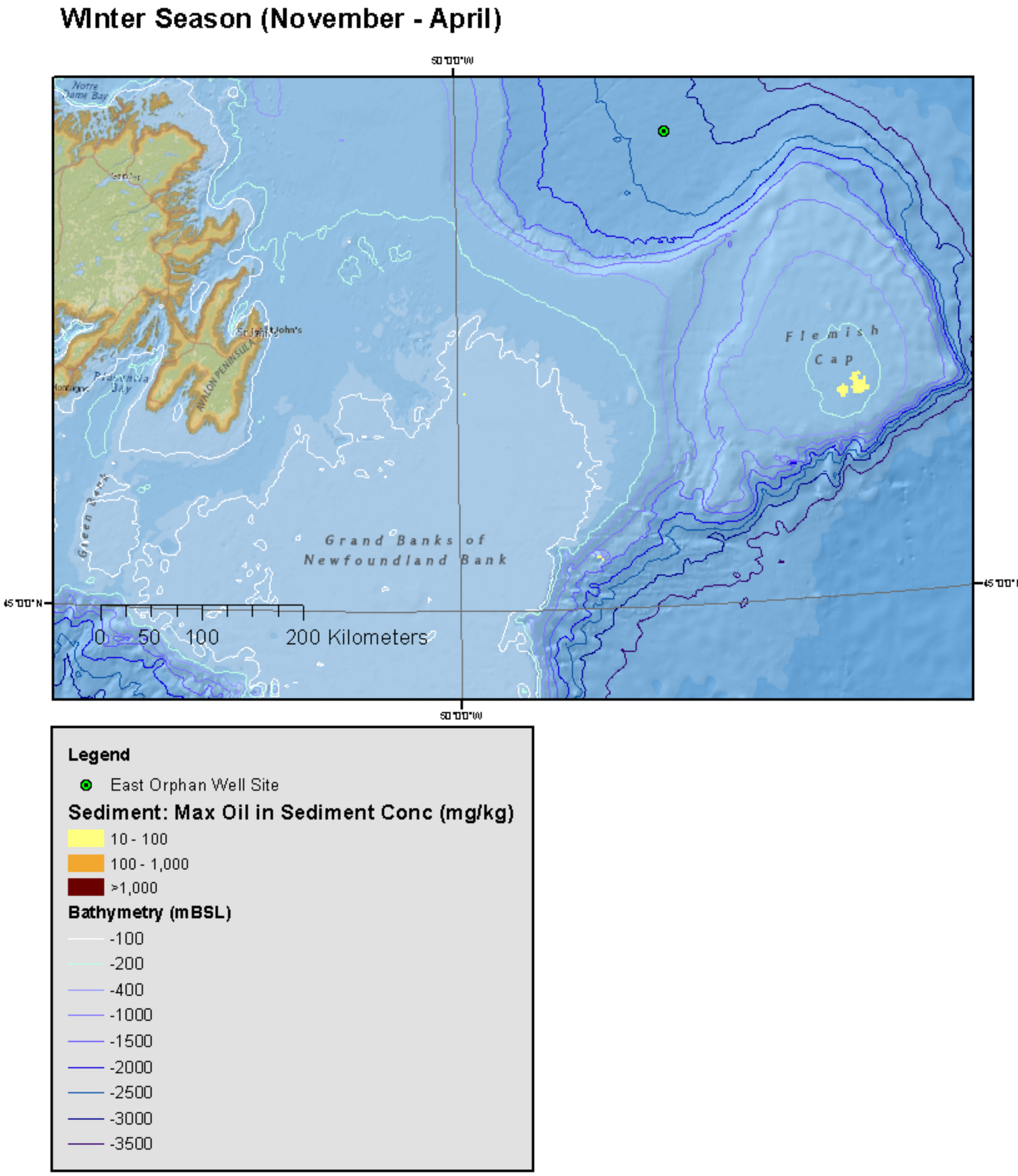
In Figures 1 and 2, a mixing depth of 5 cm has been applied to the oil in sediments outputs from OSCAR to provide an indication of the significance of oil in sediment concentrations associated with the maximum oil on shoreline trajectories for the West Orphan and East Orphan relief well scenarios.

The predicted oil in sediment concentrations only exceeded NOEC thresholds in shallow water areas round Grand Banks and the Flemish Cap. Oil concentrations exceeding acute threshold levels (>1,000 mg/kg) were not predicted to occur in either relief well scenarios. The cumulative impacted areas exceeding each oil in sediment concentration threshold for both relief well scenarios is presented in Table 1.



Note: Map showing the maximum oil in sediment concentrations at the end of the simulation period (160 days) assuming a 5 cm mixing depth.

Figure 1 Scenario 1: West Orphan Relief Well Scenario (120 day duration) – Maximum Oil on Shoreline Scenario (Winter Season), start date 31st Dec 2009 02:00 GMT)



Note: Map showing the maximum oil in sediment concentrations at the end of the simulation period (160 days) assuming a 5 cm mixing depth.

Figure 2 Scenario 3: East Orphan Relief Well Scenario (120-day duration) – Maximum Oil on Shoreline Scenario (Winter Season), start date 30th January 2010 06:00 GMT)

Table 1 Summary of the Cumulative Impacted Areas Exceeding Oil in Sediment Concentration Thresholds for the Maximum Oil on Shoreline Trajectories Selected from West Orphan and East Orphan Stochastic Subsea Well Blowout Scenarios

	Deterministic simulations	Scenario 1 - WO Well Blowout - Relief Well	Scenario 3 - EO Well Blowout - Relief Well
		128,000 bpd (Initial oil release rate) / 120 days duration	39,000 bpd (Initial oil release rate) / 120 days duration
	Season	"Winter Season" (November - April)	"Winter Season" (November - April)
	Simulation number	100	104
	Start time	31 December 2009 02:00	30 January 2010 06:00
	Simulation duration	160 days	160 days
	Release duration	120 days	120 days
	Initial Release rate	128,282 bbls/day	39,195 bbls/day
	Total oil release	1,350,011 tonnes	460,148 tonnes
Oil in Sediment	Percentage of total oil released incorporated into bottom sediment	2.4 %	2.1 %
	Mass of oil incorporated into bottom sediment	32,670 tonnes	9,665 tonnes
	Cumulative Impacted Area Exceeding Oil in Sediment Concnetration Thresholds:		
	> NOEC limit (10 mg/kg)	6,071 km^2	408 km^2
	> Sub-lethal effects theshold (100 mg/kg)	236 km^2	- km^2
	> Acute threshold (>1,000 mg/kg)	- km^3	- km^3
	Flemish Pass / Eastern Canyon ***Oil in Sediment Concentration Threshold:***		No Intersection with Environmentally Sentitive Areas
	> NOEC limit (10 mg/kg)	23 km^2	
	> Sub-lethal effects theshold (100 mg/kg)	23 km^2	
	> Acute threshold (>1,000 mg/kg)	- km^3	
	Lilly Canyon - Carson Canyon ***Oil in Sediment Concentration Threshold:***		
	> NOEC limit (10 mg/kg)	13 km^2	
	> Sub-lethal effects theshold (100 mg/kg)	- km^2	
	> Acute threshold (>1,000 mg/kg)	- km^3	
	Northeast Shelf and Slope ***Oil in Sediment Concentration Threshold:***		
	> NOEC limit (10 mg/kg)	15 km^2	
	> Sub-lethal effects theshold (100 mg/kg)	- km^2	
	> Acute threshold (>1,000 mg/kg)	- km^3	
	Southeast Shoal and Tail of the Banks ***Oil in Sediment Concentration Threshold:***		
	> NOEC limit (10 mg/kg)	2,450 km^2	
	> Sub-lethal effects theshold (100 mg/kg)	213 km^2	
	> Acute threshold (>1,000 mg/kg)	- km^3	

References

Bandara, U.C., P.D. Yapa and H. Xie. 2011. Fate and transport of oil in sediment laden marine waters. Journal of Hydro-environment Research, 5(3): 145-156.

Chao, X., S.S.Y. Wang and N.J. Shankar. 2003. Development and application of oil spill model for Singapore coastal waters. Journal of Hydraulic Engineering, 129(7): 495-503.

Muschenheim, D.K. and K. Lee. 2002. Removal of oil from the sea surface through particulate interactions: Review and prospectus. Spill Science and Technology Bulletin.

OSPAR Recommendation 2006/5 on a Management Regime for Offshore Cuttings Piles.

Patin, S. 1999. Environmental Impact of the Offshore Oil and Gas Industry. EcoMonitor Publishing, East Northport, New York. 425 pp.

Royal Society of Edinburgh. 1997. The Impact of an Oil Spill in Turbulent Waters: The Braer. Proceedings of a symposium held at the Royal Society of Edinburgh, 7-8 September 1995.

Sørensen, L., A.G. Melbye and A.M. Booth. 2014. Oil droplet interaction with suspended sediment in the seawater column: Influence of physical parameters and chemical dispersants. Marine Pollution Bulletin, 78(1-2): 146-152.

1.14.2 Information Requirement: IR-71

External Reviewer ID:

N/A

Reference to EIS:

Appendix B

Context and Rationale:

Section 1 of Appendix B of the EIS states the drill much and cuttings dispersion modelling accounted for likely discharges for the entire well drilled over a 30 day period, including water-based mud (WBM) discharges at seafloor for initial hole sections (pre-riser installation), bulk WBM discharges, and treated synthetic-based mud (SBM) associated cuttings from the MODU, post-riser installation. However, the EIS states that each well will take 60 days to drill. It is unclear how the modelling for 30 days is applicable in a 60 day context.

Specific Question of Information Requirement:

Provide the rationale for modelling a 30-day well drilling period when it is expected to take 60 days to drill a well. Discuss the potential environmental effects of a well drilling period consistent with the estimated length of time for well drilling in the Project.

Response:

The well durations employed in dispersion modelling for each well location of 30 days are based on the best estimates of the drilling schedule provided by BP Global Wells Organization. The more conservative 60-day well durations mentioned in the EIS translates to the same amounts of drill solid material being released over a longer period of time (i.e., slower rate of penetration) and/or with longer periods of non-drilling activity between sections (e.g., running casing). As the hindcast HYCOM current dataset was analyzed to find the most benign and energetic surface metocean conditions over a five-year period, these same extremes in ambient current conditions would still be valid if the well duration was extended by 30 days. Hence, there would be no significant difference in the areal footprint and thickness of cuttings deposited on the seabed if the drilling schedule was extended by 30 days.

1.14.3 Information Requirement: IR-72

External Reviewer ID:

N/A

Reference to EIS:

Section 15;

Appendix D

Context and Rationale:

Oil spill dispersion modelling (stochastic) completed for the EIS set an eastern model boundary to 30° longitude. Figures in Section 15 of the EIS and in Appendix D illustrating model results show that a potential spill may extend beyond the model domain. As a result, the potential for shoreline contact, including in international jurisdictions, is unclear.

Specific Question of Information Requirement:

Provide a rationale for the selection of boundaries for stochastic modelling. Discuss the limitations of the truncated spatial extent of spill dispersion results, including the implication for transboundary effects.

Response:

The modelling domain boundary at 30°W longitude was limited by the spatial extent of the 3-D HYCOM dataset that was used to drive oil dispersion and transport in OSCAR modelling. The eastern boundary limit is similar to that used in other EIS oil spill modelling studies for this region. As the current vectors terminate at this border any oil that reaches the boundary tends to "artificially" accumulate along this margin (relief well scenarios only), thereby distorting the stochastic contours outputs (e.g., probability contours). Nevertheless, any transboundary effects along the eastern margin are likely to be minimal as any surface oil arriving along the boundary after >20 days will be substantially weathered and at sheen thicknesses (EIS Appendix D Figures 7.8, 7.9, 7.18, and 7.19). The only Marine Protected Area (MPA) extending beyond this border is the Charlie-Gibbs South and North High Seas MPA (OSPAR designated), which covers the Mid-Atlantic Ridge (MAR). Geospatial statistics that assess the potential oil exposure risk from the West Orphan and East Orphan blowout scenarios within the Charlie-Gibbs South and North High Seas MPAs (west of 30° W longitude) are presented in EIS Appendix D Annex D.

1.14.4 Information Requirement: IR-73

External Reviewer ID:

ECCC-18

Reference to EIS:

Section 15.4.7.1;

Section 7.2.2.1 of Appendix D

Context and Rationale:

Figure 7.67 in Section 7.2.2.1 of Appendix D in the EIS illustrates that the terminal level for plume dynamics is for the East Orphan Basin is between 2100-2700 mbsl. The Agency noted that based on this figure a larger proportion of oil would be expected to be in the dissolved phase deeper than the top 100 metres of the water column as is shown in the East Orphan Basin figures. Environmental effects on species inhabiting the water column below 100 metres water depth could be underestimated if only the top 100 metres of water depth is considered.

Environment and Climate Change Canada stated that it is unclear how the results for subsea transport below the 100 meter depth and the related oil-in-sediment fates, as described in Appendix D, are included in the conclusions in Section 15.4.7.1.

Specific Question of Information Requirement:

With respect to sub-sea transport of oil below 100 metres and the related oil-in-sediment fates discuss the following:

- the rationale for assessing the concentrations of dissolved phase hydrocarbons in the top 100 metres of the water column even if this does not represent the maximum concentration of hydrocarbon;
- the potential for transport at depth of the dispersed plume leading to suspended particles and benthic sedimentation fates, including the possible interactions with effects such as pycnoclines and thermoclines as well as possible benthic currents. (This could be limited to the stochastic results for the vertical water column of the subsea releases in figures F7.22 and F7.33 in Appendix D, as well as in the Appendix D annexes for the water column profile environmental data.) and
- predictions for impacts on benthos (as area maps), indicating the areal extent of potentially-affected sediments.

Response:

There is a 10 million cell limit on the number of grid cells that can be used to describe the water column within OSCAR. As oil is less dense than water, the majority of oil released during the blowout rises to the sea surface and spends most of the time either as an oil slick/film on the surface or becomes broken up into oil droplets by wave action and re-entrained into the upper water column. The justification for limiting the depth of the water column modelling grid in stochastic modelling is to ensure that the spatial extent and resolution of grid cells describing the water column isn't sacrificed by using up grid cells to cover regions in the lower water column where oil isn't present. It therefore allowed the maximum lateral extent of surface and shoreline oiling to be determined at an acceptable resolution.

The environmental effects on species inhabiting the water column below 100 m water depth has not been underestimated as separate near-field domain stochastic simulations were carried out for the relief well scenarios in which the modelling grid was extended all the way to the sea floor. This enabled the lateral extent of oil droplets and dissolved oil in the water column at environmentally significant concentrations to be established. The nearfield modeling showed that the subsea probability of oil exceeding the 58 ppb total hydrocarbon concentration threshold at water depths >100 m is limited to a maximum radius of circa 70 km from each wellsite location for probabilities >1% (see EIS Appendix D, Figures 7.22 and 7.33).

As the majority of oil rises to the surface within a few hours (see EIS Appendix D Figures 7.58 and 7.68), the radial extent that the plume and oil droplets move away from the release location is relatively small compared to the lateral transport of oil once it arrives at the surface.

As described in the response to IR 70, a limitation of OSCAR is that sedimentation calculations for oil are deactivated in stochastic mode, so there is no stochastic output for the seafloor. Sedimentation is only accounted for in deterministic simulations.

Oil sedimentation is most likely to occur in shallow water environmental where high turbulence can increase the concentration of suspended mineral fines in the water column, enhancing oil droplet / particulate collision frequencies. The mechanism of oil sedimentation is fully described in the response to IR-70 and maps from deterministic simulations are presented which show the potential areal extent of affected sediments.

1.15 Accidents and Malfunctions - Effects

1.15.1 Information Requirement: IR-74

External Reviewer ID:

N/A

Reference to EIS:

Section 15.5.2.3

Context and Rationale:

Section 15.5.2.3 of the EIS discusses the potential effects of an accident or malfunction on marine and migratory birds. With respect to a marine diesel spill, it states that upon contact with the shoreline diesel tends to penetrate porous sediments quickly and washes off quickly by waves and tidal flushing. However, there is no discussion of how the shoreline geology of Newfoundland and Labrador may influence the predicted environmental effects of a marine diesel spill in the nearshore environment on marine and migratory birds, including the duration of residual effects.

Specific Question of Information Requirement:

Discuss how the shoreline geology of the Newfoundland and Labrador may influence the predicted environmental effects of a marine diesel spill in the nearshore environment on marine and migratory birds including the duration of residual effects.

Response:

The shorelines around the major marine bird nesting colonies in eastern Newfoundland are rocky. However, gull and tern colonies are often on low islands with sand or shingle beaches, some of which are underlain by rock. In Newfoundland, both types of shoreline are subject to the action of high wave energy. The rocky shorelines around most Newfoundland seabird colonies would not absorb oil, as is the case with porous sediments. As discussed in Section 15.5.2, the persistence of oil in in porous sediments (sand, gravel, shingles) underlain by rock substrates in Prince William Sound, Alaska, following the *Exxon Valdez* oil spill (Day et al. 1997) appeared to be lower than in porous sediments underlain by porous sediments elsewhere (Culbertson et al. 2007). Oil has even shorter persistence on rocky shorelines. However, aggressive cleaning of rocky shorelines may lead to loss of cover provided by the original biological growth. This may be followed by colonization of opportunistic species that delay the return of the shoreline's cover to its original community of biological growth (Short 2017). However, despite a high wave energy environment in Prince William Sound, *Exxon Valdez* oil in porous beach sediments persists years after the spill, leading to chronic, long-term exposure of harlequin duck and sea otter (*Enhydra lutris*) to oil-contaminated prey, as demonstrated by the presence of physiological oil-exposure indicators in the former two species (Short 2017).

Despite variation in the porosity of shorelines and variation in the persistence of oil among those types of substrates, diesel spilled from a vessel collision is not anticipated to reach the coastal shorelines of Newfoundland and Labrador, Nova Scotia, New Brunswick, Prince Edward Island or Quebec (refer to response to IR-78). Therefore. The predicted environmental effects, including the duration of residual effects (short term to medium term), of a marine diesel spill in the nearshore environment on marine and migratory birds remain unchanged from the EIS.

References:

Culbertson, J.B., I. Valiela, E.E. Peacock, C.M. Reddy, A. Carter and R. VanderKruik. 2007. Long-term biological effects of petroleum residues on fiddler crabs in salt marshes. Marine Pollution Bulletin, 54: 955-962.

Day, R H., S.M. Murphy, J.A. Wiens, G.D. Hayward, E.J. Harner and L.N. Smith. 1997. Effects of the *Exxon Valdez* Oil Spill on Habitat Use by Birds in Prince William Sound, Alaska. Ecological Applications, 7: 593-613.

Short, J.W. 2017. Advances in Understanding the Fate and Effects of Oil from Accidental Spills in the United States Beginning with the *Exxon Valdez*. Archives of Environmental Contamination and Toxicology, 73: 5-11.

1.15.2 Information Requirement: IR-75

External Reviewer ID:

MTI-01

Reference to EIS:

Section 15.5.1

Context and Rationale:

Section 15.5.1 provides the effects assessment for accidents and malfunctions on marine fish and fish habitat. However, effects of an oil spill were not considered for Atlantic Salmon, particularly effects on migration through avoidance of oiled areas.

Specific Question of Information Requirement:

Discuss how a spill may interact with migratory species such as Atlantic Salmon, and whether significant disturbance or avoidance behaviour may occur. Update proposed mitigation and follow-up, if applicable.

Response:

The effects of oil associated with an accidental event on marine fish, including salmon, have principally been described using laboratory studies with farm raised fish or caged fish that are unable to avoid oil exposure (e.g., Barnett and Toews 1977; Thomas and Rice 1987; Fraser 1992; Pineiro et al. 1996; Zhou et al. 1997; Stagg et al. 1998; Meador et al 2006; Stieglitz et al. 2016). Many of these studies showed effects on feeding, food conversion, or changes in enzyme levels based on exposure; however, returns to baseline were generally noted in 2 to 8 weeks (Fraser 1992; Stagg et al. 1998). Of note, many of the concentrations used in these lab studies were very high compared to the exposures that would be expected from an accidental spill in the open ocean due to dilution.

Few studies have been conducted on the avoidance behaviour of returning adult salmon to hydrocarbons in water under natural conditions. Weber et al (1981) conducted a behavioural study on adult Pacific salmon (*Oncorhynchus* sp.) where hydrocarbons that closely approximated the water-soluble fraction of Prudhoe Bay crude oil were added to in one of two fishways as salmon were migrating upriver. They found that migrating salmon substantially avoided (i.e., when 50 percent of fish which were expected to ascend a fishway avoided it) hydrocarbons in the water at concentrations of 3,200 µg/L. Concentrations used in the study ranged from 300 to 6,100 µg/L.

The effects assessment of a potential oil spill (Section 15.5.1 of the EIS) applies generally to marine fish and fish habitat. The potential effects on Atlantic salmon are consistent with this effects assessment. The greatest impact on mortality and habitat availability resulting from an oil spill is expected to be on the acute mortality of egg and larval fish and planktonic prey species. Acute oil exposure to near surface nekton species typically lasts for a 24- to 48-hour period. This period tends to be brief and localized due to the loss of the acutely toxic water-soluble low molecular weight aromatic components of oil due to dilution, weathering, and mitigative measures (Lee et al. 2015). Given that salmon egg and larval stages are restricted to freshwater, the potential effects to salmon are limited to potential changes in food availability and direct effects on highly mobile marine life history stages. However, since the impacts on the nekton tend to be limited spatially and temporally, it is not predicted that Atlantic salmon would be affected from an oil spill at the population level.

References:

Barnett, J. and D. Toews. 1977. The effects of crude oil and the dispersant, Oilsperse 43, on respiration and coughing rates in Atlantic salmon (*Salmo salar*). Canadian Journal of Zoology, 56: 307-310.

Fraser, A. 1992. Growth and food conversion by Atlantic salmon parr during 40 days exposure to crude oil. Transactions of the American Fisheries Society, 121(3): 322-332.

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

Meador, J.P., F.C. Sommers, G.M. Ylitalo and C.A. Sloan. 2006. Altered growth and related physiological responses in juvenile Chinook salmon (*Oncorhynchus tshawytscha*) from dietary exposure to polycyclic aromatic hydrocarbons (PAHs). Canadian Journal of Fisheries and Aquatic Science, 63: 2364-2376.

Pineiro, M.E.A., M.A.L. Yusty, S.T.C. Gonzales-Barros and J.S. Lozano. 1996. Aliphatic hydrocarbon levels in turbot and salmon farmed close to the site of the Aegean Sea oil spill. Bulletin of Environmental Contamination and Toxicology, 57: 811-815.

Stagg, R.M., C. Robinson, A.M. McIntosh and C.F. Moffat. 1998. The effects of the "*Braer*" oil spill, Shetland Isles, Scotland, on P4501A in farmed Atlantic salmon (*Salmo salar*) and the common dab (*Limanda limanda*). Marine Environmental Research, 46(1-5): 301-306.

Stieglitz, J.D., M.M. Edward, R.H. Hoenig, D.D. Benetti and M. Grosell. 2016. Impacts of Deepwater Horizon crude oil exposure on adult mahi-mahi (*Coryphaena hippurus*) swim performance. Environmental Toxicology and Chemistry, 35(10): 2613-2622.

Thomas, R.E. and S.D. Rice. 1987. Effect of water-soluble fraction of Cook Inlet crude oil on swimming performance and plasma cortisol in juvenile coho salmon (*Oncorhynchus kisutch*). Comparative Biochemistry and Physiology, 87(1): 177-180.

Weber, D.D., D.J. Maynard, W.D. Gronlund and V. Konchin. 1981. Avoidance reactions of migrating adult salmon to petroleum hydrocarbons. Canadian Journal of Fisheries and Aquatic Sciences, 38: 779-781.

Zhou, S., H. Heras and R.G. Ackman. 1997. Role of adipocytes in the muscle tissue of Atlantic salmon (*Salmo salar*) in the uptake, release and retention of water-soluble fraction of crude oil hydrocarbons. Marine Biology, 127: 545-553.

1.15.3 Information Requirement: IR-76

Reviewer ID:

DFO-11; WM-29

Reference to EIS:

Section 15.5.1.1

Context and Rationale:

Section 15.5.1.1 of the EIS states that larval and juvenile pelagic and benthic fish species are at a greater risk of exposure as they are often less motile than adults and have shown higher sensitivity to lower concentrations of hydrocarbons.

Fisheries and Oceans Canada stated that this statement does not consider that one of the primary factors that may increase the potential impact of oil spills / accidents to juvenile fish and fish larvae is that for the most part they are suspended within the pelagic zone of the water column which is where components of oil spills will travel prior to reaching the surface.

While the sensitivities of larvae and juvenile pelagic and benthic fish species were identified, there was no discussion of the link between the timing of the sensitive periods, the pelagic zone that support these life stages, and the potential effects of an accidental event if it were to occur.

Specific Question of Information Requirement:

Describe the potential effects of an accidental event / oil spill on pelagic fish larvae and juveniles with consideration of the zone of the water column in which the components of the oil spill will travel prior to reaching the surface and the pelagic zone that fish larvae and juveniles would be expected to reside.

Response:

Section 15.4 of the EIS presents the results of spill fate and behavior modelling. The stochastic modeling results (EIS Section 15.4.7.1) provide surface area exposure estimates of acutely toxic water-soluble oil concentrations for the top 100 m of the water column. This approach covers the pelagic zone that fish eggs, larvae and juveniles are expected to reside. The stochastic model output does not represent the extent of any one oil spill event (which would be substantially smaller) but rather provides a summary of the total individual simulations for a given scenario or oil type.

The effects of a spill on marine fishes is expected to be greater during the spring and summer seasons (when most species spawn) when there are greater concentrations of eggs, larvae, and juvenile fishes in the offshore pelagic zone. For any given spill, however, the area of acute toxicity is small relative to the vast offshore pelagic zone from which eggs, larvae, and juvenile fishes are anticipated to inhabit. Eggs and larvae will circulate with the currents over a broader region. Given this, the very low risk of exposure to a significant accidental spill, and the contingency and response measures described in EIS Section 15, it is not expected that marine fishes (or their habitat) will be affected at the population level.

References:

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

1.15.4 Information Requirement: IR-77

External Reviewer ID:

ECCC-15

Reference to EIS:

Section 15.5;
Section 15.5.2;
Section 15.5.2.1

Context and Rationale:

Section 15.5.2.1 of the EIS states that there are few studies related to the effects of chemically-treated oil on the thermal balance of birds and differing opinions on whether they should be employed to reduce effects on seabirds. However, a review of the effects of oil pollution, chemically treated oil, and cleaning on the thermal balance of birds indicated that the effects of contamination by oil-dispersant mixtures may be similar to that of the oil alone, with results of one study indicating that oil treated with dispersants may be more harmful to birds than untreated oil (Jenssen 1994 and references therein).

Environment and Climate Change Canada advises that two additional references, Fiorello et al. 2016 and Whitmer et al 2018, which describe the possible negative impacts of dispersants on birds should be considered in the analysis.

<u>References</u>

Fiorello, C.V., Freeman, K., Elias, B.A., Whitmer, E., and Ziccardi, M.H. (2016). Ophthalmic effects of petroleum dispersant exposure on common murres (*Uria aalge)*: An experimental study. *Marine Pollution Bulletin*. **113**:387-391.

Whitmer, E.R., Elias, B.A., Harvey, D.J., and Ziccardi, M.H. (2018). An Experimental Study of the Effects of Chemically Dispersed Oil on Feather Distribution and Waterproofing in Common Murres (*Uria aalge*). *Journal of Wildlife Diseases*. **54**(2): 315-328

Specific Question of Information Requirement:

Taking into consideration information from Fiorello et al 2016 and Whitmer et al 2018, provide an updated discussion on the potential effects of dispersant use on marine and migratory birds.

Response:

Section 15.3.3.3 of the EIS discusses oil spill tactical response methods, including but not limited to, dispersant application. This discussion acknowledges the potential benefits of dispersant application in particular circumstances (e.g., reduced risk of interaction with surface oil slicks) but also acknowledges potential risks of adverse environmental effects of dispersant use. Sections 15.3.3.3 and 15.5.2.1 of the EIS reference studies noting possible adverse effects of dispersants and oil-dispersant mixtures on migratory birds, including effects on plumage insulation and thermoregulation. Fiorello et al. (2016) studied effects of dispersant and dispersed oil on common murres and observed ophthalmic effects (including conjunctivitis and corneal ulcers) which could lead to partial or complete loss of vision and ultimately affect foraging ability and survival of seabirds. Whitmer et al. (2018) found that seabird waterproofing is negatively affected in a similar dose-dependent manner by crude oil, chemically dispersed oil, and chemical dispersants and concluded that while dispersant use may reduce exposure of marine wildlife (including birds) to crude oil on the surface of the water, a zero-risk assumption should not be used for dispersant application when seabirds are present.

BP will undertake a Spill Impact Mitigation Assessment (SIMA) as part of the preparation of the Oil Spill Response Plan to understand the effects of spill response strategies, including dispersants. The SIMA will be used to assess and compare the feasibility and environmental and socio-economic impacts of employing different oil spill response techniques (including dispersant application). The baseline case for the SIMA for the Project will be one of "no action" (use of no tactical response methods) to assess the relative merits of each potential response option. In the event of a spill, an incident-specific SIMA would be prepared and if dispersant use is advisable, BP will seek approval for dispersant application from the Canada-Newfoundland and Labrador Offshore Petroleum Board Chief Conservation Officer. Dispersants will not be used by BP without prior regulatory approval. Should dispersants be approved for application, an incident-specific monitoring and sampling plan would be developed to evaluate the effectiveness and potential impacts of dispersant use.

References:

Fiorello, C.V., K. Freeman, B.A. Elias, E. Whitmer and M.H. Ziccardi. 2016. Ophthalmic effects of petroleum dispersant exposure on common murres (*Uria aalge*): An experimental study. Mar. Pollu.t Bull., 113: 387-391. https://doi.org/10.1016/j.marpolbul.2016.10.027

Whitmer, E.R., B.A. Elias, D.J. Harvey and M.H. Ziccardi. 2018. An experimental study of the effects of chemically dispersed oil on feather structure and waterproofing in Common Murres (*Uria aalge*). Journal of Wildlife Diseases, 54(2), 315-328. DOI: 10.7589/2017-01-016.

1.15.5 Information Requirement: IR-78

External Reviewer ID:

N/A

Reference to EIS:

Section 9.1.3;
Section 9.3.1;
Section 9.3.5

Context and Rationale:

The EIS Guidelines require that direct and indirect adverse effects on migratory birds, including effects of oil spills in the nearshore or that reach land on landbird species, are examined. Important Bird and Biodiversity Areas and seabird colonies are located on the eastern Avalon Peninsula that could be affected by a spill.

Section 15.5.2.3 of the EIS discusses the potential environmental effects of accidents and malfunctions on marine and migratory birds. With respect to marine diesel spills from a platform supply vessel, the EIS presents information from the modelling for a vessel collision completed from the Nexen Energy ULC Flemish Pass Exploration Drilling Project offshore Newfoundland and Labrador. The modelled site was in the offshore, approximately halfway between St. John's and the defined Project Area for the Nexen Energy ULC Flemish Pass Exploration Drilling Project. Results of the modelling predicted no shoreline contact. However, no description is provided in the EIS of the potential effects of a vessel collision in close proximity to the shore.

Specific Question of Information Requirement:

Provide a discussion on the potential effects of a spill on coastal species and habitats, including marine and migratory birds, if a vessel collision was to occur in close proximity to shore.

Response:

A nearshore spill of fuel resulting from a vessel collision may potentially affect marine and migratory birds depending on the location, season and weather. There is potential for increased mortality, and for injury or health effects from ingestion of oil, loss of insulation, or ingestion of oiled prey.

A spill coming into contact with coastal concentrations of birds would result in the greatest mortality, injury or health effects to marine and migratory birds. The largest concentrations occur during the colonial waterbirds nesting season, during the nesting season where colonial waterbirds feed on spawning congregations of pelagic fish in shallows, and during the winter at over-wintering areas of coastal, gregarious (flocking) waterfowl. Spills reaching within a few hundred metres of a nesting colony may potentially have the greatest effect, since large numbers of adult birds rest on the waters around the colony for extended periods of time. As discussed in EIS Section 6.2.4, piping plover (*Species at Risk Act* [SARA] Schedule 1, Endangered) nests on sandy beaches along the southwestern and western coastline of

Newfoundland, although breeding was reported near the Cape Freels Coastline Important Bird Area prior to 2014, so is not likely to be affected by a nearshore spill from a Project vessel.

Diving species that spend the greatest amount of their time on the sea surface would be most at risk, i.e., the alcids (the murre species, razorbill, and Atlantic puffin). Colonies with large numbers of alcids along the eastern and southern coasts of Newfoundland consist of Funk Island with over 470,000 pairs of common murre and 2,000 pairs of Atlantic puffin (see EIS Section 6.2, Table 6.9), Baccalieu Island with 75,000 pairs of Atlantic puffin and 1,440 pairs of common murre, Witless Bay Islands with almost 262,000 pairs of common murre and over 304,000 pairs of Atlantic puffin, and Cape St. Mary's with over 15,000 pairs of common murre. Some of the largest concentrations of nesting northern gannet in North America are also found at Cape St. Mary's (over 13,000 pairs), and Funk Island (over 10,000 pairs). During winter, most of the 200 harlequin ducks (SARA Schedule1, Special Concern) wintering in Newfoundland are found at Cape St. Mary's. Thousands of long-tailed ducks and common eiders, and smaller numbers of other duck species, loons, guillemots, murres, and dovekies winter in coastal Newfoundland. Their numbers become increasingly more concentrated as winter progresses and the sea ice covers the shallow feeding areas along the north coast of Newfoundland, pushing these birds southeastwards to the east coast of the Avalon Peninsula. BP's preference is to conduct drilling between May and October. The number of individuals potentially affected by a nearshore spill is very difficult to predict because of the influence of density of seabirds in the area, wind velocity and direction, wave action, distance to the shore, and temperature (Burger 1993).

As discussed in EIS Section 15.5.2.3, nearshore spills may also cause a change in nearshore habitat quality and use, at least temporarily. Examples of habitat in coastal Newfoundland supporting concentrations of marine and migratory birds that may be affected by a nearshore spill include spawning beaches of pelagic fish (murres, puffin, guillemot, gannet, kittiwake), mussel beds (diving species of ducks), intertidal kelp beds (shorebirds), subtidal kelp beds (harlequin duck), and sandy beaches (piping plover).

However, based on the vessel collision oil (diesel) spill trajectory models (RMRI 2006; Nexen Energy ULC 2018), oil is predicted to move east, with no predicted shoreline contact in Newfoundland and Labrador, Nova Scotia, New Brunswick, Prince Edward Island or Quebec.

References:

Burger, A.E. 1993. Estimating the mortality of seabirds following oil spills: Effects of spill volume. Marine Pollution Bull., 26: 140-143.

Nexen Energy ULC. 2018. Flemish Pass Exploration Drilling Project (2018-2028). Environmental Impact Statement. Available online: https://ceaa-acee.gc.ca/050/documents/p80117/122066E.pdf. Accessed August 2018.

RMRI (Risk Management Research Institute). 2006. Quantitative Assessment of Oil Spill Risk for the South Coast of Newfoundland and Labrador (Phase 1). Prepared for Transport Canada. RMRI Ref. CAN/0179/R001.

1.15.6 Information Requirement: IR-79

External Reviewer ID:

KMKNO-12

Reference to EIS:

Section 15.5.1.1

Context and Rationale:

Section 15.5.1.1 of the EIS states that studies have shown that bacterial respiration, through biodegradation of hydrocarbons, has the potential to cause oxygen depletion, eventually leading to hypoxia in the areas near spills. However, the size of the potential area of affected by hypoxia and the potential effects on species is not discussed.

Specific Question of Information Requirement:

Discuss the size and potential impacts of hypoxia to species as the result of a potential spill.

Response:

Hypoxic, or low oxygen availability, conditions can reduce the survival and reproduction of many aerobic species exposed for a prolonged period. There is substantial variation in the deep ocean dissolved oxygen levels across the globe (JAG, 2012; Beegle-Krause, 2016). Some regions of the ocean experience naturally low deep-water oxygen levels (e.g., Eastern Pacific Ocean), while others experience seasonally low deep-water oxygen levels due to anthropogenic inputs (e.g., Gulf of Mexico). The Western North Atlantic Ocean, where the Project Area is located, has some of the highest deep water dissolved oxygen levels in the world which may help reduce concerns about oil spill induced hypoxic events. However, it is important to also consider that organisms in the Western North Atlantic Ocean may be more sensitive to reductions in dissolved oxygen than organisms in regions of the ocean were oxygen levels are more commonly low (Dam 2013; Zhang et al. 2013; Gallo and Levin 2016). Modelling exercises focused on regions with lower deep water dissolved oxygen than that found in the Project Area suggest that a spill in the Western North Atlantic Ocean is unlikely to create a substantial hypoxic zone (Beegle-Krause 2016). Based on modelling exercises of Adcroft et al. (2010), hypoxic conditions tend to form in deeper waters as the oil is broken down and the hypoxic area is smaller than the overall oil spill plume. Given the above evidence as a whole, the size and duration of the potential area of affected by hypoxia from a hypothetical oil spill is not expected to influence organisms at the population level.

References:

Adcroft, A., R. Hallberg, J.P. Dunne, B.L. Samuels, J.A. Galt, C.H. Barker and D. Payton. 2010. Simulations of underwater plumes of dissolved oil in the Gulf of Mexico Geophys. Res. Lett. Geophys. Res. Lett., doi:10.1029/2010GL044689. 20 pp.

Beegle-Krause, C.J., R.L Daae, C. Stefanakos and J. Skancke. 2016. Potential biodegradation of subsea released oil phase 3: case studies of potential dissolved oxygen depression in six areas. SINTEF Materials and Chemistry. Trondheim, Norway. Project No. 102009229.

Dam, H.G. 2013. Evolutionary adaptation of marine zooplankton to global change. Annual Reviews in Marine Science. 5:349-370.

Gallo, N.D., and L.A. Levin. Fish ecology and evolution in the world's oxygen minimum zones and implications of ocean deoxygenation. Advances in Marine Biology. 74: 117-198.

JAG (Joint Analysis Group, Deepwater Horizon Oil Spill). 2012. Review of Subsurface Dispersed Oil and Oxygen Levels Associated with the Deepwater Horizon MC252 Spill of National Significance. NOAA Technical Report NOS OR&R 27, pp. 95. Joint Analysis Group, Deepwater Horizon Oil Spill.

Zhang, J., G. Cowie and S.W.A. Naqvi. 2013. Hypoxia in the changing marine environment. Environmental Research Letters. 8: 015025.

1.16 Accidents and Malfunctions – Emergency Planning and Response

1.16.1 Information Requirement: IR-80

External Reviewer ID:

ECCC-14; ECCC-27

Reference to EIS:

Section 15.3.3.3;
Section 15.5.2.3

Context and Rationale:

Section 15 of the EIS discusses oiled wildlife response, stating that an Oiled Wildlife Response Plan will be developed in conjunction with the OSRP, and that BP will engage specialized expertise to implement the plan, including the recovery and rehabilitation of wildlife species as needed).

No further information is provided on the Wildlife Response Plan.

Environment and Climate Change Canada noted that all emergency incidents can potentially affect wildlife, and that during these incidents Environment and Climate Change Canada acts as a resource agency, which sets wildlife emergency response standards and guidelines related to migratory birds and species at risk under its jurisdiction. As such, wildlife response requires a Wildlife Emergency Response Plan, which is a component of the Incident Command System for pollution incidents affecting wildlife, and should address all of the various procedures and strategies required to mount an effective wildlife response. At minimum, a Wildlife Emergency Response Plan must include the following information:

- information on the wildlife potentially at risk in the area;
- mitigation measures to deter non-affected wildlife from affected areas;
- mitigation and response measures to be undertaken if wildlife and/or sensitive habitats become contaminated by the incident (including treatment of oil-affected wildlife); and
- the type and extent of wildlife monitoring that would be conducted during and following a pollution incident.

Specific Question of Information Requirement:

Taking into consideration the information provided by Environment and Climate Change Canada, provide further information on the proposed Wildlife Emergency Response Plan, including who would be involved in its development, the timing of its preparation, standard content including likely mitigation measures, how the plan would be implemented and how data and information collected during its implementation would be used.

Response:

BP will prepare a Wildlife Emergency Response Plan in conjunction with the Oil Spill Response Plan to be submitted to the Canada-Newfoundland and Labrador Offshore Petroleum Board during the Operations Authorization application process. BP recently developed a Wildlife Emergency Response Plan for the Scotian Basin Exploration Project in Nova Scotia, for submission to the Canada-Nova Scotia Offshore Petroleum Board (CNSOPB). This Wildlife Emergency Response Plan, which was reviewed by Environment and Climate Change Canada (ECCC) and accepted by the CNSOPB, will serve as a template for BP's Wildlife Emergency Response Plan for the Newfoundland Orphan Basin Exploration Program. Working with professionals with expertise in wildlife response offshore Newfoundland, BP intends to update and modify this existing Wildlife Emergency Response Plan to reflect the specific risks, species, facilities, and requirements for mounting an effective wildlife response in Newfoundland.

Based on BP's recent experience in Nova Scotia, and ECCC's guidance, the Wildlife Emergency Response Plan is expected to resemble the following sample Table of Contents.

Sample Table of Contents – Wildlife Emergency Response Plan

1.16.2 Information Requirement: IR-81

External Reviewer ID:

N/A

Reference to EIS:

Section 15.5;
Section 15.3

Context and Rationale:

Section 15 of the EIS states that a SIMA will be conducted that will inform the selection of an overall spill response strategy for the Project. However, the EIS does not explain how the SIMA is conducted, what is included in the assessment, how it enables spill responders and stakeholders to choose the best response option.

Specific Question of Information Requirement:

Provide information on the Spill Impact Mitigation Assessment (SIMA), including:

- how the SIMA is conducted;
- what is included in the assessment; and
- identify who the stakeholders are that would be involved in SIMA development and processes.

Response:

The objective of a Spill Impact Mitigation Assessment (SIMA, formerly known as a Net Environmental Benefit Analysis or NEBA), when applied to oil spills, is to conduct an evaluation that will inform selection of the response options that will result in the best overall recovery of the ecological, socio-economic and cultural resources of concern, while maintaining safety of responders as the primary goal. In most spill scenarios, no single response option is likely to be completely effective. In many cases, the best approach to minimize environmental impacts is to employ multiple response options.

As per the *Guidelines on Implementing Spill Impact Mitigation Assessment (SIMA)* (IPIECA-API-IOGP 2017), the SIMA process can be summarized in four stages:

1. **Compile and evaluate data** for relevant oil spill scenarios including fate and trajectory modelling, identification of resources at risk and determination of feasible response options.
2. **Predict outcomes/impacts** for the "No Intervention" (or "natural attenuation") option as well as the effectiveness (i.e., relative mitigation potential) of the feasible response options for each scenario.
3. **Balance trade-offs** by weighing and comparing the range of benefits and drawbacks associated with each feasible response option, including No Intervention, for each scenario.
4. **Select the best response option(s)** to form the strategy for each scenario, based on which combination of techniques will minimize the overall ecological, socio-economic and cultural impacts and promote rapid recovery.

These Guidelines (IPIECA-API-IOGP 2017) will be used to guide the development of the SIMA for the Project. All response options determined to be both feasible and potentially effective in the Project Area will be evaluated.

The SIMA process will be used during pre-spill contingency planning process and, if needed, during incident response. When used to support contingency planning, the SIMA helps to develop the most effective response strategy for each planning scenario and determine subsequent provisioning of response equipment and supporting logistics. When used for incident response, the planning scenario (and associated response strategy) is selected which most closely resembles the incident circumstances, with adjustments made as necessary to account for actual incident conditions.

BP will develop the SIMA in consultation with the Canada-Newfoundland and Labrador Offshore Petroleum Board (C-NLOPB), Environment and Climate Change Canada, and the Canadian Science Table. BP will also consult with the C-NLOPB to identify other appropriate stakeholders/rights-holders and determine how to involve them within the development and/or review of the SIMA.

References:

IPIECA-API-IOGP (Global Oil and Gas Industry Association for Environmental and Social Issues-American Petroleum Institute-International Association of Oil and Gas Producers). 2017. Guidelines on Implementing Spill Impact Mitigation Assessment (SIMA). IOGP Report 593. Available at: http://oilspillprevention.org/~/media/Oil-Spill-Prevention/spillprevention/r-and-d/spill-response-planning/sima-2017.pdf

1.16.3 Information Requirement: IR-82

External Reviewer ID:

C-NLOPB-22; WM-31

Reference to EIS:

Section 15.3.3.3

Context and Rationale:

Section 15.3.3.3 of the EIS provides a discussion on the oil spill tactical response methods to be implemented in the event of a spill. The Canada-Newfoundland and Labrador Offshore Petroleum Board has advised that the discussion of offshore containment and recovery is incomplete noting that there is no information on the quantity of oil that could be contained or recovered (i.e., percentage of spilled product that could be recovered) with this equipment.

Specific Question of Information Requirement:

With respect to the containment and recovery response method, provide a discussion of the percentage of spilled product that can be contained or recovered.

Response:

The percentage of spilled product that can be recovered is dependent on several variables specific to the conditions of any release. These include, but are not limited to, sea state, weather, characteristics and weathering of the spilled material, size of the release, type and quantity of response equipment available, encounter rate of response equipment with the oil, etc. As such, it is not possible, nor prudent, to try to estimate the percentage of spilled product that can be recovered for a theoretical spill. Historically, for actual spills, recovery rates of 1% to 10% are typical. Given the conditions in the North Atlantic, recovery rates towards the lower end of this range should be expected. The Oil Spill Response Plan will contain a Tactical Response Plan for Containment and Recovery that will detail the specific equipment available, its limitations, and its rated recovery capacity. The containment and recovery capability for BP’s Newfoundland Orphan Basin Exploration Drilling Program will, at a minimum, be comparable to that of the other operators in Newfoundland and Labrador and meet any applicable regulatory expectations.

1.16.4 Information Requirement: IR-83

External Reviewer ID:

WM-11; NORPEN-02

Reference to EIS:

Section 15.4.7.1

Context and Rationale:

Section 15.4.7.1 of the EIS states that the results of the stochastic model demonstrated the potential locations for spill effects to exceed threshold levels beyond the Regional Assessment Area boundary, and in some cases, beyond Canadian jurisdiction (i.e., Saint-Pierre and Miquelon - France, Greenland and the Azores). While it was stated that the average probabilities are low (less than 10 percent) and arrival times are greater than 50 days, a member of the public and an Indigenous group inquired about the response of other nations with respect to a spill, and consultation on the Project and the EIS.

Additionally, Section 15.3.2 of the EIS indicates the local and federal government bodies that would be notified and engaged to support response efforts and provide oversight in the event of a spill. However, EL 1149 is outside the jurisdiction of the local and federal government agencies listed for emergency response and it is not clear in the EIS who would be notified and involved in response to an incident in EL 1149 if it were to occur.

Specific Question of Information Requirement:

Given the potential for spill effects beyond the Regional Assessment Area boundary, and beyond Canadian jurisdiction:

- describe the international obligations that would apply for incidents that may occur outside the exclusive economic zone (i.e., in Exploration Licence 1149) and implications for the Environmental Protection Plan, Safety Plan, Incident Management Plan, and Spill Response Plan;
- discuss if, and how, nations that may be impacted in the event of an accidental event have been consulted on the Project, and if these nations will be consulted on the development of the oil spill response plan;
- discuss the potential responses of other jurisdictions in the event that oil was released into international water; and
- confirm the organizations that would be notified and engaged in spill response if an incident were to occur in EL 1149.

Response:

As indicated by the oil spill trajectory modelling conducted for the Project (see Appendix D of the EIS), depending on the spill (and response) scenario, there is a possibility of oil from a blowout reaching international waters and shorelines associated with St. Pierre et Miquelon (France), the Portugal (including the Azores), and/or Greenland.

The Oil Spill Response Plan (OSRP) that BP will be preparing and submitting to the Canada-Newfoundland and Labrador Offshore Petroleum Board for approval prior to drilling will identify and contain contact information for the nations and jurisdictions that could be impacted by a release event, along with the timing and criteria for such notifications. Given the long arrival times for impacts to reach many of these international jurisdictions (most are more than 70 days, assuming a capping stack response is unsuccessful in stopping the flow of hydrocarbons from the well), the specific response options to be employed in those locations would be determined by the Incident Management Team at the time of a release, in conjunction with potentially impacted jurisdictions where response might be implemented.

It should be noted that, since the initial drilling activity planned for the Newfoundland Orphan Basin Exploration Drilling Program will be in the West Orphan Basin, the initial OSRP will be focused on responding to Project-related spills originating from activities occurring within the exclusive economic zone (EEZ). The OSRP, along with other Project Plans (e.g., the Incident Management Plan, Safety Plan), will be reviewed before drilling each well (in the West Orphan Basin and East Orphan Basin exploration licences), and updated as appropriate. The OSRP will also be updated to outline the options and procedures necessary to respond outside of the Canadian EEZ.

1.16.5 Information Requirement: IR-84

External Reviewer ID:

FFAW-02; PNIN-04; KMKNO-39; WM-33

Reference to EIS:

Section 15.2.2.1;
Section 15.3;
Section 15.5.1.3

Context and Rationale:

In 2017 and 2018, the following three incidences were reported in offshore drilling operations in Atlantic Canada:

- on March 30, 2017, a near miss occurred when an iceberg closely approached the SeaRose floating production, storage and offloading facility in the White Rose Field;
- on June 22, 2018, a spill of synthetic-based mud occurred offshore Nova Scotia during the Scotian Basin Exploration Project; and
- on November 16, 2018, a spill of hydrocarbons occurred at the White Rose Field of Husky Energy.

Section 15.3 of the EIS states that response management strategies are based on principles of preparedness, response and recovery and incorporate lessons learned from within the company and the wider industry.

With respect to the Scotian Basin Exploration Drilling Project, the EIS states that the Proponent will use learnings from that incident to help prevent similar incidents from occurring on other current and future drilling programs and that information on the proponent's spill response, and monitoring activities during and after the event will contribute to the understanding of potential accidents and malfunctions. No specific information or examples were provided. The EIS does not discuss whether monitoring activities were undertaken after the Scotian Basin spill event and how monitoring results would be applied to this Project.

Specific Question of Information Requirement:

Describe the lessons learned from previous events in the Nova Scotia and Newfoundland and Labrador offshore and the methodologies that would be employed during this Project to ensure accidents and malfunctions similar to these are avoided.

Discuss any monitoring activities undertaken following the synthetic-based mud spill on June 22, 2018 on the Scotian Basin Exploration Project offshore Nova Scotia to verify effects predictions (e.g., synthetic-based mud deposition on the seabed and effects to benthic habitat and species) and how the results of the monitoring activities may inform this Project.

Response:

Although the two incidents associated with the White Rose Field are production projects did not involve exploration drilling, BP recognizes that these incidents, in addition to the synthetic-based mud (SBM) discharge incident during BP's Scotian Basin Exploration Project, offer valuable lessons which can be incorporated in future offshore exploration activities.

With respect to the ice incursion incident on March 29, 2017, it is understood, based on the Canada-Newfoundland and Labrador offshore Petroleum Board's (C-NLOPB's) Enquiry Report (C-NLOPB 2018) that Husky did not follow its Ice Management Plan, and the *SeaRose* floating production, storage and offloading facility was not disconnected as per required procedures. Responsive actions taken by Husky included, but not were not limited to, a comprehensive review of Husky's ice management and emergency response plans. A review by the enquiry team reported several observations and opportunities for improvement in the IMP. BP will ensure that the Ice Management Plan for the Newfoundland Orphan Basin Exploration Drilling Program is fully incorporated into emergency response plans and that specific duties and scenarios related to ice management and severe weather contingency plans are clearly defined and understood by key personnel. BP will also consult with the C-NLOPB during the preparation of the Ice Management Plan to understand additional lessons learned to be incorporated as appropriate.

The investigation into the November 2018 spill at White Rose is still ongoing. BP will review investigation findings when they are available to determine if there are any lessons to be incorporated into the planning and implementation of the Newfoundland Orphan Basin Exploration Drilling Program.

The SBM discharge on the Aspy D-11 well in June 2018 occurred due to a loss of integrity of the mud boost line on the drilling riser. The learnings from the investigation were to improve riser mud boost line inspection procedures and enhance pressure monitoring of the boost line during operations which have been implemented globally in BP.

Following the SBM discharge incident, BP, in consultation with the Canada-Nova Scotia Offshore Petroleum Board (CNSOPB), initiated an environmental study to determine the extent of environmental effects from the SBM release.

The program consisted of the following components:

- A remote operated vehicle (ROV) from the drilling operation was used to conduct high-definition video surveys of the area around the drilling operation. From these surveys, a third-party marine scientist was hired to interpret the results and estimate the areal extent of any SBM constituents on the seafloor.
- BP conducted dispersion modeling to estimate the aerial extent and thickness of the any SBM on the seafloor.
- A sediment sampling plan was developed and implemented, using the ROV to collect grab samples from the seafloor. The samples were analyzed for constituents of the SBM to provide qualitative evidence as to the absence or presence of SBM and validate the results of the video observations and modeling results.

There was no sheen or plume observed during or after the incident and no oiled birds were observed. Video footage of the seabed and sediment sampling validated the dispersion modelling and showed sedimentation on the seafloor was similar to that expected from routine drilling discharges. The maximum thickness of seabed deposition was estimated to be 3.5 mm. No burying or smothering of benthic organisms was observed.

No mitigation or remediation has been proposed by BP. An investigation by the CNSOPB is ongoing.

BP will incorporate lessons learned from their June 2018 incident on the Scotian Basin Exploration Project as well as lessons shared by the C-NLOPB from past unauthorized discharge of SBM events in the Newfoundland and Labrador offshore area to reduce risk of an SBM unplanned release occurring during the Newfoundland Orphan Basin Exploration Drilling Program.

References:

C-NLOPB (Canada-Newfoundland and Labrador Offshore Petroleum Board). 2018. Enquiry Report Ice Incursion Incident *SeaRose FPSO* July 26, 2018. Available at: https://www.cnlopb.ca/wp-content/uploads/iceier.pdf

1.16.6 Information Requirement: IR-85

External Reviewer ID:

ECCC-17

Reference to EIS:

Section 15.3.2

Context and Rationale:

Section 15.3.2 of the EIS states that the proponent is a member of Oil Spill Response Limited (OSRL). Its subsea division (the Subsea Well Intervention Services) provides OSRL members with the opportunity to access subsea intervention capabilities, including subsea dispersant equipment, and capping and containment equipment. Although timeframes for the deployment of capping stacks have been provided, none are provided for the deployment of subsea dispersant equipment.

It is important to understand the response measure timeframes involved with the deployment of all subsea incident response apparatus so that well control preparation activities and associated timeframes can be fully appreciated and the magnitude of environmental effects resulting from any extended timelines can be properly determined and characterized to the greatest extent possible in order to help inform a determination of significance of any residual effects.

Specific Question of Information Requirement:

Provide timelines associated with the deployment time for subsea dispersant equipment following an accidental event.

Provide information on the timelines for individual steps within the deployment process including timelines associated with deployment from the warehouse to the ship, transit time to St. John's and to the site, and confirm if the equipment can be used on site immediately upon arrival.

Response:

The ability to deploy subsea dispersant (subject to obtaining regulatory approval) comprises three core elements: a vessel with downline to provide a conduit for fluid delivery; the topside and subsea hardware for application; and the dispersant stocks.

BP would leverage all available sources to identify a suitable subsea dispersant injection vessel. This may involve using an existing vessel contracted to the Project (e.g., platform supply vessel); drawing on mutual aid resources; or contracting vessels of opportunity on hire elsewhere.

BP has access to internal hardware stored in Houston and to Oil Spill Response Limited (OSRL) hardware within the Subsea Incident Response Toolkit held in Norway and Brazil. These would be mobilized concurrently with the capping stack. OSRL maintains the SIRT equipment "response ready" for prompt air freight and, subject to aircraft availability, it would be mobilized by air to Newfoundland within 24 to 48 hours of notification. The Environment and Climate Change Canada-approved spill treatment agent (i.e., dispersant) can be mobilized from the OSRL global dispersant stockpile, as well as from BP-owned inventories around the globe. Initial supplies of dispersant would be expected to start arriving by air in Newfoundland within 48 to 72 hours of notification. Details on mobilization of subsea dispersant equipment and dispersant will be included in BP's Capping and Containment Response Plan and Oil Spill Response Plan, which will be submitted to the Canada-Newfoundland and Labrador Offshore Petroleum Board as part of the Operations Authorization application process for the drilling program. In circumstances where subsea dispersant application is a preferred response tactic, BP's objective is to be able to commence subsea dispersant injection within 10 days of notification, pending regulatory approval.

1.16.7 Information Requirement: IR-86

External Reviewer ID:

ECCC-16

Reference to EIS:

Section 15.3.3.1;
Section 15.3.3.2

Context and Rationale:

Sections 15.3.3.1 and 15.3.3.2 of the EIS provide information on the timelines involved with the mobilization and installation of a capping stack, following the loss of well control. However, no information has been provided on the expected operational lifespan, the timing of decommissioning, or on any follow-up monitoring activities that would be required after a capping stack has been removed from a wellhead.

It is important to understand the lifespan and decommissioning implications for wells that may become compromised due to blowout events so as to better understand and characterize any longer-term environmental effects that may occur, and may therefore need to be monitored, at blowout-affected well sites.

Specific Question of Information Requirement:

Provide information on the operational lifespan of proposed capping stacks and any contingencies in place to either extend their service or to replace them.

Provide information on when a capping stack system may be decommissioned and describe any potential wellhead integrity monitoring efforts that would follow, including expected timeframes of such.

Response:

As a member of Oil Spill Response Limited (OSRL), BP has access to OSRL's capping stack equipment. The design life of an OSRL capping stack is six months of continuous flowing service, or two years if the well is in a shut-in state. Once a capping stack is installed a controlled shut-in would be executed. The well would be monitored via the capping stack once the well is shut-in and hydrocarbon release halted. Thereafter efforts would be pursued in parallel regarding top kill operations and/or relief well drilling. The top kill option involves using the capping stack valves to pump kill weight fluids (e.g., drilling mud, cement) into the wellbore. Concurrently the relief well program would be executed to intersect the incident well. If a successful top-kill is executed further evaluation may be necessary regarding the need to complete the relief well scope.

The design life of the OSRL stack affords ample time for both well kill options. A conservative estimate of time to kill the incident well would be 120 days based on a relief well. However it is expected that a relief well for the Project could be drilled in a much shorter timeframe.

At the appropriate time during/after plug and abandonment operations (after proper barriers are installed in the well) and regulatory approval is given to do so, the capping stack would be removed. Removal of equipment and any subsequent monitoring required would be undertaken in accordance with the requirements set out in the *Newfoundland Offshore Petroleum Drilling and Production Regulations*.

1.16.8 Information Requirement: IR-87

External Reviewer ID:

C-NLOPB-21

Reference to EIS:

Section 15.3.3.2

Context and Rationale:

If a blowout incident were to occur, Section 15.3.3.2 of the EIS states that one option is to commence the mobilization of the air-freightable capping stack from Stavanger, Norway to the St. John's International Airport using an Antonov AN-124 aircraft.

The Canada-Newfoundland Offshore Petroleum Board has advised that a review of St. John's International Airport published infrastructure statistics indicates a primary runway length of 2600 metres. However, the runway length requirement for an Antonov 124, according to Air Charter Service, are 3000 metres.

Based on the runway availability and requirements it is not apparent that the deployment and use of the air freightable capping stack is feasible.

Specific Question of Information Requirement:

Discuss the feasibility of air freight potential for a capping stack being transported to the St. John's International Airport. If runway length at the St. John's International is not sufficient, discuss alternate locations to which the capping stack could be transported. If alternate airports are identified, confirm that the timeline for the capping stack to reach the site is unchanged.

Response:

BP will prepare a Capping and Containment Response Plan for submission to the C-NLOPB as part of the Operations Authorization application process under the Accord Acts. This Plan will describe the roles, responsibilities and processes to be undertaken and addresses resource and logistic requirements for a capping and containment response. Given the noted limitations of the St. John's runway, both Gander International Airport and Halifax Stanfield International Airport would be under consideration for an air freightable capping stack option. Both of these airports have runways that exceed 3,000 m in length. Alternate airports may be considered for receipt of suitable ancillary and supporting cargo, such as subsea dispersant injection hardware, to alleviate some freight volume from the primary airports where appropriate.

Considerable due diligence is necessary in terms of assessing local infrastructure suitability for receipt and onward transfer of the air freightable capping stack option. This will be documented as part of the Capping and Containment Response Plan. There are many variables involved in a response and the plan will include both sea freight and air freight options to ensure the Incident Management Team can evaluate and identify the most expedient route to cap an incident well. Estimated durations for all options will be detailed within the specific Capping and Containment Response Plan. Given the distances from suitable airports to marine ports, and the relative well locations, marginally longer durations than those cited for the Scotian Basin Exploration Project would be envisaged for the air-freight option (estimated to be nine days for Scotian Basin Exploration Project) and marginally shorter for the sea freight option (estimated to be approximately 15.5 days).

1.17 Effects of the Environment on the Project

1.17.1 Information Requirement: IR-88

External Reviewer ID:

WM-57

Reference to EIS:

Section 16.1.2

Context and Rationale:

On November 16, 2018, the Husky Energy SeaRose production platform experienced a loss of pressure from the subsea flowline while preparing to restart production. At the time of restarting, waves were recorded at 8.4 metres.

Section 16.2 of the EIS states that implementing operating limits and stop-work procedures in the event of unsafe conditions will reduce the potential of occurrence and magnitude of effects of the environment on the Project. However, no details pertaining to parameters for extreme weather conditions under which Project activities would be modified, suspended or delayed are provided.

Specific Question of Information Requirement:

Discuss parameters for extreme weather conditions for which Project activities would be modified, suspended or delayed.

Response:

Prior to spud, BP will develop well-specific operating guidelines (WSOG). The WSOG is an important tool to manage operational risk as it will determine when alerts should be given and what action is appropriate. The WSOG depends primarily on the mobile offshore drilling unit (MODU) that will be used to drill the well. BP has not yet selected a MODU for the drilling program. Each MODU has its own defined safe operating limits which will determine the maximum conditions under which operations can continue. BP has an expectation that anyone can stop the job for safety reasons and the operation at the time can be discussed. If conditions are deemed unsafe or pre-set limits have been reached or are suspected of being reached due to weather or rig movement, the Offshore Installation Manager on the MODU has the authority to modify, suspend, or delay operations before the operating limits are reached.

Parameters for extreme weather conditions may include wind speed and direction, wave height, current, heave and heave velocity and specific limits will depend on the MODU safe design operating limit.

1.17.2 Information Requirement: IR-89

External Reviewer ID:

C-NLOPB-16; C-NLOPB-23

Reference to EIS:

Section 16.2

Context and Rationale:

Section 16.2 of the EIS provides mitigation measures specific to oceanographic conditions, sea ice, icebergs and superstructure icing, and geological stability and seismicity; however, it does not include a discussion of moving the MODU to safe waters when sea ice or iceberg conditions threaten the safety of the MODU. The C-NLOPB advised this is the primary tool for managing harsh ice conditions (sea ice or iceberg presence) in the offshore of Newfoundland.

Specific Question of Information Requirement:

Update the discussion on sea ice/iceberg mitigation strategies to include the transiting of the MODU to a safe location.

Response:

As indicated in Section 16.2 of the EIS, BP will prepare and submit an Ice Management Plan (Plan) as part of the application for Operations Authorization-Drilling Program as per the Offshore Physical Environmental Guidelines (National Energy Board et al. 2008). This Plan will be developed in conjunction with the drilling contractor (yet to be selected for the Project) and will include details on sea ice/iceberg monitoring and detection, and risk assessment, mitigation and contingency procedures. Ice management principles, strategy and approach will be included in the Ice Management Plan including ice alertness with zone definitions to determine response and physical response measures which may include towing and/or deflection of ice and disconnect and departure from the wellsite to a safe location.

References:

National Energy Board, Canada-Newfoundland and Labrador Offshore Petroleum Board, and Canada-Nova Scotia Offshore Petroleum Board). 2008. Offshore Physical Environmental Guidelines. Available at: https://www.cnlopb.ca/wp-content/uploads/guidelines/peg_guidelines.pdf

1.17.3 Information Requirement: IR-90

External Reviewer ID:

MTI-16

Reference to EIS:

Section 15.3.3.3

Context and Rationale:

Section 15.3.3.3 of the EIS provides an overview of tactical response methods to oil spills, in the event of an emergency, including the use of containment and recovery equipment, dispersants and surveillance and tracking measures. The proponent recognizes that the effectiveness of some of the methods will be affected by specific environmental conditions (e.g. wave height and visibility) and that it is possible that some of the options may not be feasible at the time of the spill.

While the EIS states that a description of how different tactics will be selected for different scenarios and locations will be discussed in the Spill Response Plan, there is no discussion in the EIS related to the limitations of the spill response equipment, in particular with regards to weather conditions in the North Atlantic. For example, the efficacy of booms and skimmers and in-situ burning are limited to favourable water conditions, and surveillance and tracking of spills also has limitations of efficacy due to sea state and weather conditions.

Specific Question of Information Requirement:

Based on the historical metocean and weather data offshore Newfoundland and Labrador, discuss the effective limitations of proposed tactical response measures, including an estimate of the expected number of days and month periods when such weather conditions persist to accommodate such equipment. In addition, discuss how conditions may impact the effectiveness of monitoring and surveillance programs.

Response

The weather and metocean conditions in offshore Newfoundland and Labrador (including high waves, strong winds, limited visibility due to clouds and fog, etc.) can be challenging and will place limitations, at times, on the effectiveness (how well it works) and/or feasibility (the ability to implement) to deploy the considered response tactics. No tactic will be deployed if, first and foremost, it is not safe to do so. The Oil Spill Response Plan that will be developed for the Project will contain a specific section on monitoring and surveillance, as well as a set of Tactical Response Plan (TRP) annexes which will contain detailed information for implementing each of the potential response tactics. Each TRP will describe factors that can limit the effectiveness and feasibility of deploying that tactic. Also included in the TRP will be an estimate of the times that conditions may allow deployment of each tactic. A Spill Impact Mitigation Assessment (SIMA) will also be prepared as part of the preparation of the Oil Spill Response Plan to inform selection of the response options that will result in the best overall recovery of the ecological, socio-economic and cultural resources of concern, while maintaining safety of responders as the primary goal. In most spill scenarios, no single response option is likely to be completely effective. In many cases, the best approach to minimize environmental impacts is to employ multiple response options.

The effectiveness of mechanical containment and recovery as well as in situ burning response tactics can be limited by sea state and visibility, requiring calm seas and light winds and good visibility to be considered safe and effective response tactics. Meteorological conditions are also key factors in determining the effectiveness of dispersant application; subsea dispersant injection is less sensitive to meteorological conditions and is not affected by visibility.

Specific to monitoring and surveillance of any spilled oil, BP intends to rely on multiple options to implement this tactic. For example, in addition to visual observation from aircraft or vessels, which can be substantially limited by safety, weather and visibility conditions, each support vessel, as well as the mobile offshore drilling unit, will be equipped with a satellite tracking buoy which can be deployed in almost all conditions. These buoys are meant to float with the oil and give the ability to track the location of a slick by satellite, 24/7, in most any weather conditions. Additional options will include satellite imagery, as well as multispectral imagery from fixed wing sources, such as those provided by Transport Canada aircraft.

Specific details on tactical response measures including monitoring and surveillance will be included in the Oil Spill Response Plan for the Project which will be prepared and submitted to the Canada-Newfoundland and Labrador Offshore Petroleum Board as part of the Operations Authorization application process. In the unlikely event of a spill during operations, the selection of appropriate response tactics will be informed by the SIMA and Oil Spill Response Plan (including the TRP annexes) in consideration of specific spill circumstances (including type, location and volume of spill and meteorological conditions).

1.17.4 Information Requirement: IR-91

External Reviewer ID:

C-NLOPB-17

Reference to EIS:

Section 16.1.3

Context and Rationale:

Section 16.1.3 of the EIS discusses the probabilities of a major earthquake, as well as a minor and major landslide in the Eastern Canadian offshore. However, Section 6.6.2 of the EIS Guidelines require a discussion of the different probability patterns (e.g., 5-year event versus 100-year events) for environmental factors, which is not included in the EIS.

Specific Question of Information Requirement:

Describe the probability patterns (e.g., 5-year versus 100-year events) for environmental factors such as seismic events and submarine landslide potential.

Response:

The magnitude of the 5-year return period seismic event is on the order of 2 to 4.7 based on data recorded over the last 33 years. The magnitude of the 100-year return period seismic event would possibly be larger but cannot be easily quantified given the sparseness of data over the last few hundreds of years.

Section 5.2 and 16.2 indicated that national Earthquake Database lists 6 earthquakes that had occurred within or bordering the Project Area since detailed record keeping began in 1985 through 2018, a 33-year period. This corresponds to roughly one event every 5.5 years, on average. Three events had recorded magnitudes between 2 and 4 and the other 3 events had magnitudes between 4 and 4.7.

The 100-year event would possibly have a larger magnitude but cannot be easily calculated directly due to sparseness of data prior to 1985. Lamontagne et al. (2007) provide a list of 161 magnitude 6 or larger earthquakes in Canada from 1600-2006. One earthquake (magnitude 7.2) and a large aftershock (magnitude 6.0) were reported off the east coast of Canada during this time period and were hundreds of kilometers from the Project Area. Section 16.1.4 of the EIS indicates that this magnitude 7.2 earthquake is a 354-year event. More data would be needed to estimate the 100-year event. It is likely that smaller earthquakes occurred near the Project Area over this time interval but were likely not recorded by instruments (for recent earthquakes) or observed and recorded by inhabitants due to the distance the Project Area is away from land.

Based on past work the probability of the 5-year and 100-year slope failure with run-out that would impact the Project Area is low, with the most recent observed slope failure occurring some 7,000 years ago.

Indeed, Piper et al. (2019) and Tripsanas et al. (2008) indicate the most recent evidence of slope failure occurred some 7,000 to 8,000 years before present.

Cameron et al. (2014) calculated a 10,000-year reoccurrence interval for slope failures based on measurements from a number of slope failures in the south Orphan Basin. For the north Orphan Basin, Piper et al. (2019) identified that the last major event occurred some 37,000 years before present. It is possible that smaller and more frequent slope failures have occurred but have not been detected to date. However, it would be expected that such events would be limited to areas immediately adjacent to steep slopes and would not run-out into the Exploration Leases, some 10s of kilometers away from the steep slopes.

References:

Cameron, G.D.M., D.J.W. Piper and K. MacKillop. 2014. Sediment failures in northern Flemish Pass; Geological Survey of Canada, Open File 7566. 141 pp. doi:10.4095/293680

Lamontange, M., S. Halchuk, J.F. Cassidy and G.C. Rogers. 2007: Significant Canadian Earthquakes 1600-2006, Geologic Survey of Canada, Open File 5539.

Piper, D.J.W., E. Tripsanas, S.C. Mosher and K. MacKillop. 2019, Paleoseismicity of the continental margin of eastern Canada: Rare regional failures and associated turbidites in Orphan Basin: Geosphere, 15(1): 85-107. https:// doi .org /10.1130 /GES02001.1.

Tripsanas, E.K., D.J.W. Piper and D.C. Campbell. 2008. Evolution and depositional structure of earthquake-induced mass-movements and gravity flows: Southwest Orphan Basin, Labrador Sea. Marine and Petroleum Geology, 25(7): 645-662.

1.18 Cumulative Effects

1.18.1 Information Requirement: IR-92

External Reviewer ID:

C-NLOPB-18

Reference to EIS:

Section 14.4.4.2

Context and Rationale:

Section 14.4.4.2 of the EIS states that "potential water quality and sound effects from the Project and other third-party physical activities may temporarily reduce habitat availability within the RAA… Although this cumulative change in habitat quality and use has potential to disrupt reproductive, foraging and feeding, and/or migratory behaviour of marine mammals and sea turtles if the availability of important habitat areas, including designated special areas, is affected, the likelihood of this cumulative interaction is considered low given the distances over which Project and non-Project activities are taking place, as well as the localized nature of potential residual Project effects." No further information is provided to support the statement that effects would be localized. Underwater sound can travel hundreds of kilometres.

Consideration should be given to how mapping could be used to illustrate the potential for overlapping cumulative effects on valued components as a result of several projects exerting discrete areas of influence simultaneously.

The Agency's Technical Guidance document on Assessing Cumulative Effects under CEAA 2012 (April 2017 draft) identifies methodological options for analysis of cumulative effects, including quantitative models and spatial analysis.

Specific Question of Information Requirement:

Update the assessment of potential cumulative environmental effects on marine mammals using appropriate methodology (e.g. mapping, quantification and/or otherwise) taking into account:

- the spatial extent of effects from activities (e.g. noise on whales) and associated cumulative effects of creating multiple zones of avoidance in the Project Area;
- the spatial range of populations of species, recognizing that effects on individuals from the same population in different areas would result in cumulative effects to the species; and
- that species would be affected by multiple activities (e.g. noise from drilling units, production facilities and seismic operations, as well as vessel interactions).

Include consideration of various underwater noise sources occurring at the same time (e.g. multiple exploration units operating simultaneously, exploration drilling occurring at the same time as geophysical activities, marine shipping etc.) and associated cumulative effects on marine mammals, including how and where thresholds for behavioral modifications or injury may be exceeded. Consider the potential accessibility of unaffected corridors between areas of influence on marine mammals and provide figures to illustrate potential projects/activities and associated zones of influence (e.g. range of effects) to which they could be exposed.

Discuss the need for mitigation and monitoring or follow-up, and update predictions regarding the significance of effects accordingly.

Response:

It is important to address the reviewer's comment that "No further information is provided to support the statement that effects would be localized. Underwater sound can travel hundreds of kilometres." In EIS Section 14.4.4.2, the reader is referred to the detailed effects assessment for marine mammal and sea turtle presented in Section 10 of the EIS, which provides information as to how the localized effects prediction was derived. It is also important to acknowledge that although certain sounds can be detected 100s of kilometres away, that does not mean that marine mammals and/or sea turtles can detect and will respond to these sounds.

In terms of concurrent Project activities, there would only be one mobile offshore drilling unit (MODU) actively drilling in an exploration licence (EL) at a time. Likewise, BP would only conduct a single vertical seismic profiling (VSP) program (i.e., which typically take less than 24 hours of airgun activity to conduct) at a time. During a drilling program, there would be attendant support vessels and supply vessels. It is unlikely that other operators would conduct exploration drilling within the Project Area during the BP drilling program. It is possible that a seismic survey or portion of a seismic survey could occur in the Project Area during BP's drilling program, as discussed in Section 14 of the EIS.

Further discussion on the potential for cumulative effects for marine mammals (and sea turtles) is provided below.

Cumulative Change in Risk of Mortality or Physical Injury

There are two primary types of anthropogenic activities in the Regional Assessment Area (RAA) that may result in cumulative mortality effects with the Project: vessel strikes and entanglement in fishing gear. Underwater sound from Project activities is not expected to result in marine mammal or sea turtle mortality.

In their most recent five-year baleen whale serious injury and mortality determinations, National Oceanographic and Atmospheric Administration (NOAA) Fisheries reported an average of six large whale mortalities per year resulting from ship strikes along the east coast of North America, and another seven ship strikes in the region resulting in injury (either serious or non-serious) to the whale (Henry et al. 2017). The actual number of ship strike mortalities is likely much greater due to underreporting, the impossibility of recovering all carcasses, and the difficulty in determining cause of death in many cases. NOAA Fisheries reported that, on average, about 41 large whale mortalities per year during 2011 to 2015 had insufficient information to determine cause of death (Henry et al. 2017). It is uncertain how many marine mammals may be struck by vessels in the RAA. Since 2002, there have been two reports of supply vessels striking a whale at night on the Grand Banks; however, the whales were not re-sighted to allow confirmation of the incidents and such ship strikes are considered rare (Lawson, J., pers. comm., June 2018). While nearly all species of large whale have been involved in vessel strikes (Laist et al. 2001), of greatest concern is the

North Atlantic right whale. However, this species is considered uncommon in the RAA and rare in the Project Area.

It is unlikely that platform supply vessels (PSVs) transiting to and from the Project Area and within the Project Area will strike a marine mammal or a sea turtle. During transit to/from the Project Area, PSVs will travel at vessel speeds not exceeding 22 km/hour (12 knots), except as needed in the case of an emergency. In the event that a marine mammal or sea turtle is detected in proximity to the PSV, vessel speed will be reduced (refer also to response provided for IR-28). Overall, the risk of marine mammals and sea turtles incurring injury or experiencing mortality is considered low. This risk is further reduced for species at risk given that the rare occurrence of these species, with perhaps the exception of fin whales. Given that the Project is not expected to result in mortality (or injury) to marine mammals and sea turtles, there is limited potential for this type of cumulative effect.

Along with vessel strikes, marine mammals are also at increased risk of mortality or injury due to entanglement in fishing gear. Entanglement in fishing gear (particularly longlines) has been identified as a primary threat for sea turtles, including the endangered leatherback and loggerhead sea turtles (Committee on the Status of Endangered Wildlife in Canada [COSEWIC] 2010, 2012). Marine mammals are also at risk of entanglement in fishing gear; this is one of the leading causes of mortality for the North Atlantic right whale (COSEWIC 2013). Given that the Project is not expected to result in mortality or injury to marine mammals and sea turtles, there is limited potential for cumulative mortality effects.

Underwater sound from anthropogenic activities has the potential to elicit auditory injury (permanent threshold shift [PTS]) in marine mammals and sea turtles. As reviewed in EIS Section 10.3.3.1, sounds from the MODU are not expected to result in auditory injury or temporary threshold shift (TTS) in hearing. Of most concern, is exposure of marine mammals and sea turtles to strong impulsive sounds from airgun arrays. Based on the information and analysis summarized in EIS Section 10.3.3.1 and with the implementation of mitigation measures, it is unlikely that VSP conducted for the Project will result in injuries (PTS) for marine mammals or sea turtles. Most marine mammals would have to occur and remain within close range of the air source array, less than 20 m to approximately 400 m, to incur auditory injury. Overall, the risk of marine mammals and sea turtles incurring hearing impairment (injury) is considered very low.

It is possible that a seismic survey may occur in and/or near the Project Area during BP's drilling program and that marine mammals and possibly sea turtles will be exposed to underwater sound from multiple geophysical surveys. In recent years, there has been as many as three concurrent 3D seismic surveys in slope waters south of the Project Area with a concurrent 2D seismic survey offshore Labrador (LGL 2017). Based on available information and acoustic modelling undertaken for the Project, marine mammals would have to occur within 10s to 100s of metres of an airgun array to potentially experience PTS. Adverse auditory effects on marine mammals and sea turtles, appear unlikely beyond a localized area from the sound source particularly since most marine mammals exhibit at least localized avoidance of an active seismic source. In addition, seismic programs will use mitigation measures such as ramp-ups, delayed start-ups, and shut-downs of the airgun arrays as well as spatial separation between seismic surveys (typically a minimum of 30 km; LGL 2017). Given that the Project is not expected to result in auditory injury to marine mammals and sea turtles, there is limited potential for this type of cumulative residual effect.

Cumulative Change in Habitat Quality and Use

Marine mammals and sea turtles within the RAA are routinely exposed to anthropogenic sound from vessel traffic, oil and gas activities, fishing activities and in nearshore areas, marine construction activities. The key question in this assessment is whether behavioural effects (i.e., changes in habitat quality and use) from Project activities will combine in an additive and/or synergistic way with behavioural effects resulting from other anthropogenic activities. Behavioural responses of marine mammals to sound can depend on many factors including species, state of maturity, experience, current activity, reproductive state, and time of day (e.g., Richardson et al. 1995; Ellison et al. 2012); this multitude of factors, along with data gaps, makes effects predictions difficult. If a marine mammal responds to an underwater sound by changing its behaviour or moving a small distance, the impacts of the change are unlikely to be biologically important to the individual, let alone the stock or population (e.g., New et al. 2013a). However, if a sound source displaces marine mammals from an important feeding or breeding area for a prolonged period, impacts on individuals and populations could be serious (Lusseau and Bejder 2007; Weilgart 2007; New et al. 2013b; Nowacek et al. 2015; Forney et al. 2017). Relative to marine mammals, there is limited information on the effects of underwater sound on sea turtles. Sea turtles are unlikely to experience cumulative effects to the same degree as marine mammals because they are considered rare in the Project Area.

As assessed in EIS Section 10.3.3, sound from Project activities are not predicted to result in significant residual adverse effects on marine mammals and sea turtles. Based on acoustic modelling results and conservatively assuming a 120 dB re 1 μPa rms sound pressure level (SPL) criterion for avoidance, it is suggested that marine mammals may potentially exhibit avoidance responses to continuous sound sources (i.e., drilling) at distances ranging from 23 km to 40 km. For impulsive sound sources (i.e., VSP), applying a 160 dB re 1μPa rms SPL criterion for avoidance, marine mammals may exhibit avoidance at distances ranging from 3 km to 9 km, based on acoustic modelling. These criteria are intended to serve as a tool in effects assessment and marine mammal response will vary greatly depending on many factors (see above). Given that there will be limited concurrent Project activities and that activities will occur periodically over a seven year-period, there is limited potential for marine mammals to exhibit longer-term avoidance of the area.

Marine mammals may exhibit localized and likely short-term avoidance of fishing vessels, transiting vessels, and existing production facilities in the Jeanne d’Arc Basin (see EIS Section 10.3.3.2 for a review of marine mammal response to vessels). Continuous underwater sound and other environmental disturbances are generated by the production facilities and attending supply vessels at Hibernia, Terra Nova, Hebron, and White Rose. Transient sound is generated by associated shuttle tankers and supply vessels transiting to and from each of these production facilities. There will be limited potential for cumulative effects of the Project due to the distances between the Project Area and existing production facilities (i.e., >200 km). It is also unlikely that short-term and localized effects experienced by a marine mammal at Jeanne d’Arc production fields would lead to additive cumulative effects for that individual that may move to the Project Area. Sea turtles are considered uncommon in Jeanne d’Arc Basin and rare in the Project Area. The spatial range of all populations of marine mammals that are likely to occur in the RAA overlaps with the Project Area.

There is some potential for cumulative effects from underwater sound from fishing vessels and Project activities. However, this potential is reduced because fishing activities mainly occurs in the western portion of the Project Area, primarily outside of the ELs and the number of fishing vessels active in the area at a given time is limited. Safety zones around the MODU where fishing vessels are not expected to occur will limit potential for overlap, and thus, additive or synergistic cumulative behavioural effects on this valued component are unlikely. It is also unlikely that short-term and localized behavioural effects experienced by a marine mammal near a fishing vessel outside of the Project Area would lead to additive cumulative effects for that individual that may move to the Project Area.

The potential for cumulative behavioural effects from underwater sound from marine traffic and Project activities is reduced because the Project Area is distant from most major shipping routes to North America as well as the primary shipping route into St. John's (see EIS Figure 14.1) and thus, additive or synergistic cumulative behavioural effects on marine mammals (and sea turtles) are unlikely. A primary shipping route does occur through the northwest corner of EL 1149. Regardless, it is also unlikely that short-term and localized behavioural effects experienced by a marine mammal near a transiting vessel within or outside of the Project Area would lead to additive cumulative effects for that individual that may move to the Project Area.

Whereas sounds generated by offshore production facilities in the Jeanne d'Arc Basin are continuous and year-round over multiple years, sounds generated by individual exploration drilling and geophysical surveys, particularly VSP, are considered relatively short-term in nature. However, geophysical surveys generate higher sound levels which are impulsive. As noted above, it is possible that a geophysical survey may occur in or near the Project Area at the same time as other geophysical surveys in the RAA and that marine mammals and possibly sea turtles will be exposed to underwater sound from multiple geophysical surveys. In recent years, there has been as many as three concurrent 3D seismic surveys in slope waters south of the Project Area with a concurrent 2D seismic survey offshore Labrador (LGL 2017). It is uncertain how a marine mammal will respond to sound arriving from multiple sources and possibly from multiple directions. However, for surveys involving airgun(s) in the Project area, sound is not expected to propagate well to shelf waters. As such, whales in shelf waters are not predicted to experience behavioural effects from a seismic survey in the Project Area. Concurrent seismic surveys typically maintain a minimum separation distance of 30 km, but could be separated by hundreds of kilometres as was the case for seismic surveys in 2017 in the Flemish Pass area (LGL 2017); this spatial separation should reduce the potential for additive and/or synergistic cumulative effects.

The conclusions reached in the cumulative effects assessment remain unchanged. BP will conduct a marine mammal and sea turtle mitigation and monitoring program during VSP surveys that follows the requirements in the Statement of Canadian Practice with Respect to the Mitigation of Seismic Sound in the Marine Environment.

References:

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1.18.2 Information Requirement: IR-93

External Reviewer ID:

FFAW-04

Reference to EIS:

Section 13.1.2

Context and Rationale:

Section 13.1.2 of the EIS states that “[t]here have been concerns among stakeholders that the combination of fisheries closure areas along with safety zones from oil and gas activities can potentially contribute to cumulative effects on fishing. ”Fish Food and Allies Workers-Unifor has raised concerns regarding commercial fishers needing to avoid safety zones and areas with increased vessel traffic.

Section 14.7.1 of the EIS (which includes reference to section 14.6.4) provides a cumulative environmental effects assessment of commercial fisheries and other ocean users, which states that the 500 metre safety zone that will exclude harvesting activities will be localized within an area of approximately 0.8 square kilometres for up to 60 days for each of the wells and that the safety zones associated with other exploration and production drilling projects will increase the cumulative area that will be temporarily unavailable. No further information is provided, including whether the potential for multiple wells to be drilled concurrently on this project was considered in the assessment. The concerns raised by stakeholders, as indicated above in Section 13.1.2 and by FFAW, are not addressed directly.

A figure illustrating the safety zones from the proposed 20 exploration wells for this project could be used to demonstrate the area restricted to ocean users by project safety zones. A figure illustrating safety zones for all existing and proposed production and exploration wells located in the Regional Assessment Area would demonstrate the cumulative environmental effects of safety zones from multiple projects.

The area of safety zones closed to other ocean users could be calculated and compared with the fishing areas in the Regional Assessment Area.

Specific Question of Information Requirement:

Describe the potential for overlapping safety zones as a result of concurrent well drilling from this project. Include a figure as applicable.

Discuss the cumulative area lost to harvesting from production and exploration well drilling in the Regional Assessment Area and any potential mitigation measures. Include a figure and area calculations as applicable.

Response:

As stated in the EIS, a 500-m radius safety zone will be established around the Project mobile offshore drilling unit (MODU), within which fisheries and other ocean users will be excluded while the MODU is in operation. This will amount to the localized exclusion of fisheries and other ocean users within an area of approximately 0.8 km² for approximately 60 days for each of the wells to be drilled in the Project Area.

BP is not proposing to drill concurrent wells as part of this Project. Although this is not explicitly stated in the EIS, Section 1.1 of the EIS notes that it is anticipated that exploration drilling will be carried out in multiple phases so that initial well results can be analyzed to inform the execution strategy for subsequent wells. Section 2.7 of the EIS indicates that drilling activities will not be continuous and will be in part determined by rig availability and previous wells' results. Refer also to the response to IR-4.

Since Project exploration wells will be drilled sequentially, rather than concurrently, there is no potential for Project-related safety zones to overlap temporally as a result of concurrent well drilling from this Project. However, the safety zone around the Project MODU and the various safety zones associated with other third-party exploration and production drilling activities may overlap temporally within the Regional Assessment Area (RAA), thereby contributing to a cumulative reduction in the total area available for use by fisheries and other ocean users in this area.

Table 1 presents the approximate total areas occupied by the safety zones that have been established for ongoing offshore oil production projects in the RAA and provides an overview of project-specific safety zone requirements. These safety zones are also illustrated on Figure 1.

The sizes, locations, and timing of the safety zones associated with other exploration drilling projects in the RAA will depend on the number and types of drilling facilities that are used, the number and locations of the wells to be drilled, and the timing of drilling activities. Many of these details about third-party drilling exploration projects are not publicly available until after the drilling activities are underway or completed. Therefore, the following analysis of the potential cumulative area that may be lost to fisheries and other ocean users from production and exploration drilling in the RAA is based on several assumptions, as outlined below.

An Operating Licence (OL) is required for all petroleum-related activities in the Newfoundland offshore area, including geophysical and other exploration activities, exploration drilling, and production drilling. OLs are valid for a maximum period of one year and expire on the March 31st immediately following the date of issuance. Canada-Newfoundland and Labrador Offshore Petroleum Board (C-NLOPB) Annual Reports for the past five fiscal years (April 1st to March 31st) indicate that 19 OLs were issued in 2013-2014, 21 OLs were issued in 2014-2015, 20 OLs were issued in 2015-2016, 20 OLs were issued in 2016-2017, and 17 OLs were issued in 2017-2018 (C-NLOPB No Date).

Table 1 Safety Zones Associated with Ongoing Offshore Oil Production Projects in the Regional Assessment Area

Offshore Oil Production Project	Approximate Total Area Occupied by Safety Zone(s)	Safety Zone Requirements
Hibernia	17 km²	Fisheries and other ocean users are not permitted to enter the Hibernia Safety Zone without the permission of the Installation Manager.
Terra Nova	269 km²	Fisheries and other ocean users must obtain authorization from the Operator and comply with instructions given while in the Terra Nova Safety Zone. [1]
White Rose	93 km²	Notices to Mariners for the area prohibit unauthorized navigation of the White Rose safety zone.
Hebron	6 km²	Fisheries and other ocean users are not permitted to enter the Hebron safety zone without the permission of the Installation Manager.
Total of Approximate Area Within Which Fisheries and Other Ocean Users May be Excluded from Safety Zones Associated with Ongoing Offshore Oil Production Projects in the RAA [2]		385 km²

Source: One Ocean No Date

NOTES:

1 The Terra Nova Safety Zone is encompassed within a larger Precautionary Zone that occupies a total area of approximately 1,077 km² and has a radius of 10 nautical miles (nm) around the production installation. Although vessels must notify the Operator before entering the Precautionary Zone, fisheries and other ocean users are not excluded from this area. The Terra Nova Safety Zone also contains a smaller Fisheries Exclusion Zone (approximately 14 km² in area) within which fisheries and other ocean users are prohibited.

2 There is approximately 2 km² of spatial overlap between the Terra Nova Safety Zone and the Hebron Safety Zone; this area of overlap has been subtracted from the grand total.

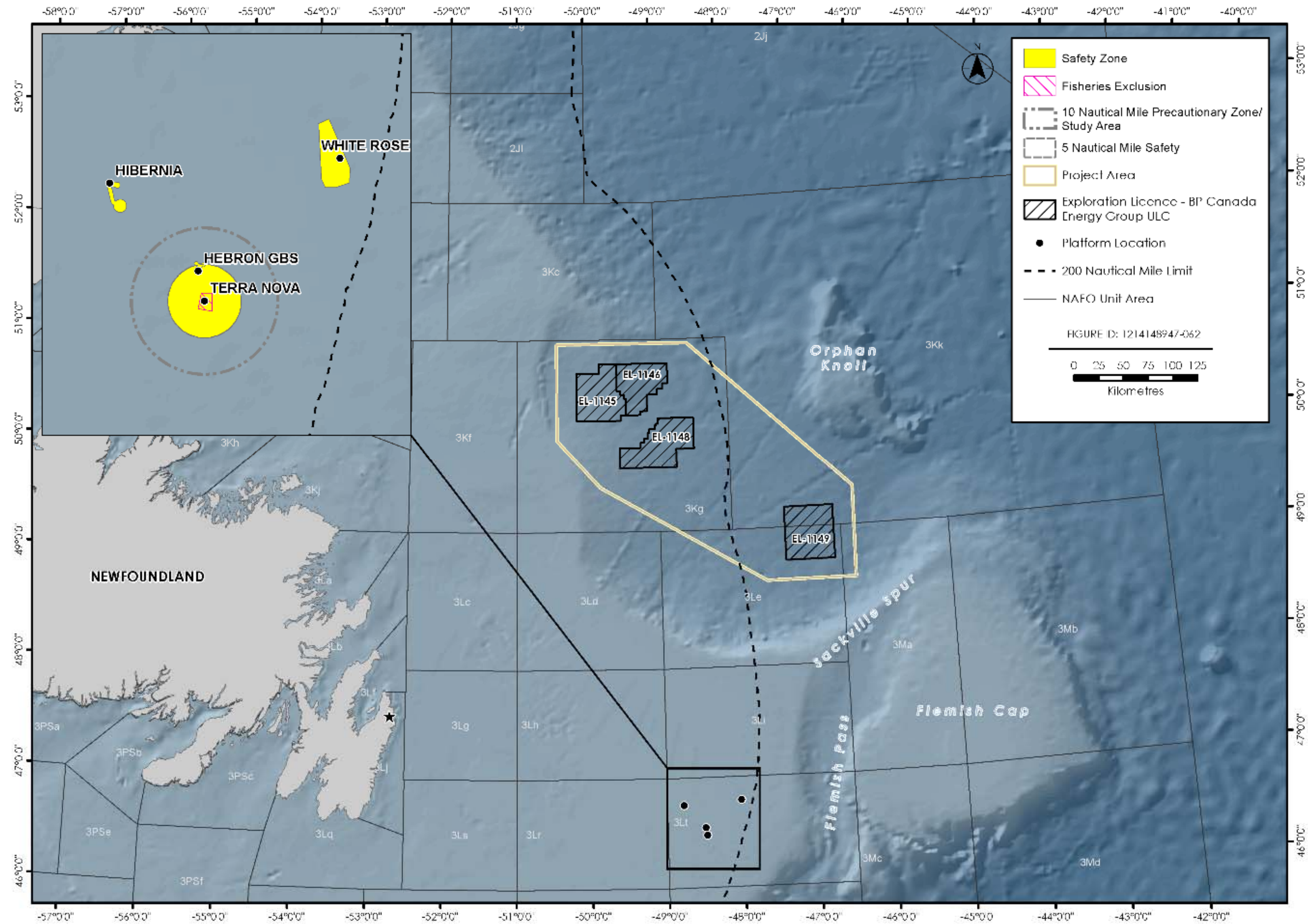

Figure 1 Hibernia, Terra Nova, White Rose, and Hebron Safety Zones

Based on the average number of OLs issued annually during the 2013 to 2018 period, it can be assumed for the purposes of this cumulative effects assessment (CEA) that an average of 19 other petroleum-related projects and/or activities (potentially including geophysical surveys and/or drilling for exploration and/or production purposes) may be carried out in the RAA during any given year within the temporal boundaries of the Project. For the purposes of responding to this Information Requirement, it is also conservatively assumed that each of these activities will be associated with a 500-m radius safety zone in which fisheries and other ocean users will be temporarily excluded. This is considered to be a conservative assumption since the regulatory requirements for establishing safety zones (i.e., under the *Newfoundland Offshore Petroleum Drilling and Production Regulations* pursuant to the *Canada-Newfoundland and Labrador Atlantic Accord Implementation Act*, under the *Offshore Drilling and Production Regulations* pursuant to the *Canada Oil and Gas Operations Act*, and under the *Collision Regulations* pursuant to the *Canada Shipping Act, 2001*) pertain to exploration and production drilling activities only and are not directly applicable for geophysical and other non-drilling exploration activities.

In the unlikely event that all 19 of these hypothetical 500-m radius safety zones (each approximately 0.8 km² in area) are implemented within the RAA simultaneously, this would amount to a total area of approximately 15 km² from which fisheries and other ocean users may be temporarily excluded. If it is assumed, even more conservatively, that the approximately 0.8 m² safety zone associated with the Project MODU and the 383 km² combined area of safety zones associated with the ongoing Hibernia, Terra Nova, White Rose, and Hebron offshore production drilling projects (Table 1 above) are also implemented at the same time then access to approximately 15 km² area is restricted, that could cumulatively result in the temporary exclusion of fisheries and other ocean users from an area occupying a total of approximately 398.8 km².

The 398.8 km² cumulative area in which fisheries and other ocean users may be temporarily excluded due to the presence of Project and non-Project safety zones associated with the offshore oil and gas industry represents approximately 0.03% of the RAA. In addition, approximately 9% of the RAA is subject to fisheries restrictions or closures associated with the designated special areas described in Section 6.4 of the EIS. Thus, when factoring in the fisheries restrictions or closures in these designated special areas, it is conservatively estimated that up to approximately 9.03% of the RAA could temporarily become inaccessible to fisheries in the unlikely scenario that safety zones are simultaneously implemented around the Project MODU; the Hibernia, Terra Nova, White Rose, and Hebron offshore oil production projects; and 19 other third-party exploration or production drilling projects in the RAA. Conversely, approximately 91% of the RAA would be expected to remain harvestable by commercial and Indigenous fishers, and available for use by other ocean users, even under these hypothetical circumstances. No additional mitigation is proposed.

References:

C-NLOPB (Canada-Newfoundland and Labrador Offshore Petroleum Board). No Date. Annual Reports. Available at: https://www.cnlopb.ca/information/annualreports/.

One Ocean. No Date. Protocols for Communication with Oil Installations on the Grand Banks. Available at: http://www.oneocean.ca/pdf/One%20Ocean%20Communication%20Protocol0312.pdf.

1.18.3 Information Requirement: IR-94

External Reviewer ID:

PNN-21

Reference to EIS:

Section 14.2.2;
Section 14.2.4.1

Context and Rationale:

Section 14.2.6 of the EIS concludes that the residual cumulative environmental effects on fish and fish habitat are predicted to be not significant and that the conclusion has been determined with a moderate to high level of confidence based on an understanding of the general environmental effects of exploration drilling and vertical seismic profiling operation, as well as the effectiveness of standard mitigation measures. However, little analysis has been provided to support this statement.

Première Nation des Innus de Nutashkuan expressed concern related to the cumulative effects of the Project on fish and fish habitat, in particular the cumulative effects associated with an increase of oil and gas production activities.

Specific Question of Information Requirement:

Provide an updated analysis to support the conclusion that the residual cumulative environmental effects on fish and fish habitat are predicted to be not significant and that the conclusion has been determined with a moderate to high level of confidence.

Response:

The EIS references the overall experiences of several offshore oil and gas production activities in the region. Specifically, operators of production developments are required to conduct Environmental Effects Monitoring (EEM) programs to identify and quantify any environmental effects related to their operations. These plans are designed to evaluate the effectiveness of actions to reduce effects, provide an early warning of undesirable changes in the environment, and assist in identifying research and development needs. Thus far, EEM programs in Atlantic Canada have not demonstrated adverse environmental impacts in the offshore oil and gas industry, beyond minor, localized changes that were predicted in the EIS documentation (Hibernia Management and Development Company Limited 2017; Suncor Energy 2017; Husky Energy 2019).

Cumulative environmental effects on fish and fish habitat are predicted to be adverse, low to moderate in magnitude, occurring within the Valued Component-specific Local Assessment Area, sporadic to regular in frequency, short- to medium-term in duration, and reversible. With the application of proposed Project-related mitigation and environmental protection measures, the residual cumulative environmental effects on marine fish and fish habitat (including species at risk) are predicted to be not significant. Therefore, no additional mitigation measures beyond those in place to mitigate the Project's direct effects are needed to address potential cumulative effects.

The overall level of confidence in the conclusion of the significance of effects is generally considered to be medium to high given the decades of experience studying environmental effects of offshore drilling and production. To be cautious, however, the confidence level can also be considered medium in consideration of the ongoing research and information gathering, particularly regarding effects on individual species throughout their life stages.

References:

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Husky Energy. 2019. White Rose 2016 Environmental Effects Monitoring Program. Prepared by Stantec Consulting Ltd. for Husky Energy, St. John's, NL.

Suncor Energy. 2017. Terra Nova Environmental Effects Monitoring Program (2014). Prepared by Stantec Consulting Ltd. for Suncor Energy Inc., St. John's, NL.

1.18.4 Information Requirement: IR-95

External Reviewer ID:

ECCC-11

Reference to EIS:

Section 14.3.4;
Section 14.3.4.1

Context and Rationale:

Environment and Climate Change Canada has advised that in addition to migratory birds being attracted to offshore exploration and production facilities, the cumulative effects of artificial light have created a significant footprint[1] in the offshore which did not exist a few decades ago. The deterioration of the physical offshore environment due to light pollution needs to be considered beyond the immediate vicinity of each individual installation. The addition of the Project's exploration drilling MODUs would contribute to the overall footprint of projects in the Newfoundland and Labrador offshore that produce artificial light that attract migratory birds. More specifically, the cumulative impact of multiple artificial light footprints in a previously pristine environment needs to be taken into account, particularly with respect to how this may be altering the behaviour of nocturnal species (e.g. millions of Leach's Storm-petrels that regularly forage in and migrate through the area).

<u>Reference</u>

[1]Cinzano, P., Falchi, F., and Elvidge, C.D. (2001). The first World Atlas of the artificial night sky brightness. Monthly Notices of the Royal Astronomical Society. 328(3): 689-707.

Specific Question of Information Requirement:

Review the information provided by Environment and Climate Change Canada related to cumulative effects of artificial light, and update the assessment of potential cumulative environmental effects on migratory birds with how the presence of the new MODUs and other support vessels in the Project Area would contribute to the overall amount of artificial light currently present in the offshore and how this increase could impact migratory birds.

Identify mitigation measures and monitoring or follow-up if needed, and update predictions regarding the significance of effects accordingly.

Response:

The electrical lighting and flares on current production and exploration facilities offshore of Atlantic Canada have added artificial light sources to an area where previous light sources consisted only of fishing and cargo vessels (Cinzano et al. 2001; Falchi et al. 2016). Each source of light may attract nocturnally active birds from up to 16 km (Poot et al. 2008; Rodríguez et al. 2014, 2015). It is acknowledged that the artificial light footprint from the Project's drilling mobile offshore drilling units (MODUs) and service vessels, although not necessarily overlapping with the light footprints from existing vessels and platforms, will temporarily add to the total area affected by artificial light from those existing light sources and potentially affect more individual birds. Breeding Leach's storm-petrels that forage in the Project Area commute from nesting colonies on Baccalieu Island and Gull Island, Witless Bay, and back again (Hedd et al. 2018). Other individuals from these colonies travelling to deep water areas to the southeast of the Project Area pass through the existing producing oilfields on their way between their nesting colony and deep-water foraging areas. All of these artificial light footprints, although affecting different individual birds, have the potential to cumulatively affect the nesting populations of Baccalieu and Gull Islands.

It is also acknowledged that the stranded bird recoveries from production and drilling installations in offshore Newfoundland that have been summarized in the EIS may not, in some instances, have been the result of dedicated, systematic searches. However, the data from seismic programs discussed in the EIS are the result of consistently dedicated, systematic, thorough searches by biologists (LGL 2017). Those data suggest that a very high percentage of stranded Leach's storm-petrels are found alive and can be released shortly afterward. With systematic searches of MODUs and Project vessels by Project crew the effects of attraction to artificial lighting can therefore be mitigated effectively to prevent significantly adding to effects caused by other artificial light sources on Leach's storm-petrel populations nesting at Baccalieu and Gull Islands. As discussed in EIS Sections 9.3.2 and 9.5, personnel trained in accordance with procedures in Environment and Climate Change Canada (2016) will conduct routine systematic checks for stranded birds, recover them, release live birds, and document the effort and outcomes. Refer also to the response to IR-39.

References:

Cinzano, P., F. Falchi, and C. Elvidge. 2001. The first World Atlas of the artificial night sky brightness. Monthly Notices of the Royal Astronomical Society, 328: 698-707.

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LGL Limited. 2017. Study of Seabird Attraction to the Hebron Production Platform: A Proposed Study Approach. Rep. No. SA1190. Rep. by LGL Limited, St. John's, NL, for Hebron Project, ExxonMobil Properties Inc., St. John's, NL. 30 pp. + Appendices.

Poot, H., B.J. Ens, H. de Vries, M.A.H. Donners, M.R. Wernand and J.M. Marquenie. 2008. Green Light for Nocturnally Migrating Birds. Ecology and Society, 113: 47. [online].

Rodríguez, A., G. Burgan, P. Dann, R. Jessop, J.J. Negro and A. Chiaradia. 2014. Fatal Attraction of Short-Tailed Shearwaters to Artificial Lights. PLoS ONE, 9: e110114.

Rodríguez, A., B. Rodríguez and J.J. Negro. 2015. GPS tracking for mapping seabird mortality induced by light pollution. Scientific Reports (Nature Lond.), 5: 10670.

1.18.5 Information Requirement: IR-96

External Reviewer ID:

WM-69

Reference to EIS:

Section 14.5.2

Context and Rationale:

Section 14.3.6 of the EIS states that "with the application of proposed Project-related mitigation and environmental protection measures, the residual cumulative effects on marine and migratory birds (including SAR [Species at Risk]) are predicted to be not significant. Therefore, no additional mitigation measures beyond those in place to mitigate the Project's direct effects are needed to address potential cumulative effects." Evidence regarding the effectiveness of mitigation measures related to direct project effects has not been provided.

Specific Question of Information Requirement:

Provide a rationale supporting no need for additional mitigation measures for cumulative effects other than those planned to mitigate the Project's direct effects, or identify a broader range of potential mitigation measures to address potential cumulative effects on birds.

Response:

Mitigating the attraction of nocturnally active seabirds to artificial lighting by reducing light emissions through measures such as shielding upward radiation of light or reducing the total amount of lighting has been shown to be effective in reducing the number of birds stranding (Reed et al. 1985; Rodríguez et al. 2014). Recovering seabirds stranded at artificial lighting and returning them to the sea has also been shown to be effective in reducing mortality for a variety of species (Rodríguez et al. 2017). In the Newfoundland offshore, the practice of dedicated daily searches by trained personnel on board geophysical exploration vessels has shown that a high percentage of stranded Leach's storm-petrels survive the initial stranding and can be recovered and released alive if found shortly after stranding (LGL 2017).

Mitigating the attraction of nocturnally active birds to flares by minimizing flaring during periods of marine and migratory bird vulnerability will be effective because the large majority of bird strandings on offshore Newfoundland installations and vessels has been shown to occur from mid-September to mid-October (LGL 2017).

A recent study showing avoidance of seismic survey activity by a marine bird species up to 100 km from the survey location suggests that the practice of ramping-up the air source array can effectively mitigate the likelihood of hearing injury in seabirds (Pichegru et al. 2017).

Treatment of synthetic-based mud on drill cuttings in accordance with Offshore Waste Treatment Guidelines (OWTG) (National Energy Board et al. 2010) is anticipated to mitigate the formation of hydrocarbon concentrations at the water's surface greater than 3 micrometres (μm) thickness, which is the primary discharge that has potential to adversely affect marine and migratory birds. Hydrocarbon sheens are not anticipated from exploration drilling activities, although if they do occur, will be very short term, dispersing within 24 hours.

The attraction of marine birds to food waste at Project installations or vessels or to prey species that are attracted to that food waste, and potential negative interactions with those facilities, is effectively mitigated by maceration of food waste and discharge below the surface and subsequent dilution, as per the OWTG and MARPOL.

The disturbance of incubating or brooding marine birds that could lead to nest predation and egg/nestling death from exposure is effectively mitigated by the routing of PSV and helicopter traffic to avoid nesting colonies in accordance with *Seabird Ecological Reserve Regulations, 2015*, and the ECCC's *Avoidance Guidelines*.

Given the effectiveness of these measures at mitigating direct Project effects on marine and migratory birds, the Project is not predicted to contribute to the cumulative effects of other projects. As a result, no additional mitigation measures are necessary.

References:

LGL Limited. 2017. Study of Seabird Attraction to the Hebron Production Platform: A Proposed Study Approach. Rep. No. SA1190. Rep. by LGL Limited, St. John's, NL, for Hebron Project, ExxonMobil Properties Inc., St. John's, NL. 30 pp. + appendices.

National Energy Board, Canada-Newfoundland and Labrador Offshore Petroleum Board and Canada-Nova Scotia Offshore Petroleum Board). 2010. Offshore Waste Treatment Guidelines. vi + 28 pp.

Pichegru, L., R. Nyengera, A. M. McInnes and P. Pistorius. 2017. Avoidance of seismic survey activities by penguins. Scientific Reports (Nature London), 7: 16305.

Reed, J. R., J. L. Sincock and J. P. Hailman. 1985. Light attraction in endangered Procellariiform birds: Reduction by shielding upward radiation. Auk, 102: 377-383.

Rodríguez, A., G. Burgan, P. Dann, R. Jessop, J. J. Negro and A. Chiaradia. 2014. Fatal Attraction of Short-Tailed Shearwaters to Artificial Lights. PLoS ONE, 9: e110114.

Rodríguez, A., J. Moffett, A. Revoltós, P. Wasiak, R. R. McIntosh, D. R. Sutherland, L. Renwick, P. Dann and A. Chiaradia. 2017. Light pollution and seabird fledglings: Targeting efforts in rescue programs. Journal of Wildlife Management, 81: 734-741.

2.0 CLARIFICATIONS

2.1 Project Description

2.1.1 Clarification: CL-01

External Reviewer ID:

C-NLOPB-02; C-NLOPB-03; C-NLOPB-04

Reference to EIS:

Section 1.5.1;
Section 1.5.3

Context and Rationale:

Table 1.2 of the EIS (Summary of Key Relevant Offshore Legislation and Guidelines) lists relevant regulations and guidelines that fall under the jurisdiction of the C-NLOPB. However, the list is incomplete as it does not contain the Safety Plan Guidelines.

Similarly, Table 1.3 of the EIS references statutes that are not applied in C-NLOPB jurisdiction. Although the "Regulations Establishing a List of Spill-treating Agents SOR/2016-108" are made under *Canada Oil and Gas Operations Act*, the use of the those regulations in C-NLOPB jurisdiction is described under the *Accord Acts* and the "*Energy Safety and Security Act* (S.C. 2015, c. 4)" also is described under the *Accord Acts*.

Required Clarification:

Revise Table 1.2 to refer to all regulations and guidelines relevant to the Project environmental assessment, including but not limited to:

- Safety Plan Guidelines; and
- Revise Table 1.3 to remove legislation which does not apply in offshore of Newfoundland or describe the applicability of *Canada Oil and Gas Operations Act* and the *Energy Safety and Security Act* to this Project.

Response:

EIS Table 1.2 has been updated (Table 1) to include the following guidelines:

- Safety Plan Guidelines (Canada-Newfoundland and Labrador Offshore Petroleum Board [C-NLOPB] et al. 2011)
- Incident Reporting and Investigation Guidelines (C-NLOPB and Canada-Nova Scotia Offshore Petroleum Board [CNSOPB] 2018)
- Physical Environmental Programs Guidelines (National Energy Board [NEB] et al. 2008)

- Measures to Protect and Monitor Seabirds in Petroleum-Related Activity in the Canada-Newfoundland and Labrador Offshore Area (C-NLOPB undated)

Section 1.5.3 of the EIS references legislation that is not directly applicable to the Project. Table 1.3 of the EIS references the *Canada Oil and Gas Operations Act* with respect to the *Regulations Establishing a List of Spill-treating Agents*. However, the use of those Regulations in C-NLOPB jurisdiction is described through amendments made under the *Canada-Newfoundland and Labrador Atlantic Accord Implementation Act* and *Canada-Newfoundland and Labrador Atlantic Accord Implementation Newfoundland and Labrador Act* (Accord Acts).

The *Energy Safety and Security Act*, as referenced in Table 1.3 of the EIS, came into force in 2016 to enable amendments to existing energy legislation including the *Canada-Newfoundland Atlantic Accord Implementation Act*. As noted in the EIS, amendments brought forward by the *Energy Safety and Security Act* aim to strengthen the safety and security of offshore oil production through improved oil spill prevention, response, accountability, and transparency. As noted above, applicable amendments, which includes the enablement of use of approved spill-treating agents under certain conditions, have since been made to the Accord Acts.

The *Canada Oil and Gas Operations Act* and *Energy Safety and Security Act* therefore do not require reference as other applicable legislation for the Project in C-NLOPB jurisdiction and should be removed from Table 1.3. Table 2 provides an updated version of EIS Table 1.3.

References:

C-NLOPB (Canada-Newfoundland and Labrador Offshore Petroleum Board). Undated. Measures to Protect and Monitor Seabirds in Petroleum-Related Activity in the Canada-Newfoundland and Labrador Offshore Area. Available online at: https://www.cnlopb.ca/wp-content/uploads/news/measuresseabirds.pdf

C-NLOPB (Canada-Newfoundland and Labrador Offshore Petroleum Board) and CNSOPB (Canada-Nova Scotia Offshore Petroleum Board). 2017. Compensation Guidelines Respecting Damage Relating to Offshore Petroleum Activity

C-NLOPB (Canada-Newfoundland and Labrador Offshore Petroleum Board) and CNSOPB (Canada-Nova Scotia Offshore Petroleum Board). 2018. Incident Reporting and Investigation Guidelines. April 2018. Available online at: https://www.cnlopb.ca/wp-content/uploads/guidelines/incrptgl.pdf

C-NLOPB (Canada-Newfoundland and Labrador Offshore Petroleum Board), CNSOPB (Canada-Nova Scotia Offshore Petroleum Board) and NEB (National Energy Board). 2011. Safety Plan Guidelines. March 31, 2011. Available online at: https://www.cnlopb.ca/wp-content/uploads/guidelines/safety_plan_guidelines.pdf

NEB (National Energy Board), CNSOPB (Canada-Nova Scotia Offshore Petroleum Board), and C-NLOPB (Canada-Newfoundland and Labrador Offshore Petroleum Board). 2008. Offshore Physical Environmental Guidelines. September 2008. Available online at: https://www.cnlopb.ca/wp-content/uploads/guidelines/peg_guidelines.pdf

NEB (National Energy Board), CNSOPB (Canada-Nova Scotia Offshore Petroleum Board), and C-NLOPB (Canada-Newfoundland and Labrador Offshore Petroleum Board). 2009. Offshore Chemical Selection Guidelines for Drilling and Production Activities on Frontier Lands

NEB (National Energy Board), CNSOPB (Canada-Nova Scotia Offshore Petroleum Board), and C-NLOPB (Canada-Newfoundland and Labrador Offshore Petroleum Board). 2010. Offshore Waste Treatment Guidelines.

NEB (National Energy Board), CNSOPB (Canada-Nova Scotia Offshore Petroleum Board), and C-NLOPB (Canada-Newfoundland and Labrador Offshore Petroleum Board). 2011. Environmental Protection Plan Guidelines

Table 1 EIS Table 1.2 (Updated): Summary of Key Relevant Offshore Legislation and Guidelines

Legislation / Guideline	Regulatory Authority	Relevance	Potentially Applicable Permitting Requirement(s)
Canada-Newfoundland Atlantic Accord Implementation Act (S.C. 1987, c. 3) and the Canada-Newfoundland and Labrador Atlantic Accord Implementation Newfoundland and Labrador Act (R.S.N.L. 1990, c. C-2)	Natural Resources Canada / Newfoundland and Labrador Department of Municipalities and Environment	The Accord Acts give the C-NLOPB the authority and responsibility for the management and conservation of the petroleum resources offshore Newfoundland and Labrador in a manner that protects health, safety, and the environment while maximizing economic benefits. The Accord Acts are the governing legislation under which various regulations are established to govern specific petroleum exploration and development activities.	The regulatory approvals identified below may be required pursuant to section 142 of the *Canada-Newfoundland Offshore Petroleum Resources Accord Implementation Act*, section 135 of the *Canada-Newfoundland Offshore Petroleum Resources Accord Implementation* (Newfoundland and Labrador) *Act*, and the regulations made under the Accord Acts.
Newfoundland Offshore Petroleum Drilling and Production Regulations (and associated Guidelines)	C-NLOPB	These regulations outline the various requirements that must be adhered to when conducting exploratory drilling for and/or production of petroleum.	The primary regulatory approvals necessary to conduct an offshore drilling program are an Operations Authorization (OA) and a Well Approval (ADW) pursuant to the Accord Acts and these regulations.
Newfoundland Offshore Certificate of Fitness Regulations	C-NLOPB	These regulations outline the associated requirements for the issuance of a Certificate of Fitness to support an authorization for petroleum exploration in the Newfoundland offshore area. The Regulations are implemented to require that the equipment and/or installation of exploratory equipment is fit for the purposes for which it is intended to be used and may be operated safely without posing threat to persons or the environment in a specified location and timeframe.	A Certificate of Fitness will be required in support of the Project.
Offshore Waste Treatment Guidelines (NEB et al. 2010)	NEB / C-NLOPB / CNSOPB	These guidelines outline recommended practices for the management of waste materials from oil and gas drilling and production facilities operating in offshore areas regulated by the C-NLOPB and CNSOPB. The Offshore Waste Treatment Guidelines (OWTG) were prepared in consideration of the offshore waste / effluent management approaches of other jurisdictions, as well as available waste treatment technologies, environmental compliance requirements, and the results of environmental effects monitoring programs in	Adherence to OWTG

Legislation / Guideline	Regulatory Authority	Relevance	Potentially Applicable Permitting Requirement(s)
		Canada and internationally. The OWTG specify performance expectations for the following types of discharges associated with exploration drilling: • emissions to air • drilling muds and solids • bilge water, ballast water and deck drainage • well treatment fluids • cooling water • desalination brine • sewage and food wastes • water for testing of fire control systems • naturally occurring radioactive material	
Offshore Chemical Selection Guidelines for Drilling and Production Activities on Frontier Lands (NEB et al. 2009)	NEB / C-NLOPB / CNSOPB	These guidelines provide a framework for chemical selection that minimizes the potential for environmental effects from the discharge of chemicals used in offshore drilling and production operations. An operator must meet the minimum expectations outlined in the Offshore Chemical Selection Guidelines (OCSG) as part of the authorization for any work or activity related to offshore oil and gas exploration and production. Any chemicals intended for discharge to the marine environment must • be included on the Oslo and Paris Commissions Pose Little or No Risk (PLONOR) to the Environment List • meet certain requirements for hazard classification under the Offshore Chemical Notification Scheme • pass a Microtox test (i.e., toxicity bioassay) • undergo a chemical-specific hazard assessment in accordance with UK Offshore Chemical Notification Scheme models and/or • have the risk of its use justified through demonstration to the C-NLOPB that discharge of the chemical will meet OCSG objectives.	Adherence to OCSG

Legislation / Guideline	Regulatory Authority	Relevance	Potentially Applicable Permitting Requirement(s)
Compensation Guidelines Respecting Damage Relating to Offshore Petroleum Activity (Compensation Guidelines) (C-NLOPB and CNSOPB 2017)	C-NLOPB / CNSOPB	These guidelines describe compensation sources available to potential claimants for loss or damage related to petroleum activity offshore Newfoundland and Labrador and Nova Scotia; and outline the regulatory and administrative roles which the Boards exercise respecting compensation payments for actual loss or damage directly attributable to offshore operators.	Adherence to Compensation Guidelines
Environmental Protection Plan Guidelines (NEB 2011)	C-NLOPB / CNSOPB / NEB	These guidelines assist an operator in the development of an Environmental Protection Plan (EPP) that meets the requirements of the Accord Acts and associated regulations and the objective of protection of the environment from its proposed work or activity.	Adherence to Environmental Protection Plan Guidelines
Statement of Canadian Practice with respect to the Mitigation of Seismic Sound in the Marine Environment (SOCP)	Fisheries and Oceans Canada (DFO) / Environment and Climate Change Canada (ECCC) / C-NLOPB / CNSOPB	The SOCP specifies the minimum mitigation requirements that must be met during the planning and conduct of marine seismic surveys, in order to reduce effects on life in the oceans. These mitigation measures are also typically applied to walk-away VSP operations and wellsite surveys. These mitigation requirements focus on planning and monitoring measures to avoid interactions with marine mammal and sea turtle species at risk where possible and reduce adverse effects on species at risk and marine populations.	Adherence to SOCP
Safety Plan Guidelines (C-NLOPB et al. 2011)	C-NLOPB / CNSOPB / NEB	These Guidelines are intended to provide guidance to Operators in developing a Safety Plan to meet the requirements of the Drilling and Production Regulations. In particular, the Safety Plan Guidelines echo the regulatory expectation that an operator take all necessary precautions to reduce risk to a level that is as low as reasonable practicable (ALARP). The Safety Plan Guidelines require the Safety Plan to describe procedures, practices, resources, and sequence of key safety-related activities and monitoring measures necessary to ensure the safety of the proposed work or activity.	A Safety Plan is required as part of the Operations Authorization.

Legislation / Guideline	Regulatory Authority	Relevance	Potentially Applicable Permitting Requirement(s)
Incident Reporting and Investigation Guidelines (C-NLOPB and CNSOPB 2018)	C-NLOPB / CNSOPB	These Guidelines are intended to assist operators, employers and others with responsibilities under the Accord Acts with respect to the reporting and investigation of incidents and other events that occur in the offshore area.	Adherence to the Incident Reporting and Investigation Guidelines
Physical Environmental Programs Guidelines (NEB et al. 2008)	NEB / C-NLOPB / CNSOPB	These Guidelines clarify regulatory requirements for Operators of drilling or production installations concerning the observing, forecasting and reporting of physical environmental data.	Adherence to Physical Environmental Programs Guidelines
Measures to Protect and Monitor Seabirds in Petroleum-Related Activity in the Canada-Newfoundland and Labrador Offshore Area (C-NLOPB undated)	C-NLOPB	This document acknowledges advice from Environment and Climate Change Canada (ECCC) Canadian Wildlife Service (CWS) on the conservation and protection of seabirds near offshore facilities which is incorporated into C-NLOPB conditions of authorization.	Adherence to Measures to Protect and Monitor Seabirds in Petroleum-Related Activity in the Canada-Newfoundland and Labrador Offshore Area

Table 2 EIS Table 1.3 (Updated): Summary of Other Potentially Relevant Federal and Provincial Legislation

Legislation	Regulatory Authority	Relevance	Potentially Applicable Permitting Requirement(s)
Canada Shipping Act, 2001		The *Canada Shipping Act, 2001* is intended to promote safety in marine transportation and protect the marine environment from damage due to navigation and shipping activities.	PSVs (and the MODU itself while in transit) are required to comply with the Act and associated regulations.
Canadian Environmental Protection Act, 1999 (CEPA)	ECCC	CEPA pertains to pollution prevention and the protection of the environment and human health to contribute to sustainable development. Among other items, CEPA provides a wide range of tools to manage toxic substances, and other pollution and wastes, including disposal at sea.	Disposal at Sea Permits (under the *Disposal at Sea Regulations* pursuant to CEPA) have not been required in the past for exploration drilling projects. Therefore, such a permit is not anticipated to be required in support of the Project.
Fisheries Act	DFO / ECCC (administers section 36, specifically)	The *Fisheries Act* contains provisions for the protection of fish, shellfish, crustaceans, marine mammals, and their habitats. Under the *Fisheries Act*, no person shall carry on any work, undertaking, or activity that results in serious harm to fish that are part of a commercial, recreational, or Aboriginal fishery, or to fish that support such a fishery, unless this activity has been authorized by the Minister of Fisheries and Oceans. Section 36 of the *Fisheries Act* pertains to the prohibition of the deposition of a deleterious substance into waters frequented by fish.	Authorization from the Minister of Fisheries and Oceans under section 35(2) of the *Fisheries Act* has not been required in the past for offshore exploration drilling projects due to the absence of anticipated serious harm. Therefore, such an authorization is not anticipated to be required in support of the Project.
Migratory Birds Convention Act, 1994 (MBCA)	ECCC	Under the MBCA, it is illegal to kill migratory bird species not listed as game birds or destroy their eggs or young. The Act also prohibits the deposit of oil, oil wastes or any other substance harmful to migratory birds in any waters or any area frequented by migratory birds.	The salvage of stranded birds during offshore Project operations may require a handling permit under section 4(1) of the *Migratory Birds Regulations* pursuant to the MBCA.
Navigation Protection Act (NPA)	Transport Canada	The NPA is intended to protect specific inland and nearshore navigable waters (as identified on the list of "Scheduled Waters" under the NPA) by regulating the construction of works on those waters and by providing the Minister of Transport with the power to remove obstructions to navigation.	No applicable permitting requirements under the NPA have been identified for the Project, as the Project Area is located offshore, outside of the Scheduled Waters specified in the NPA.
Oceans Act	DFO	The *Oceans Act* provides for the integrated planning and management of ocean activities and legislates the marine protected areas program, integrated management program, and marine ecosystem health program. Marine protected areas are designated under the authority of the *Oceans Act*.	No applicable permitting requirements under the *Oceans Act* have been identified for the Project.

Legislation	Regulatory Authority	Relevance	Potentially Applicable Permitting Requirement(s)
Species at Risk Act (SARA)	DFO / ECCC / Parks Canada	SARA is intended to protect species at risk in Canada and their "critical habitat" (as defined by SARA). All activities must comply with SARA. Section 32 of the Act provides a complete list of prohibitions. Under SARA, proponents are required to complete an assessment of the environment and demonstrate that no harm will occur to listed species, their residences or critical habitat or identify adverse effects on specific listed wildlife species and their critical habitat, followed by the identification of mitigation measures to avoid or minimize effects.	Under certain circumstances, the Minister of Fisheries and Oceans may issue a permit under section 73 of SARA authorizing an activity that has potential to affect a listed aquatic species, any part of its critical habitat, or the residences of its individuals. However, such a permit is not anticipated to be required in support of this Project.
Regulations Establishing a List of Spill-treating Agents, SOR/2016-108	ECCC	The Minister of the Environment has determined that certain spill treating agents (as listed in the Regulations) are acceptable for use in Canada's offshore. As a result, the C-NLOPB is able to authorize the use of one or more of the two spill-treating agent products listed in Schedule 1 of the Regulations to respond to an oil spill.	Specific implications for spill prevention and response, should BP request to deploy dispersants in the unlikely event of an oil spill.
Newfoundland and Labrador (NL) *Endangered Species Act* (NL ESA)	NL Department of Fisheries and Land Resources	The NL ESA provides special protection for native plant and animal species considered to be endangered, threatened or vulnerable in the province.	No applicable permitting requirements under the NL ESA have been identified for the Project.
Seabird Ecological Reserve Regulations, NLR 66/97	NL Department of Fisheries and Land Resources	These Regulations prohibit or limit industrial development and certain activities that can cause disturbance to breeding seabirds, including but not limited to boat traffic and low-flying aircraft near the colonies during the breeding season.	PSVs and helicopters will comply with regulatory requirements. No applicable permitting requirements under the *Seabird Ecological Reserve Regulations* have been identified for the Project.

2.2 Physical Environment

2.2.1 Clarification: CL-02

External Reviewer ID:

ECCC-23

Reference to EIS:

Section 5.3.1

Context and Rationale:

Section 5.3.1.2 states, "Wave heights and periods in the MSC50 database are computed using a Pierson Moskowitz spectrum." Environment and Climate Change Canada advises that this is an insufficient (and possibly misleading) description of how waves in the data set are generated.

Required Clarification:

Describe the wind fields and wave model used in the preparation of the MSC50 data set.

Response:

The wind fields in the MSC50 data set were developed by starting with the NCAR/NCEP (National Center for Atmospheric Research / U.S. National Centers for Environmental Prediction) global reanalysis for 1958-1997 wind fields. Those fields were then manually refined by marine meteorologists based on observations from buoys, ships, scatterometer winds and tropical model output and storm analyses. The resulting wind field was then used as input for a third-generation spectral wave model. The resulting wave fields were then verified against buoy and altimeter observation data (Swail et al. 2006).

References:

Swail, V.R., V.J. Cardone, M. Ferguson, D.J. Gummer, E.L. Harris, E.A. Orelup and A.T. Cox. 2006. The MSC50 Wind and Wave Reanalysis. 9th International Wind and Wave Workshop, September 25-29, 2006. Victoria, B.C.

2.2.2 Clarification: CL-03

External Reviewer ID:

ECCC-22; KMKNO-09

Reference to EIS:

Section 5.3.1.1

Context and Rationale:

The proponent provides a description of the International Comprehensive Ocean-Atmosphere Data Set (ICOADS) used in the analysis of the marine climatology for the Project Area. However, no information was provided as to the location or number of data points included for the eastern and western sections of the Orphan Basin. Environment and Climate Change Canada advised that a discussion of the limitations of the analysis is required.

Required Clarification:

Provide the number of observations used in the data analysis for both the eastern and western sections of the Orphan Basin and discuss the limitations of the analysis. Provide a figure illustrating the location of the ICOADS data points in the Project Area.

Response:

The number of observations used in the data analysis for the western section of the Orphan Basin (Region A) is 27,247. The number of observations used in the data analysis for the eastern section of the Orphan Basin (Region B) is 56,573.

BP and its consultants acknowledge there are limitations with the analysis, although despite these limitations the ICOADS data is still helpful in characterizing the marine climatology for the Project Area. The Enhanced Trimming data set was trimmed to exclude outliers which fall outside of 4.5 standard deviations from the smoothed median. Despite this analysis, valid observations may still have been excluded from the data set. Conversely, invalid data which fell within the limits of the quality control analysis may have been included in the data set.

While the ship-based reports have been quality controlled to the extent possible, they are likely to contain some observation errors in addition to position report errors, particularly for the older reports. As well, the data set is known to contain a ‘fair weather bias’, which arises for the following reasons: ship’s captains may choose to avoid areas of heavy weather, and since the reporting program is voluntary, fewer observations are likely to be taken under adverse weather and sea state conditions. This bias is more likely to be present during the winter season and over temperate and northern seas where vessel traffic is light.

Kent et al. (1993) demonstrated various systematic inconsistencies in the meteorological observations from voluntary observing ships. These inconsistencies were mostly dependent on the method of estimation that was used. Sea surface temperature data from engine intake thermometers were found to be biased high by an average of 0.3ºC. The dew point temperatures from fixed thermometer screens were biased high compared to psychrometer readings. The magnitude of the bias was approximately 1ºC and varied with dew point temperature. Wind speeds from anemometers were biased high compared to visual winds by about two knots for winds up to about 25 knots. It was unknown whether visual winds or anemometer winds were more accurate. Compared to daytime values, visual winds at night were underestimated by approximately 1 m/s at 15 m/s and 5 m/s at 25 m/s.

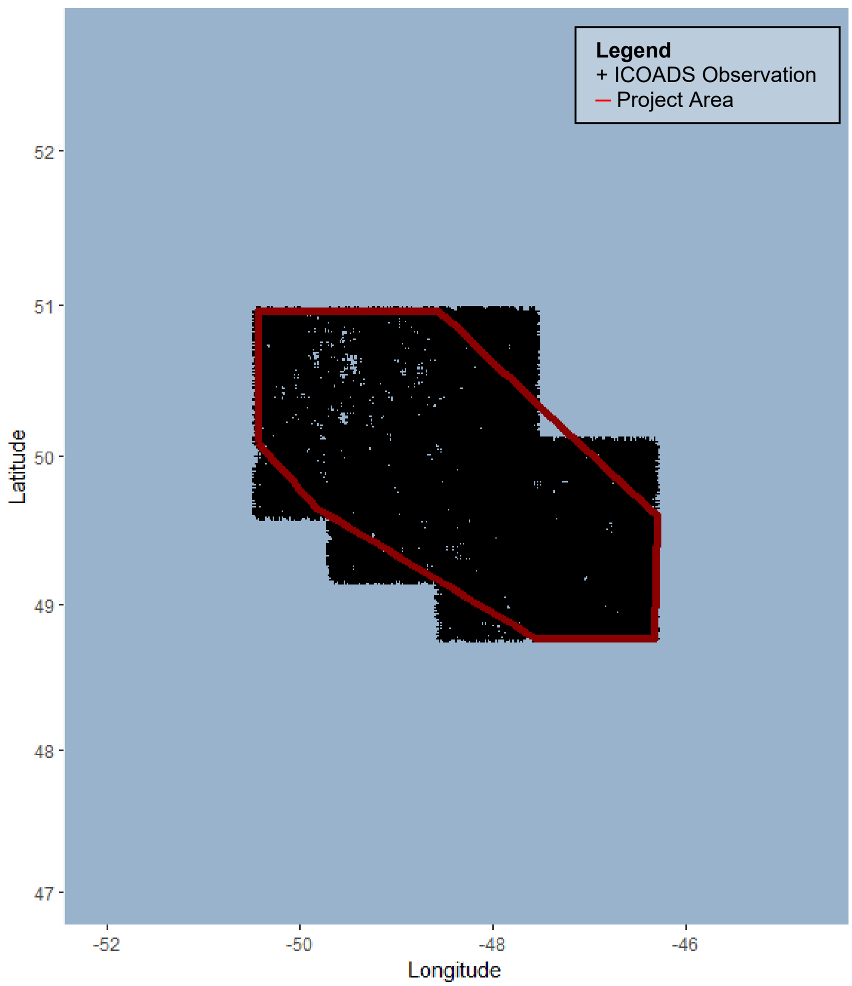

Figure 1 ICOADS Data Points in Project Area

References:

Kent, E., P. Taylor, B. Truscott and J. Hopkins. 1993. The Accuracy of Voluntary Observing Ships' Meteorological Observations – Results of the VSOP-NA. Journal of Atmospheric Oceanic Technology, 10: 591-608.

2.2.3 Clarification: CL-04

External Reviewer ID:

ECCC-03

Reference to EIS:

"Section 5.5; Section 5.5.1.3, Figure 5.56"

Context and Rationale:

"Section 5.5 of the EIS describes the ice conditions. Figure 5.56 of the EIS is labeled "Median Concentration of Sea Ice in the Project Area for the Week of March 12 (1981-2010)"; however, Environment and Climate Change Canada advises that it is actually the median of predominant ice type when ice is present.

Given that this figure is mislabeled it is unclear whether the associated data presented in Section 5.5.1.3 is median concentration of sea ice, or median of predominant ice type when ice is present."

Required Clarification:

Provide a corrected Figure 5.56 and confirm whether data in Section 5.5.1.3 is in fact for median concentration of sea ice. If not, provide an updated discussion of sea ice to clarify this discrepancy.

Response:

After cross-checking with Environment Canada ice charts, EIS Figure 5.56 is mislabelled in this report, it is in fact "Median of Ice Type when Ice is Present, Week of March 12, 1981-2010".

The chart that should have been used in this report is, "Median of Ice Concentration, March 12, 1981-2010", as shown below. https://iceweb1.cis.ec.gc.ca/30Atlas/page1.xhtml?lang=en

However, the associated data in EIS Section 5.5.1.3 does still accurately reflect median concentration of sea ice, it is simply a matter of the wrong figure used in the report.

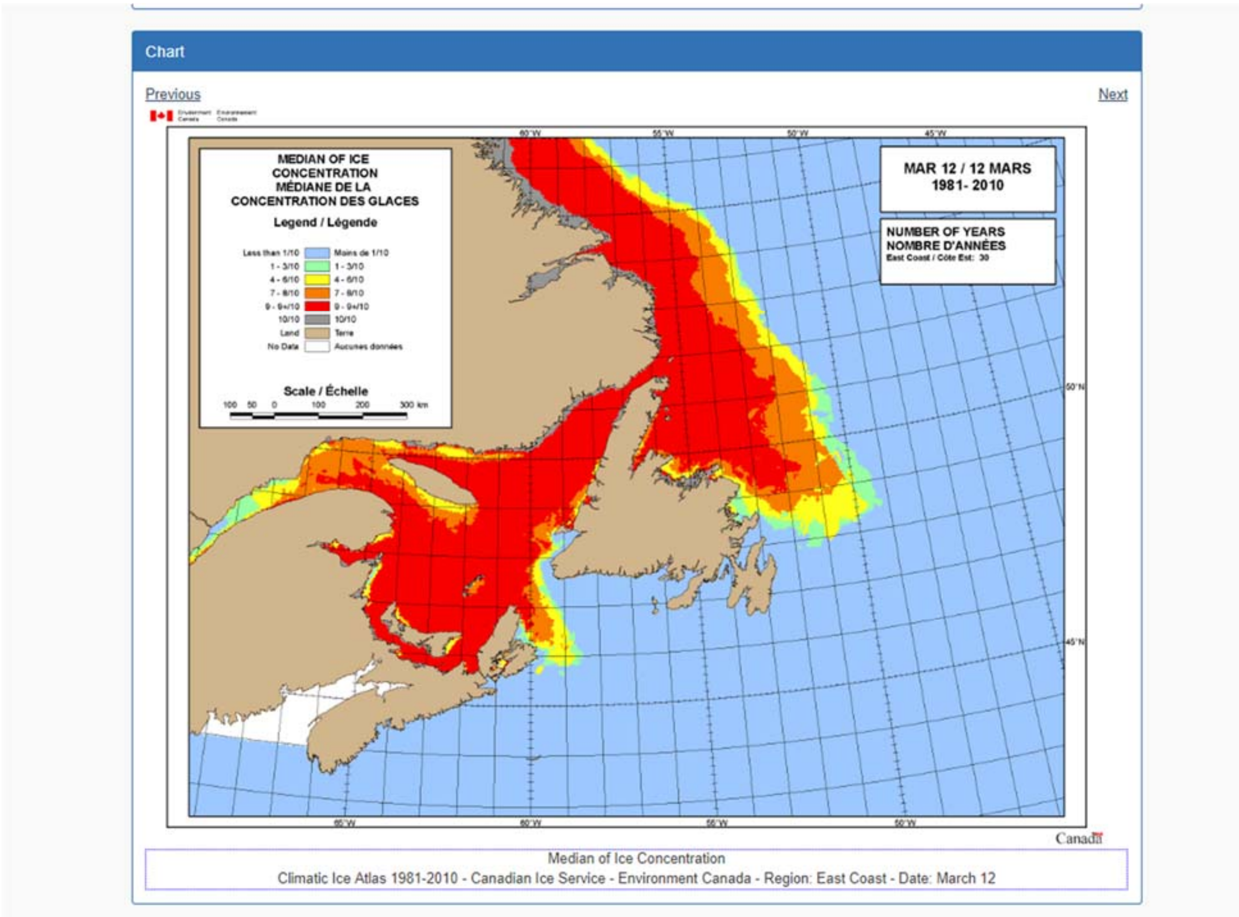

Figure 1 EIS Figure 5.56 (Revised): Median of Ice Concentration, March 12, 1981-2010

2.3 Fish and Fish Habitat

2.3.1 Clarification: CL-05

External Reviewer ID:

N/A

Reference to EIS:

Section 8.1.3

Context and Rationale:

Table 8.1, in Section 8.1.3 of the EIS, presents the potential environmental effects, pathways, and measurable parameters related to the potential environmental effects of the Project on marine fish and fish habitat. With respect to change in risk of mortality or physical injury, the measurable parameter relates only to mortality, there is no measure identified or discussed related to fish injury.

Required Clarification:

Provide clarification on the measurable parameters related to fish injury as considered in the risk analysis of the potential environmental effect of the project on marine fish and fish habitat.

Response:

It is assumed that physical injury to fishes will reduce or eliminate their potential to survive and reproduce. Therefore, in the context of risk analysis, physical injury is treated as equivalent to mortality.

As noted in the response to IR-20, changes to mortality risk and suitable habitat availability form the backbone of assessing potential changes in the community ecology of the entire ecosystem. The goal of an EIS is to define broad categories of Project-related effects that can link Project-related activities to Project-related measurable effects. In the EIS, the measurable parameters are defined in terms of population-level effects. An analysis focused on the identification and mitigation of population-level effects to all species within the ecosystem based on mortality and habitat availability is inherently considering changes in abundance, community structure, or changes in food availability or quantity.

2.3.2 Clarification: CL-06

External Reviewer ID:

DFO-CL-30

Reference to EIS:

Section 6.0

Context and Rationale:

Table 6.4 of the EIS which identified the key fish species from the 2016-2017 Canadian research vessel survey sets within the Regional Assessment Area and the Project Area. However, Figure 7.18 of the EIS indicates that there has been domestic harvesting of Shrimp within the Regional Assessment Area and the Project Area.

Fisheries and Oceans Canada requested clarification on whether the absence of Shrimp was due to low prevalence in the study area, or a result of the use of only 2016 data.

Required Clarification:

Confirm if the absence of Shrimp as a listed key species in the Project Area and Regional Assessment Area is a result the data or due to stock status of the species.

Response:

EIS Table 6.4 appears in EIS Section 6.1.7 Finfish (Demersal and Pelagic Species), therefore the table is focused on finfish species. EIS Section 6.1.5 Pelagic Macroinvertebrates describes the presence of multiple shrimp species in the Regional Assessment Area and Project Area as confirmed by Fisheries and Oceans Canada Research Vessel survey data.

2.3.3 Clarification: CL-07

External Reviewer ID:

DFO-CL-32

Reference to EIS:

Section 6.0;
Section 6.1, Table 6.1;
Section 6.1.7

Context and Rationale:

Fisheries and Oceans Canada noted that in Section 6.0, the term "abundance" was frequently used when discussing weights. Likewise, in Section 6.1, the distinction between Relative Abundance (%) and Average Occurrence (%) is unclear. Fisheries and Oceans Canada advised that in fisheries stock assessment terminology "abundance" is generally employed when discussing numbers of fish with respect to numbers per tow. As such, the use of abundance in this context is somewhat confusing and should be replaced with "biomass" terminology.

For example, Section 6.1.7 (page 6.19), states "The results of the RV survey indicate Deepwater Redfish, Greenland Halibut, Roughhead Grenadier, scyphozoan (marine jellyfish), Roundnose Grenadier, Witch Flounder and Northern Wolffish make up 91% of the catch by weight, with redfish contributing 41% of the abundance by weight. Distribution of the six most abundant fish species in the Project Area are shown in Figures 6.6 to 6.11.". Terminology is confusing as 7 species are listed as making up 91% of the catch by weight while redfish are listed as contributing 41% of the abundance by weight.

Required Clarification:

Define what abundance represents, and clarify if the distribution of the six most "abundant" fish species in the area based upon weight or numbers.

Response:

The general use of the term "abundance" in the EIS is used to refer to either number of fish (relative or otherwise) or as an expression of biomass. Each specific usage of "abundance" depends on the context of the paragraph and/or the definition of the word in the referenced documents.

EIS Figures 6.6 to 6.11 refer to biomass (kg). In the quoted statement above from EIS Section 6.1.7, "catch by weight" and "abundance by weight" are synonymous. For clarity, the statement can be rewritten as follows:

"The results of the RV survey indicate deepwater redfish, Greenland halibut, roughhead grenadier, scyphozoan (marine jellyfish), roundnose grenadier, witch flounder and northern wolffish make up 91% of the catch by weight (biomass), with redfish contributing 41% of the catch by weight (biomass). Distribution of the six most abundant (in terms of biomass) fish species in the Project Area are shown in EIS Figures 6.6 to 6.11."

2.3.4 Clarification: CL-08

External Reviewer ID:

DFO-CL-40

Reference to EIS:

Section 8.3.3

Context and Rationale:

Section 8.3.3. of the EIS states "The lack of bioaccumulation and low toxicity of cuttings substances indicates that direct toxicity of water-based (drilling) mud (WBM) or synthetic-based (drilling) mud (SBM) to benthic fauna is unlikely (IOGP 2016). However, it is difficult to distinguish between cuttings toxicity and the indirect effects on benthic communities caused by sediment alteration and organic enrichment (IOGP 2016)."

Fisheries and Oceans Canada stated that these statements are conflicting; the first sentence indicates that direct toxicity of WBM or SBM to benthic fauna is unlikely, whereas the second sentence indicates that it is difficult to distinguish between cuttings toxicity (which the previous sentence indicated is unlikely) and the indirect effects caused by sediment alteration and organic enrichment.

Further, it could also be argued that sediment alteration and organic enrichment are direct (not indirect) effects upon benthic fauna.

As such, clarification is required on the toxicity of WBM and SBM on benthic fauna.

Required Clarification:

Provide clarification on the direct and indirect effects of SBM and WBM on benthic fauna.

Response:

Water-based mud (WBM) and synthetic-based mud (SBM) discharges may affect benthic fauna through the following pathways (International Association of Oil & Gas Producers 2016):

- Burial
- Short -term elevations in suspended particulate matter and turbidity
- Changes in benthic topography and texture
- Direct toxicity
- Oxygen depletion
- Sediment organic enrichment

To clarify the intent of the quoted passage above, it is difficult to distinguish (i.e., partition cumulative effects) between the causal elements impacting benthic fauna in the field. Field studies have demonstrated limited effects associated with toxicity of drill waste discharges, with adverse effects more likely to result from smothering (Hurley and Ellis 2004; Neff et al. 2004; Neff 2010). Adherence to the Offshore Waste Treatment Guidelines (National Energy Board et al. 2010) and the Offshore Chemical Selection Guidelines (National Energy Board et al. 2009) also reduces the potential for effects from toxicity.

The effects of WBM and SBM accumulation in sediments are typically minor and localized (International Association of Oil & Gas Producers 2016); borne out by the environmental effects monitoring programs conducted in the Newfoundland offshore area (Hibernia Management and Development Company Limited 2017; Suncor Energy 2017; Husky Energy 2016). Further, biological recovery (biodegradation by the microbial community) is typically complete in a matter of a few years. Lab-based studies suggest that modern WBM and SBM have low toxicity to benthic organisms due in part to low bioavailability (Trannum et al. 2011). Long-term (30 years) monitoring of sediment hydrocarbon chemistry in the Beaufort Sea has shown no notable impact from offshore oil and gas activities, although it is noted that WBM and associated drill cuttings are the only types permitted for discharge in the Beaufort Sea. Concentrations of total polycyclic aromatic hydrocarbons (TPAH) were variable but similar to those measured in other marine regions of Alaska where oil activities have not occurred. Sediment TPAH concentrations were below sediment quality guideline values, indicating a low risk of harm to benthic marine communities (Durell and Neff 2019).

In summary, it is recognized that there are various pathways through which the benthic environment may be affected by drilling discharges. However, drill waste deposition modelling (Appendix B of the EIS) predicts a relatively small footprint of benthic environment would be affected per well and these effects will be managed through adherence to the Offshore Waste Treatment Guidelines (National Energy Board et al. 2010) and the Offshore Chemical Selection Guidelines (National Energy Board et al. 2009), and through the conduct of a pre-drill survey to confirm the absence of sensitive environmental features such as habitat forming coral or species at risk (refer to response to IR-32).

References:

Durell, G.S. and J.M. Neff. 2019. Effects of offshore oil exploration and development in the Alaskan Beaufort Sea: Long-term patterns of hydrocarbons in sediments. Integrated Environmental Assessment and Management.15(2):224-236.

Hibernia Management and Development Company Limited. 2017. Hibernia Production Phase Environmental Effects Monitoring Program – Year Nine (2014) Volume 1 – Interpretation. Prepared by Stantec Consulting Ltd. for Hibernia Management and Development Company Limited, St. John’s, NL.

Hurley, G. and J. Ellis. 2004. Environmental Effects of Exploratory Drilling in Offshore Canada: Environmental Effects Monitoring Data and Literature Review-Final Report. Prepared for the Canadian Environmental Assessment Agency-Regulatory Advisory Committee. 61 pp. + App.

Husky Energy. 2019. White Rose 2016 Environmental Effects Monitoring Program. Prepared by Stantec Consulting Ltd. for Husky Energy, St. John’s, NL.

International Association of Oil & Gas Producers. 2016. Environmental fates and effects of ocean discharge of drill cuttings and associated drilling fluids from offshore oil and gas operations. Report 543, Version 1, March 2016. 145 pp.

National Energy Board, Canadian Newfoundland and Labrador Offshore Petroleum Board, and Canada-Nova Scotia Offshore Petroleum Board. 2009. Offshore Chemical Selection Guidelines for Drilling and Production Activities on Frontier Lands. iii + 13 pp.

National Energy Board, Canadian Newfoundland and Labrador Offshore Petroleum Board, and Canada-Nova Scotia Offshore Petroleum Board. 2010. Offshore Waste Treatment Guidelines.

Neff, J.M. 2010. Fates and Effects of Water Based Drilling Muds and Cuttings in Cold-Water Environments. Prepared for Shell Exploration and Production Company, Houston, Texas, x + 287 pp.

Neff, J.M., G. Kjeilen-Eilersten, H. Trannum, R. Jak, M. Smit and G. Durell. 2004. Literature Report on Burial: Derivation of PNEC as Component in the MEMW Model Tool. ERMS Report No. 9B. AM 2004/024. 25 pp.

Suncor Energy. 2017. Terra Nova Environmental Effects Monitoring Program (2014). Prepared by Stantec Consulting Ltd. for Suncor Energy Inc., St. John’s, NL.

Trannum, H.C., H.C. Nilsson, M.T. Schaanning and K. Norling. 2011. Biological and biogeochemical effects of organic matter and drilling discharges in two sediment communities. Marine Ecological Progress series. 442: 233-36.

2.4 Marine Mammals and Sea Turtles

2.4.1 Clarification: CL-09

External Reviewer ID:

DFO-CL-02

Reference to EIS:

Section 2.8.5.5

Context and Rationale:

Table 2.16 in Section 2.8.5.5 of the EIS does not provide units for the 95 percent Horizontal Distance.

Required Clarification:

Provide the units used for 95 percent Horizontal Distance.

Response:

The units used for the 95th percent Horizontal Distance is kilometres (km) (see Table 1 [revised Table 2.16]).

Table 1 EIS Table 2.16 (Revised): Predicted 95% Distances (km) from VSP Operations to rms SPL Sound Level Isopleths for Flemish Pass in May and the Scotian Basin in February and August

rms SPL (dB re 1 µPa)	95% Horizontal Distance ($R_{95\%}$) Predicted in May in Flemish Pass[1] (km)	95% Horizontal Distance ($R_{95\%}$) Predicted in February in the Scotian Basin[2] (km)	95% Horizontal Distance ($R_{95\%}$) Predicted in August in the Scotian Basin (km)
200	0.04 (Sites A & B)	0.04 (Site A & B)	0.04 (Site A & B)
190	0.26 (Site A) 0.14 (Site B)	0.1 (Site A & B)	0.09 (Site A & B)
180	0.4 (Site A) 0.41 (Site B)	0.28 (Site A & B)	0.28 (Site A & B)
170	1.27 (Site A) 1.74 (Site B)	1.78 (Site A) 1.52 (Site B)	1.74 (Site A) 1.52 (Site B)
160	5.26 (Site A) 6.10 (Site B)	3.19 (Site A) 2.83 (Site B)	3.17 (Site A) 2.95 (Site B)

1 Refer to Table 13 in Matthews et al. (2017)
2 Refer to Table 11 in Zykov (2016)
Tables 11 and 13 referenced above also present R_{max} values, which are the maximum range at which a given sound level was encountered in the modelled maximum-over-depth sound field. Figure 8 in Zykov (2016) provides a schematic showing the difference in R_{max} versus $R_{95\%}$ values.

References:

Matthews, M.-N.R., Z. Alavizadeh, L. Horwich and M. Zykov. 2017. Underwater Sound Propagation Assessment: Nexen Energy ULC Flemish Pass Exploration Drilling Project (2018–2028). Document Number 01514, Version 2.0. Technical report by JASCO Applied Sciences for AMEC Foster Wheeler.

Zykov, M.M. 2016. Modelling Underwater Sound Associated with Scotian Basin Exploration Drilling Project: Acoustic Modelling Report. Document Number JASCO Document 01112, Version 2.0. Technical report by JASCO Applied Sciences for Stantec Consulting Ltd..

2.4.2 Clarification: CL-10

External Reviewer ID:

DFO-CL-20

Reference to EIS:

Section 10.3.3.1

Context and Rationale:

Section 10.3.3.1 of the EIS states that "they propose thresholds of 210 dB SEL_{cum} and 207 dB_{peak}, which are consistent with those proposed for fish species whose swim bladder is not involved with hearing. Sound levels from vertical seismic profiling operations are predicted to be below these levels at distances beyond a couple of hundred metres (Matthews et al. 2017)." The reference to VSP levels being below 210 dB SELcum and 207 dB peak within a couple hundred metres cannot be found in Matthews et al., 2017.

Required Clarification:

Provide the reference for vertical seismic profiling levels being below 210 dB SELcum and 207 dB peak beyond a couple hundred metres.

Response:

The reviewer is referred to Tables 11 and 12 in Matthews et al. (2017), where SPL peak values (which are unweighted) for the vertical seismic profiling (VSP) source array are provided. Estimated distances to received sound pressure level (SPL) peak values of 202 dB are at most 120 m. Note that there is an error in Table 12 for high-frequency cetaceans; the SPL peak value of 202 dB should be 0.120 km not 120 km (M.-N. Matthews, JASCO Applied Sciences, pers. comm., 25 March 2019). Likewise, a 210 dB (cumulative sound exposure level) SEL_{cum} sound level (based on modelling results for different marine mammal groups) is unlikely to occur beyond a couple of hundred metres from the source array (see predicted distances for SEL_{cum} in Tables 11 and 12). Furthermore, based on the modelling results for VSP, it is estimated that the range to 210 dB SEL_{cum} unweighted is approximately 200 to 250 m from the centre of the array; this is based on 2,000 pulses of the VSP array (i.e., 24 hours of operation) (M. Zykov, JASCO Applied Sciences, pers. comm., 25 March 2019).

References:

Matthews, M.-N., Z. Alavizadeh, L. Horwich and M. Zykov. 2017. Underwater Sound Propagation Assessment: Nexen Energy ULC Flemish Pass Exploration Drilling Project (2018-2028). Rep. by JASCO Applied Sciences, Dartmouth, NS for Amec Foster Wheeler, St. John's, NL. 54 pp. + Appendices.

2.4.3 Clarification: CL-11

External Reviewer ID:

DFO-CL-21

Reference to EIS:

Section 10.3.3.1

Context and Rationale:

Section 10.3.3.1 of the EIS makes reference to "...sound level isopleths." It is not clear what a sound level isopleth is.

Required Clarification:

Define a "sound level isopleth" as it relates to section 10.3.3.1 of the EIS.

Response:

In general terms an isopleth is a line drawn through all points having the same numerical value. In the case of a sound level isopleth, the line has equal sound pressure or exposure levels (National Oceanographic and Atmospheric Administration 2018).

References:

National Oceanographic and Atmospheric Administration. 2018. Revision to: Technical Guidance for Assessing the Effects of Anthropogenic Sound on Marine Mammal Hearing (Version 2.0): Underwater Acoustic Thresholds for Onset of Permanent and Temporary Threshold Shifts. US Department of Commerce, NOAA Technical Memorandum NMFS-OPR-59, 167 pp.

2.4.4 Clarification: CL-12

External Reviewer ID:

DFO-CL-22

Reference to EIS:

Section 10.3.3.1

Context and Rationale:

Section 10.3.3.1 of the EIS states that “modelling results suggest that if a baleen whale occurs within approximately 5-6 kilometre of the vertical seismic profile air gun array… for a 24-hour period (i.e., the full duration of the VSP survey) there is risk of auditory injury (PTS).” The EIS also references BOEM 2017 to indicate that “…most predicted incidents of auditory injury would occur at greater distances from the source.” It is not clear as to how far from the source would be considered to be a “greater distance” and how this would relate to the 5 to 6 kilometre value provided above.

Required Clarification:

Describe how far from the source a “greater distance” would be from the source of sound and how this would relate to the 5 to 6 kilometre value.

Response:

The intended meaning of the reference to Bureau of Ocean Energy Management (BOEM 2017) is that marine mammals are unlikely to incur permanent threshold shift (PTS) from exposure to air gun pulses at close range (e.g., within the safety zone) because the avoidance reactions of many marine mammals, along with commonly-applied monitoring and mitigation measures (visual monitoring, ramp ups, and shut downs when mammals are detected within or approaching the “safety zone”), would reduce the already-low probability of exposure of marine mammals to sounds strong enough to induce PTS. BOEM (2017) noted that if PTS were to occur based on exposure to seismic survey sound, it would “likely be measured in a few decibel loss in hearing sensitivity, not profound loss” and that it was predicted to occur at distances greater than the immediate area around the air gun array. BOEM (2017) did not reference a specific distance; regardless, this distance would vary based on environmental setting and the specific sound source.

References:

BOEM (Bureau of Ocean Energy Management). 2017. Gulf of Mexico OCS Proposed Geological and Geophysical Activities. Volume I: Chapter 1-9.

2.4.5 Clarification: CL-13

External Reviewer ID:

DFO-CL-09

Reference to EIS:

Section 10.3.3.1

Context and Rationale:

Section 10.3.3.1 of the EIS states that "…repeated, or (in some cases) single exposures to a level well above that causing TTS [temporary threshold shift] onset, might elicit PTS [permanent threshold shift]…" And "United States National Marine Fisheries Service guidelines provide the most current guidance on threshold levels of underwater sound for the onset of TTS and PTS in marine mammals." The levels to elicit PTS are provided in Table 10.4 of the EIS; however, the levels for temporary threshold shift onset are not provided.

Required Clarification:

Provide the threshold levels for onset of temporary threshold shift for auditory injury.

Response:

Table 1 (Table 10.4 from the EIS) is copied below for reference.

Table 1 EIS Table 10.4: Acoustic Threshold Levels for Permanent Threshold Shift Onset

Hearing Group	PTS Onset Threshold Levels (NMFS Acoustic Guidelines [2016[1]])			
	Impulsive Sound		Non-impulsive Sound	
	dB SPL_{peak}	dB SEL_{cum}	dB SPL_{peak}	dB SEL_{cum}
Low-frequency Cetaceans	219	183	219	199
Mid-frequency Cetaceans	230	185	230	198
High-frequency Cetaceans	202	155	202	173
Phocids (in water)	218	185	218	201

Notes:
dB (decibel) SPL_{peak} has a reference value of 1 µPa
dB SEL_{cum} has a reference value of 1 $\mu Pa^2 s$
1 Final guidelines released by NMFS in July 2016 update their draft thresholds (NOAA 2015, 2016) and replace their previous interim dB SPL_{rms} criteria for injury (i.e., 180 dB SPL_{rms} for cetaceans and 190 dB SPL_{rms} for pinnipeds [NOAA n.d.])

No direct measurements of marine mammal permanent threshold shift (PTS) have been published; PTS onset thresholds have been extrapolated from marine mammal temporary threshold shift (TTS) measurements (i.e., using growth rates from terrestrial and marine mammal data) (National Oceanic and Atmospheric Administration [NOAA] 2018 Section II).

For impulsive sounds, the onset of PTS is assumed to be 15 dB or 6 dB higher than TTS when considering SEL_{cum} and SPL_{flat}, respectively. For non-impulsive sounds, the onset of PTS is assumed to be 20 dB higher than TTS when considering SEL_{cum} (NOAA 2018). TTS is not considered an auditory injury; it is more commonly related to a potential behavioural response. TTS is the mildest form of hearing impairment that can occur during exposure to a strong sound (Kryter 1985). While experiencing TTS, the hearing threshold rises and a sound must be stronger in order to be heard. It is a temporary phenomenon, and (especially when mild) is not considered to represent physical damage or "injury" (Southall et al. 2007; Le Prell 2012).

References:

Kryter, K.D. 1985. The Effects of Noise on Man. 2nd ed. Academic Press, Orlando, FL. 688 p.

Le Prell, C.G. 2012. Noise-induced hearing loss: from animal models to human trials. p. 191-195 *In*: A.N. Popper and A. Hawkins (eds.), The effects of noise on aquatic life. Springer, New York, NY. 695 pp.

NOAA (National Oceanic and Atmospheric Administration). Undated. Marine Mammals: Interim Sound Threshold Guidance (webpage). National Marine Fisheries Service, National Oceanic and Atmospheric Administration, US Department of Commerce. Available at: http://www.westcoast.fisheries.noaa.gov/protected_species/marine_mammals/threshol d_guidance.html.

NOAA (National Oceanic and Atmospheric Administration). 2015. Draft Guidance for Assessing the Effects of Anthropogenic Sound on Marine Mammal Hearing: Underwater Acoustic Threshold Levels for Onset of Permanent and Temporary Threshold Shifts. In: National Oceanic and Atmospheric Administration and U.S. Department of Commerce. Revised version for Second Public Comment Period. 180 pp. Available at: http://www.nmfs.noaa.gov/pr/acoustics/draft%20acoustic%20guidance%20July%202015. pdf.

NOAA (National Oceanic and Atmospheric Administration). 2016. Document Containing Proposed Changes to: National Oceanic and Atmospheric Administration Draft Guidance for Assessing the Effects of Anthropogenic Sound on Marine Mammal Hearing- Underwater Acoustic Threshold Levels for Onset of Permanent and Temporary Threshold Shifts. In: National Oceanic and Atmospheric Administration and U.S. Department of Commerce. 24 pp. Available at: http://www.nmfs.noaa.gov/pr/acoustics/draft_guidance_march_2016_.pdf.

NOAA (National Oceanic and Atmospheric Administration). 2018. 2018 Revision to: Technical Guidance for Assessing the Effects of Anthropogenic Sound on Marine Mammal Hearing (Version 2.0): Underwater Acoustic Thresholds for Onset of Permanent and Temporary Threshold Shifts. US Dept. of Commer., NOAA. NOAA Technical Memorandum NMFS-OPR-59, 167 pp.

Southall, B.L., A.E. Bowles, W.T. Ellison, J.J. Finneran, R.L. Gentry, C.R. Greene Jr., D. Kastak, D.R. Ketten, J.H. Miller, P.E. Nachtigall, W.J. Richardson, J.A. Thomas, and P.L. Tyack. 2007. Marine mammal noise exposure criteria: initial scientific recommendations. Aquatic Mammals 33(4):411-522.

2.5 Migratory Birds

2.5.1 Clarification: CL-14

External Reviewer ID:

N/A

Reference to EIS:

Section 9.3.3.1

Context and Rationale:

Section 9.3.3.1 of the EIS states that "To mitigate potential effects from vertical seismic profiling activities, air gun operations will incorporate a ramp-up…to provide an opportunity from diving marine birds to move away". However, later on in the same paragraph it states that above the water, atmospheric sounds from the air gun array is substantially reduced.

It is unclear how the ramp-up would provide mitigation for diving birds as prior to the dive they would be in the air and therefore not hearing the ramp-up.

Required Clarification:

Provide clarification as to how a ramp-up procedure mitigates the effects of noise on marine birds.

Response:

In air, sound from a submerged air gun source array is reduced to a level not causing injury or mortality. However, the in-air sound is audible to birds, as demonstrated by startle responses to seismic source arrays being activated that are routinely visible in gulls and skuas flying near submerged air gun arrays (A. Lang, LGL Limited, pers. obs.). Although the responses seen in diving marine alcids on the surface cannot easily be attributed to being related to either sound from a source array or to the movement of the source vessel, it is reasonable to conclude that they are capable of hearing the source array being activated. Pichegru et al. (2017) documented avoidance behavior by a marine bird species (African penguin), diverting feeding grounds by up to 100 km from a 2D seismic survey, suggesting the birds chose to avoid underwater sound disturbances. Therefore, ramp-ups could alert those diving marine birds that are resting on the surface during the initial part of the ramp-up. In addition, dive durations of common murres measured in various studies average 67 to 101 seconds and reach as high as 153 seconds (Gaston and Jones 1998). As a result, those birds that are not deterred by the first few source pulses of a ramp-up and initiate a dive, would be submerged sufficiently long to hear one or more source pulses during the ramp-up procedure.

References:

Gaston, A. J., and I. L. Jones. 1998. The Auks. Bird Families of the World, Oxford University Press, New York, NY. 349 p.

Pichegru, L., R. Nyengera, A. M. McInnes and P. Pistorius. 2017. Avoidance of seismic survey activities by penguins. Scientific Reports (Nature London), 7: 16305.

2.5.2 Clarification: CL-15

External Reviewer ID:

N/A

Reference to EIS:

Section 14.3.4.2

Context and Rationale:

Section 14.3.4.2 of the EIS states that helicopters will fly a lateral distance of 2 kilometres over active colonies when possible.

Required Clarification:

Clarify the circumstances under which it would not be possible for helicopters to remain at least 2 kilometres from bird colonies.

Response:

Project helicopters will fly at a lateral distance of 2 km from known active bird colonies during routine operations. In the unlikely event of an emergency response, such as a search and rescue event or surveillance and monitoring associated with an oil spill reaching nearshore waters and/or shorelines, there may be circumstances where helicopter use could be required that could result in an impingement of the 2 km buffer. However, in such cases, Environment and Climate Change Canada – Canadian Wildlife Service would be consulted and would be made aware of any special circumstances that may require reduction of the 2 km buffer zone.

2.6 Species at Risk

2.6.1 Clarification: CL-16

External Reviewer ID:

DFO-CL-06

Reference to EIS:

Section 6.1.8, Table 6.6;
Section 8.3.4;
Section 8.3.5

Context and Rationale:

Table 6.6 in Section 6.1.8 of the EIS states there are two species at risk that have a high/moderate potential to occur in the Project Area: Northern Wolffish and Spotted Wolffish. Critical habitat proposed by Fisheries and Oceans Canada for Northern and Spotted Wolffish is comprised of several discontinuous critical habitat areas. The EIS states that cumulatively, the critical habitat for both species is approximately 655.80 square kilometres and partially overlaps with the Project Area however, the EIS does not provide a figure showing the location of the proposed critical habitat in relation to the Project Area and Exploration Licences.

Required Clarification:

Provide a high resolution map that shows the proposed critical habitat for Northern and Spotted Wolffish and any overlap with Exploration Licences.

Response:

Figure 1 depicts the proposed critical habitat for northern and spotted wolffish in relation to the Project Area. None of the proposed critical habitat for spotted wolffish overlaps with the Project Area. Approximately 0.6% of proposed critical habitat for northern wolffish overlaps with the Project Area, although there is no overlap with BP's exploration licences.

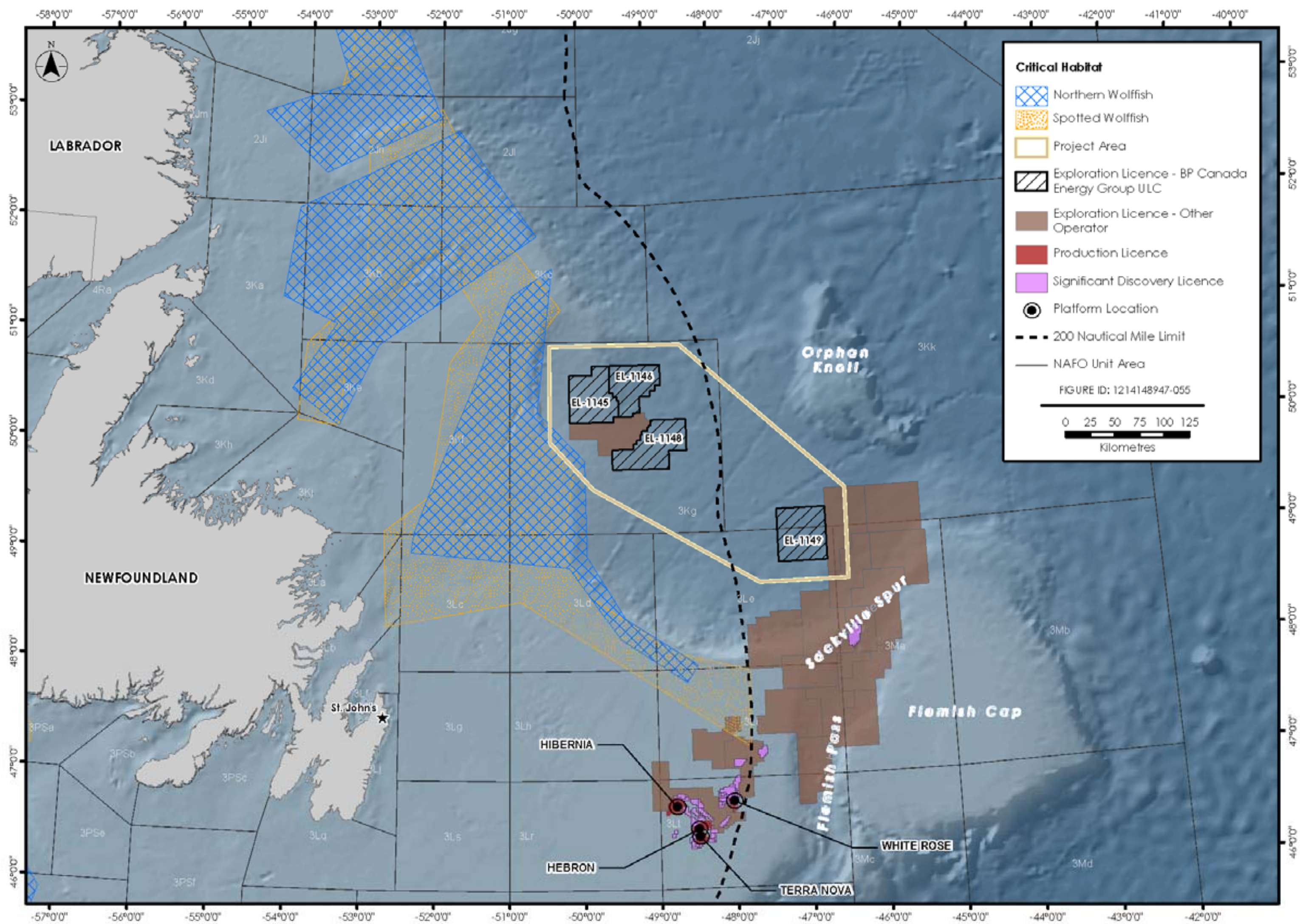

Figure 1 Proposed Critical Habitat for Northern and Spotted Wolffish

2.7 Indigenous Use

2.7.1 Clarification: CL-17

External Reviewer ID:

DFO-CL-17

Reference to EIS:

Section 7.4.2, Table 7.15

Context and Rationale:

Fisheries and Oceans Canada noted the following errors in Table 7.15 in Section 7.4.2 of the EIS:

Innu Nation holds several food, social and ceremonial (FSC) licences for Sheshatshiu and Natuashish for salmon, Arctic char, and trout. This sentence should read: Innu Nation holds two FSC licences one for Sheshatshiu and one for Natuashish covering salmon, Arctic char, and trout.

NCC holds several FSC licences including for salmon, trout, Arctic char, Atlantic cod, rock cod, herring, scallop, whelk, smelt and seal. This sentence should read: The NCC holds two FSC licences for species such as salmon, trout, Arctic char, Atlantic cod, rock cod, herring, scallop, whelk, smelt and seal.

No information is available for FSC licences for the Qalipu Mi'kmaq First Nation. This sentence should read: Qalipu Mi'kmaq First Nation does not hold a FSC licence.

Miawpukek First Nation (MFN) holds several FSC licences for scallop, lobster, mackerel, herring, rainbow trout, brook trout, cod, eels, smelt, capelin, seals (harp, grey, and harbor), snow crab, whelk, and redfish. This sentence should read: The MFN holds one FSC licence for the following species: scallop, lobster, mackerel, herring, rainbow trout, brook trout, cod, eels, smelt, capelin, seals (harp, grey, and harbor), snow crab, whelk, and redfish.

Required Clarification:

Revise Table 7.15 to clarify the number of licences held by the Innu Nation, NCC, Qalipu and MFN.

Response:

EIS Table 7.15 has been updated (Table 1) as indicated by the above comments.

Table 1 EIS Table 7.15 (Updated): Newfoundland and Labrador Indigenous Groups Community Profiles

Community Indicator	Description
Labrador Inuit (Nunatsiavut Government)	
Location and Proximity to Project Area	The Labrador Inuit's traditional territory extends from Cape Chidley in the north, to south of Groswater Bay and west to the Labrador-Quebec border. The Labrador Inuit Settlement Area is approximately 590 km from the Project Area.
General Overview	Following three decades of land claims negotiations between the Labrador Inuit Association (LIA) and the Governments of Canada and Newfoundland and Labrador, the Nunatsiavut Government, an Inuit regional self-government, was established. On December 1, 2005 the *Labrador Inuit Land Claims Agreement* (LILCA) came into effect which sets out the details of land ownership, resource-sharing, and self-government within the established Labrador Inuit Settlement Area (LISA), and provides for harvesting rights in and outside the LISA. Labrador Inuit Lands are approximately 15,800 km² in area, within the LISA boundary. The Nunatsiavut Government represents over 2,524 Labrador Inuit beneficiaries living in five Inuit communities: Nunainguk (Nain), Agvitok (Hopedale), maggovik (Makkovik), KipukKak (Postville) and Tikigiaksaugusik (Rigolet) (Nunatsiavut Government 2017; Sikumiut Environment Management Ltd. 2011). There are 7,133 Labrador Inuit Canada-wide. The Project does not overlap with any of the lands covered by this treaty.
Health and Socio-economic Conditions	The Labrador Inuit communities are accessible and serviced for half the year (from July to November) by ferries operated by the Government of Newfoundland and Labrador and Nunatsiavut Group of Companies (NGC) and regional airlines such as Air Borealis (Statoil 2017). There are schools within each community, administered by the Newfoundland and Labrador English School District. Emergency services are provided to each community through Royal Canadian Mounted Police (RCMP) detachments and volunteer fire brigades in Nain, Rigolet, Makkovik and Hopedale (Nalcor Energy 2011). Each community is visited by a physician every four to six weeks. Dominant industries for the Labrador Inuit include public administration, health care and social assistance, mining and tourism (Nalcor Energy 2011). Major employers are the Torngat Fish Producers Co-op, NGC, the Inuit Community Governments and the Voisey's Bay Mine / Mill (Nalcor Energy 2011).
	As described in more detail below, the Nunatsiavut Government hold several commercial communal licences for a variety of fish and marine species. In Nain, there is a fisheries operation base for the processing of char and turbot (Nalcor Energy 2011). In Postville, employment has been created through the crab, shrimp, and turbot fishery (Town of Postville 2003). There is also a fish plant in Makkovik.
Physical and Cultural Heritage (including archaeological, paleontological, historical, or architectural sites)	The Labrador Inuit, descendants of the prehistoric Thule, are hunters drawn to Labrador for the large number of whales and wildlife, with the earliest ancestors living primarily along the north coast (Nunatsiavut Government 2017). They are culturally and linguistically part of the Inuit peoples who occupy the Arctic and parts of the sub-Arctic from Alaska east across northern Canada, Greenland and the Arctic edges of the former Soviet Union and are the most southern expansion of this culture (Nexen Energy ULC 2018). Pre-contact Inuit lifestyle included harvesting during all seasons for food, clothing, shelter and tools and seasonal migration to follow animals and fish which they depended on (Nexen Energy ULC 2018). From the late 19th century to the early part of the 20th century, Inuit became involved in the market economy and began to earn income from industries focused on trapping and seal hunting, as well as fishing for char, cod, and salmon (Nexen Energy ULC 2018). There are approximately 1,800 known archaeological sites within the land claim area (Torngasok 2013). There are no known sites in or near the Project Area.

Community Indicator	Description
Current Use of Lands for Traditional Purposes	The Labrador Inuit undertake current land and resource use activities on their traditional lands within the LISA. These activities include: hunting for seals, birds, rabbits, caribou, and moose; fishing; ice fishing; and trapping and gathering (Sikumiut Environmental Management Ltd. 2008). Traditional food has important value beyond market criteria, due to its cultural, social, and nutritional qualities, representing an integral part of the Inuit lifestyle (Nexen Energy ULC 2018). Hunting of migratory birds is also an important part of their harvest (Sikumiut Environmental Management Ltd. 2008). Following the ice break-up in the spring, the Inuit also hunt or net harp, ringed, harbour, grey and bearded seals in the outer island areas and in the bays (VBNC 1997). The Labrador Shelf area is fished extensively for crab, rock cod, cod, Arctic char, sculpins, mussels, winkles, and sea urchins (Sikumiut Environmental Management Ltd. 2008). Although there is no commercial salmon fishery, an Indigenous traditional fishery for Atlantic salmon exists in Labrador.
Commercial Communal Fishing	The Nunatsiavut Government hold several commercial communal licences for groundfish, Greenland halibut, seal, scallop, snow crab, shrimp and Arctic char. Groundfish licences are held for NAFO Divisions 2GHJ, 3KL and Greenland halibut may be harvested in 2+3K and 3LMNO (Nexen Energy ULC 2018). Seal licences permit harvesting in Sealing Areas 4 through 33, Atlantic-wide. Scallop licences are issued for Scallop Area 1 off the coast of Northern Labrador, and snow crab licences are issued for Snow Crab Areas 1 and 2 and an Exploratory licence for NAFO 2H (Nexen Energy ULC 2018). Northern shrimp licences are held for Shrimp Areas 4 and 5. The Nunatsiavut Government also has a commercial communal Arctic char licence for the area from Cape Rouge to Cape Chidley in Northern Labrador.
Food, Social, Ceremonial Fishing	The Nunatsiavut Government hold two FSC licences including for trout, salmon, Arctic char, seal and smelt. These species may be harvested in the Upper Lake Melville Area and in the LISA. As per the LILCA (Chapter 13 – Fisheries Chapter of the Agreement), beneficiaries have the right to harvest at any time of the year throughout the LISA for any species or stock of fish or aquatic plant, up to the quantity needed for their FSC purposes. In addition, despite the commercial salmon fishery being closed in Labrador, there is an Aboriginal traditional fishery for Atlantic salmon. The Nunatsiavut Government holds FSC licences for species that may migrate between the Project area and the LISA.
Asserted or Established Aboriginal and / or Treaty Rights	The Labrador Inuit have established Aboriginal rights under Section 35 of the *Constitution Act 1982*, and beneficiaries of the LILCA have treaty rights within the LISA as set out in the Agreement, including the right to harvest species throughout the LISA. In addition, the Agreement allows for a negotiated arrangement for Beneficiaries residing in Labrador, outside of LISA to harvest for food social and ceremonial purposes in tidal waters of Upper Lake Melville, outside of LISA (12E area).
Labrador Innu (Innu Nation)	
Location and Proximity to Project Area	The Labrador Innu reside primarily in two communities: Sheshatshiu in Central Labrador and Natuashish on the North Coast (Statoil 2017). Small numbers of Innu also reside in Happy-Valley Goose Bay, Labrador (Statoil 2017). The Labrador Innu land claim is approximately 535 km from the Project Area.

Community Indicator	Description
General Overview	In September 2008, the Government of Newfoundland and Labrador and Innu Nation announced the signing of the *Tshas Petapen* (“New Dawn”) Agreement. This Agreement resolved key issues between Innu Nation and the Province related to the Innu land claim, as well as impacts and benefits related to past and proposed hydroelectric developments in western and central Labrador (Statoil 2017). Since that time, the provincial and federal governments and the Innu Nation have completed detailed agreements on tripartite Labrador Innu Land Rights Agreement-in-Principle (AIP), which was signed by all three parties in 2011 (Labrador and Aboriginal Affairs Office n.d.). In 2017, the population of the Innu of Labrador was approximately 2,700 (Nexen Energy ULC 2018). Sheshatshiu, located on the south bank of North West River, formed part of the community of North West River until 1979, at which time the Innu established a separate community which is now a reserve with an elected Chief and Band Council. The community of Natuashish was formed following the Innu’s relocation from the previous community at Utshimassit (Davis Inlet) and is now a reserve with an elected Chief and Band Council. The Project does not overlap with any lands claimed by the Labrador Innu.
Health and Socio-economic Conditions	Sheshatshiu and Natuashish are relatively small communities that offer services and infrastructure to their members and residents. Sheshatshiu, the largest Innu community in Labrador, is 40 km by road from Happy Valley-Goose Bay and accessible year-round. The Natuashish community is approximately 300 km north of Happy-Valley Goose Bay and only accessible by plane or boat. Within Sheshatshiu, an elementary-secondary school, Sheshatshiu Innu School, accommodates approximately 400 students from kindergarten to grade 12 (Innu Education Inc. 2014). The community of Natuashish also has a school, the Mushuau Innu Natuashish School, accommodating approximately 450 students from kindergarten to grade 12 (Innu Education Inc. 2014). Both schools are administered by the Innu School Board. The RCMP provides emergency services to both communities. In Sheshatshiu, the RCMP and Health Canada have collaborated to establish a Sheshatshiu Crisis Intervention Team to support members of the community in times of crisis (Nalcor Energy 2011). There is a fire hall with two fire fighting vehicles in Natuashish (Nalcor Energy 2011). The Labrador Grenfell Regional Health Authority provides health and community services to both communities. In Sheshatshiu, the Health Authority and the Sheshatshiu Innu Health Commission operate a community health clinic with basic trauma and resuscitation equipment (Statoil 2017). In Natuashish, the Health Authority, in partnership with Mushuau Innu Health Commission, operate a community health clinic with an emergency room bed, basic trauma and resuscitation equipment and a defibrillator (Statoil 2017). The Innu Business Development Centre was created to establish businesses and contribute to Innu communities. Innu Nation has invested in a variety of businesses including accommodation and food services, aircraft services, arts, entertainment, recreation, automotive, construction, waste management, forestry, and tourism. As described in more detail below, Innu Nation holds several commercial communal licences for a variety of fish and marine species. Ueushuk Fisheries Ltd., hold a mid-shore groundfish licence for various areas and a shrimp licence.

Community Indicator	Description
Physical and Cultural Heritage (including archaeological, paleontological, historical, or architectural sites)	The Labrador Innu are descendants from Algonkian-speaking hunter-gathers (Heritage Newfoundland and Labrador 2018). Traditionally, the Labrador Innu were a nomadic people; however, following the establishment of Innu settlements in the 1960s, traditional land use and harvesting practices changed considerably. In terms of culture and language, the Innu are the easternmost group of a very widespread people known as the Cree (Heritage Newfoundland and Labrador 2018). Labrador Innu culture and heritage are focused on their relationship to game animals, particularly caribou, which are the focus of their philosophical and religious beliefs (Heritage Newfoundland and Labrador 2018). Nearly 500 Innu archaeological sites are known to be throughout Northern, central and Western Labrador. These sites are generally in inland and coastal areas and were often discovered in relation to developments such as communities, roads, railway, and mining areas. There are no known sites in or near the Project Area.
Current Use of Lands for Traditional Purposes	The Labrador Innu undertake current land and resource use activities on their traditional lands within Labrador (headwaters of Eagle River; the area bounded by Winnokapau Lake, Smallwood Reservoir, Seal Lake and Nipishish Lake; Shipiskan Lake, Snegamook Lake, and Shapio Lake) and parts of Quebec. These activities include: hunting for caribou, black bear, and small game; fishing; trapping; and gathering of wild foods. Hunting of migratory birds such as geese, eider ducks, and turrs is also an important aspect of their harvest. Important bird harvesting areas include near the Trans Labrador Highway, west of Churchill Falls, and the Labrador Shelf (Sikumiut Environmental Management Ltd. 2008). Innu also hunt seal in the spring, summer, and fall (VBNC 1997).
Commercial Communal Fishing	Innu Nation holds several commercial communal licences for groundfish, mackerel, capelin, shrimp, and halibut. Innu Nation hold licences for groundfish in NAFO 0, 2GHJ, 3KL, groundfish (mobile gear) in NAFO 2GHJ, 3KL, mackerel and capelin in Fishing Areas 1 to 11, and shrimp in Shrimp Area 4. Ueushuk Fisheries Limited hold a mid-shore groundfish licence for various areas for harvesting of a variety of species. Ueushuk Fisheries Ltd. also hold a shrimp licence for Shrimp Areas 6 and 7.
Food, Social, Ceremonial Fishing	Innu Nation holds two FSC licences one for Sheshatshiu and one for Natuashish covering salmon, Arctic char, and trout. The Natuashish fishing area includes all tidal waters of Labrador extending north and east from Cape Harrigan and south and east of Anaktalik Bay. The licence is restricted to these areas and within the 12-nautical mile limit. The Sheshatshiu fishing area includes all tidal waters of Labrador extending from Fish Cove Point, north to Cape Harrison, including Lake Melville and the inland waters of Little Lake and Grand Lake in Upper Lake Melville. The licence is restricted to these areas and within the 12-nautical mile limit. Despite the commercial salmon fishery being closed in Labrador, there is an Aboriginal traditional fishery for Atlantic salmon.
Asserted or Established Aboriginal and / or Treaty Rights	Innu Nation claim Aboriginal rights and title to most of Labrador and parts of Quebec. Innu Nation asserts Aboriginal rights to land and resources within Labrador and to resources along the Labrador coast, including the right to hunt, fish, and gather throughout its traditional territory.
NunatuKavut Community Council (NCC)	
Location and Proximity to Project Area	The NunatuKavut Community Council (NCC) claims traditional territory that extends from Central to Southeastern Labrador. NCC members primarily reside in southern and central Labrador, particularly along the southeast coast. The territory is approximately 390 km from the Project Area.

Community Indicator	Description
General Overview	Originally established as the Labrador Metis Association in 1985, the NCC is the governing body, representing a membership of over 6,000 Inuit of south and central Labrador, collectively known as the Southern Inuit of NunatuKavut (NCC 2013). The NCC has asserted a land claim, covering most of Central and Southeastern Labrador (NCC 2013). To date, this claim has not been accepted for negotiation by the federal or provincial governments. Members primarily reside in Cartwright, Paradise River, Charlottetown, Pinsent's Arm, William's Harbour, Black Tickle / Domino, Norman Bay, Port Hope Simpson, St. Lewis, Mary's Harbour and Lodge Bay (Statoil 2017; Russell 2018). Census data are not available for NCC members as a group. In 2016, the population of these communities range from 15 (Paradise River) to 572 (Cartwright), with five communities (Paradise River, Pinsent's Arm, William's Harbour, Norman Bay and Lodge Bay) having fewer than 100 people (Martin et al. 2012). The Project does not overlap with any lands claimed by the NCC.
Health and Socio-economic Conditions	The Trans-Labrador Highway (TLH) serves the southeast coast of Labrador. Most communities are accessibly by road via the TLH (Nalcor Energy 2011), while some communities are only accessible by plane or boat. During the winter months, a 1,500 km winter trail system connects Southern Labrador to all communities in Labrador and provides the only transportation link for many otherwise unconnected coastal communities (Nalcor Energy 2011). Some communities have road access, airstrips, basic municipal services (i.e., waste removal and water supply) and nursing clinics while others do not (Martin et al. 2012). Health, policing, and education services also vary. RCMP travel to communities periodically from locations such as Mary's Harbour and Cartwright (Martin et al. 2012). Most communities have schools, but Paradise River, William's Harbour, Pinsent's Arm and Lodge Bay do not. Students from Pinsent's Arm and Lodge Bay travel to St. Mary's All Grade School in Mary's Harbour (Martin et al. 2012). Many of the communities have medical clinics, operated by Labrador-Grenfell Regional Health Authority. Clinics typically provide primary health care services and are staffed with nurses (Nalcor Energy 2011). Generally, a physician and dentist visit each community every six weeks. The NCC is invested in seasonal and year-round businesses including hotels, motels, bed and breakfasts, convenience stores and gas bars (Martin et al. 2012). As described in more detail below, the NCC holds several commercial communal fishing licences for a variety of fish and marine species. The major employer in southern Labrador communities is the fishery. Employing hundreds of individuals, the Labrador Fisherman's Union Shrimp Company has processing facilities in Cartwright, Charlottetown, Pinsent's Arm, Mary's Harbour and L'Anse au Loup (Labrador Shrimp Company 2014). NDC Fisheries Limited hold quotas for 450,000 lbs. of snow crab as well as shrimp quotas and is required to hire NunatuKavut members as crew.
Physical and Cultural Heritage (including archaeological, paleontological, historical, or architectural sites)	In the 17^{th} Century, contact was made between the Labrador Inuit and Europeans. In southern Labrador, these interactions were based on the trade with seasonal fishers and whalers (Statoil 2017). As early as 1775, the first generation of people of mixed descent between the Labrador Inuit and European fur traders appeared (Nalcor Energy 2010). Over time, the population grew, and settlements were established throughout central and southern Labrador (Nalcor Energy 2010). In terms of culture, NCC members' practices and resources are focused on the lands and waters of Labrador. There are no known heritage sites in or near the Project Area.

Community Indicator	Description
Current Use of Lands for Traditional Purposes	Members of the NCC place a strong emphasis on the importance of traditional food. The core areas traditionally used by NCC members for current land and resource use activities are focused on central and southeastern Labrador, including the Churchill River Valley and extending from the Sandwich Bay region, south to Port Hope Simpson and Williams Harbour, and west to the area of the Paradise and Eagle rivers (Nalcor Energy 2011). These activities include: hunting for caribou, moose, bear, hare and porcupine; fishing; trapping marten; and plant harvesting. Hunting of migratory birds such as sea duck and turr, is also an important aspect of their harvest. Important bird harvesting areas include the islands of the Backway, Table Bay, and St. Peter's Bay (Statoil 2017). The NCC establishes annual *Spring Bird / Egg Harvest and Conservation Guidelines*, which specify the opening and closing of dates, the seasonal take of birds and gull eggs that may be harvested per household, and any associated restrictions (NCC 2013). Members of NCC also harvest marine mammals, with seals providing income and a source of meat and oil (Russell 2018).
Commercial Communal Fishing	The NCC holds several commercial communal licences for groundfish, shrimp, snow crab, capelin, herring seal, scallops, and toad crab. NDC Fisheries (Nunacor) also holds several commercial communal licences and operates enterprises for groundfish in NAFO 2GHJ, 3KL, and 4RS, scallop in Scallop Areas 1 and 2, shrimp in Shrimp Area 6 as well as for whelk, northern shrimp, snow crab, capelin, herring and toad crab in southern Labrador. The NCC also holds two seal harvesting licences in Seal Fishing Areas 4 to 33 (Atlantic-wide).
Food, Social, Ceremonial Fishing	The NCC holds two FSC licences for species such as salmon, trout, Arctic char, Atlantic cod, rock cod, herring, scallop, whelk, smelt and seal. Fishing areas are Fish Cove Point and Cape Charles in Labrador and Upper Lake Melville but is restricted to these areas and within the 12-nautical mile limit. NCC members also fish throughout central and southeastern Labrador, Happy Valley-Goose Bay, Grand Lake and its tributaries, Sebaskachu Bay and Sebaskachu River, Mud Lake, Traverspine River, the mouths of Caroline Brook, McKenzie River, and lakes south of the Churchill River for Atlantic salmon. Despite the commercial salmon fishery being closed in Labrador, there is still an Aboriginal traditional fishery for Atlantic salmon.
Asserted or Established Aboriginal and / or Treaty Rights	The NCC asserts Aboriginal and treaty rights to land and resources within Labrador and to resources along the Labrador coast, including the right to hunt, fish, and gather throughout its traditional territory.
Qalipu Mi'kmaq First Nation	
Location and Proximity to Project Area	Qalipu Mi'kmaq First Nation members live in 67 communities in Newfoundland, with satellite administrative offices in Glenwood, Grand Falls-Windsor, and St. George's. The Nation's central administrative office is in Corner Brook (Qalipu First Nation 2016). Qalipu Mi'kmaq First Nation communities are approximately 346 km from the Project Area.
General Overview	In 2008, the Government of Canada and the Federation of Newfoundland Indians (FNI) signed the Agreement of Recognition of the Qalipu Mi'kmaq Indian Band to establish a landless band for the Mi'kmaq of Newfoundland (Indigenous and Northern Affairs Canada INAC) 2017). The Qalipu Mi'kmaq do not have any recognized Aboriginal or treaty rights. The Agreement is not a treaty within the meaning of section 25 and section 35 of the *Constitution Act, 1982*. The signed Agreement initiated the enrolment process, with approximately 25,000 applications received within the first year (Qalipu First Nation 2016). The Qalipu Mi'kmaq First Nation have not signed treaties with the Crown and there is no land base associated with the Qalipu First Nation. In September 2011, the Qalipu was established as an Indian band under the *Indian Act* and 23,877 members were found eligible and registered as founding members (Qalipu First Nation 2016). The Project does not overlap with the 67 communities inhabited by members.

Community Indicator	Description
Health and Socio-economic Conditions	Because Qalipu members live in over 60 communities in Newfoundland, consolidated information and services, economic conditions, and community health is not readily available. Members access services and programs provided by municipal and provincial agencies, private businesses and services agencies in communities and regions where they reside. Economic and corporate development are led by the Qalipu Development Corporation (QDC) (Qalipu First Nation 2016). Qalipu First Nation has several wholly-owned commercial enterprises including Mi'kmaq Commercial Fisheries Incorporated (MCF), Qalipu Management Services Incorporated (QMS), Qalipu Marine Holdings (QMH) and Qalipu Project Support Services Limited (QPSS). Business partnerships have been negotiated and implemented between Qalipu and several different construction firms. Marine Contractors Inc. Qalipu was created as a partnership between Qalipu and Marine Construction to enable Qalipu to bid on civil construction opportunities from Emera NL. Other business entities are Qalipu Project Support Services, Qalipu Safety and Industrial Supply, and Eastern Door Logistics. In 2016-2017, the Band earned revenues of $10.2 million and had total expenditures of $9.6 million (Qalipu First Nation 2017). As described in more detail below, the Qalipu Mi'kmaq First Nation and MCF hold several commercial communal fishing licences for a variety of fish and marine species. Additionally, the Qalipu Mi'kmaq First Nation and the Miawpukek First Nation (MFN) have developed a joint fisheries initiative, Mi'kmaq Alsumk Moiwimsikik Koqoey Association (MAMKA). MAMKA also hold commercial communal licences for different fish and marine species.
Physical and Cultural Heritage (including archaeological, paleontological, historical, or architectural sites)	Historical evidence demonstrates that the Mi'kmaq were living in Newfoundland by the 16th century; by the 17th century there are increasing historical references (Heritage Newfoundland and Labrador 2018). From 1600 to 1700, Mi'kmaq families hunted, fished, and trapped along Newfoundland's southwest coast to Placentia Bay (Pastore 1998). Families would travel back and forth between Cape Breton and Newfoundland (Pastore 1998). In the early 19th century, their range further expanded to include most of the interior of Newfoundland, for hunting and trapping purposes (Pastore 1998). Limited publicly-available information exists on historic and cultural Qalipu sites; however, one has been identified (seal rocks near the Town of St. George's on the west coast (St. George's Indian Band 2017). Currently, there are 21 known Mi'kmaq archaeological sites in interior and coastal Newfoundland between the Port au Port peninsula and Clarenville (Inside Newfoundland and Labrador Archaeology 2013). In terms of culture, Qalipu First Nation's practices and resources are focused on the lands and waters of the Island of Newfoundland. There are no known heritage sites in or near the Project Area.
Current Use of Lands for Traditional Purposes	The Qalipu undertake current land and resource use activities on their traditional lands which are extensive areas of land, sea, and water. These activities include hunting for caribou, moose, partridge and snowshoe hares, fishing, and harvesting of wild berries (Emera Newfoundland and Labrador 2013). Hunting of marine and migratory birds such as turr is also considered an important traditional activity. The harvesting of seals and groundfish is of lesser importance, but still practiced (Emera Newfoundland and Labrador 2013).
Commercial Communal Fishing	The Qalipu hold several commercial communal licences for lobster, snow crab, mackerel, herring, squid, scallops, capelin, whelk, shrimp, eel, smelt and bait. Lobster fishing licences are for LFA 4B, 13A, and 13B and snow crab licences are for Snow Crab Areas 4, 12, 12C, 12E and 12F. MAMKA also holds several commercial communal licences for snow crab, herring, capelin, lobster, and bait. MAMKA also holds a commercial communal scallop licence.
Food, Social, Ceremonial Fishing	Qalipu Mi'kmaq First Nation does not hold an FSC licence.

Community Indicator	Description
Asserted or Established Aboriginal and / or Treaty Rights	At this time, BP is unaware of the Qalipu expressing any asserted or established Aboriginal and/or treaty rights.
Miawpukek First Nation (MFN)	
Location and Proximity to Project Area	Miawpukek Mi'kamawey Mawi'omi First Nation (Miawpukek First Nation or MFN)) is comprised of one reserve, located at the mouth of the Conne River on the south coast of Newfoundland and Labrador (BP 2017; Statoil 2017). The Miawpukek First Nation community is approximately 460 km from the Project Area.
General Overview	Samiajij Miawpukek is approximately 224 km south of Gander with an area of 1666 ha (BP 2017). According to traditional oral history, the Samiajij Miawpukek community was established in 1870. It was officially designated as Samiajij Miawpukek Indian Reserve under the *Indian Act* in 1987 (Miawpukek First Nation 2017). In 2013, MFN signed a Self-Government Agreement-in-Principle with the provincial government, giving them the opportunity to govern their internal affairs and assume greater responsibility and control over decisions that affect their community. The Agreement is not considered a treaty or a land claims agreement within the meaning of sections 25 and 35 of the *Constitution Act, 1982*; however, it is an important component to self-government for the Miawpukek First Nation (Government of Newfoundland and Labrador 2013). The registered population of the Miawpukek First Nation is more than 3,000 individuals, with nearly 28% living on-reserve (INAC 2017). The Project does not overlap with the reserve lands.
Health and Socio-economic Conditions	The MFN community is accessible year-round by road. In 2017, a new school was opened in the community, accommodating 180 students from kindergarten to grade 12. The school also houses a dental office and daycare centre. Since 1975, MFN has been providing health services to the community. The Conne River Health and Social Services (CRHSS) designs and delivers a range of community-based programs such as a medical clinic, wellness centre, youth centre and nutrition centre (CRHSS 2008). The MFN community owns and operates small businesses such as Christmas tree farms, hunt camps and small fisheries, and the Miawpukek Gas Bar and Convenience Store (INAC 2012). The MFN has partnered with several outside communities and corporations in ventures including tourism and aquaculture (INAC 2012). The MFN also owns and operates the Jipuijij'kuei Kuespem Nature Park which provides camping, kayak / canoe rentals, walking trails and float plane charters (Explore Newfoundland and Labrador 2010). As described in more detail below, the MFN hold several commercial communal licences for a variety of fish and marine species.
Physical and Cultural Heritage (including archaeological, paleontological, historical, or architectural sites)	Some historical evidence exists demonstrating that the Mi'kmaq were living in Newfoundland by the 16th century, and by the 17th century there are increasing historical references (Heritage Newfoundland and Labrador 2018). From 1600 to 1700, Mi'kmaq families hunted, fished, and trapped along Newfoundland's southwest coast to Placentia Bay (Pastore 1998). Families would travel back and forth between Cape Breton and Newfoundland (Pastore 1998). In the early 19th century, their range expanded to include most of the interior of Newfoundland, for hunting and trapping purposes (Pastore 1998). Currently, there are 21 known Mi'kmaq archaeological sites in interior and coastal Newfoundland between the Port au Port peninsula and Clarenville (Inside Newfoundland and Labrador Archaeology 2013). In terms of culture, Miawpukek First Nation's practices and resources are focused on the lands and waters of the Island of Newfoundland. There are no known sites in or near the Project Area.

Community Indicator	Description
Current Use of Lands for Traditional Purposes	The Mi'kmaq continue to use extensive areas of land, sea, and water for recreational and subsistence purposes such as hunting for caribou, moose, partridge and snowshoe hares; fishing; and harvesting of wild berries (Emera Newfoundland and Labrador 2013). Hunting of marine and migratory birds such as turr is also an important traditional activity. The harvesting of seals and groundfish is of lesser importance (Emera Newfoundland and Labrador 2013).
Commercial Communal Fishing	The MFN holds several commercial communal licences for groundfish, capelin, herring, mackerel, snow crab, squid, swordfish, scallop, bluefin tuna and other tuna species, and seal. MFN has nine enterprises that permit access to NAFO 3KL, three tuna licences permitting access to 3LN, and one seal licence permitting access to Seal Fishing Areas 4-33 (Atlantic-wide). The First Nation also holds licences for sea cucumber and whelk in NAFO 3Ps. In addition, MFN holds tuna and swordfish licences for the Scotia-Fundy region.
Food, Social, Ceremonial Fishing	The MFN holds one FSC licence for the following species: scallop, lobster, mackerel, herring, rainbow trout, brook trout, cod, eels, smelt, capelin, seals (harp, grey, and harbor), snow crab, whelk, and redfish.
Asserted or Established Aboriginal and / or Treaty Rights	The MFN assert Aboriginal rights, including the right to hunt, fish, and gather.

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2.7.2 Clarification: CL-18

External Reviewer ID:

DFO-CL-18

Reference to EIS:

Section 6.1.9

Context and Rationale:

Section 6.1.9 of the EIS states "All of these Atlantic Salmon populations, except the Inner Bay of Fundy population, have the potential to occur in the Project Area". It cannot be said with certainty that the Inner Bay of Fundy population will not occur in the Project Area.

Required Clarification:

Clarify the uncertainty related to the occurrence of the Inner Bay of Fundy population of salmon in the Project Area.

Response:

It is correct that one cannot state with absolute certainty that Inner Bay of Fundy (IBoF) salmon are not in the Project Area. However, as detailed and referenced in EIS Section 6.1.9, the available evidence suggests this population tends to remain in the Gulf of Maine during the marine phase of its life cycle. As described in Lacroix (2013), recent satellite tags confirm that the general home range of IBoF salmon (kelts) extends to the Gulf of Maine and the southern shores of Nova Scotia. However, given the available data, certainty regarding marine habitat use and migration pathways cannot be guaranteed. Data on genetic differentiation of stocks contained within both the Labrador coastal fishery (Bradbury et al. 2015) as well as the Saint Pierre and Miquelon fishery off southern Newfoundland (Bradbury et al. 2016) identified a potential IBoF genetic signature in these areas. While the proportion was very low relative to other identified stocks, it does suggest that IBoF salmon may be among those adults returning from both staging areas. Both the genetic research and the telemetry studies show that IBoF salmon are primarily limited to the Bay of Fundy and southern shores of Nova Scotia. However, based on the above information and application of the precautionary principle, the quoted passage should now read:

"All of these Atlantic salmon populations have the potential to occur in the Project Area; however the presence of IBoF salmon is considered unlikely."

References:

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2.8 Commercial Fisheries

2.8.1 Clarification: CL-19

External Reviewer ID:

N/A

Reference to EIS:

Section 7.2.7.1

Context and Rationale:

Section 7.2.7.1 of the EIS indicates that in terms of international harvesting, the Northern Shrimp fishery in NAFO Unit Areas 3MLNO is subject to a moratorium. This would exclude northern shrimp harvest in a portion of the Project Area that overlaps NAFO Unit Area 3MLNO.

However, as illustrated in Figure 13.1 of the EIS, a portion of the Project Area, and portion of Exploration Licence 1149 is in NAFO Unit Area 3K, which is not subject to a moratorium. In addition, Table 7.7 of the EIS indicates that Northern Shrimp were harvested in 3K between 2012 and 2017. However, it is not clear of the harvest in those years is a result of the domestic fishery within the exclusive economic zone (illustrated in Figure 7.19), or if a portion of the harvest was fished outside the exclusive economic zone.

Required Clarification:

Confirm if there has been a targeted Northern Shrimp fishery conducted by international harvesters in NAFO Unit Area 3K outside the Canadian exclusive economic zone that overlap with the project area. If there has been harvest by international fleets of Northern Shrimp in the project area outside the exclusive economic zone, confirm if there has been harvest of Northern Shrimp in Exploration Licence 1149. Update the effects assessment, if required.

Response:

Based on NAFO data from 2012-2017, there are no catches of northern shrimp (prawn) by international harvesters in NAFO Unit Area 3K. Data showing catches for northern prawn in Table 7.7 were attributed to domestic fishery within the exclusive economic zone. For further details on the updated International Fisheries section, please refer the response for IR-64.

2.8.2 Clarification: CL-20

External Reviewer ID:

DFO-CL-12

Reference to EIS:

Section 7.2.3

Context and Rationale:

Section 6.1.9.2 of the EIS Guidelines require the proponent to describe current and historical use of waters, including commercial fisheries activities. Fisheries and Oceans Canada noted that the data provided in Section 7.2.3, Table 7.2 and 7.3 and Figure 7.2, 7.3, and 7.4 indicates that the catch in the Project Area includes data from NAFO 3Ld rather than NAFO Unit Area 3Le as would be expected for the location of this Project.

Required Clarification:

Confirm if the data presented in Section 7.2.3, Table 7.2 and 7.3 and Figure 7.2, 7.3, and 7.4 include data from NAFO 3Ld rather than NAFO Unit Area 3Le. If data from NAFO Unit Area 3Le has not been included, revise the related figures and tables to present the information on the harvest from the correct NAFO Unit Areas that overlap with the Project Area.

Response:

Data from NAFO Unit Area 3Ld, instead of 3Le, was used for table and calculations in EIS Section 7.2.3. EIS Tables 7.2 and 7.3 have been updated (Tables 1 and 2, respectively), as well as EIS Figures 7.3 and 7.4 (Figures 1 and 2, respectively).

Revised Section 7.2.3.1 Domestic Fishing within the Project Area

Within the Project Area, domestic commercial fishing activity appears to be focused primarily on groundfish species, along with northern shrimp and snow crab. The Project Area falls within the Northeast Newfoundland Slope closure marine refuge area which, as of December 2017, is closed to all bottom contact fishing activities. There were ten species fished commercially within the Project Area between 2012 and 2016: Greenland halibut, redfish, grey sole / witch flounder, Atlantic halibut, American plaice, rough-head grenadier, Atlantic cod, skate, snow crab and northern shrimp. EIS Tables 7.2 and 7.3 illustrate the publicly available data for landings weight and value, in order to help distinguish the more valuable fisheries occurring within the Project Area. *Greenland halibut is the top harvested species by weight, accounting for 43 % of landed weight of commercial fish catch within the Project Area between 2012 and 2016. However, snow crab is the fishery with the highest value, accounting for 55% of landed value between 2012 and 2016. Greenland halibut and northern shrimp are the next most valuable fisheries at 36% and 8% of total landed value, respectively. Remaining groundfish species account for less than 1% of the total landed weight and landed value.*

Table 1 EIS Table 7.2 (Updated): Domestic Offshore Harvest by Species within the Project Area, 2012 to 2016, Annual Weight (t)

Species	2012	2013	2014	2015	2016	Total	Percent of Total
Turbot / Greenland Halibut	2,069	1,652	1,722	1,407	1,735	8,586	43
Crab, Queen/Snow	1,143	1,373	1,253	1,382	2,984	8,136	41
Shrimp, *Pandalus borealis*	1,370	1,313	274	222	78	3,256	16
Redfish	14	10	1	1	2	27	0
Grenadier, Rough-Head	7	-	-	-	-	7	0
Halibut – Atlantic	0	0	0	0	0	2	0
Skate	1	-	-	-	-	1	0
Greysole / Witch	1	-	-	-	-	1	0
American Plaice	-	-	-	-	-	N/A	N/A
Cod, Atlantic	-	-	-	-	-	N/A	N/A

Table 2 EIS Table 7.3 (Updated): Domestic Offshore Harvest by Species within the Project Area, 2012 to 2016, Annual Value ($)

Species	2012	2013	2014	2015	2016	Total	Percent of Total
Crab, Queen / Snow	4,913,295	5,950,573	6,463,968	7,528,037	19,577,629	44,433,502	55
Turbot / Greenland Halibut	7,334,214	4,861,121	5,040,027	5,310,639	6,572,527	29,118,529	36
Shrimp, *Pandalus Borealis*	2,234,835	2,690,604	560,597	861,857	244,879	6,592,772	8
Redfish	11,054	6,769	487	339	1,566	20,214	0
Halibut – Atlantic	336	3,808	3,129	1,858	5,477	14,608	0
Grenadier, Rough-Head	2,031	-	-	-	-	2,031	0
Skate	914	-	-	-	-	914	0
Greysole / Witch	578	-	-	-	-	578	0
American Plaice	-	-	-	-	-	0	0
Cod, Atlantic	-	-	-	-	-	0	0

Updated EIS Figures 7.3 and 7.4 (Figures 1 and 2, respectively) show the level of fishing activity for both weight and value that has taken place in the Project Area (PA) and Regional Assessment Area (RAA) from 2012 to 2016.

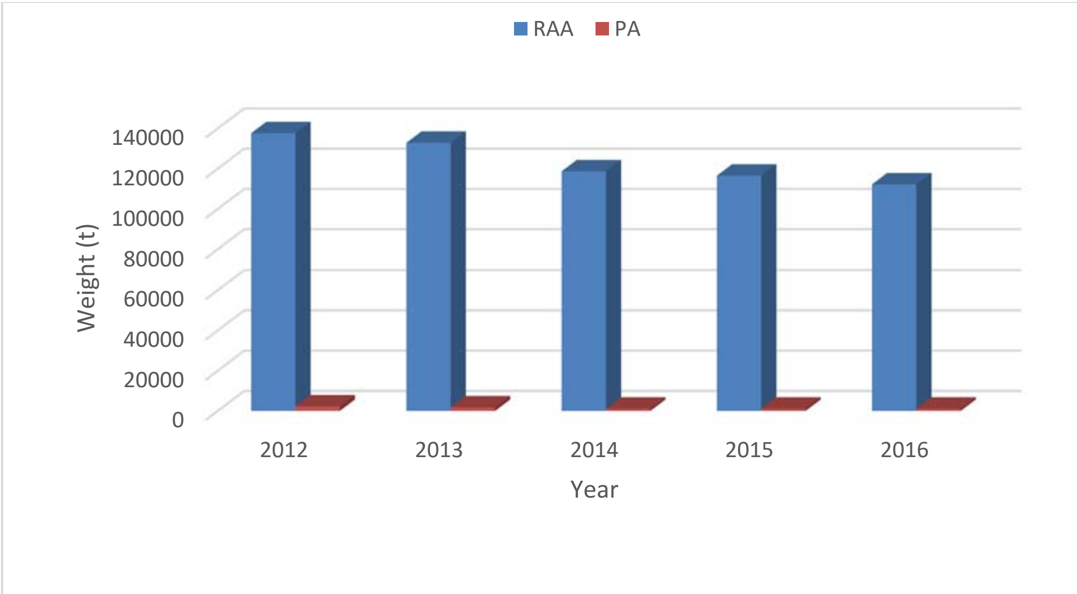


Figure 1 **EIS Figure 7.3 (Updated): Quantity of Harvest by Year, Project Area and RAA, All Species, 2012 to 2016**

Figure 2 **EIS Figure 7.4 (Updated): Value of Harvest by Year, Project Area and RAA, All Species, 2012 to 2016**

2.9 Accidents and Malfunctions

2.9.1 Clarification: CL-21

External Reviewer ID:

DFO-CL-26

Reference to EIS:

Section 15.4.7.1

Context and Rationale:

Section 15.4.7.1 of the EIS includes the statement "In addition, the plume trap height occurs at much greater water depth than for the East Orphan well blowout scenarios, therefore the oil is dispersed and diluted more readily to concentrations below the threshold level, reducing the footprint."

Fisheries and Oceans Canada advised that the statement needs clarification, as the West Orphan Basin site is shallower (1360 metres) than the East Orphan Basin site (2785 metres).

Additionally, the statement referenced from Section 15.4.7.1 does not align with information presented in Section 1 of Appendix D, which states the following:

"… occurs at much greater water depth for the East Orphan well blowout scenarios…"Clarification related to the plume trap height at each blowout scenario is required.

Required Clarification:

Provide clarification on the depths of the plume height termination for overboard discharges and for each well blowout scenario, in relation to each other, confirming if the statement in Section 15.4.7.1 should read "… occurs at much greater water depth for the East Orphan well blowout scenarios…".

Response:

The Terminal Level for Plume Dynamics (TLPD) occurs at about 535 m below sea-level for the West Orphan well blowout scenarios (Appendix D, Section 7.2.1.1) and 2,435 m below sea-level for the East Orphan well blowout scenarios (Appendix D, Section 7.2.2.1).

There is a typo in the Appendix D Oil Spill Trajectory Modelling Report, Executive Summary that has been carried over to Section 15.4.7.1 of the EIS. The word "than" should be deleted from the following statement that appear in both sections.

"In addition, the plume trap height occurs at much greater water depth ~~***than***~~ for the East Orphan well blowout scenarios"

2.9.2 Clarification: CL-22

External Reviewer ID:

N/A

Reference to EIS:

Section 15.4.6.

Context and Rationale:

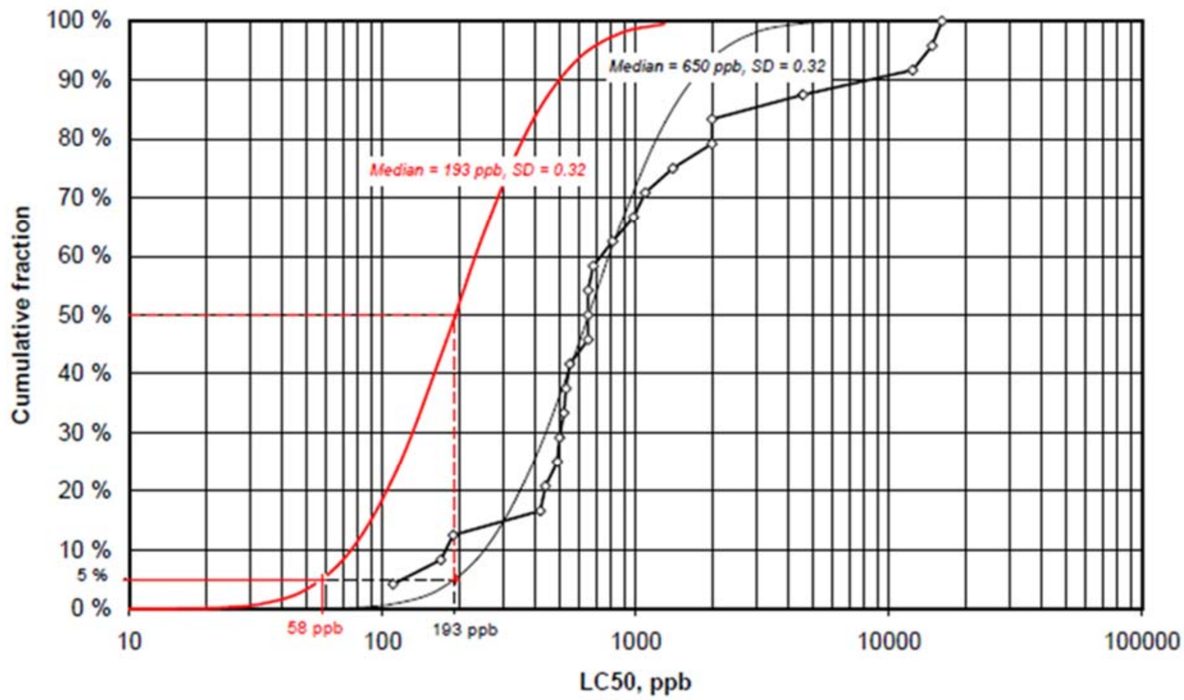
Section 15.4.6 (Table 15.9) of the EIS presents the defined thresholds used in spill modelling. It is stated that, "Work undertaken by Neilson proposed a value for acute exposure to dispersed oil of 58 ppb, based on the toxicity of chemically dispersed oil to various aquatic species, which showed the 5% effect level is 58 ppb". It is unclear what the 5 percent effect level is and what it represents for this project.

Required Clarification:

Provide an explanation on what the 5 percent effect level represents and how that applies to the current project.

Response:

Nilsen et al. (2006) calculated a lethal effect level (LC5) of 58 ppb THC for dispersed oil in sensitive species, represented by fish larvae. The effect level is extracted from a species sensitivity distribution (SSD) based on a dataset compiled by the National Research Council of the National Academies (2005), and using a standard deviation (SD) of 0.32. The SSD contains 24 different LC50 data points obtained in laboratory experiments with various marine organisms exposed to crude oil with added dispersant. All data used for the SSD rely on measured rather than nominal exposure concentrations. The SSD has a median value of 650 ppb, thus considered a representative LC50 for marine organisms exposed to dispersed oil. The concentration representing a lethal dose level to 5% of all marine organisms (193 ppb in the SSD) is considered representative of a sensitive species and used to construct a parallel slope (SD 0.32) with a median value 193 ppb THC. The 5% effect level in this parallel effect curve (58 ppb THC) is then considered a representative LC5 for sensitive water column organisms including fish eggs and larvae. The rationale for how the lethal effect level was identified is shown in Figure 1 below which is also presented in EIS Appendix D - Oil Spill Trajectory Modelling report, Section 5.5.3 Figure 5.9.



Note: The red line is the cumulative distribution curve of interest. This sensitive species dose-response curve shows the 5% percentile LC_{50} value and SD = 0.32. From this dose-response curve, the threshold value (5% lethal risk) is found to be 58 ppb.

Figure 1 LC_{50} Values from Toxicity Studies on Dispersed Oil on Various Aquatic Species

References:

Nilsen, H., H. Greiff Johnsen, T. Nordtug and Ø. Johansen. 2006. Threshold values and exposure to risk functions for oil components in the water column to be used for risk assessment of acute discharges (EIF Acute). Statoil contract no.: C.FOU.DE.B02.

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2.9.3 Clarification: CL-23

External Reviewer ID:

N/A

Reference to EIS:

Section 15.4

Context and Rationale:

Throughout Section 15.4 of the EIS spill information with respect to volume and release rate presented in petroleum barrels only. As there are two petroleum barrel measures, metric and imperial, clarification on the unit is required.

Required Clarification:

Confirm if the reference to barrels is based on an imperial or metric measure.

Response:

The EIS spill information presented in Section 15.4 is presented in oilfield barrels. The nominal conversion factor is 1 cubic metre = 6.2898 oil barrels.

2.10 Effects of the Environment on the Project

2.10.1 Clarification: CL-24

External Reviewer ID:

N/A

Reference to EIS:

Section 16.2

Context and Rationale:

Table 16.8 in Section 16.2 states "MODU will have the capability to disconnect the riser from the well in a short period of time, to reduce the risk of damage to the well, riser, and MODU." However, "a short period of time" is not defined.

Required Clarification:

Define "a short period of time" with respect to disconnecting the riser from the well.

Response:

As discussed in EIS Section 16.2, there may be circumstances of extreme weather where the mobile offshore drilling unit (MODU) must shut in the well, and disconnect the blowout preventer as a preventive measure. The length of time required for a planned disconnect procedure can vary from approximately 36 hours to 5 days and depends on several factors. It is therefore standard procedure, once the blowout preventer and riser have been installed on the well, to calculate, on a daily basis, the time required to disconnect safely. Factors that can influence the length of time to disconnect include the current rig activity, water depth, working depth in the wellbore, existing meteorological and oceanographic (metocean) conditions, and forecasted metocean conditions. These factors can influence the method (and therefore timing) of MODU disconnect.