Polarcus UK Ltd.

Environmental Assessment Eastern Newfoundland 2D/3D/4D Seismic Survey Program 2016 – 2022 Administrative Consolidation (Addendum I, II and III)

Date: **December 19, 2018**

Prepared for Polarcus UK Ltd.

By RPS

December 19, 2018

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1 Introduction

Polarcus UK Ltd., is proposing to conduct two dimensional (2D), three dimensional (3D) and / or four dimensional (4D) seismic surveys in the Newfoundland Labrador Offshore Area (the Project). The Project area identified in Figure 1.1 is in Eastern Newfoundland. The project was scoped on the basis of Polarcus conducting seismic surveys over one or more years between 2016 and 2022. As part of the required regulatory review, Polarcus submitted an Environmental statement on the 31st December 2016, in compliance with the EA requirements and processes of the C-NLOPB.

Comments from the Canada-Newfoundland & Labrador Offshore Petroleum Board (C-NLOPB) were received on the 30th June 2017. Following this an addendum document (Addendum I) was submitted addressing those comments in February 2018.

Since that time, further comments from the C-NLOPB were received on 06th April 2018 (which were addressed in Addendum 2). Further comments have also been received on October 18, 2018. Following this an addendum document (Addendum 3) was submitted addressing those comments received from C-NLOPB.

This document is intended to combine all three addendum responses in one Administrative Consolidation document as requested by the C-NLOPB on November 20, 2018.

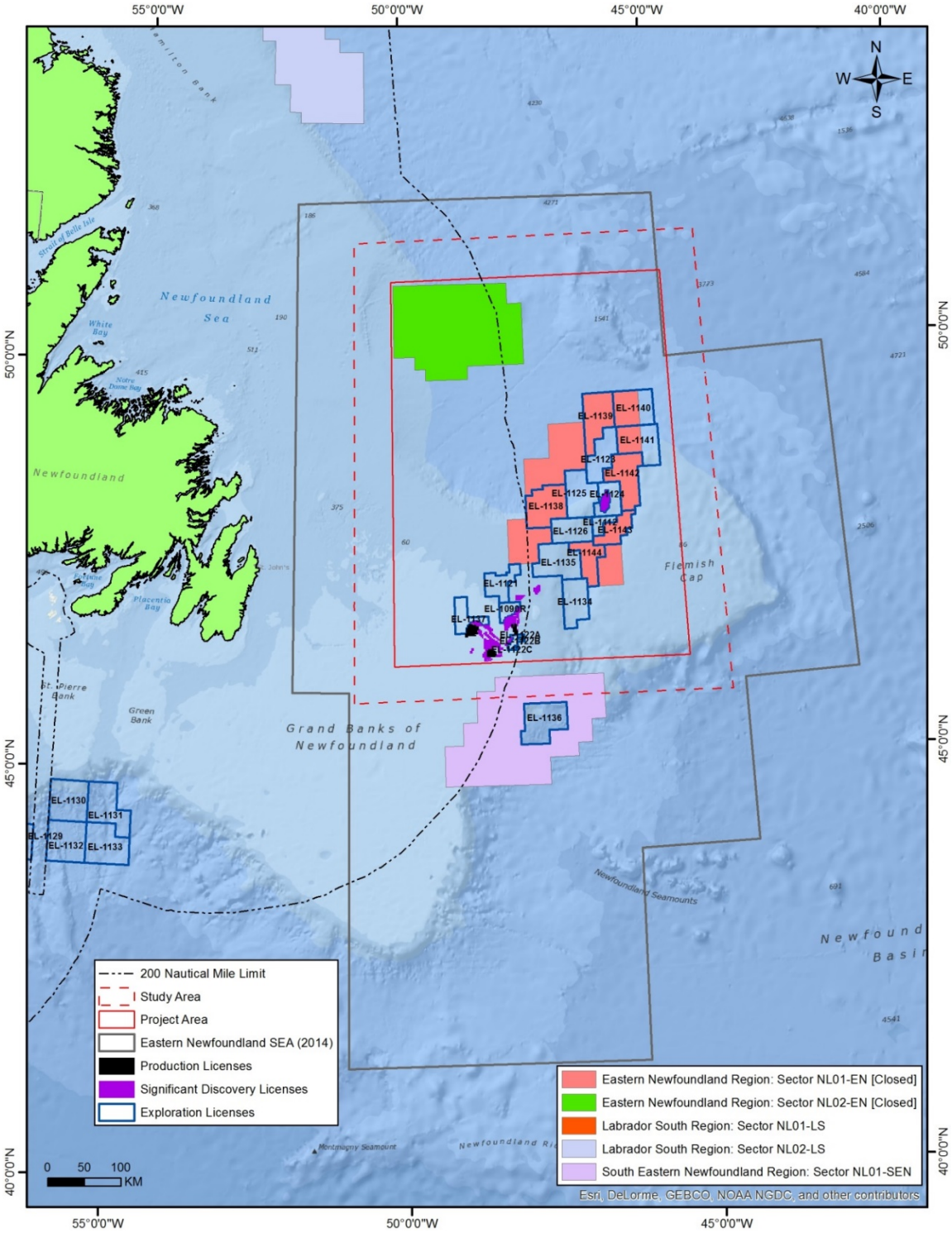


Figure 1.1 Eastern Newfoundland Project Area and Study Areas

2 General Comments

2.1 Canada-Newfoundland and Labrador Offshore Petroleum Board

"In light of the recently released publication, Widely Used Marine Seismic Survey Air Gun Operations Negatively Impact Zooplankton (McCauley, R. et al. Nature Ecol. Evol. 1, 0195 (2017)), please report on the implications of the study results for the conclusions of the environmental assessment and the mitigation measures that are described therein."

Response:

The recent study identified above highlights and provides better understanding of the impact of offshore seismic source (air gun) operation on zooplankton. Replicated experiments were conducted over 2 days, offshore Tasmania, Australia in water depths of 34-36 metres. The air guns used in the study were in the same pressure range as for the Polarcus survey (2000 psi), towed at a similar depth. Measurements undertaken during the tow showed a decrease in abundance zooplankton and an increase in mortality along the prevailing track of the tow line, with this impact zone spreading over a wider area for the first 78 minutes following the passing of the air gun, when corrected for drift. The maximum range of this measured (by sonar) reduction in zooplankton was 1.2 kilometres. On the second day of the experiment, zooplankton abundance was lower before airgun firing, which meant that a similar zone of impact could not be visualised by sonar, however a statistically significant reduction in abundance and increase in mortality were found after air gun passage.

It should be noted that there are a number of uncertainties in the study results. It is not possible to draw any conclusions as to the cause of the drop in abundance of zooplankton on Day 2 of the survey without detailed information on mixing, advection, currents etc. In addition, there was an increase in the water column on Day 2. The study has made no attempt to examine the impact mechanism of the air gun, although it does present a hypothesis. Seismic activities and impact on plankton is deemed to be negligible when compared to the effect of storms and vessels propeller (Mc Cauley, 1994); nevertheless, it is part of the cumulative impact on plankton abundance.

This research paper does not change the conclusions of the assessment, mitigation measures remain the same: limit seismic acquisition to the strict minimum necessary, as well as taking into account plankton bloom period (highlighted in Section 4.9, Table 4.8) when planning for seismic activities.

"How do you propose to monitor the plankton bloom period to ensure conformity to your proposed mitigation?"

Response:

Within the EA report, there are no specific mitigation measures identified for plankton. The response to the comment in the Addendum refers to "*limit seismic acquisition to the strict minimum necessary, as well as considering plankton bloom period (highlighted in Section 4.9, Table 4.8) when planning for seismic activities to be carried out*". The latter was an error made in the response and on further review would not be a practicable mitigation measure. Therefore, there are no new mitigation measures to be included within the EA report. Section 5.8.1 of the

EA report gives the assessment for the fish habitat component of the Fish and Fish Habitats VEC (which includes plankton) where the assessment predicts residual effects to be negligible and not significant. No specific mitigation measures for plankton are therefore necessary and therefore no monitoring of plankton bloom periods is needed.

"As a point of information, The Geophysical, Geological, Environmental and Geotechnical Program Guidelines were updated in September 2017."

Response:

Comment noted.

2.2 Environment and Climate Change Canada (ECCC)

"Please note that our previously submitted comments (sent on 27 January 2016) are still applicable.

Due to the recent change in name of Environment Canada to Environment and Climate Change Canada, references to the departmental name and associated acronyms (i.e. EC-CWS to ECCC-CWS) should be updated accordingly."

Response:

Comment noted.

2.3 Department of National Defence (DND)

"Please identify a specific individual or office to serve as a Point of Contact (POC) for MARLANT queries and concerns"

Response:

Polarcus can confirm that a highly experienced Single Point of Contact will be in place for the duration of the program and contact details will be provided to Department of National Defence (DND) ahead of any operations.

"Please ensure the appropriate Notice to Mariners will be issued for all underwater activities and any significant surface ventures, such as use of flares, buoys, and unconventional lighting; "

Response:

Polarcus can confirm that an appropriate Notice to Mariners will be issued for the program.

"Please ensure the appropriate Notice to Airmen will be issued for all activities that could affect air safety, such as use of balloons, Unmanned Aerial Vehicles (UAVs) or tethered airborne devices; "

Response:

Polarcus can confirm that there will be no activities that could affect air safety, such as use of balloons, Unmanned Aerial Vehicles (UAVs) or tethered airborne devices; this equipment is not part of Seismic Surveys.

"Please ensure engagement of CTF 84, through Director General Naval Strategic Readiness (DGNSR), to ensure de-confliction with possible Allied submarine activities. "

Response:

Contact details to be provided to Polarcus for "Director General Naval Strategic Readiness" (DGNSR) so that project details can be shared to ensure no conflict with possible Allied submarine activities.

2.4 Groundfish Enterprise Allocation Council (GEAC)-Canadian Association of Prawn Producers (CAPP)

"We note that the study area overlaps substantially with shrimp and groundfish harvesting activities undertaken by our membership. The timing of the project activities (May 1st to November 30th) will certainly lead to some overlap between our harvesting activities and potential seismic activity.

The fishery avoidance mitigation measures described by the document are inadequate to address our past negative experiences with the seismic exploration. The document suggests that no fisher will be required to relocate based on the exploration activities. We do not share this conclusion, especially given that we have observed substantial reduction in catch rates of both shrimp and groundfish as a result of seismic testing within the general vicinity. This means that although a seismic survey vessel may not force us to immediately relocate to avoid the survey vessel, the resultant impacts of fish distribution from the seismic pulses will cause us to significantly alter our fishing plans – even leading us to abandon some areas for several months. We request that the EA include some parameters on the avoidance of activity, to be determined through direct discussion with us. This avoidance should include both a spatial and temporal element to allow our harvesting activities to continue without reductions in catch rates.

We take special notice to the effects assessment presented in Section 5.8 of the document. The effects assessment seems limited to direct mortality or injury, and any reference to behavioural changes is only mentioned in passing. We took special interest in Figure 5-2 which suggests that a behavioural threshold from the noise assessment may extend out beyond 9 km from the acoustic energy source – this is consistent with our observations whereby species change distribution according to survey activities and will distribute themselves in a fashion unavailable for harvest. It is our experience that this effect is large in magnitude and requires a prescribed avoidance protocol and advance planning to avoid negative impacts on our harvesting activities. This should be described in the mitigation of these perceived significant effects and be negotiated with fishing industry participants.

We suggest that there is not sufficient information in this document to adequately assess the impacts of seismic exploration on shrimp and groundfish behaviour and distribution.

We submit these comments based on our past experience with seismic exploration near our harvesting grounds. This experience has generally not been positive, and we seek to improve our relationships with the oil and gas exploration."

Response:

It is imperative that there is a two-way flow of information between all parties involved. The spatial and temporal element of the survey programme will be communicated to stakeholders. Through early engagement plans can be adapted. Polarcus will work closely with GEAC-CAPP to minimize potential effects on both parties. We thank GEAC-CAPP for their comments and commitment to ongoing communication.

"We appreciate that Polarcus has undertaken to resolve our concerns, but we must highlight that no new evidence has been provided."

"We are disappointed about this and must re-iterate that this is an evidence-based process and nothing has been provided to support or suggest that these activities will not be to the detriment of our harvesting activities. Because of this, our original concerns still stand.

"To mitigate these concerns, we request that an appropriate avoidance protocol be negotiated between Polarcus and CAPP/GEAC members, prior to the project proceeding. This will provide a level of comfort to our operators that they will not be negatively impacted by increased exploration effort on the part of Polarcus."

Response:

When Polarcus determines the timing and location of the lines for the anticipated seismic program in the assessed area, meetings can be held to share information and mitigate concerns.

2.5 Fish, Food and Allied Workers (FFAW)

"While fisheries data for the current principal commercial species (Section 4.8.1 and page 5-6) were reviewed in the document there is no discussion regarding the regime shift (discussed at the most recent shrimp and crab assessments) that is currently underway in our dynamic marine environment. This shift was discussed for Atlantic cod at the industry consultation in February 2016 (page A-34). Increased fishing activity is anticipated for all groundfish species (e.g. Atlantic cod, turbot, Atlantic halibut, grey sole, redfish, yellowtail flounder, etc.) during the temporal scope of this EA. This is particularly relevant for the company when planning annual survey layouts and locations (Section 5.6.1). It is critical that effective and regular communication ensue with the fishing industry throughout the EA lifespan so that the seismic company is kept apprised of ongoing developments with fisheries in the project area. "

Response:

It is noted that increased fishing activity is anticipated and agreed that efficient two-way communication is key for informed decisions to be taken and for planning to be adjusted where

relevant. Our objective is to schedule ongoing seismic surveys to have no impact on commercial fishing. We understand the two-way flow of information between all parties involved is imperative so that active fishing gear can be avoided. Polarcus can ensure on-going communication through weekly meetings with fisheries groups and the provision of look ahead maps for the coming week's seismic acquisition. Polarcus thanks FFAW/Unifor for committing to continue regular dialogue.

Response Section 5.6.1

It is noted and agreed that the following should be added to this section;

> "Our objective is to schedule ongoing seismic surveys to have no impact on commercial fishing".
>
> "It is critical that effective and regular communication ensue with the fishing industry throughout the EA lifespan so that Polarcus is kept apprised of ongoing developments with fisheries in the project area".

"While the EA Addendum provides written commentary to avoid negative interaction with the fishing industry (e.g. use of a support vessel, use of a Fisheries Liaison Officer and use of the location of fixed gear/fishing activity from previous years) it also states that "it is imperative that there is a two-way flow of information" and that "the spatial and temporal element of the survey programme will be communicated to stakeholders" such that "through early engagement plans can be adapted." We have not heard from the proponent regarding any offshore plans since February 9th, 2016.

"As previously commented, it is critical that effective and regular communication ensue with the fishing industry throughout the EA lifespan so that the seismic company is kept apprised of ongoing developments within our dynamic fishing industry."

Response:

Polarcus will again be meeting with proponents prior to commencement of the project in consultation. Further details will follow from these meetings, but until these meetings are held nothing further can yet be added on this point. These meetings can be scheduled when Polarcus determines a start time for the survey likely to be in 2019.

2.6 Fisheries and Oceans Canada (DFO)

"As a point of information, a new Fisheries Act Closure, the Northeast Newfoundland Slope Closure/Marine Refuge area, has been established for sensitive benthic habitat and overlaps with the Study Area."

Response:

Comment noted.

3 Specific Comments

3.1 Environment and Climate Change Canada (ECCC)

"Section 5.6.5 Marine Mammal / Wildlife Protection, page 5-21 *- The link to the "C-NLOPB Guidelines 2016" should be typed out so that it can be used from a printed document. "*

Response:

Acknowledged. http://www.cnlopb.ca/pdfs/guidelines/ggegpg.pdf

"Section 5.6.5 Marine Mammal / Wildlife Protection, page 5-21 *- Quote: "For seabird monitoring, the Canadian Wildlife Service (CWS) has developed a pelagic seabird monitoring protocol that should be used when undertaking seabird observations. Copies of the Eastern Canada seabirds at Sea (ECSAS) standardized protocol for pelagic seabird surveys from moving and stationary platforms..."*

This paragraph is incomplete and should be further described. "

Response:

(Gjerdrum C., 2012). This sentence was meant to show the reference to the Seabird Monitoring Protocol followed by Marine Mammal Observers.

"Section 5.6.5 Marine Mammal / Wildlife Protection - Seabird Strandings, page 5-22 *- It is not clear how stranded seabirds will be detected onboard the ship. ECCC-CWS recommends at minimum a daily search of the ship, with attention given to small, dark areas that would be missed in routine ship safety checks. "*

Response:

Section 2.3 Project Overview of the original EA states

"MMSOs will conduct seabird surveys during the project period; the Survey method will follow the Eastern Canada Seabirds at Sea (ECSAS) Standardized Protocol for Pelagic Seabird Surveys from Moving and Stationary Platforms (Gjerdrum C., 2012). One of the MMSOs will check the decks for stranded birds and dead birds each day, with close attention to dark and protected areas under machinery. Deckhands will be instructed to alert the MMSO on duty if stranded birds were found. If stranded birds were recovered and released it would follow the handling methods devised by Williams and Chardine (Chardine, 1999). Any dead birds will be disposed of at sea."

Response for further clarity:

Marine Mammal Seabird Observers will be onboard the seismic vessel and will conduct daily searches of the vessel, with attention given to small, dark areas that would be missed in routine ship safety checks, for stranded seabirds. The seabird handling and release protocol devised by Williams and Chardine (Chardine, 1999) will be followed in the event of a stranded bird.

"Section 5.6.5 Marine Mammal / Wildlife Protection - Wildlife Data Collection, page 5-22 *- ECCC-CWS has a mobile version of the Eastern Canada Seabirds at Sea (ECSAS) database that can be*

provided to the proponent, which will facilitate data entry. The MMO or delegated personnel can enter data into the database while undertaking observations, with little to no need for post-processing. "

Response:

A copy of the mobile version of the ECSAS database will be obtained. In the event that the MMSO cannot enter the information directly into the data base at sea, it can be entered in upon completion of the project from the shore to assist ECCC-CWS.

"Table 5-11 Assessment of Residual Environmental Effects on the Seabird VEC, page 5-41 *- Recommend changing magnitude of "Unplanned Events" from Low to Medium. "*

Response:

As marine diesel oil is a light hydrocarbon, the majority of spilt oil will evaporate rapidly, therefore the chance of contact with bird species is low and is much reduced when compared to a similar spill of more persistent crude oil. It is therefore felt that it is unlikely that 10 to 25 percent of individuals/habitat in the Study Area (as defined by the "Medium" magnitude criteria) would be affected. It is proposed that the magnitude definition "low" best describes the level of likely residual environmental effects of unplanned events on the seabird VEC and this should not be amended.

3.2 Canada-Newfoundland and Labrador Offshore Petroleum Board (C-NLOPB)

*"**Section 1.2 Regulatory Context and Relevant Legislation, page 1-4** – the Geophysical, Geological, Environmental and Geotechnical Program Guidelines were updated in April 2017."*

Response:

Noted. The new citation for C-NLOPB (2017) as follows:

C-NLOPB. 2017. Geophysical, Geological, Environmental and Geotechnical Program Guidelines, April 2017. 57 p.

"Section 2.1 Introduction, page 2-1 *– Polarcus has assessed conducting one or more 2D, 3D and/or 4D seismic surveys within its proposed Study Area. As stated in Section 5.1.1 of the Scoping Document, the* ***Project Area****, not the Study Area, is the area in which seismic survey activities are to occur, including the area of the buffer zone normally defined for line changes "*

Response:

Noted. Propose that the sentence is edited to read as follows: "Polarcus has assessed conducting one or more 2D, 3D and/or 4D seismic surveys within its proposed Project Area."

"Section 2.1 Introduction, page 2-1 *– There is the possibility that Polarcus could conduct more than one survey in any given year. Please identify the maximum number of surveys in any given*

year, as well as the activities and equipment that constitute the Project, to ensure that potential environmental effects, including cumulative effects, are assessed for the full 2016 to 2022-time period. "

Response:

The possible combinations of concurrent seismic survey types that may be conducted by Polarcus in any given year during 2018-2022 are 2D-2D, 2D-3D, and 3D-3D. This means two 2D surveys or one 2D survey and one 3D survey or two 3D surveys in any given year. Thus, no more than two surveys in the project area in any given year.

The activities are 2D and or 3D seismic surveys, no more than two of any of the above combinations in any given year. The equipment is the research vessel, streamers and airgun array. Polarcus could collect Gravity data and Gravity equipment would be onboard. There will be a supply and support vessel for the project.

"Section 2.2 Spatial and Temporal Boundaries, 1st para, page 2-1 *– Please provide more clarity on the combination of surveys each year (i.e. the maximum number and type of survey each year). "*

Response:

See response to above comment.

"Section 2.3 Project Overview, page 2-2 *– Please confirm the number of MMSOs that are to be onboard the seismic vessel. Also, marine mammal observations are to be continuous and checking for stranded/dead birds are a separate activity. "*

Response:

Polarcus can confirm that not less than two MMSOs are to be onboard the seismic vessel and the MMSOs will conduct continuous marine mammal observations. It is noted that checking for stranded/dead birds is a separate activity.

"Section 2.3.2 Project Scheduling, page 2-3 *– If the scope of work includes activity....information will be submitted. What information and where will it be submitted? "*

Response:

Seismic surveys will be conducted between 1 May and 30 November of any year, from 2018 until 2022. If the scope of work includes activity occurring simultaneously in close proximity to other marine installations or structures or other vessels, a SIMOPS Plan will be submitted to the C-NLOPB in the Safety Plan, as a part of the Geophysical Program Authorization to demonstrate that activities ongoing in the field will be properly coordinated and that affected parties have agreed documented protocols to manage the coordination of activities.

"Section 2.3.3, Supply and Support Vessel, page 2-3 *– Please confirm that a scout vessel will accompany the seismic vessel when acquiring data.*

Response:

As it is stated in the original EA in Section 5.6.3 "Use of Support / Guard Vessel";

"If there is a possibility of the survey program working in areas adjacent to active fishing, Polarcus will use a support vessel to scout ahead, usually along the planned route of a survey line, to make sure there are no fishing boats or gear in the area. Information about any sightings or radio communications will be relayed back to the survey ship and the FLO."

Section 3.1 Bathymetry, pg 3-1 *– The Eastern Newfoundland Strategic Environmental Assessment (C-NLOPB August 2014) should be properly cited and referenced in the report. "*

Response:

Noted. The citation is stated as follows:

The Eastern Newfoundland Strategic Environmental Assessment (C-NLOPB August 2014). http://www.cnlopb.ca/sea/eastern.php

"Section 2.3.5 Gravity and Magnetic Survey, pg 2-3 – *Polarcus will collect gravity and magnetic data and it has been assessed as part of the potential project interactions, but not listed as separate project activities in the environmental interactions table. They should be listed as separate project activities in the environmental interactions table."*

Response:

Noted. Table 5-2 amended to include gravity and magnetic survey as separate activities as follows.

Table 5-2 Potential Interactions between Project Activities and VECs

Project Activities	Fish and Fish Habitat VEC					Fisheries and Other Ocean Users VEC			Seabirds VEC	Marine Mammals VEC and Sea Turtles VEC				Species at Risk VEC	Sensitive Areas VEC
	Water and Sediment Quality	Eggs and Larvae	Juveniles	Pelagic Fish	Bottom dwelling fish	Mobile Invertebrates and Fishes (e.g. gillnet	Sedentary Benthic Invertebrates (e.g. crab	Research Surveys (e.g. trawls and crab pots		Toothed Whales	Baleen Whales	Seals	Sea Turtles		
Underwater Noise															
Airgun Array															
Seismic Vessel															
Supply / Support															
Physical Presence of:															
Seismic Vessel															
Supply Vessel															

Project Activities	Fish and Fish Habitat VEC					Fisheries and Other Ocean Users VEC			Seabirds VEC	Marine Mammals VEC and Sea Turtles VEC				Species at Risk VEC	Sensitive Areas VEC
	Water and Sediment Quality	Eggs and Larvae	Juveniles	Pelagic Fish	Bottom dwelling fish	Mobile Invertebrates and Fishes (e.g. gillnet	Sedentary Benthic Invertebrates (e.g. crab	Research Surveys (e.g. trawls and crab pots		Toothed Whales	Baleen Whales	Seals	Sea Turtles		
Helicopter [1]															
Onshore[2] facilities															
Vessel Lights															
Sanitary/Domestic Waste															
Liquid Waste															
Atmospheric Emissions															
Garbage[3]															
Gravity and Magnetic Survey Equipment															
Unplanned Events															
Other Projects and Activities															
Offshore Oil and Gas Activities															
Fisheries															
Marine Transportation															

"Section 2.3.9 – Seismic Streamers, page 2-9 – *Please confirm the maximum streamer number for future years (2018-2022). "*

Response:

The maximum streamer length for future years (2018-2022) will be 12,000m. The maximum number of streamers is 14.

"Section 4.8.3 Shipping, page 4-68 *- The description provided is not adequate and requires additional details / information (e.g. numbers of vessels per port, numbers of cruise ships, ferry services). Only with this information combined with a prediction of future activity, can the statement in Section 6.2 (page 6-2) "Thus, potential for cumulative effects with other shipping is predicted to be low and not significant" apply. "*

1 Crew change will occur via ship to ship transfer, helicopters will only be used in the event of an emergency situation.

2 There will be no new onshore facilities as existing infrastructure will be used.

3 Not applicable as garbage will be brought onshore

Response:

We reviewed this data set. A search for vessel traffic data and reports revealed that the majority of information available had limitations in relation to the study area. A summary of the relevant findings from the search is provided below.

The Canadian Year-Round Shipping Traffic Atlas for 2013: Volume 1, East Coast Marine Waters (Simard et al. 2014) contains monthly vessel traffic density data for 2013 derived from CCG's AIS database. However, the data does not extend eastwards beyond 49°W and therefore most of the Polarcus Study Area is not included in the Atlas. The traffic density maps do indicate that during May to November 2013, the highest traffic density occurred nearshore east and north of Newfoundland's Avalon Peninsula, particularly in the vicinity of St. John's, and south of the island of Newfoundland (and south of the Study Area). Offshore vessel tracks (within the field of view presented in Simard et al. 2014) were predominantly located south of 48°N during May, June, October and November and overall vessel traffic increased during July, August and September (see Figures 118, 141, 164, 187, 210, 233 and 256 in Simard et al. 2014).

No information was found to suggest that the potential cumulative effects with other shipping in the study area would be anything other than low and not significant.

"Section 5.5 Effects Assessment, page 5-8 *– It is not clear to what extent data gaps noted within the Eastern Newfoundland Offshore SEA have been acknowledged / identified / addressed and whether any new information is included. This should be clarified and amended accordingly."*

Response:

The data gaps mentioned in the SEA and particularly in Section 4.3.4.1 of the SEA have been considered. The information provided in Section 4.8 of Polarcus Environmental Assessment encompasses data up to 2014 whilst data collect from the SEA are presented until 2012.

"Section 5.6.5 Marine Mammal / Wildlife Protection, Reporting, page 5-22 – *The final environmental report submitted to the C-NLOPB on January 31st should be accompanied by the marine mammal and seabird observation data (GGEG Guidelines – Appendix 2, C-NLOPB 2017)."*

Response:

Noted. The Final Environmental report submitted to the C-NLOPB as per C-NLOPB Guidelines (GGEG Guidelines – Appendix 2, C-NLOPB 2017) will include the marine Mammal and Seabird Observations data).

"Section 5.6.3 Fisheries Avoidance, page 5-19 *– If there is a possibility of the survey program working in areas adjacent to active fishing; Polarcus will use a support vessel to scout ahead.... For any geophysical, geological, environmental and geotechnical program authorized in the offshore area, the use of a standby/picket/guard/chase vessel is considered best practice in this respect (GGEG Guidelines – Appendix 2, C-NLOPB 2017).*
The use of a guard vessel, also known as a scout, picket, or chase vessel, has been identified as a mitigation measure to prevent negative interactions with fishers and others. The primary purpose

of a guard vessel is to increase the forward looking range (both radar and visual surveillance) of the seismic vessel by travelling ahead on the planned data acquisition route. This action increases the amount of time available for gear/vessel avoidance by the seismic vessel and thus reduces the likelihood of a negative interaction between the seismic program and fishers.
When the absence of a guard vessel is unavoidable and prior to that absence, Polarcus will risk assess the conduct of the operation without the guard vessel present and plan and implement appropriate measures to reduce the likelihood of a negative interaction with fishers. The following mitigation measures are considered appropriate in the absence of a guard vessel and may be implemented, as required, to maintain safe operations and avoid negative interaction with fishers:

- *maximize communication with commercial fishers in the area via the Fisheries Liaison Officer (FLO);*
- *maintain vigilant visual and radar watch from the seismic vessel;*
- *scout ahead with the guard vessel as far as appropriate and practical, prior to departure;*
- *plan the absence, when possible, for a time when the seismic vessel is operating in an area of least commercial fishing activity;*
- *move to an area of lesser fishing activity until the guard vessel returns; and/or*
- *suspend data acquisition and recover seismic equipment until the program can proceed without potential negative interaction with fishing activities.*

In cases where an absence is unplanned [ex. medical evacuation or other emergency], the seismic vessel will, as a minimum, maximize communication with fishers and maintain a high level of vigilance for visual and radar observation. Once the situation is under control, Polarcus will complete a risk assessment to determine what other mitigations, if any, are appropriate. "

Response:

This will be adhered to and documented in the Polarcus Safety Plan in the Geophysical Program Authorization application.

"Section 5.6.5 Marine Mammal/Wildlife Protection, Reporting, page 5-22 *– Please note that the Geophysical, Geological, Environmental and Geotechnical Program Guidelines (April 2017) require that the marine mammal and seabird observations are to be submitted to the C-NLOPB within six months after the completion of the seismic survey.*

Section 5.8.6 Sensitive Areas VEC, page 5-51 – Please revise in consideration of the new information requested in review comments. "

Response:

Noted.

*"**Section 6.2 Vessel Traffic and Research Surveys**, page 6-2 – See comment on Section 4.8.3."*

Response:

Noted. See response to comment on *Section* 4.8.3

Related changes

*"**Section 6.4 Summary, page 6-3** – Please revise in consideration of the new information requested in review comments. "*

Response:

Section 6.4 Summary has been reviewed considering the new information requested in review comments and it is felt that the summary accurately reflects the findings of the EA and that the project is not likely to result in significant adverse effects to any VEC.

*"**Section 7 Assessment Summary and Conclusions,** page 7-1 – Please review and update the summary and conclusion taking into consideration the new information added to the environmental assessment report based on review comments."*

Response:

Section 7 Assessment Summary and Conclusions has been reviewed considering the new information requested in review comments and it is felt that the summary and conclusions made still stand and accurately reflect the findings of the EA and that the overall residual impact post mitigation measure remains localized, short-term and transient.

*"**Section 4.8.3 Shipping, page 4-68 of EA Report and page 3-11 of Addendum** - The comment on "Shipping" has not been adequately addressed. See section 4.3.5 Other Human Activities of the "Eastern Newfoundland Strategic Environmental Assessment" (2014) and update information as appropriate. Please provide the full Simard et al. 2014 reference."*

Response:

The response provided in the Addendum should be revised as per the below (new text is provided in bold):

The Canadian Year-Round Shipping Traffic Atlas for 2013: Volume 1, East Coast Marine Waters (*Simard et al., 2014*) contains monthly vessel traffic density data for 2013 derived from CCG's AIS database. However, the data does not extend eastwards beyond 49°W and therefore most of the Polarcus Study Area is not included in the Atlas. The traffic density maps do indicate that during May to November 2013, the highest traffic density occurred nearshore east and north of Newfoundland's Avalon Peninsula, particularly in the vicinity of St. John's, and south of the island of Newfoundland (and south of the Study Area). Offshore vessel tracks (within the field of view presented in *Simard et al., 2014*) were predominantly located south of 48°N during May, June, October and November and overall vessel traffic increased during July, August and September (see Figures 118, 141, 164, 187, 210, 233 and 256 in *Simard et al., 2014*).

The maritime industry does play an important part of the coastal communities of Newfoundland and Labrador. The Eastern Newfoundland region has 17 shipping ports, of which St. John's has the most diverse shipping activity and industrial infrastructure. Nine of these ports (Argentia, Bay Roberts, Come By Chance, Holyrood, Lewisporte, Long Pond, Marystown, St. John's and Newfoundland Offshore (St. John's)) have both domestic and international shipping activity; four (Fortune, Harbour Grace, Long Harbour and Bay Bulls) are used for international shipping, and four (Arnold's Cove, Carmanville, Catalina, Clarenville) have

domestic shipping only. Smaller harbours are maintained primarily for fishing and recreational activities. Come By Chance and Fortune are also key international shipping ports in Newfoundland and Labrador (C-NLOPB, 2014).

St John's port is the main port authority in Newfoundland and Labrador. It has been in operation for over 50 years, with its 50th Anniversary in 2015. It is deemed to be an important Canadian port for domestic and international shipping.

Historically eastern Newfoundland and Labrador ports experience a larger number of domestic shipping movements than international movements. Domestic activity includes a large amount of shipping attributed to Eastern Newfoundland's offshore oil and gas industry. Placentia Bay sees substantial oil tanker traffic each year along with other marine activities at several zones of convergence (C-NLOPB, 2014). Domestic movements are also made up of many provincial ferry services which deliver passengers and freight to remote coastal communities that are not connected by road (C-NLOPB, 2014).

International shipping lanes are present within the southern half of the study area, mainly heading to/from the Port of St. John's (Figure 1.2). However, these lanes can also be used by vessels not bound for Newfoundland ports. The density of vessels using these lanes is low to moderate with between 8-12 vessel tracks per square kilometre (Figure 1.2).

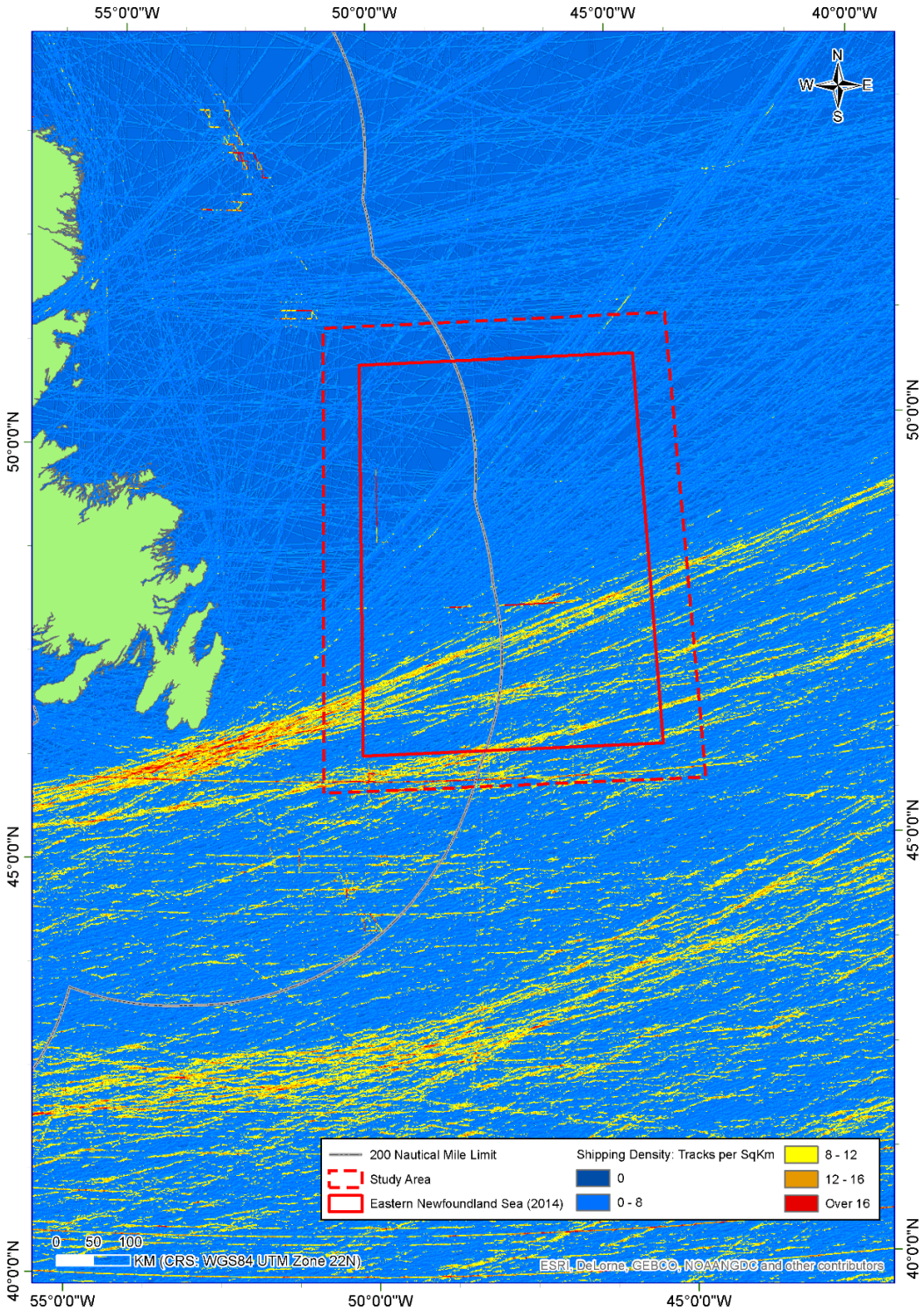


Figure 1.2. Commercial Shipping Traffic Density near the Study Area

The above review has shown that, most of the shipping activity in the region consists of domestic traffic moving to and from local ports. There are international shipping lanes in the Study Area, but the density of shipping traffic is low to moderate. **The information therefore suggests that the potential cumulative effects with other shipping in the study area would be low and not significant.**

References

Simard, Y., Roy, N., Giard, S. & Yayla, M. (2014), Canadian Year-round Shipping Traffic Atlas for 2013: Volume 1, East Coast Marine Waters, Fisheries and Oceans Canada, [Internet, available: <http://publications.gc.ca/collections/collection_2014/mpo-dfo/Fs97-6-3091-1-eng.pdf>].

Halpern, B.S., Walbridge, S., Selkoe, K.A., Kappel, C.V., Micheli, F., Agrosa, C.D., Bruno, J.F., Casey, K.S, Ebert, C., Fox, H.E., Fujita, R., Heinemann, D., Lenihan, H.S., Madin, E.M.P., Perry, M.T., Selig, E.R., Spalding, M., Steneck, R., & Watson, R. (2008), A Global Map of Human Impacts to Marine Ecosystems; Commercial Activity (Shipping), Science, 319(5865): pp. 948–952. Dataset available on: National Center for Ecological Analysis and Synthesis (NCEAS), 2013, A Global Map of Human Impacts to Marine Ecosystems; Commercial Activity (Shipping), The Regents of the University of California, 2013, [Internet], available: <http://www.nceas.ucsb.edu/GlobalMarine/impacts>.

*"**Section 5.5 Effects Assessment, page 5-8 of EA Report and page 3-11 of Addendum** - The comment on "Effects Assessment" has not been adequately addressed. It remains unclear to what extent data gaps noted within the Eastern Newfoundland Offshore SEA have been acknowledged / identified / addressed and whether any new information is included. To say that the Polarcus Environmental Assessment (2017) is more recent is insufficient."*

Response:

The bullet points in section 5.5.1 of the EA (page 5-8) should be amended to include the below bullet point after the third bullet point:

- "Any data gaps identified which could affect the confidence of the assessment;"

Following the second paragraph on page 5-10 of the EA, the below two paragraphs should be added:

The Eastern Newfoundland SEA outlines the main data gaps for the region, mainly stemming from the difficulty of studying offshore species and the inherent complexity of the offshore systems, leaving various information gaps even in relatively well researched areas.

For fish species and fish habitats, the key data gaps for the area include benthic invertebrate communities, sessile species (including corals and sponges) responses to oil and gas activities, and regime shifts and climate change factors (*C-NLOPB, 2014*).

For marine birds, apart from the usual well documented limitations of sightings data, the SEA recognises that seabird data offshore Newfoundland and Labrador (and elsewhere in Eastern Canada) is limited. The SEA recognises that operators may implement their own offshore

monitoring programs during their operations. There is also a poor understanding currently of light attraction from offshore activities such as flaring, although for seismic survey work such effects are no more than those associated with shipping (*C-NLOPB, 2014*).

For marine mammals and sea turtles, the SEA recognises that more data is needed to bolster the temporal and seasonal data in the region, as well as behavioural data and understanding. The SEA recognises that operators may implement their own marine mammal monitoring programs during operations and recommended marine mammal monitoring protocols for the region are also given.

For commercial fisheries, the DFO catch landings data is considered adequate, although it is appreciated that the datasets are not always entirely complete or comprehensive for all fisheries and species (*C-NLOPB, 2014*).

These data gaps have been considered when considering the level of confidence for each prediction and assigning the corresponding ratings.

*"**Section 5.8.6 Sensitive Areas VEC, page 5-51 of EA Report** - Please revise in consideration of the new information requested in review comments." and **Page 3-13 of Addendum** - There was no reply provided to this original comment."*

Response:

The updates provided throughout this document, and the addition of recent species distribution modelling work on sponges, sea pens and corals (*Kenchington et al., 2016*), has been reviewed and thus more up to date references and studies are now included, these do not materially change the findings and conclusions of the impact assessment undertaken. The updates provided therefore do not warrant changes to this section of the EA report.

*"**Section 6.4 Summary, page 6-3 of EA Report and page 3-13 of Addendum** – the reply to this comment will have to be revisited in light of the inadequate replies to comments on the original environmental assessment and section update as appropriate."*

Response:

The new shipping data presented in response to comment "*"**Section 4.8.3 Shipping, page 4-68 of EA Report and page 3-11 of Addendum***" above has shown that most of the shipping activity in the region consists of domestic traffic moving to and from local ports. There are international shipping lanes in south of the Study but the density of shipping traffic is low to moderate.

Section 6.4 Summary has been reviewed considering the new information requested in review comments and it is felt that the summary accurately reflects the findings of the EA and that the project is not likely to result in significant adverse effects to any VEC.

*"**Section 7 Assessment Summary and Conclusions, page 7-1 of EA Report and page 3-13 of Addendum** – the reply to this will have to be revisited in light of the inadequate replies to comments on the original environmental assessment and section updated as appropriate."*

Response:

Section 7 Assessment Summary and Conclusions has been reviewed and following this review it is concluded that the summary and conclusions made still stand and accurately reflect the findings of the EA. However, considering comment responses, the below paragraph should be added to section 7 after paragraph 4 (ending "*…as part of this Environmental Assessment.*"):

The EA acknowledges the general data gaps in the offshore environment, namely; benthic invertebrate communities and sessile species, limited offshore seabird data, and marine mammal temporal, seasonal and behavioural data. The data gaps mainly arise from the difficulty of studying offshore species and the inherent complexity of the offshore systems. The seabird and marine mammal observation program implemented throughout operations, conducted in accordance with the recommended monitoring protocol outlined in ESRF Report #156 *Recommended Seabird and Marine Mammal Observation Protocols for Atlantic Canada* (2004) for marine mammals, and the Canadian Wildlife Service (CWS) pelagic seabird monitoring protocol *Eastern Canada Seabirds at Sea (ECSAS) standardized protocol for pelagic seabird surveys from moving and stationary platforms*, will contribute to the overall pool of data in the offshore environment of the region.

3.3 Fisheries and Oceans Canada (DFO)

"Section 1.2 Regulatory Context and Relevant Legislation, Page 1-4 - the first bullet in the second paragraph should be amended to read "Fisheries and Oceans Canada (DFO). "

Response:

Noted.

"Section 2.3.8 Seismic Source Parameters, page 2-8, first paragraph *- "two arrays consisting of three-gunstrings each" and "three arrays consisting of two gunstrings each" it is not clear what this terminology refers to - is "gunstring" analogous to "acoustic source", if so then this should be clarified accordingly. "*

Response:

An array consists of sub-arrays which are also called gunstrings. The gunstrings contain a string of individual airguns. The configurations assessed include two arrays with each array consisting of three gunstrings and three arrays with each array consisting of two gunstrings. This is depicted in Figure 2.5.

*"**Page 3-14 of Addendum** - Specification of the number of airguns on each gunstring should be provided."*

Response:

Section 2.3.8 of the original EA describes the potential source parameters. Detailed specifications of the airgun array will be provided once the potential 2019 project design has been completed and parameters have been selected.

"Section 3.1 Bathymetry, page 3-1, 2nd paragraph, first sentence *- a reference to the "Eastern Newfoundland Offshore SEA" the wording / reference to the SEA should be made and consistent throughout not only this but other sections of the EA that provide reference to this SEA. "*

Response:

Noted. The citation will be stated as follows:

The Eastern Newfoundland Strategic Environmental Assessment (C-NLOPB August 2014). http://www.cnlopb.ca/sea/eastern.php

Reference and wording to the SEA will be amended throughout the EA so it is consistent.

"Section 3.2.1 Air Temperature, page 3-3, 3rd paragraph, last sentence *- "…during the summer months the coldest observed temperatures were around 4.4 degrees Celsius in June (Figure 3.2)…", data for the month of June is not shown in Figure 3.2. It is felt that the data for air temperature should be described for all 12 months. "*

Response:

Noted. A new Figure 3.2 as follows.

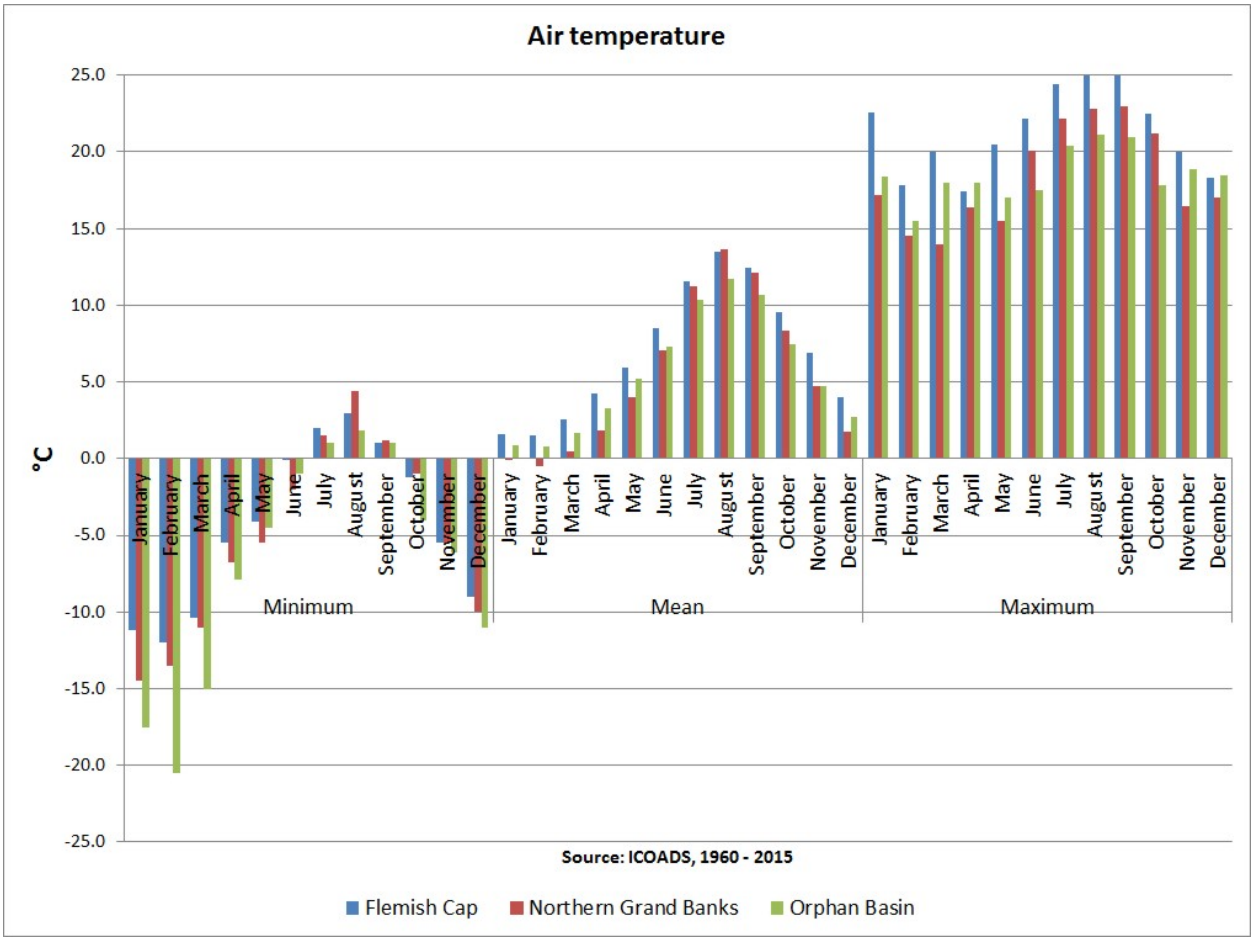


Figure 3.2 Air Temperature

"Section 3.2.2 Wind, page 3-4, Figure 3.3 *- should be amended to reflect wind speed for all 12 months ".*

Response:

Noted. A new Figure 3.3 as follows.

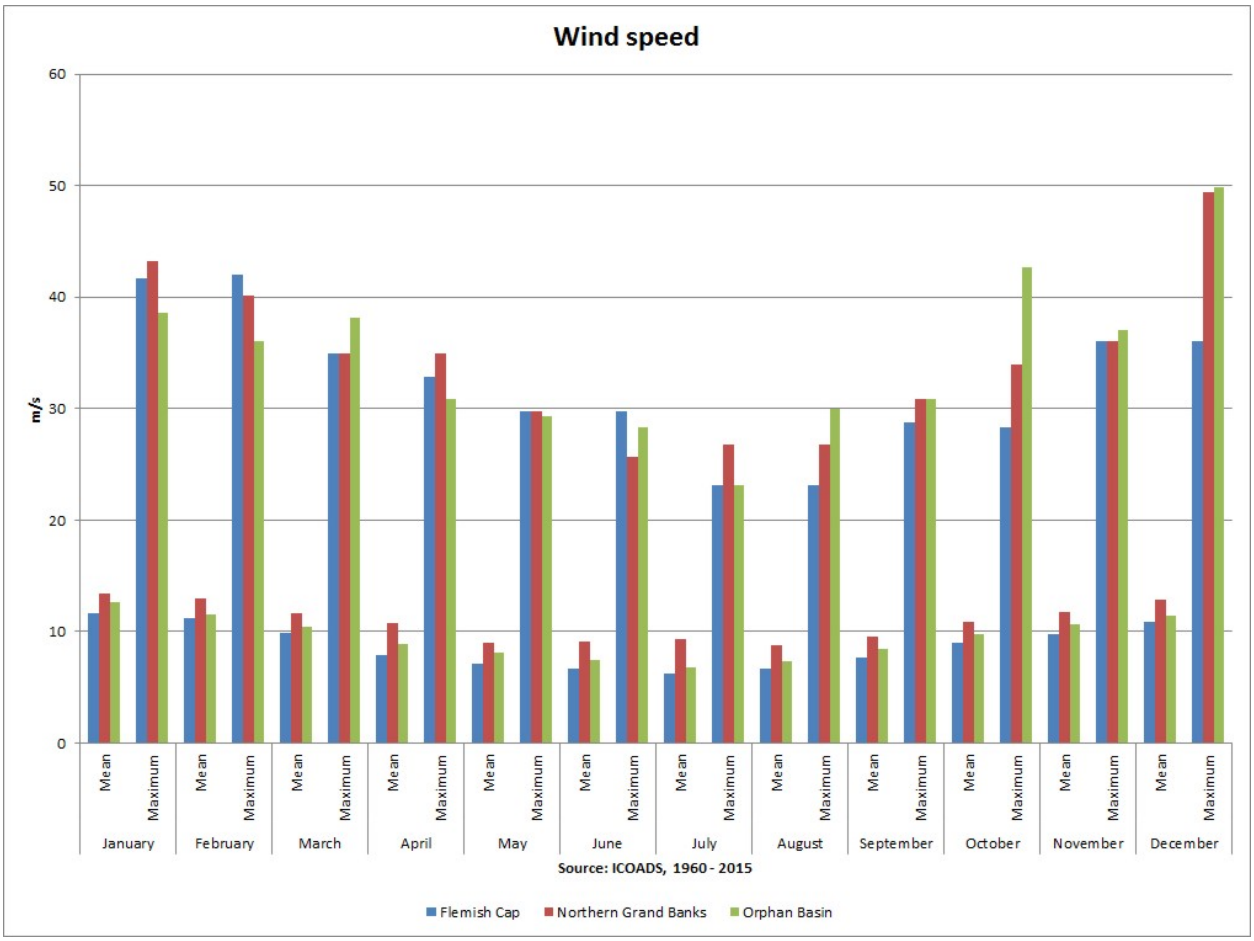


Figure 3.3 Wind Speed

"Section 3.2.3 Precipitation and Visibility, page 3-6 & 3-7, Table 3.2 and Table 3.3 *– these should be amended to provide data for all 12 months for precipitation and visibility respectively.*

Response:

Noted. A new Table 3.2, Figure 3.4, Table 3.3 and Figure 3.5 as follows.

Figure 3.5 in the EA Addendum does not describe tropical storm systems. Figure 3.5 in the EA Addendum is correctly described by its caption in the EA Addendum: *Frequency of occurrence for selected precipitation types within the Study Area*. This is a new figure to be added to the EA report and does not correspond to the original Figure 3.5 in the EA report.

Table 3.2 Precipitation within the Study Area (ICOADS, 1960 – 2015)

Precipitation Type	Percentage Occurrence		
	Flemish Cap	Northern Grand Banks	Orphan Basin
Freezing Rain / Drizzle	Percentage Occurrence		
January	43	18	0
February	29	25	32
March	14	29	32
April	0	10	16
May	14	4	0
June	0	1	0
July	0	0	0
August	0	0	0
September	0	1	0
October	0	1	0
November	0	3	0
December	0	8	20
Rain	Percentage Occurrence		
January	10	8	9
February	8	6	6
March	7	8	6
April	8	8	8
May	7	9	7
June	9	8	7
July	5	6	7
August	7	7	7
September	9	8	10
October	11	10	13
November	10	11	13
December	9	9	8
Snow	Percentage Occurrence		
January	24	26	26
February	27	26	26
March	17	20	22
April	8	7	5
May	3	2	1
June	0	0	0
July	0	0	0
August	0	0	0
September	0	0	0
October	1	1	1
November	6	4	5
December	14	14	14

Table 3.3 Visibility within the Study Area (ICOADS, 1960 – 2015)

Region	Very Poor (<0.5 km)	Poor (0.5 – 2 km)	Fair (2 – 10 km)	Good (> 10 km)
Flemish Cap	Percentage Occurrence			
January	1	6	46	47
February	1	7	47	45
March	1	10	41	48
April	3	15	40	43
May	5	20	36	39
June	10	26	33	31
July	13	32	28	27
August	9	20	30	42
September	4	12	36	48
October	2	9	38	51
November	2	7	45	45
December	1	8	49	42
Northern Grand Banks	Percentage Occurrence			
January	4	10	43	44
February	4	12	44	40
March	5	13	42	40
April	9	17	41	32
May	12	21	35	32
June	17	24	31	27
July	24	28	27	22
August	12	16	33	39
September	6	9	33	52
October	4	7	36	53
November	4	9	37	50
December	3	9	39	48
Orphan Basin	Percentage Occurrence			
January	1	8	54	36
February	1	9	51	39
March	2	13	49	36
April	3	15	42	40
May	4	12	43	41
June	8	19	35	38
July	13	27	33	27
August	7	17	37	39
September	3	9	38	50
October	2	7	43	48
November	1	8	46	45
December	1	7	49	43

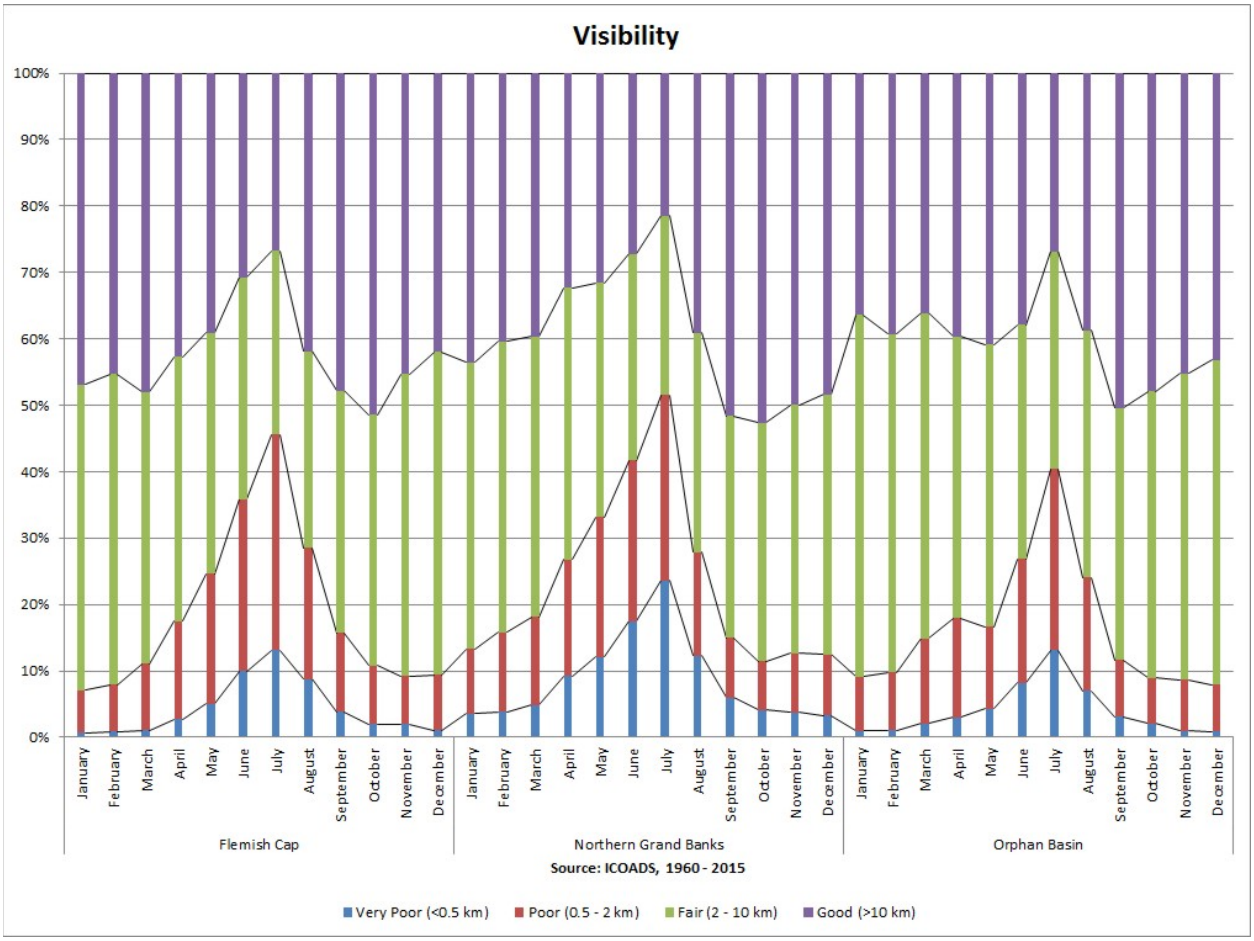


Figure 3.4 Visibility for ICOADS Regions (1960 – 2015)

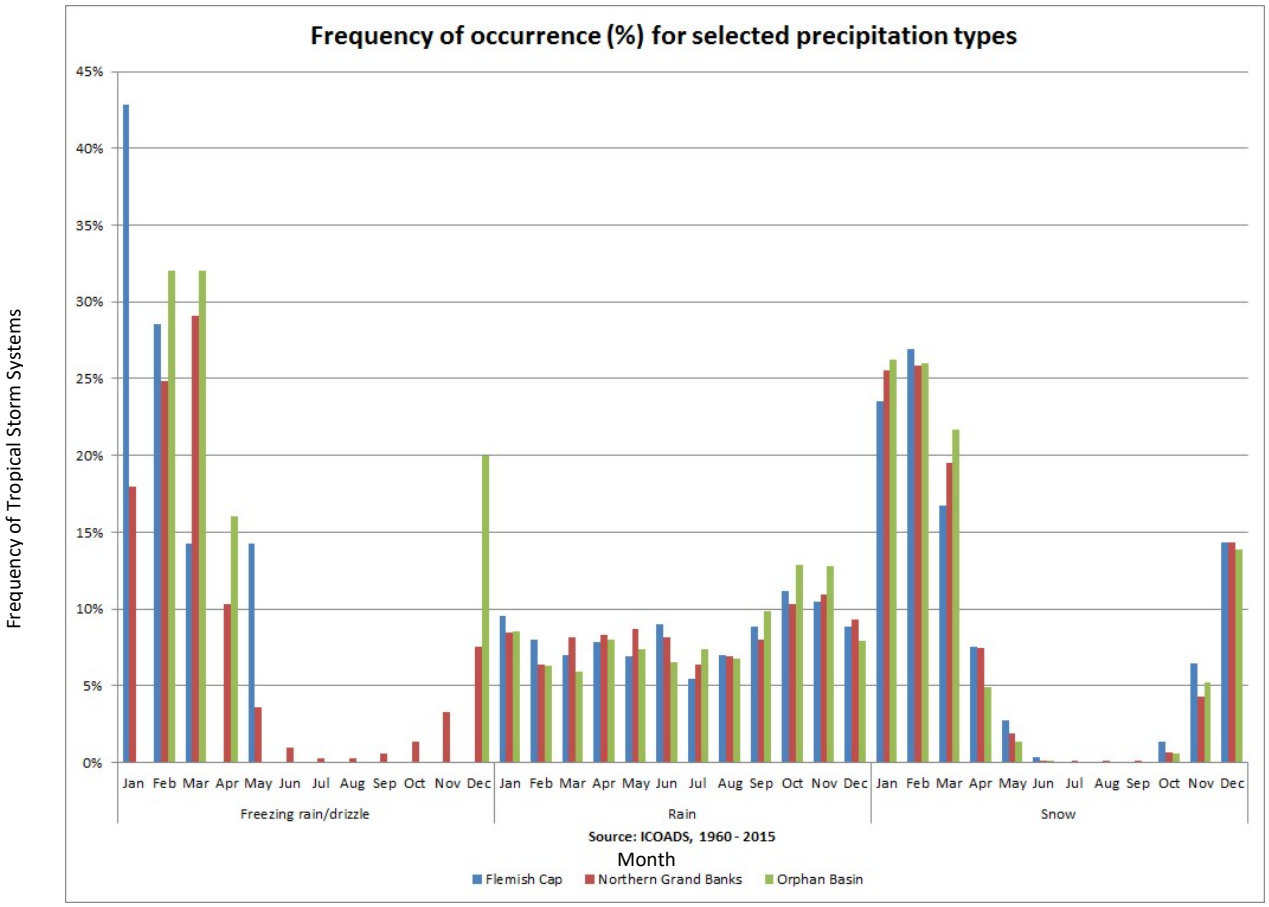


Figure 3.5 Frequency of occurrence for selected precipitation types within the Study Area (ICOADS, 1960 – 2015)

*"**Pages 3-17 and 3-20 of Addendum** - Values in Table 3.2 of the Addendum are not consistent with those provided in Table 3.2 of the EA Report. Information provided in Table 3.2 of the Addendum should be validated. Figure 3.5 in the Addendum does not appear to describe tropical storm systems. Y-axis should be revised accordingly."*

Response:

The values presented in Table 3.2 of the EA Addendum are correct and based on 12 months as requested in the EA Comments. The values provided in Table 3.2 of the EA report are erroneous and should be replaced with those in Table 3.2 of the Addendum.

The data in Table 3.2 has been validated by adding a "total" row at the end of each precipitation type. A revised Table 3.2 is provided below.

Precipitation Type	Percentage Occurrence		
	Flemish Cap	Northern Grand Banks	Orphan Basin
Freezing Rain / Drizzle	**Percentage Occurrence**		
January	42.9%	18.0%	0.0%
February	28.6%	24.8%	32.0%
March	14.3%	29.1%	32.0%
April	0.0%	10.3%	16.0%
May	14.3%	3.6%	0.0%
June	0.0%	1.0%	0.0%
July	0.0%	0.3%	0.0%
August	0.0%	0.3%	0.0%
September	0.0%	0.5%	0.0%
October	0.0%	1.4%	0.0%
November	0.0%	3.3%	0.0%
December	0.0%	7.5%	20.0%
Total	***100***	***100***	***100***
Rain	**Percentage Occurrence**		
January	9.5%	8.5%	8.5%
February	8.0%	6.3%	6.3%
March	7.0%	8.1%	5.9%
April	7.8%	8.3%	8.0%
May	6.9%	8.7%	7.3%
June	9.0%	8.1%	6.5%
July	5.5%	6.4%	7.3%
August	7.0%	6.9%	6.8%
September	8.8%	8.0%	9.8%
October	11.2%	10.4%	12.8%
November	10.4%	10.9%	12.8%
December	8.8%	9.3%	7.9%
Total	***100***	***100***	***100***
Snow	**Percentage Occurrence**		
January	23.5%	25.6%	26.3%
February	27.0%	25.9%	26.0%
March	16.7%	19.5%	21.6%
April	7.5%	7.5%	4.9%
May	2.7%	1.9%	1.3%
June	0.3%	0.1%	0.1%
July	0.0%	0.1%	0.0%
August	0.0%	0.1%	0.0%
September	0.0%	0.0%	0.0%
October	1.4%	0.7%	0.6%
November	6.5%	4.3%	5.2%
December	14.3%	14.4%	13.9%
Total	***100***	***100***	***100***

Table 3.2 Precipitation within the Study Area (ICOADS, 1960 – 2015)

"Section 3.2.4 Storms, page 3-8, Figure 3.5 *- this should be amended to provide information / data on extreme wind speed for all 12 months, also it is noted that Figure 3.5 requires a description of the x- and y-axis. "*

Response:

Data on extreme wind speed for all 12 months is now presented in Figure 3.3 above.

A new Figure 3.5 is on prior page with X and Y axis labelled.

*"**Response to "Pages 3-17 and 3-20 of Addendum" (page 13 of Addendum 2)** - Figure 3.5 in the Addendum includes "Frequency of Tropical Storm Systems" on the y-axis. Based on the proponent's response, this label is incorrect. An appropriate y-axis label for Figure 3.5 should be provided".*

Response:

The y axis in Figure 3.5, EIA Addendum 1 and 2 should be labelled as per the below:

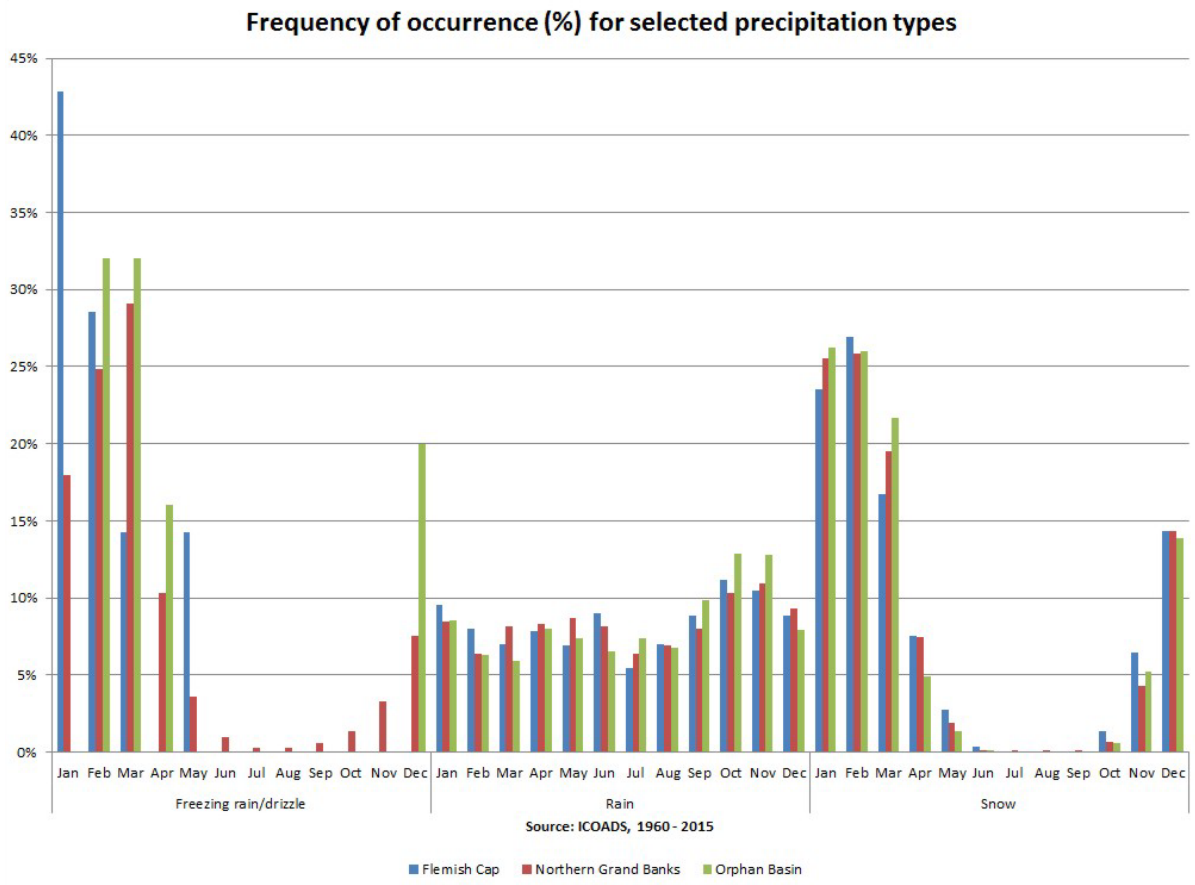


Figure 3.5 Frequency of Occurrence for Selected Precipitation Types within the Study Area (ICOADS, 1960 – 2015)

"Section 3.3.1 Waves, page 3-8 *– this section should be amended to provide a definition of significant wave height as well Figure 3.6 should provide data for significant and maximum wave height for all 12 months. "7*

Response:

Noted. The following text should be included in Section 3.3.1.

Three general regions were defined for the purposes of this EA to cover the Study Area, and these were used to query the ICOADS for 1960 to 2015 and assemble statistics of meteorological and marine conditions across this region.

The significant wave height (Hs) is traditionally defined as the mean wave height of the highest third of the waves (H 1/3) (*Holthuijsen et al. 2007)*. It is also defined as four times the standard deviation of the surface elevation – or equivalently as four times the square root of the zeroth-order moment (area) of the wave spectrum.

A summary of monthly significant wave height (Hs) and maximum wave heights (absolute) is presented in Figure 3.6 (data from NCDC et al., 2015) for the three ICOADS regions comprising the Study Area.

The largest seas are observed farthest offshore, in the Orphan Basin region. Significant wave (Hs) heights range from 2.0 m (July) to 4.9 m (April). Maximum wave heights range from 7.0 m (July) to 15.0 m (January, October and December).

A new Figure 3.6 as follows.

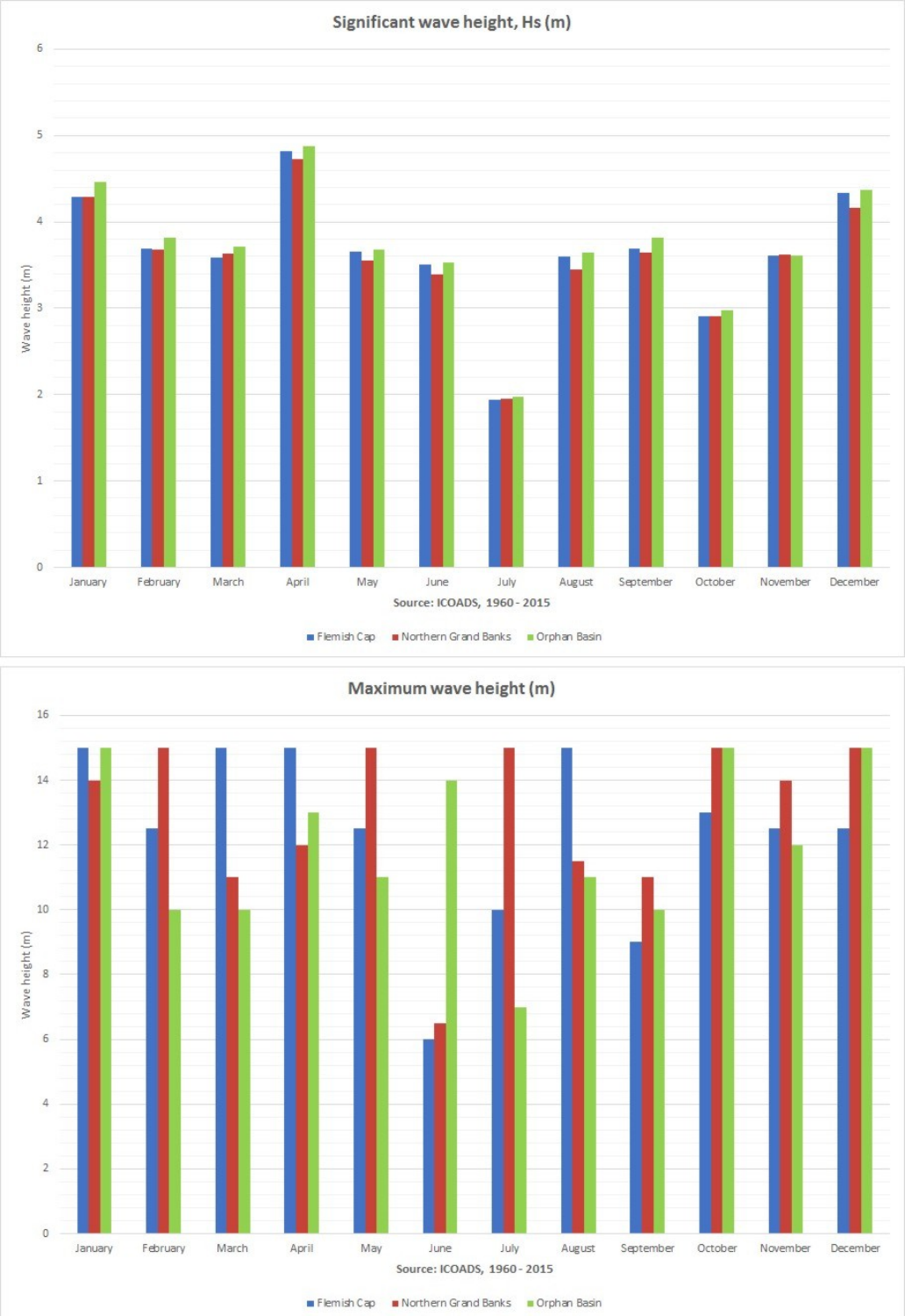


Figure 3.6 Significant wave height (Hs) and maximum wave heights for the Study Area

The Y axis of Figure 3.6 in the Addendum should be labelled as per the response below.

*"**Pages 3-21 and 3-22 of Addendum** - It is not clear which definition of significant wave height is presented in Figure 3.6. Clarification should be provided."*

Response:

Significant wave height (Hs) is being represented. The y axis of Figure 3.6 in the Addendum has been updated as per the revised figure below.

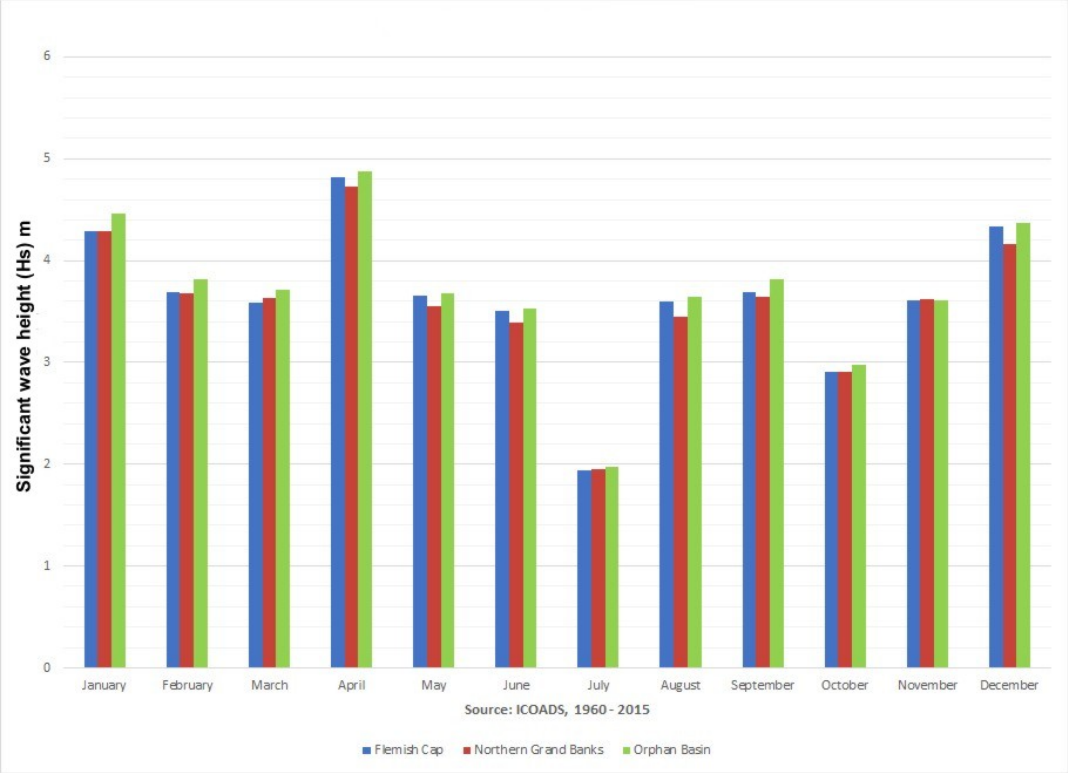


Figure 3.6 Significant wave height (Hs) and maximum wave heights for the Study Area

*"**Page 3-26 of Addendum** - Groupings for the X-axis and scale for the Y-axis should be provided."*

Response:

Figure 3.7 in the Addendum should be replaced with the below:

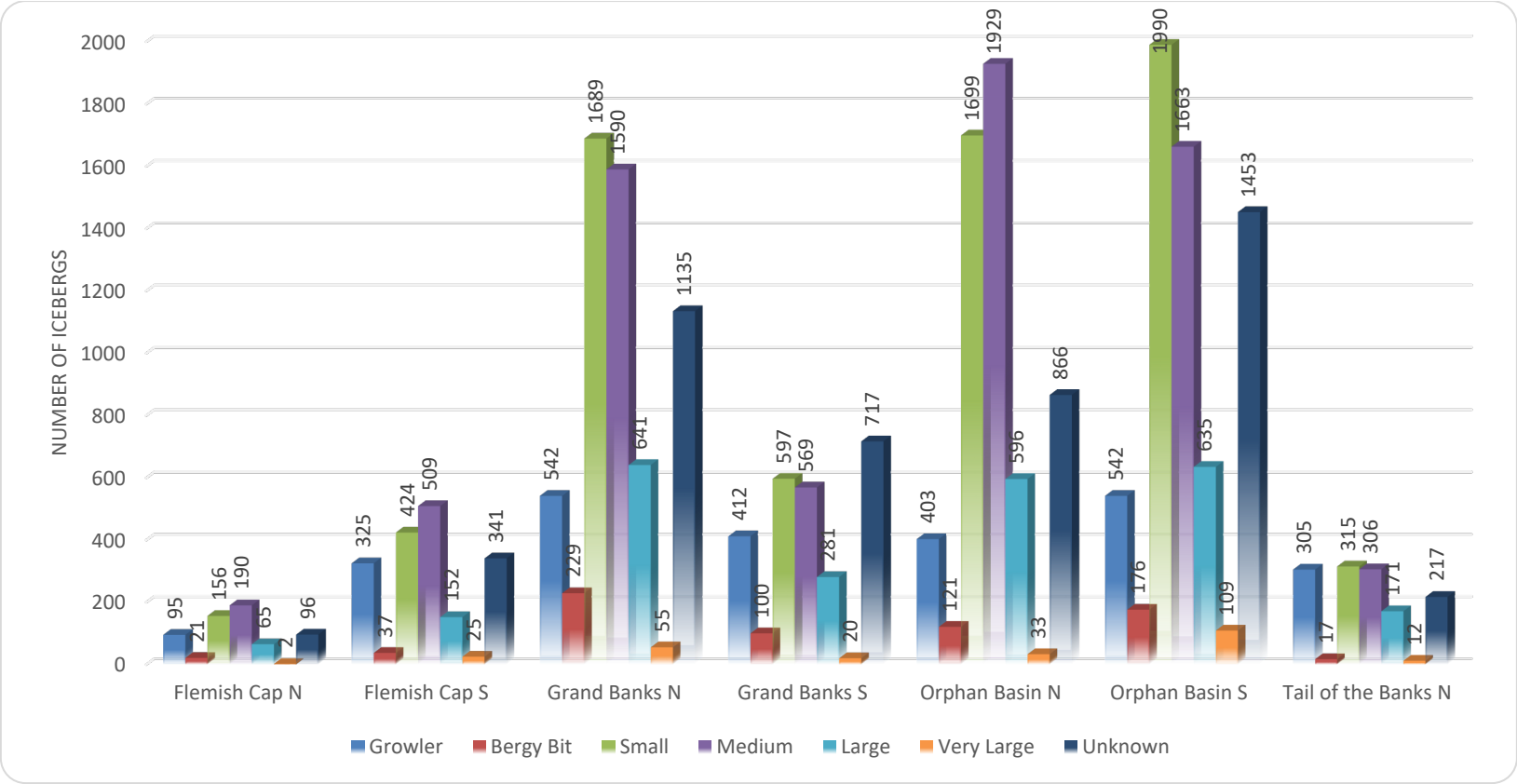


Figure 3.7. Iceberg Numbers Recorded across the Study Area (NRC-PERD Iceberg Sighting Database [1889 to 2012])

"Section 3.3.2 Currents, page 3-9 *– it is felt that this section would benefit from the inclusion of a figure depicting the major ocean currents in the study / project area. "*

Response:

A new figure 3.8 follows.

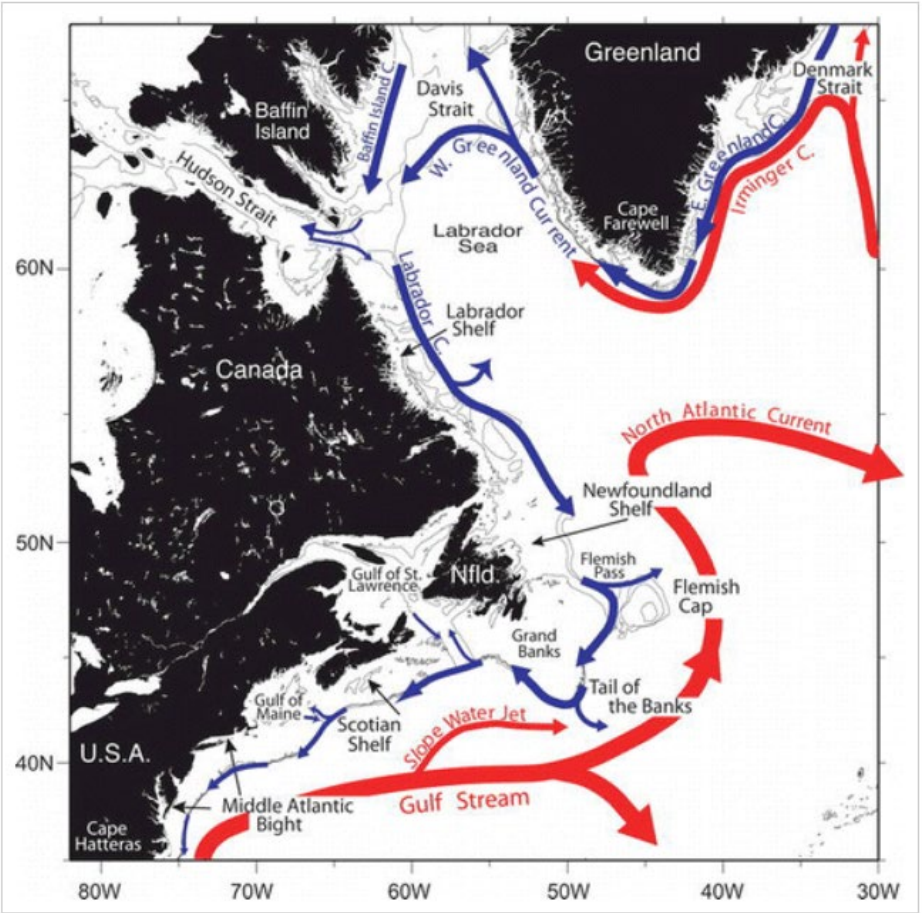


Figure 3.8 Major Ocean Currents and Surface Circulation Features in the Northwest Atlantic Ocean (Frantantoni and Pickart, 2007)

"Section 3.4.1 Sea Ice, page 3-10 *- Figures showing 30-year median sea ice coverage within the study area can be found in the Canadian Ice Service 30-Year Ice Atlas, and should be included in this section."*

Response:

Noted. The 30-year median sea ice coverage within the Study Area shown below for start to end of potential seismic operations (May and November). Open water throughout Study Area in 30 year based on median sea ice coverage (Figure 3.9) and Break-Up/Freeze-Up (Figure 3.10).

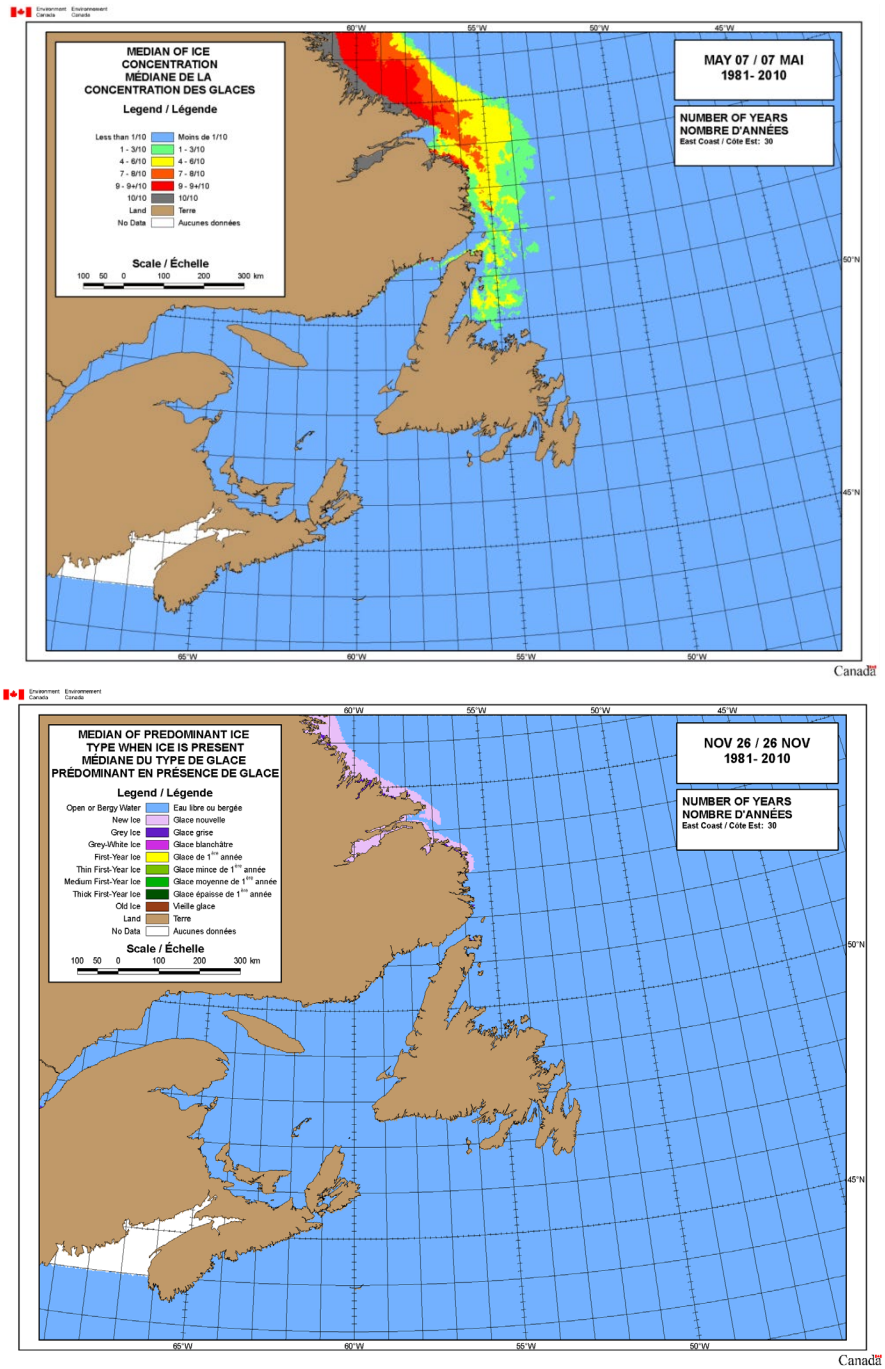
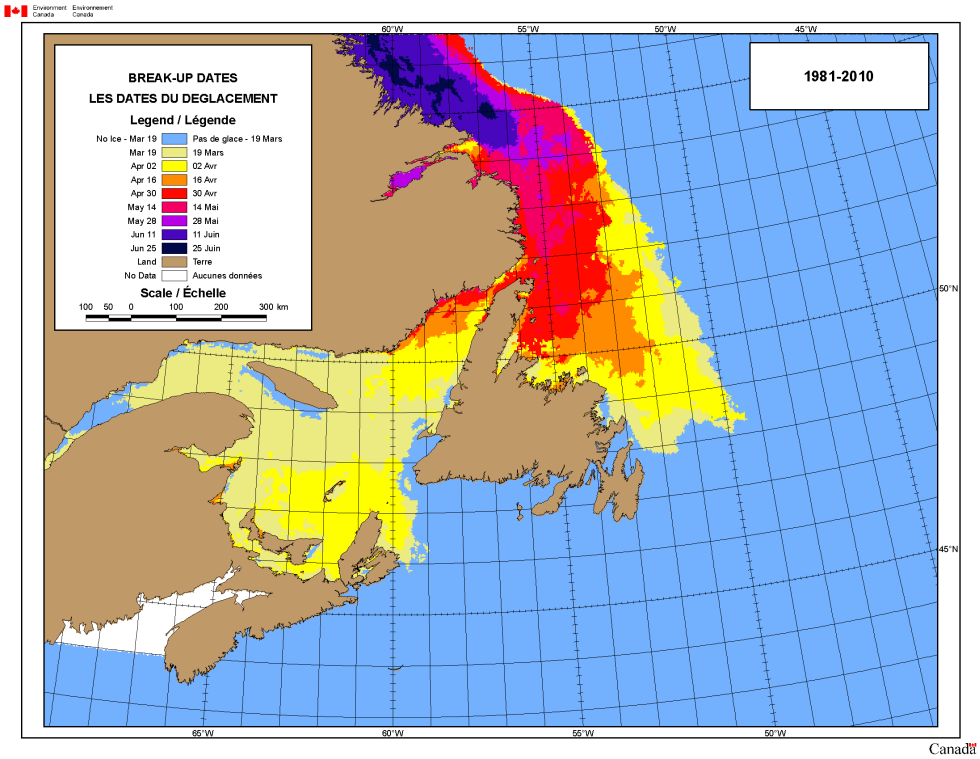


Figure 3.9 30 -Year Median Concentration of Sea Ice in East Coast Waters, 1981-2010 (first week May (top) and last week November (bottom)) (CIS, 2011)



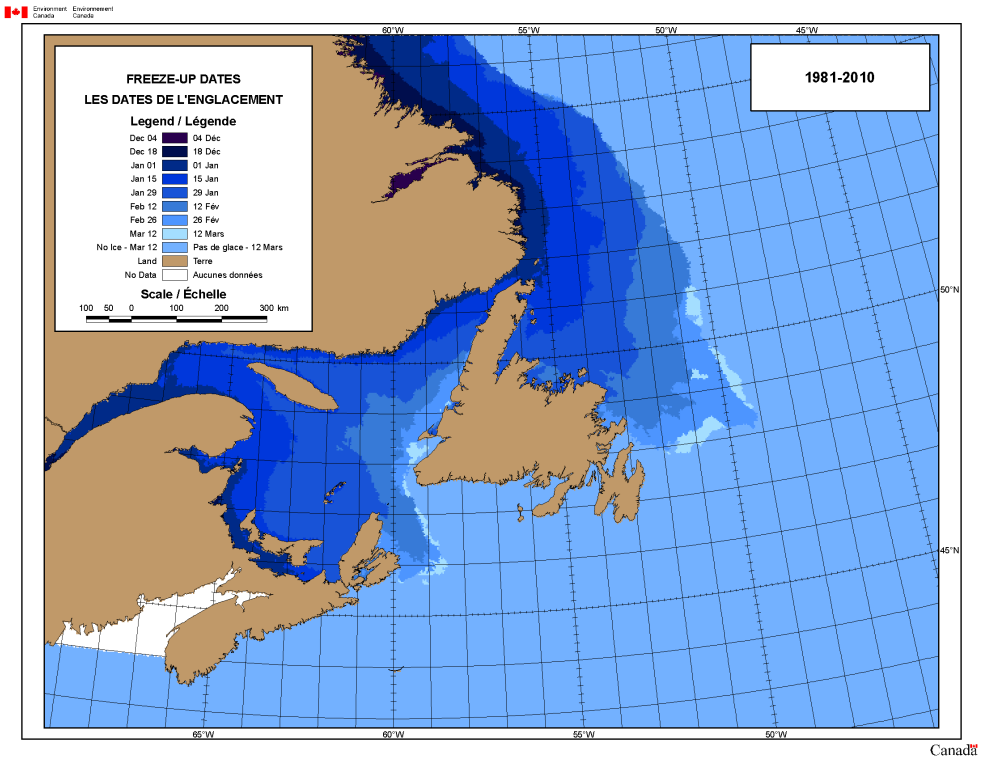


Figure 3.10 30-Year Break-Up and Freeze-Up dates Sea Ice in East Coast Waters, 1981-2010 (Break-Up (top) and Freeze-Up (bottom)) (CIS, 2011)

"Section 3.4.2 Icebergs, page 3-10, Figure 3.7 *– this requires amendment to provide a description for the x- and y-axis ".*

Response:

The data presented in the original EA Fig 3.7 is from the SEA (2014). The X- axis should read ICOADS data regions and the y-axis should read frequency of iceberg type.

"Section 4 Biological and Socioeconomic Environment, page 4-1 *- As a general comment it is felt that the description of the biological and socioeconomic environment should be organized to reflect the accepted VECs e.g. Fish and Fish Habitat VEC; Seabirds and Migratory Birds VEC; Marine Mammals and Sea Turtles VEC; Sensitive and Protected Areas VEC; and Fisheries VEC. This structure would then flow to the description of Environmental Effects (i.e. Chapter 5) ".*

Response:

Noted.

"Section 4 Biological and Socioeconomic Environment, page 4-1, Table 4-3 *- it is not clear whether the updated baseline information relative to species at risk noted in Table 4.1 includes information available from the Species at Risk Registry available on the national DFO website. This should be clarified with proper reference to same in Table 4.1 and it must also be ensured that the relevant sections of Chapter 4 of the EA that describe the various Species at Risk also include updated information that is available from the above noted registry. Also, with respect to description of commercial fisheries, Table 4.1 only references DFO commercial fishery / landing data. A portion of the study area is located outside of the 200-mile EEZ and in such areas proponents should utilize NAFO catch data and information that may be available to describe commercial fishing / landings. Table 4.1 should include reference to this data/information and subsequent descriptions of commercial fishing provided in later sections of Chapter 4 should also make use of any relevant NAFO data / information."*

Response:

Table 4.1 amended as follows to reflect that the species at risk registry from the DFO website has been used.

Table 4.1 Baseline Data Updated Since the Eastern Newfoundland SEA (August, 2014).

Data	Section	Eastern Newfoundland SEA (August 2014)	Polarcus Project-Based EIA	Data Source
High density areas and protection zones for corals, seamounts and sponges (Section 4.3)	4.3	2013 (Coral and sponge distribution); 2014 (Coral areas closed to bottom fishing)	2014 (Coral and sponge distribution); 2015 (Coral areas closed to bottom fishing)	NAFO (Northwest Atlantic Fisheries Organization)
Top 10 for measures of abundance and biomass (DFO Research Vessel (RV) Fisheries Surveys) (Section 4.4)	4.4	2005-2009	2010-2014	Fisheries and Oceans Canada Research Vessel (RV) Fisheries surveys conducted spring and fall, offshore Newfoundland by DFO Newfoundland
Fish species at risk and otherwise of special conservation concern (DFO Research Vessel (RV) Fisheries Surveys) (Section 4.4.2)	4.4	2005-2009	2010-2014	Fisheries and Oceans Canada Research Vessel (RV) Fisheries surveys conducted spring and fall, offshore Newfoundland by DFO Newfoundland **Species at Risk Public Registry - DFO**
Seabird seasonal distribution and abundance (Section 4.5.1)	4.5.1	2010 to 2013	2006 to December 2015	Environment Canada, Canadian Wildlife Service, Eastern Canada Seabirds at Sea database **Species at Risk Public Registry - DFO**
IBAs and seabird colony sites (Section 4.5.2)	4.5.2	IBA 2013; EC-CWS 2013	IBA 2016; EC-CWS 2016	Bird Studies Canada. 2016. Important Bird Areas of Canada Database. Port Rowan, Ontario: Bird Studies Canada. http://www.ibacanada.org; Atlantic Canada Colonial Waterbird database (EC-CWS, 2016)
Marine mammal sightings (Section 4.6.1)	4.6.1	Up to 2014	Up to 2015	Fisheries and Oceans Canada Marine Mammals Sightings Database
Ecologically and biologically sensitive areas (EBSAs) (Section 4.7.1)	4.7.1	DFO (2007 – 2013)	DFO (2007, 2013); CBD (2016)	Fisheries and Oceans Canada; Convention on Biological Diversity
Distribution of other species of commercial importance (DFO Research Vessel (RV) Fisheries Surveys) (Section 4.8.1)	4.8.1.1	2005-2009	2010-2014	Fisheries and Oceans Canada Research Vessel (RV) Fisheries surveys conducted spring and fall, offshore Newfoundland by the Fisheries and Oceans Canada.
DFO Fisheries catch data by weight and value (Section 4.8.1)	4.8.1.2	2008-2012	2010-2014	Fisheries landings (catch) data analysed by Fisheries and Oceans Canada Ottawa

DFO Commercial fishing locations (Section 4.8.1.1)	4.8.1.2	2008-2012	2010-2014	Fisheries landings (catch) data analysed by Fisheries and Oceans Canada Ottawa
DFO Key fisheries landed by species (Section 4.8.1.2)	4.8.1.2	2008-2012	2010-2014	Fisheries landings (catch) data analysed by Fisheries and Oceans Canada Ottawa
DFO Fish harvests by gear types (Section 4.8.1.3)	4.8.1.3	2008-2012	2010-2014	Fisheries landings (catch) data analysed by Fisheries and Oceans Canada Ottawa
Sealing (Section 4.8.1.4)	4.8.1.4	2011-2013	2015	Fisheries and Oceans Canada
Shipwrecks, UXO (Section 4.8.4)	4.8.4	2013	2016	The Department of National Defence

Response:

The titles of Tables 4.3, 4.4, 4.5 and 4.6 amended as follows to reflect that the species at risk registry from the DFO website has been used.

Table 4.3. Species Selection Rationale (Canadian RV Surveys, 2010-2014, Species at Risk Public Registry – DFO, 2017)

Table 4.4. Marine Fish Species at Risk within the Eastern Newfoundland Offshore Area (C-NLOPB, 2014, Species at Risk Public Registry – DFO, 2017)

Table 4.5. Bird Species at Risk within the Eastern Newfoundland Offshore Area (C-NLOPB, 2014, Species at Risk Public Registry – DFO, 2017)

Table 4.6. Marine Mammal and Turtle Species at Risk that are Known to or May Occur within the Study Area (C-NLOPB, 2014, Species at Risk Public Registry – DFO, 2017).

*"**Pages 3-27 to 3-30 of Addendum** - In Table 4.1, The Species at Risk Registry should also be referenced for marine mammals and sea turtles. Table 4.1 should be amended to include NAFO catch data and other relevant NAFO data considering that a substantial portion of the Study Area is outside the 200-mile EEZ. With respect to NAFO data provided in the Addendum (pages 3-29 to 3-30), the associated NAFO Divisions should be specified."*

Response:

Table 4.1 has been amended as follows to reflect that the species at risk registry from the DFO website has been referenced for marine mammals and sea turtles and to include NAFO catch data and other relevant NAFO data.

Table 4.1. Baseline Data Updated Since the Eastern Newfoundland SEA (August 2014)

Data	Section	Eastern Newfoundland SEA (August 2014)	Polarcus Project-Based EIA	Data Source
High density areas and protection zones for corals, seamounts and sponges (Section 4.3)	4.3	2013 (Coral and sponge distribution); 2014 (Coral areas closed to bottom fishing)	2014 (Coral and sponge distribution); 2015 (Coral areas closed to bottom fishing)	NAFO (Northwest Atlantic Fisheries Organization)
Top 10 for measures of abundance and biomass (DFO Research Vessel (RV) Fisheries Surveys) (Section 4.4)	4.4	2005-2009	2010-2014	Fisheries and Oceans Canada Research Vessel (RV) Fisheries surveys conducted spring and fall, offshore Newfoundland by DFO Newfoundland
Fish species at risk and otherwise of special conservation concern (DFO Research Vessel (RV) Fisheries Surveys) (Section 4.4.2)	4.4	2005-2009	2010-2014	Fisheries and Oceans Canada Research Vessel (RV) Fisheries surveys conducted spring and fall, offshore Newfoundland by DFO Newfoundland Species at Risk Public Registry - DFO
Seabird seasonal distribution and abundance (Section 4.5.1)	4.5.1	2010 to 2013	2006 to December 2015	Environment Canada, Canadian Wildlife Service, Eastern Canada Seabirds at Sea database Species at Risk Public Registry - DFO
IBAs and seabird colony sites (Section 4.5.2)	4.5.2	IBA 2013; EC-CWS 2013	IBA 2016; EC-CWS 2016	Bird Studies Canada. 2016. Important Bird Areas of Canada Database. Port Rowan, Ontario: Bird Studies Canada. http://www.ibacanada.org; Atlantic Canada Colonial Waterbird database (EC-CWS, 2016)
Marine mammal sightings (Section 4.6.1)	4.6.1	Up to 2014	Up to 2015	Fisheries and Oceans Canada Marine Mammals Sightings Database
Species at Risk (Section 4.6.3)	**4.6.3**	**Up to 2014**	**Up to 2015**	**Species at Risk Public Registry - DFO**
Ecologically and biologically sensitive areas (EBSAs) (Section 4.7.1)	4.7.1	DFO (2007 – 2013)	DFO (2007, 2013); CBD (2016)	Fisheries and Oceans Canada; Convention on Biological Diversity
Distribution of other species of commercial importance (DFO Research Vessel (RV) Fisheries Surveys) (Section 4.8.1)	4.8.1.1	2005-2009	2010-2014	Fisheries and Oceans Canada Research Vessel (RV) Fisheries surveys conducted spring and fall, offshore Newfoundland by the Fisheries and Oceans Canada.

Data	Section	Eastern Newfoundland SEA (August 2014)	Polarcus Project-Based EIA	Data Source
DFO Fisheries catch data by weight and value (Section 4.8.1)	4.8.1.2	2008-2012	2010-2014	Fisheries landings (catch) data analysed by Fisheries and Oceans Canada Ottawa
DFO Commercial fishing locations (Section 4.8.1.1)	4.8.1.2	2008-2012	2010-2014	Fisheries landings (catch) data analysed by Fisheries and Oceans Canada Ottawa
DFO Key fisheries landed by species (Section 4.8.1.2)	4.8.1.2	2008-2012	2010-2014	Fisheries landings (catch) data analysed by Fisheries and Oceans Canada Ottawa
DFO Fish harvests by gear types (Section 4.8.1.3)	4.8.1.3	2008-2012	2010-2014	Fisheries landings (catch) data analysed by Fisheries and Oceans Canada Ottawa
Foreign (non-Canadian) fishing activity by NAFO Division	**See first addendum**	**2008-2012**	**2010-2014**	**NAFO Statlant 21A**
Foreign (non-Canadian) fishing activity by Species	**See first addendum**	**2008-2012**	**2014**	**NAFO Statlant 21A**
Foreign (non-Canadian) fishing activity by Country	**See first addendum**	**2008-2012**	**2014**	**NAFO Statlant 21A**
Sealing (Section 4.8.1.4)	4.8.1.4	2011-2013	2015	Fisheries and Oceans Canada
Shipwrecks, UXO (Section 4.8.4)	4.8.4	2013	2016	The Department of National Defence

With respect to the NAFO data provided in the Addendum (pages 3-29 to 3-30), the associated NAFO Divisions are specified in the Table on page 3-28 (Foreign (non-Canadian) Fishing Activity by NAFO Division (tonnes) (2010 – 2014)). The figures on pages 3-29 and 3-30 plot the data for all these NAFO divisions by species.

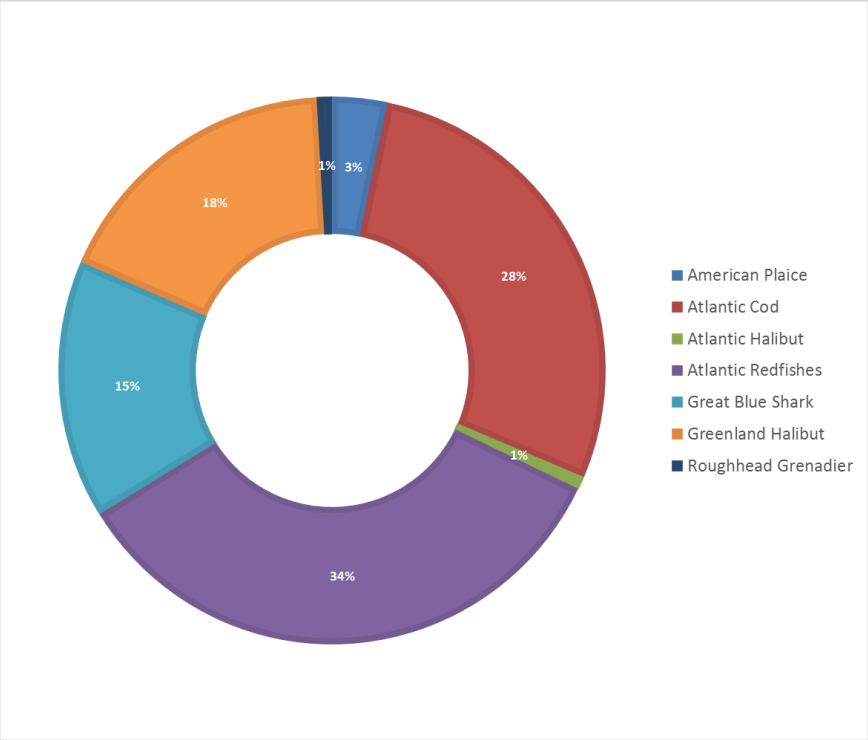
Section 4.8.1.2 does not present the output of NAFO catch data as NAFO catch data was not used for fishing outside the 200-mile EEZ. DFO catch landings data was the source for commercial fishing locations. These are two different data sources, but the NAFO specific data source was not used so the total catch weight and values presented are from DFO catch landings only, not NAFO. NAFO specific data has been used to prepare total catch weight and value tables related to fishing outside the 200-mile EEZ as follows.

Foreign (non-Canadian) Fishing Activity by NAFO Division (tonnes) (2010 – 2014) (NAFO Statlant 21A)

NAFO Division	2010	2011	2012	2013	2014	Total
3K	1	8				**9**
3L	14,204	12,948	11,687	10,659	10,068	**59,566**
3M	20,583	24,725	25,885	27,596	25,795	**124,584**
3N	12,424	12,441	12,899	13,704	8,617	**60,085**
Total	**47,212**	**50,122**	**50,471**	**51,959**	**44,480**	**244,244**

Foreign (non-Canadian) Fishing Activity by Species (2014) (NAFO Statlant 21A)

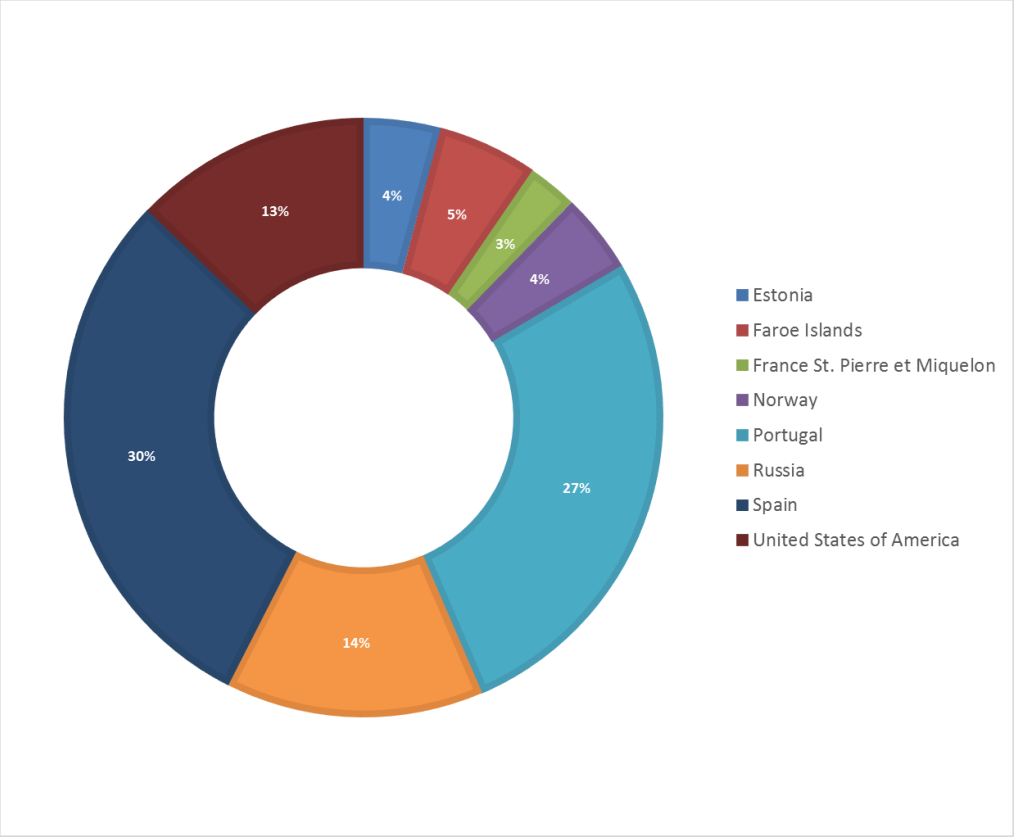
Species	Total Catch (tonnes)
American Plaice	2,162
Atlantic Cod	18,500
Atlantic Halibut	500
Atlantic Redfishes	22,433
Great Blue Shark	10,073
Greenland Halibut	11,613
Roughhead Grenadier	569
Total	**65,850**



***Most Landed species by percentage weight (tonnes) for foreign (non-Canadian) vessels, 2014 (*NAFO Statlant 21A)**

Foreign (non-Canadian) Fishing Activity by Country (2014) (NAFO Statlant 21A)

Country	Total Catch (tonnes)
Estonia	2,716
Faroe Islands	3,530
France St. Pierre et Miquelon	1,756
Norway	2,827
Portugal	17,662
Russia	9,129
Spain	19,431
United States of America	8,394
Total	**65,445**



Total catch by percentage weight (tonnes) for foreign (non-Canadian) vessels, 2014 (NAFO Statlant 21A)

"Section 4.1 Plankton, Section 4.2 Benthos and Section 4.3 Deep-water Corals and Sponges, pages 4-2 to 4-4 *- similar to the comment made above these sections should all be included within a larger more inclusive Fish and Fish Habitat VEC. Also, the descriptions seem to lack information*

to describe species that may be (or that may be expected to be) present, their relative abundance, relative distribution and relative variability. It is also not clear to what extent any data gaps within the Eastern Newfoundland Offshore SEA have been acknowledged / identified / addressed and whether any new information has been brought to bear in the description. This should be clarified and amended accordingly. For example, there may be new and updated distribution data relative to coral and sponge presented in the 2016 CSAS report 'Delineation of Coral and Sponge Significant Benthic Areas in Eastern Canada Using Kernel Density Analyses and Species Distribution Models' (CSAS, Research Document 2016/093) which may have relevance to appropriate sections of this project EA."

Response:

Noted. An occurrence of the various species summary table is already presented in Section 4.4.

The Eastern Newfoundland Offshore SEA has been a detailed source of information in preparation of the EA report. It is acknowledged that data sourced from the Eastern Newfoundland Offshore SEA could have been more clearly highlighted across the EA report, as per an above comment. Various additional sources of data have also been used in order to compile the EA report and are referenced in Section 4 the Table 4.1.

Data gaps have been taken into account during the assessment, however it is noted that the data gaps identified in the Eastern Newfoundland Offshore SEA have not been presented in the EA in relation to Fish and Fish Habitat, Fisheries and Other Ocean Users, Seabirds, Marine Mammals, Sea Turtles, species at Risk and Sensitive Areas.

*"**Page 3-31 of Addendum** - This comment has not been adequately addressed. Information on species abundance, distribution and variability should be provided. How data gaps from the Eastern Newfoundland Offshore SEA have been taken into account should be described. Updated data and references should be provided."*

Response:

Moving sections to a larger VEC section has no added value and does not materially influence the technical content of the report or its conclusions. However, sections 4.1, 4.2 and 4.3 have been updated as per the revised sections below (updated text is provided in Bold).

The way in which data gaps from the Eastern Newfoundland Offshore SEA have been considered has been described in the response to ***Section 5.5 Effects Assessment, page 5-8 of EA Report and page 3-11 of this Addendum*** on pages 7 and 8 above.

4.1 Plankton

Plankton consists of the plants (phytoplankton) and animals (zooplankton) which live freely in the water column and drift with the water currents. Plankton community composition is variable and depends upon water circulation, the time of year, and nutrient availability. Abundance is influenced strongly by (among other factors) depth, tidal mixing, temperature stratification,

nutrient concentrations and the location of oceanographic fronts. Species distribution depends on temperature, salinity, water flow, and benthic communities.

It is important to understand plankton distribution and abundance within the Study Area since phytoplankton is the primary producer of the marine food chain (*Djiman and Sohou, 2013*) and zooplankton are the principal link between primary producers and higher trophic levels (e.g. fish, marine mammals, and seabirds). As such, plankton composition and distribution has a profound impact on the occurrence of many marine species and socioeconomic activities within the Study Area. Information on plankton within the vicinity of the Study Area has been reviewed extensively in the Eastern Newfoundland Offshore Area SEA.

Generally, the waters of the Northwest Atlantic experience a spring and autumn bloom in plankton. Previous research indicates that the dominant phytoplankton bloom occurs in the Northwest Atlantic typically in early spring, usually April or May (*Maillet et al., 2004; Harrison et al., 2013*), and is dissipated over the summer as nutrient levels are prevented from replenishing by the formation of the summer thermocline (*Harrison et al., 2013)*. Fall winds and cooler temperatures break down this thermocline, permitting nutrients to recharge and facilitating a second, weaker bloom in autumn (*Maillet et al., 2004*). Within the Eastern Newfoundland Offshore Area, larger microplankton are dominated by diatoms (e.g. Chaetoceros sp.), but dinoflagellates (Ceratium spp.) become more abundant in autumn/winter (*Harrison et al., 2013*).

Within the Study Area, the distribution of phytoplankton on the Grand Banks is controlled largely by upwelling and enhanced vertical mixing on the slopes shelf break and thermal gradients between the shelf and slope waters (*Anderson and Gardner 1986; Templeman, 2007*). The most productive areas are typically in the waters on the shelf and the shelf break over the shelf slope.

The oceanographic conditions in the study area are dominated by the sub-polar gyre driven by the south-flowing Labrador current (*Han et al., 2008*; *Wang & Greenan, 2014*). This interfaces with the northward extension of the North Atlantic Current and creates a boundary region in the vicinity of the Orphan Basin (*Han et al., 2008*) which represents the transition from Arctic influenced waters and coincides with increasing cell numbers of bacteria and phytoplankton (*Wang & Greenan, 2014*).

Primary production in the North Atlantic is strongly related to light conditions and sea-surface temperature as well as vertical water column stabilization (*Melle et al., 2014*). The seasonal cycle of primary production differs between on-shelf and deeper regions; the spring bloom starts in early spring (late March/April) and reaches its peak one month later around the Grand Banks and Flemish Cap, whereas on the Labrador shelf further to the north the spring bloom does not often start until May (*Melle et al., 2014*).

As the spring phytoplankton bloom develops it triggers a corresponding large increase in zooplankton that reproduce in relation to the abundance of the phytoplankton food source. Zooplankton are a key food source for a number of species including fish, birds and marine mammals. The timing of the bloom period directly influences populations that depend upon it as a food source. For example, the timing of the spring bloom influences the timing of salmon productivity (*Malick et al., 2015*).

In the Newfoundland region zooplankton are dominated by three large copepod species, the largest of which is the boreal species *Calanus finmarchius* which is common in the North Atlantic

from the coast of Maine to the Barents Sea (*Melle et al., 2014*). The two-other species are *Calanus glacialis* and *C. hyperboreus* which are associated with artic influxes of water from the Labrador current (*Wang & Greenan, 2014*). These species and others spend winter months at depth below the permanent thermocline into deep ocean basins (between 600 and 1,400 metres). All three species return to the surface to grow and reproduce in spring so that they can take advantage of the abundant food source provided by the phytoplankton bloom. As the reproductive cycle of these species is very closely linked to the bloom period, the timing of the period and the factors influencing it is key to their seasonal observed abundance near the sea surface.

Surveys of the Grand Banks and Newfoundland Shelf indicate a north-south decline in total zooplankton biomass, with production declining from inshore areas to the shelf edge depending on the year (*Dalley and Anderson, 1998*). Jellyfish are predominantly found in inshore areas and on the northern Grand Banks (*Dalley and Anderson, 1998*), while *C. hyperboreus* are confined mostly to the outer shelf and slope waters (*Maillet et al., 2004*). Similarly, euphausids (krill), an important prey species for marine mammals, have the highest densities in slope waters and offshore regions (*Maillet et al., 2004*). The International Young Gadoid Pelagic Trawl (1997 to 1998) found that Ichthyoplankton densities along the Northeast Newfoundland Shelf and the Grand Banks vary by orders of magnitude (*Dalley and Anderson, 1998*) and community structure can differ according to year, season and location (*Frank et al., 1992; Dalley and Anderson, 1998*). Assemblages on the Northeast Newfoundland Shelf are largely dominated by capelin (73.5 percent), sand lance (11.3 percent), lanternfish (5.9 percent), and Arctic cod (3.4 percent). During the survey, squid larvae were also noted for being widespread across the Grand Banks and Newfoundland Shelf (*Dalley and Anderson, 1998*).

<u>References</u>

Han, G., Lu, Z., Wang, Z., Helbig, J. Chen, N. & de Young, B. (2008), Seasonal variability of the Labrador Current and shelf circulation off Newfoundland, J. Geophys. Res., 113(C10013): 1-23. doi:10.1029/2007JC004376.

Malick, M. J., Cox, S. P., Mueter, F. J., & Peterman, R. M (2015), Linking phytoplankton phenology to salmon productivity along a north–south gradient in the Northeast Pacific Ocean. Canadian Journal of Fisheries and Aquatic Sciences, 72(5), 697-708.

Melle, W., Runge, J., Head, E., Plourde, S., Castellani, C., Licandro, P. & Debes, H. (2014), The North Atlantic Ocean as habitat for Calanus finmarchicus: Environmental factors and life history traits. Progress in Oceanography, 129, 244-284.

Wang, Z. & Greenan, B. J. W. (2014), Physical oceanographic conditions on Newfoundland Shelf / Flemish Cap – from a model perspective (1990-2012). Scientific Council Meeting – June 2014. NAFO SCR Doc., 14 / 008.

4.2 Benthos

Benthic fauna forms an important part of the marine ecosystem, providing a food source for other invertebrates and fish as well as cycling nutrients and materials between the water column and underlying sediments. Benthic organisms occur either the substrate surface (epifauna) or live

within the substrate (infauna). The benthos is made up of diverse species which are relatively long-lived and sedentary, and which exhibit different tolerances to stress, making them useful indicators of environmental conditions. The benthic invertebrate communities of Eastern Newfoundland are described in the Eastern Newfoundland Offshore Area SEA. The SEA found that benthic communities in the Study Area are quite diverse compared to higher trophic levels, depending on species and habitat type, and these communities can be expected to vary over time and with changing environmental conditions (*LGL 2012& 2013; Kenchington et al., 2001).*

A study by Kenchington *et al.,* (2001) on the Grand Banks, which lies within the Study Area, documented 246 benthic taxa (mostly echinoderms, polychaetes, crustaceans and molluscs), of which abundance was dominated by a polychaete (*Prionospio steenstrupi*) and a mollusc (*Macoma calcarea*), and biomass was dominated by propeller clams and sand dollars. According to oil and gas environmental monitoring associated with the White Rose and Terra Nova Oilfields (*Husky Energy, 2010; Suncor Energy, 2010*), polychaetes are numerically dominant (greater than 72 percent) in Grand Bank grabs followed by amphipods and bivalves. Schneider *et al.,* (1987) documented benthic communities of the northeastern part of the Grand Banks using video and determined that epifaunal communities were dominated by echinoderms (brittlestars, urchins and sand dollars) as well as bivalves (primarily Icelandic scallop). A study by Houston and Haedrich (1984) revealed that the southeastern Grand Banks communities were dominated by polychaetes, hooded shrimp, sipunculid worms, amphipods, echinoderms, isopods and bivalves (*Houston and Haedrich 1984*).

Benthic species are highly sensitive to the environmental conditions associated with different depths. Distribution of benthic infauna is expected to be wide over the study area and will vary according to depth and sediment type. As for many ocean areas there are assemblages of species observed with different depth zones. Benthic systems in deep sea often operate at a slower pace, with many deep-sea species having a much slower metabolism, exhibiting late maturity and long lifespans compared to shallow water species (*Smith et al., 1994*; *McClain & Schalcher 2015*; *Murillo et al. 2016*). Consequently, species over shallower areas (the Grand Banks for example) can be expected to differ from those over the deep ocean zones.

In the Grand Banks in the south-west of the study area, where water depths are in the region of 500 metres or less, previous surveys involving experimental trawling and underwater video (*Prena et al., 1999*; *Kenchington et al., 2001*) showed benthic species with greatest abundance to include propeller clams, sand dollars, brittle stars, Macoma clams and pale sea urchins.

At the Flemish Cap (in the south-east of the study area), higher species diversity has been observed at depths of between 500 and 1,000 metres (*Murillo et al., 2012*; *2016*). Distinct species groupings were observed related to depth. At relative shallow waters (around 500 metres and less) there were widely occurring species observed including sponges, crustaceans, sea anemones and sea stars. Along the slopes at 500 to 900 metres benthic communities were observed to be comprised of coral species, including black corals, cup corals, sea pens, soft corals and gorgonian corals. This depth range also had the highest diversity. At the lower slope area between 800 and 1,200 metres where silty sand was observed, echinoderms and sea pen species dominated (*Murillo et al., 2016*). Further to the north along the Flemish Cap is the Sackville Spur which is a known high-density area for deep-sea sponge assemblages

(1,000 to 1,700 metres) that are associated with high species richness and maximum bottom currents (*Knudby et al. 2013*; *Beazley & Kenchington 2015*).

In the Orphan Basin (central and northern region of the study area), representing deeper waters. There is very limited data from surveys for these deeper areas. However, a key study (*Carter et al., 1979*) took benthic samples from various depth ranges. The upper slopes of the Orphan Basin at depths of between 300 and 700 metres were characterised by gravel and sandy mud sediments where polychaetes, bivalve and echinoderms were dominant. The middle slope depth range (700 to 2,000 metres) was characterised by mud, sandy mud and gravels with polychaetes, ophuroids and molluscs dominating but in low numbers. The greatest depths sampled were of the lower slope (2,500 to 3,000 metres) which were very similar to observations from the middle slope region (*Carter et al., 1979*).

An overview of the ecology and distribution of key **macro**invertebrate **benthic** species within the Study Area is presented in Table A.1 of Appendix A. **Distribution of these species is expected to be wide over the study area and highly correlated to depth (depth ranges for macroinvertebrate species are also given in Table A.1 in the original EA).**

<u>References</u>

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Carter, L., Schafer, C. T., & Rashid, M.A. (1979), Observations on depositional environments and benthos of the continental slope and rise, east of Newfoundland. Canadian Journal of Earth Sciences, 16(4): 831-846.

Kenchington, E. L., Prena, J., Gilkinson, K. D., Gordon Jr, D. C., MacIsaac, K., Bourbonnais, C., & Vass, W. P. (2001), Effects of experimental otter trawling on the macrofauna of a sandy bottom ecosystem on the Grand Banks of Newfoundland. Canadian Journal of Fisheries and Aquatic Sciences, 58(6): 1043-1057.

Knudby, A., Kenchington, E., & Murillo, F. J. (2013), Modeling the distribution of Geodia sponges and sponge grounds in the Northwest Atlantic. PloS one, 8(12): e82306.

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Murillo, F. J., Muñoz, P. D., Cristobo, J., Ríos, P., González, C., Kenchington, E., & Serrano, A. (2012), Deep-sea sponge grounds of the Flemish Cap, Flemish Pass and the Grand Banks of Newfoundland (Northwest Atlantic Ocean): distribution and species composition. Marine Biology Research, 8(9): 842-854.

Murillo, F. J., Serrano, A., Kenchington, E., and Mora, J. (2016), Epibenthic assemblages of the Tail of the Grand Bank and Flemish Cap (Northwest Atlantic) in relation to environmental parameters and trawling intensity. Deep-Sea Research Part I: Oceanographic Research Papers, 109: 99-122.

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Banks of Newfoundland: analysis of trawl bycatch and effects on epifauna. Marine Ecology Progress Series, 181, 107-124.

Smith, C. R. (1994), Tempo and mode in deep-sea benthic ecology: Punctuated equilibrium revisited. Palaios, 9: 3-13.

4.3 Deep Water Corals and Sponges

Coral and sponge species are species that become established and attached to an object or substrate. They therefore form parts of the environments for other species which rely on them for areas of refuge and congregation. Due to their sessile nature they are vulnerable to external pressures such as trawling.

Because of their sensitivity, many coral or sponge grounds in the vicinity of the study area are protected and are closed to fishing activity. Areas of high abundance for corals, sea pens, and sponges have been identified by the Department of Fisheries and Oceans (DFO) and the Northwest Atlantic Fisheries Organization (NAFO). In response to known sensitivity of coral and sponge grounds, coral and sponge areas are protected in Canadian and NAFO waters (*NAFO, 2015*). The updated boundaries (*NAFO, 2015*) for the protected coral and sponge areas are illustrated in Figure 4.1, highlighting the coverage area for the Eastern Flemish Cap Coral Closure Area expanding in size relative to its area presented in the Eastern Newfoundland SEA (*AMEC, 2014*).

Previous benthic bottom trawl and video surveys have identified over 50 species of corals and sea pens in the wider vicinity of the study area including the Flemish Cap, Flemish pass and north-east slopes of the Grand Banks (*Murillo et al. 2011*; *Beazley et al., 2013a*; *Vàzquez et al., 2013*; *Baillon et al., 2014*). Species distribution modelling of corals has indicated that depth is the greatest predictor for coral presence (*Guijarro et al., 2016*). The Flemish Cap has also been observed to have great coral richness (*Murillo et al., 2016*). Within the study area coral biomass is mainly distributed along the slopes of the Flemish Pass, the Flemish Cap, and the Grand Banks (*Murillo et al., 2011*). However, outside the slope areas observations of coral species are fewer. However, this is likely to be due to the lack of survey data at greater depths rather than absence of species – many regions of the world report coral and sponge species at great depths. The species distribution modelling is also not considered to be so accurate for deeper areas due to the lack of survey data to verify the predictions (*Guijarro et al., 2016*).

Within the Study Area, Black corals are found at their highest densities in the Flemish Pass, the northern Flemish Cap, and Tobin's Point (Orphan Knoll) while important areas for sea pens are aggregated in the Flemish Pass, the northern Flemish Cap and in one location on the Tail of the Grand Banks. Sponges, in contrast, are more widely distributed and high densities can be found along the eastern slopes of the Grand Banks and around the Flemish Cap (*Murillo et al., 2012, NAFO, 2011, Wareham and Edinger, 2007; NAFO, 2014*) (Figure 4.1).

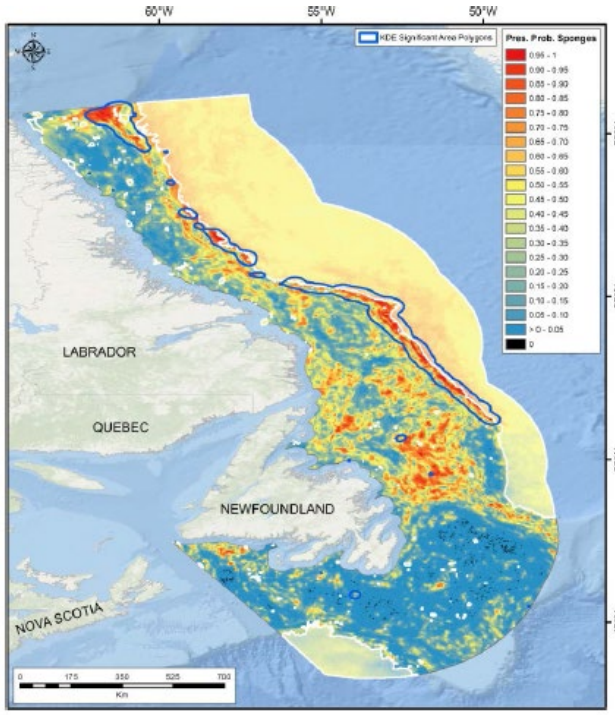
Coral species distribution within the Study Area is summarized in Table 4.2 (*Murillo et al., 2012*). An updated distribution is geographically portrayed in Figure 4.1. Symbols used to reflect updated coral and sponge distribution (*NAFO, 2014*) are displayed with larger symbols of the same colours (i.e., larger green circles represent the update of Sea pens distribution (*NAFO, 2014*)).

Kenchington *et al.* (2016) have conducted species distribution modelling in eastern Canada in an attempt to delineate significant benthic area for corals and sponges. A suite of historical data sources, including trawls and survey data were used in the work. Kernel density analysis was utilised in order to delineate areas of high biomass utilising survey data points. In all of the models described below, depth was the primary environmental predictor, with the exception of sponges where the top environmental predictor variable was Fall Primary Production Average Maximum (*Kenchington et al., 2016*).

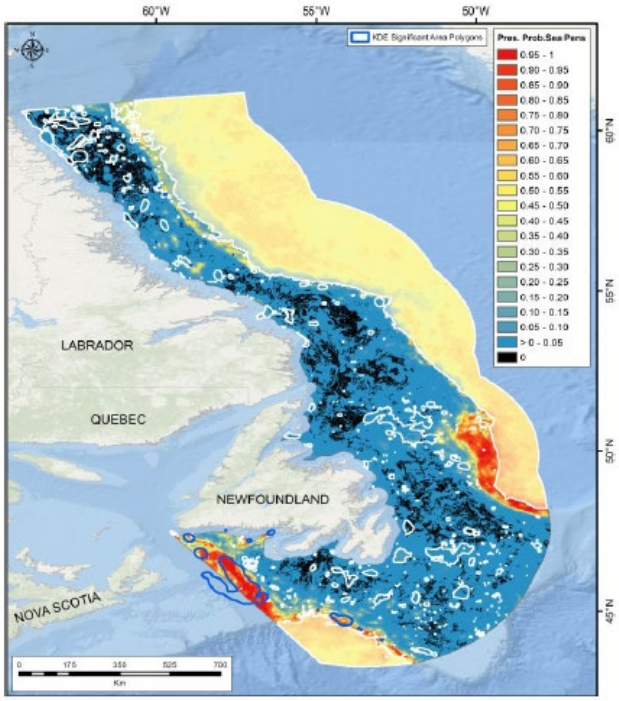
In the Newfoundland and Labrador region, the highest predicted sponge presence probabilities occurred along the Labrador Slope and on Saglek Bank (*Kenchington et al., 2016*). It can be seen in Figure 1.3 that the shelf area in the north of the Study Area is significant for predicted sponge presence based on the modelling. For sea pens, the highest predicted sea pen presence probability occurred in the Laurentian Channel and on the slope off the Northeast Newfoundland Shelf (*Kenchington et al., 2016*). The predictions of presence probability from the study also shows an area to the north of the study area of high predicted probability for presence of sea pen species (see Figure 1.3).

For large Gorgonian corals, the highest predicted presence probability of large gorgonian corals occurred on the edge of Saglek Bank and slope in northern Labrador. Moderate large gorgonian coral presence probability was predicted along the Labrador Slope (see Figure 1.3). For small Gorgonian corals the highest predicted presence probability of small gorgonian corals occurred along the slope in the 3O Closure Area southwest of Grand Bank. Small pockets of moderate small gorgonian coral presence probability were predicted along the Labrador Slope (see Figure 1.3) (*Kenchington et al., 2016*).

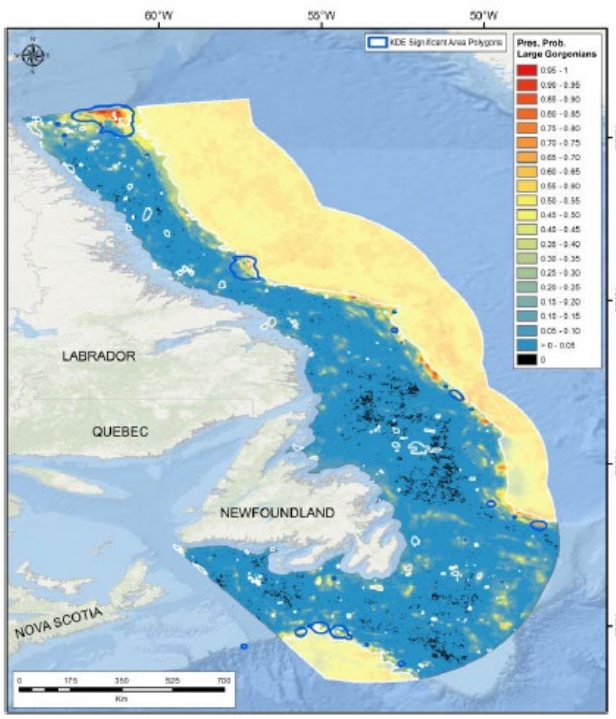
Thirty-two species of sponge have been observed in the region of the study area (*Murillo et al., 2012*; *Beazley et al., 2013a*; *Knudby et al., 2013*; *Beazley & Kenchington, 2015*). Sponges commonly associate with shelf and slop areas in the region as many species have wide depth ranges (from between 100 and 1,500 metres). Previous surveys (*Murillo et al., 2012*) indicated that the highest sponge biomass is located on the slopes associated with the Grand Banks, the Flemish Cap and the region of the Flemish Pass. Sponge species are therefore expected to be associated with the slope areas of the Grand Banks and Flemish Cap in the southern region of the study area. For the wider region, distribution maps indicate that the highest numbers of sponges are associated with the northeast Newfoundland and Labrador Shelf (*Guijarro et al., 2016*).



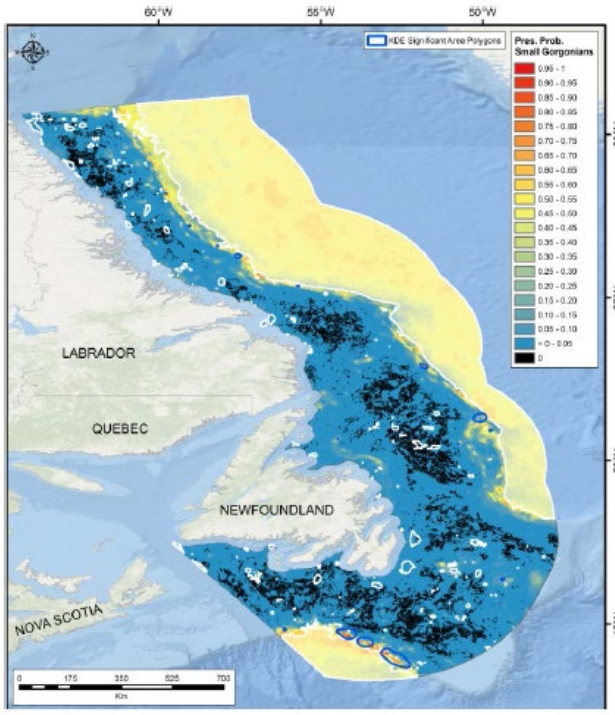
Predictions of presence probability of sponges based on a RF model on unbalanced presence and absence sponge catch data collected from DFO multispecies and shrimp trawl surveys and Spanish trawl surveys conducted in the Newfoundland and Labrador Region between 1995 and 2015. White lines indicate areas of extrapolation. Areas of significant concentrations of sponges identified by KDE are shown in blue outline.



Predictions of presence probability of sea pens based on a RF model on unbalanced presence and absence sea pen catch data collected from DFO multispecies surveys, DFO/industry shrimp surveys, and Spanish trawl surveys conducted in the Newfoundland and Labrador Region between 2003 and 2015. White lines indicate areas of extrapolation. Areas of significant concentrations of sponges identified by KDE are shown in blue outline.



Predictions of presence probability of large gorgonian corals based on a RF model on unbalanced presence and absence large gorgonian coral catch data collected from DFO multispecies surveys, DFO/industry shrimp surveys, and Spanish trawl surveys conducted in the Newfoundland and Labrador Region between 2003 and 2015. White lines indicate areas of extrapolation. Areas of significant concentrations of large gorgonian corals identified by KDE are shown in blue outline.



Predictions of presence probability of small gorgonian corals based on a RF model on unbalanced presence and absence small gorgonian coral catch data collected from DFO multispecies surveys, DFO/industry shrimp surveys, and Spanish trawl surveys conducted in the Newfoundland and Labrador Region between 2003 and 2015. White lines indicate areas of extrapolation. Areas of significant concentrations of small gorgonian corals identified by KDE are shown in blue outline.

Figure 1.3 Predictions of Presence Probability of (1) Sponges, (2) Sea Pens, (3) Large Gorgonian Corals, (4) Small Gorgonian Corals (Kenchington et al., 2016)

<u>References</u>

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Vázquez, A., Casas, J. M., Brodie, W. B., Murillo, F. J., Mandado, M., Gago, A., Alpoim, R., Bañón, R. & A. Armesto (2013), List of Species as recorded by Canadian and EU Bottom Trawl Surveys in Flemish Cap. NAFO Scientific Council Research Document, 13/005: 1-13.

*"**Page 3-31 of Addendum** - This comment has not been adequately addressed. How data gaps from the Eastern Newfoundland Offshore SEA have been taken into account should be described."*

Response:

The following text should be added to section 4.4 to provide further information on marine macroinvertebrate species. The text provided on snow crab as part of the Addendum response is also included below. (New text is provided in Bold)

Pelagic Macroinvertebrates

Macroinvertebrate species are animals that live in the benthic environment or occasionally swim up from the benthos to feed. Trawl survey data over the Flemish Cap compiled from 1977 to 2012 (*Vázquez et al., 2013*), although sporadic in the sampling that was conducted, provides a good indication of the pelagic macroinvertebrates present in the region. Among the macroinvertebrates collected in the trawls species including the northern shortfin squid (*Illex illecebrosus*) and northern shrimp (*Pandalus borealis*) were the most frequently caught. Canadian survey species abundance data overlapping the same period (2008-2012) indicates that apart from an aggregation of northern shrimp on the north-eastern edge of the Grand Banks, the majority of northern shrimp are concentrated to the north along the Newfoundland shelf. This concurs with DFO catch data from 2010 to 2014 (Figure 4.44).

Macroinvertebrate species sampled during surveys from 1977 to 2012 included (in order of observed prevalence) squid species (*Illex illecerosus*, *Histioteuthis reversa*, *Semirossia spp.*, *Histioteuthis spp.*, *H. bonnellii*, *Gonatus fabricii* and *Onychoteuthis banksii*) and shrimp species (the five most abundant species being *Pandulus borealis* (Northern shrimp), *Acanthephyra pelagica*, *Pasiphaea tarda*, *Eusergestes arcticus* and *Sergia robusta*). Octopus *Bathypolypus arcticus* and unidentified jellyfish were also caught (*Vázquez et al., 2013*).

The snow crab (*Chionoecetes opilio*) and Northern shrimp (*Pandalus borealis*) are generally found in waters from inshore regions to the edge of the continental shelf. Both species occur within the

south and west of the Study Area (Figure 4.43 and Figure 4.44) and are commercially significant within the region. Within NAFO Divisions 3KLMN, snow crab was the most landed commercial species between 2010 and 2014 representing 52.3 percent of the total weight. Shrimp were the third most landed species representing 14.3 percent of the total weight (refer to Section 4.8.1.2).

In addition to the small crustaceans there are a variety of gelatinous animals that can be found in the region including Salps, which are pelagic tunicate species that are free floating filter feeders. Species with potential presence across the study area include *Cyclosalpa pinnata*, *Pegea bicaudate*, *Salpa cylindrica* and *S. maxima* (*Madin, 1982*). A number of jellyfish species also have the potential to be present. Jellyfish are drifting animals and also active swimmers. They feed on zooplankton species as well as accumulating energy in other ways; some species contain photosynthetic symbiotic species (zooxanthellae) (*Gibbons & Richardson, 2009*). Jellyfish themselves are a food source for tuna species and leatherback turtles (*Heaslip et al., 2012*). Jellyfish are sensitive to the planktonic bloom period as it directly impacts their main source of food; in offshore areas peak jellyfish abundance occurs earlier in the summer and is associated with the peaks in phytoplankton and zooplankton abundance (*Gibbons & Richardson, 2009*).

Pelagic cephalopods (squid) are also abundant across the region. As they grow they turn into active hunters, searching for prey including pelagic fish species. They are also a food source for several species of large fish, shark, seal, dolphin and toothed whale (*Pauly & Trites, 1998*). From the compiled trawl survey data from 1977 to 2012 *Illex illecerosus* (northern shortfin squid) was by far the most frequently observed species (*Vázquez et al., 2013*). Northern shortfin squid are most commonly found associated with shelf areas of the north-east Atlantic, concentrated along the coasts of Nova Scotia and Labrador. Its depth range extends to around 1,000 metres. This species is almost exclusively fished in the north-west Atlantic. Two large international fisheries for the species exist. One in the bays of Newfoundland using jigs and jigging machines in depths from 0 to 30 metres, and occasionally otter trawls (during summer and early autumn); and an extensive otter trawl fishery along part of eastern Canada and the USA on the shelf and upper slope, and around submarine canyons in depths from between 100 to 250 metres. Japan and Canada are the two countries taking the greatest share of these catches. The species is in high demand as bait in the autumn cod fishery off Newfoundland because it does not soak and fall off the hooks as fast as finfish bait (*FAO, 2018*).

References

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Heaslip, S. G., Iverson, S. J., Bowen, W. D., & James, M. C. (2012), Jellyfish support high energy intake of leatherback sea turtles (Dermochelys coriacea): Video evidence from animal-borne cameras. PLoS ONE, 7(3), [Internet, available: <https://doi.org/10.1371/journal.pone.0033259>].

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Response

The way in which data gaps from the Eastern Newfoundland Offshore SEA have been taken into account has been described in the response to ***Section 5.5 Effects Assessment, page 5-8 of EA Report and page 3-11 of this Addendum*** on pages 7 and 8 above. The main data gaps recognised in the SEA (*C-NLOPB, 2014*) related to the fish and fish habitat VEC the key data gaps for the area include benthic invertebrate communities, sessile species (including corals and sponges) responses to oil and gas activities, and regime shifts and the potential influence of climate change factors. However, despite these known data gaps for this VEC the information provided is adequate for environmental impact assessment purposes. Therefore, although data gaps do exist, there was sufficient information available for a robust impact assessment to take place.

*"**Pages 3-32 to 3-39 of Addendum** - This comment has not been adequately addressed. The following changes are recommended:*

- *Describe how data gaps from the Eastern Newfoundland Offshore SEA have been taken into account.*
- *Ensure all relevant recent references are included and described. The response does not include any references after 2014. For example, recent work indicates that the population of Northern bottlenose whales in the Flemish Pass is unknown, which could influence the effects assessment for this species.*
- *There is inappropriate nomenclature throughout the response. Minke whale should be referred to as the Common Minke whale North Atlantic subspecies. Names provided for small dolphin species are inconsistent with Figure 4.30 in the EA Report and should be revised accordingly. For the Harbour porpoise, "Western North Atlantic Population" should be changed to "Northwest Atlantic population".*
- *Note that Long-finned pilot whales are known to occur in the Study Area based on Figure 4.29 in the EA Report.*
- *Describe the Sowerby's beaked whale.*
- *Provide likelihood of occurrence in the Study Area for the Harbour porpoise and Loggerhead sea turtle.*
- *In the first paragraph for Leatherback sea turtle, it should be noted that the Loggerhead sea turtle is Endangered under Schedule 1 of SARA."*

Response:

"Describe how data gaps from the Eastern Newfoundland Offshore SEA have been taken into account."

The Eastern Newfoundland Offshore SEA recognises common data gaps for each VEC. For the Marine Mammals and Sea Turtles VEC, the commonly recognised data gaps are that, due to the limited temporal window on which previous offshore studies were performed, there is limited temporal/seasonal data on marine species in this region. In addition, specific information on

biologically essential behaviour for marine mammals is also lacking (*C-NLOPB, 2014*). These data gaps were taken into account when considering the level of confidence for each prediction and assigning the corresponding ratings as described in section 5.5.1 of the EA.

Similarly, it is recognised that currently available abundance estimates (*Lawson and Gosselin, 2009,* In: *C-NLOPB, 2014*) for the area are based upon the limited sightings data currently available and have not been normalised against the limitations of sightings surveys (perception effects). Further good quality sightings data is therefore needed to provide validation against perception effects and to bolster data for species where abundance estimates were not possible based upon the low number of data samples.

Polarcus recognises the importance of the above data gaps. Polarcus' full commitment to the marine mammal observation programme described in section 5.6.5 of the EA will add to the knowledge base of marine mammal sightings data in the area. The protocols for reporting of marine mammal monitoring information as described in the SEA will be followed (ESRF Report #156 *Recommended Seabird and Marine Mammal Observation Protocols for Atlantic Canada* [2004]).

The general limitations of marine mammal sightings data should however be realised. Marine mammal surveys have a number of significant limitations associated with their implementation and interpretation. The Beaufort sea state, wind speed and direction, swell height and direction, rain, fog, and the horizontal and vertical sun angle all have a direct impact on overall visibility during the survey, and therefore the reliability of data gathered (*WHOI, 2006*).

Variations in visibility may result in a lower number of marine mammals being observed, which may not necessarily be a true indication of the full extent of their presence within the survey area (*Thurman, 1997*). In order to draw more accurate and informed conclusions regarding presence and distribution, the ecology of individual species must also be considered, for example, the fact that some species exhibit more cryptic behavior than others, or that some species may migrate to other areas during the year.

Ship or aerial observer surveys rely on human observers to detect marine mammals. However, these records are limited to daylight hours only, and the experience of observers is a very important factor in their detection and correct identification. Moreover, the efficiency of this method is dependent on working conditions on the vessel, for example, the regularity of breaks. Richardson *et al*. (1995) note that even with conscientious and well trained observers in good weather conditions, it is unlikely that all mammals present will be detected. As a result, sightings surveys are often rendered time-consuming, expensive, and largely ineffective if the aforementioned meteorological, oceanographic, ecological and human variables are not fully considered and incorporated into survey outputs and conclusions (*Leite Parente & Elisabeth de Araújo, 2011*). For this reason, the abundance estimates presented within the Eastern Newfoundland Offshore SEA should be treated with caution, particularly as they have not been normalised against perception effects.

Surveys conducted from fishing vessels or during seismic surveys cannot provide reliable information regarding species presence or distribution within the larger area or throughout the year due to the above recognized deficiencies in the very nature of their *modus operandi*. However, they are still valuable for providing information regarding species presence in an

otherwise data deficient environment and are often the only practicable solution to further data gathering in specific offshore locations.

References

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Woods Hole Oceanographic Institute (WHOI), 2006, Monitoring Baleen Whales with Autonomous Underwater Vehicles, [Internet], available: <http://www.whoi.edu/page.do?pid=39139&tid=282&cid=10547&ct=162>.

***"Section 4.4 Fish, page 4-4** – this section and the related Appendix A should include reference to important marine macro-invertebrate species (e.g. Snow crab, Northern shrimp etc.) that may be present within the project / study area. Despite the risk of duplication it is felt that some of the key information presented within the noted Tables in Appendix A should / could be brought forward into the main body of this section of the project EA. Also similar to the comment provided earlier it is not clear to what extent Data gaps associated with Fish and Fish habitat VEC noted within the Eastern Newfoundland Offshore SEA have been acknowledged / identified / addressed and whether any new information has been brought to bear in the description provided in Section 4.4. This should be clarified and amended accordingly."*

Response:

It is felt that bringing the information presented within the Tables in Appendix A forward into Section 4.4 would not add value to the EA overall.

The following text is added to Section 4.4:

Snow crab (*Chionoecetes opilio*) and Northern shrimp (*Pandalus borealis*) are generally found in waters from inshore regions to the edge of the continental shelf. Both species occur within the south and west of the Study Area (Figure 4.43 and Figure 4.44) and are commercially significant within the region. Within NAFO Divisions 3KLMN, snow crab was the most landed commercial species between 2010 and 2014 representing 52.3 percent of the total weight. Shrimp were the third most landed species representing 14.3 percent of the total weight (refer to Section 4.8.1.2).

The Eastern Newfoundland Offshore SEA has been a detailed source of information in preparation of the EA report. Various additional sources of data have also been used in order to compile the EA report and are referenced in Section 4, Table 4.1.

***"Section 4.4 Fish, page 4-7** with respect to information presented within Table 4.3 and the 4th paragraph on page 4-7 and Figure 4.4 (page 4-11) reference to "broadhead wolffish" is confusing. Is the broadhead wolffish the same species as the Northern wolffish (Anarhichas denticulatus) if*

so then Table 4.3, Figure 4.4 and the noted sentence should be amended accordingly. Care should be taken when using common names to ensure that the "correct" common name is used throughout the document. "

Response:

The Northern Wolffish (*Anarhichas denticulatus*) referenced in the Table 4.4 (Page 4-25) is indeed also commonly called "*broadhead wolffish*" Noted that care should be taken when using common names.

"Section 4.6 Marine Mammals and Sea Turtles, page 4-40 *- these sections are inadequate a more detailed description of marine mammals and sea turtles is required including among other things the likelihood of occurrence of the various species within the study area. Despite the risk of duplication, it is felt that some of the key information presented within the noted Tables in Appendix A as well as within the noted DFO marine mammal sightings database should / could be brought forward into the main body of this section of the project EA. Also similar to earlier comments it is not clear to what extent data gaps associated with marine mammals and sea turtles VEC noted within the Eastern Newfoundland Offshore SEA have been acknowledged / identified / addressed and whether any new information has been brought to bear in the description provided in Section 4.6. This should be clarified and amended accordingly ".*

Response:

It is felt that bringing the information presented within the Tables in Appendix A forward into Section 4.6 would not add value to the EA overall. The likelihood of occurrence of the various species within the study area is presented in the Tables in Appendix A.

More detail for Section 4.6 as follows.

North Atlantic Right Whale (*Eubalaena glacialis*)

Concentrated in the western North Atlantic, the North Atlantic Right Whales is considered to be the most endangered large whale in the world, with approximately 300 to 350 individuals remaining (C-NLOPB, 2014). The species has 'Endangered' COSEWIC status and is listed as 'Endangered' on SARA Schedule 1 (Table 4.6).

An Adult North Atlantic right whale averages 13 to 16 metres in length and 40,000 to 70,000 kilogrammes in weight. The mean age at first reproduction is ten years for females and is likely similar for males. Females typically give birth every three to five years, while a likely gestation period of over a year. North Atlantic Right whales are plankton feeders, with primary prey being the copepod *Calanus finmarchicus*, which they capture by filtering seawater through the baleen plates in their mouths.

North Atlantic Right whales are generally found in waters with surface temperatures ranging from 8 to 15 degrees Celsius, in areas that are 100 to 200 metres deep. Shifts in the distribution and abundance of their primary prey items can dramatically affect right whale distribution within their range. Right whales are only rarely sighted within the Study Area, with a peak occurrence between August and October (Table 4.8) (C-NLOPB, 2014).

Humpback Whale (*Megaptera novaeangliae*)

In Canada, Humpbacks are found on both the east and west coasts and belong to separate populations. The range of the Western North Atlantic population of Humpback Whales extends north to Labrador. This Western North Atlantic population was assessed by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) and was designated as Not at Risk.

Humpback whales are highly migratory, with seasonal movements between temperate to arctic feeding areas and low-latitude breeding areas. In the North Atlantic six distinct feeding areas: Gulf of Maine, Gulf of St Lawrence, Newfoundland and Labrador, West Greenland, Iceland and North Norway. Humpback whales are often sighted singly or in groups of two or three, except during breeding and feeding times, where groups can be as large as 15 individuals. Humpback whales feed on small schooling fish and krill. They often feed cooperatively in groups.

Adult humpback whales average 13 to 16 metres in length with females growing larger than males. The average age at sexual maturity is nine years. Calving occurs between January and April after a gestation of approximately 12 months. The inter-calving interval for humpback whales is approximately two years.

Humpback whales are considered to be relatively common within the Study Area (Figure 4.28) (C-NLOPB, 2014), although specific occurrence data is limited.

Blue Whale (*Balaenoptera musculus*)

The blue whale is widely distributed throughout the world's oceans and occurs in coastal, shelf and oceanic waters. The Atlantic Population, occurring in the Study Area, is listed as 'Endangered' on SARA Schedule 1.

An adult blue whale can reach up to 30 metres in length. The species reaches sexual maturity at between 5 and 15 years old for both sexes. The mating and calving season occurs from late fall to mid-winter in Northern hemisphere, with a gestation period of 10 to 11 months. Females have an inter-calving interval of 2 to 3 years.

In the western North Atlantic, blue whales occur in the Gulf of St. Lawrence and east of Nova Scotia in spring, summer and fall and off southern Newfoundland in winter. Blue whale usually occurs alone or in small groups. Distribution during feeding seasons is largely dependent on the areas of high concentrations of krill (euphausiids), their primary prey. The North Atlantic population of blue whales was severely depleted by whaling, and sightings of this species anywhere within its range are quite uncommon. Within the Study Area, blue whale are thought to occur October to April (Table 4.8) (*C-NLOPB, 2014*).

Fin Whale (*Balaenoptera physalus*)

Fin whale are widely distributed in all the world's oceans but typically occur in temperate and polar regions. The Atlantic population is listed as 'Special Concern' by SARA (Schedule 1) and COSEWIC.

The fin whale is one of the fastest whales on earth and can sustain speeds of up to 37 kilometres per hour and burst speeds of over 40 kilometres per hour. An adult fin whales average 18 to 20 metres in length and reaches sexual maturity at 6 to 7 years for males and 7 to 8 years for females. Mating and calving generally occurs in temperate waters during winter, before the whales migrate to northern latitudes during the summer to feed. The primary prey of the fin whale is small schooling fish such as capelin, as well as krill.

Fin whales typically occur in coastal and shelf waters, as well as in oceanic waters. They have been observed alone and in pairs but groups of up to 20 individuals are often seen on feeding grounds. The fin whale is common in the Grand Banks and the Study Area, particularly during the summer months, and its distribution is associated with the presence of abundant food supply (e.g. capelin) (Table 4.8, Figure 4.28) (C-NLOPB, 2014).

Sei Whale (*Balaenoptera borealis*)

Sei whales can reach up to 18 metres in length. They reach sexual maturity at between 5 and 15 years of age. The species has a gestation period of between 10.5 to 12 months. Mating and calving typically occur during winter months. Sei whale generally feed on copepods, euphausiids, and small fish.

The Atlantic population considered 'Data Deficient' by COSEWIC. The species migrate between tropical to subtropical latitudes in winter and temperate and subpolar latitudes in summer, staying mainly in water temperatures of eight to 18 degrees Celsius. Winter distribution seems to be widely dispersed and is not fully mapped; summer distribution is highly variable, but in the western North Atlantic it is generally north of southern Nova Scotia.

Sei whale typically occur in offshore, pelagic habitats; appear to be associated with the continental shelf edge in the northwest Atlantic. Although it has a relatively wide distribution overall, this species is considered uncommon in the Eastern Newfoundland Offshore Area and the Study Area (Table 4.8, Figure 4.28) (*C-NLOPB, 2014*).

Minke Whale (*Balaenoptera acutorostrata*)

Adult minke whales average seven to ten metres in length, the smallest of the baleen whales. Minke whales are assessed as 'Not at Risk' by COSEWIC and minke whale populations are considered to be more secure than other baleen whales. Both male and female whales reach sexual maturity at about seven to eight years. The gestational period for minke whale is 10 to 11 months, with calves birthed every two years on average.

The preferred prey items of the minke whale are sand lance and capelin, although other small schooling fishes, copepods, and krill also likely make up a large part of their diet.

Very little information is available on winter distribution of minke whale (see Marine Mammals Data Gaps Section TBC), however, the species has been reported along the western North Atlantic south of 40 degrees latitude. Minke whale migrate northward from calving grounds during spring and summer. They are a relatively solitary species; usually seen

individually or in small groups of two or three. Larger groups have been observed in areas of concentrated feeding (*C-NLOPB, 2014*).

Minke whale appear to prefer shallow water (less than 200 metres). They are commonly observed on the Grand Banks and within the Study Area in the spring and summer, associated with the presence of their prey species (*Piatt et al., 1989*) (*C-NLOPB, 2014*) (Figure 4.28).

Sperm Whale (*Physeter macrocephalus*)

The sperm whale has a worldwide distribution and is the largest of the toothed whales, growing to a length of approximately 20.5 metres with a worldwide distribution. The species is considered to be 'Not at Risk' by COSEWIC.

Adults reach reproductive maturity at between 7 and 13 years of age and have a gestation period of 14 to 16 months. The interval between births is typically three to six years. Sperm whale routinely dives to depths of hundreds of meters and may occasionally dive as deep as 3000 metres. Their primary prey item is squid (*C-NLOPB, 2014*).

Sperm whale range as far north and south as the edges of the polar pack ice, although they are most abundant in tropical and temperate waters where temperatures are higher than 15 degrees Celsius. Distribution is linked to social structure; adult females and juveniles generally occur in tropical and subtropical waters, whereas adult males are commonly alone often occurring in higher latitudes outside of the breeding season. They generally distributed over large areas that have high secondary productivity and steep underwater topography (*C-NLOPB, 2014*).

Sperm whales were observed in small numbers in the waters off Eastern and Southern Newfoundland during aerial surveys conducted in the summer of 2007 (two and nine individuals, respectively *(Lawson and Gosselin, 2009))* and have been sighted across the Study Area (Figure 4.29) (*C-NLOPB, 2014*).

Northern Bottlenose Whale (*Hyperoodon ampullatus*)

Adult northern bottlenose whales grow to approximately ten metres in length. Their pronounced beak is white on males and grey on females.

The Davis Strait-Baffin Bay-Labrador Sea population is listed by COSEWIC as a species of 'Special Concern', while localized Scotian Shelf population considered 'Endangered' by SARA (Schedule 1) and COSEWIC. The Scotian Shelf population is believed to be non-migratory, while the Labrador population migrates north to south seasonally.

The Labrador population Northern Bottlenose whale mate and give birth during April. Females reach reproductive age at between 8 to 13 years. Single offspring are produced every two years. The primary prey item of the Northern bottlenose whale is squid (*C-NLOPB, 2014*).

Northern bottlenose whales live in deep water areas of the North Atlantic and are rarely found in waters less than 800 metres deep. They are capable of remaining submerged for over an hour (*C-NLOPB, 2014*).

There are two areas of northern bottlenose whale abundance in the western North Atlantic: Davis Strait off northern Labrador and "the Gully" on the Scotian Shelf. Northern bottlenose whales are known to occur in the Grand Banks and within the Study Area and were sighted in the waters off Eastern and Southern Newfoundland during aerial surveys conducted in 2007 (*Lawson and Gosselin, 2009*) (Figure 4.29).

Killer Whale (*Orcinus orca*)

Killer whales are large members of the dolphin family. Adult male killer whales can reach a length of 6 to 8 metres while females can reach a length of 5 to 7 metres. Males reach sexual maturity at about 13 years, and females at 14 to 15 years. Calving occurs from autumn to spring, with an average inter-calving period of approximately five years. Killer whales have a wide range of prey species including marine mammals, fish and squid.

Killer whales are globally fairly abundant and have been observed in all oceans of the world. They prefer warm waters but have been reported in cold waters as well and are not known to be reliably migratory. The greatest abundance of killer whales is found within 800 kilometres of major continents and they often travel in close-knit matrilineal groups of a few to tens of individuals (C-NLOPB, 2014).

The Northwest Atlantic / Eastern Arctic population is assessed as being of 'Special Concern' by COSEWIC. Killer whales occur year-round in small numbers within the SEA and Study Area (Figure 4.29) (Lien et al., 1988).

Long-finned Pilot Whale (*Globicephala melas*)

Long-finned pilot whales are members of the dolphin family. Adult long-finned pilot whales reach a length of approximately 3.5 to 4.5 metres, with males somewhat larger than females. Calving occurs year-round, but typically during the summer months. Calves have a gestation period of 12 to 15 months.

Long-finned pilot whales feed primarily on squid but known to consume octopus, cuttlefish and some fish species as well (*C-NLOPB, 2014*).

Widely distributed throughout the world's oceans, and abundant throughout the North Atlantic as far north as 70 degrees north, long-finned pilot whale is considered 'Not at Risk' by COSEWIC.

There is no evidence for marked north-south migration, but long-finned pilot whales may migrate inshore or offshore seasonally in response to prey availability.

During aerial surveys conducted in summer of 2007, ten observations totalling 65 individual long-finned pilot whales were recorded off Southern Newfoundland, although none were observed in the Eastern Newfoundland Offshore Area (*Lawson and Gosselin, 2009*, *C-NLOPB, 2014*).

Small Dolphin Species

In addition to killer whale and long-finned pilot whale, five dolphin species may be found in Study Area: 1) Atlantic white-sided dolphin, 2) White-beaked dolphin, 3) Common bottlenose dolphin, 4) Risso's dolphin and 5) Short-beaked common dolphin (Figure 4.30).

All five species have been assessed by COSEWIC and populations were considered 'Not at Risk'. Atlantic white-sided dolphins are considered abundant throughout their range.

Diet for most small dolphin species consists of a variety of small schooling fishes and squid; Risso's dolphin feeds almost exclusively on squid.

All species occur in temperate to warm waters in the North Atlantic. The Atlantic white-sided dolphin and white-beaked dolphin also inhabit sub-Arctic portions of the North Atlantic. The short-beaked dolphin also inhabits southern waters off the coast of Venezuela and the Gulf of Mexico. Seasonal migration patterns for these species are poorly understood.

Most commonly found in groups of 30 to 70 individuals; however, larger groups numbering several hundred individuals are also observed. Small dolphin species often associate and feed with large baleen whales and are known to form mixed dolphin species groups.

Atlantic white-sided dolphins may be found throughout the SEA Area and have been recorded within 30 kilometres of the White Rose site during vessel-based surveys (*Wiese and Montevecchi, 1999, C-NLOPB, 2014*).

Harbour Porpoise (*Phocoena phocoena*)

The harbour porpoise is a small compared to other cetaceans, growing to a length of 1.2 to 1.4 metres. The species is most commonly observed near the coast and will enter small bays and estuaries.

Harbour porpoises in the Western North Atlantic Population have been divided into three different subpopulations: The Bay of Fundy/Gulf of Maine, the Gulf of St. Lawrence and the Newfoundland populations. The boundaries between these sub-populations are not well defined as there is some genetic overlap.

Most mature females reproduce each year after they reach sexual maturity at 3.5 years old. The gestational period is 10 to 11 months. Harbour porpoises feed on small schooling fish. Harbour porpoise are found in shelf waters throughout the northern hemisphere, usually in waters colder than 17 degrees Celsius. They are usually seen in small groups of one to three animals often including at least one calf (C-NLOPB, 2014).

Harbour porpoise are present in northern coastal waters during the summer months. Off Eastern Newfoundland, harbour porpoises are most likely to be found in the shallower waters of inshore areas (C-NLOPB, 2014).

Harp Seal (*Pagophilus groenlandicus*)

The harp seal is the most abundant pinniped in the northwest Atlantic, with an estimated population size of 7.7 million (2012). Populations are considered secure in the SEA region, having increased by 400 percent since the 1970s (*C-NLOPB, 2014*).

Adult harp seals may reach a length of approximately 1.7 to 2.0 metres, with both sexes similar in size. Pups are born in late February or March on the ice and females will nurse their pups for approximately 12 days, then mate and disperse. Their diet varies considerably with age and season and includes a variety of fish species, predominantly capelin, sand lance, Arctic cod, and flatfish such as halibut. Other fish and invertebrates such as crustaceans, krill, squid and shrimp are also taken.

Older harp seals form large moulting concentrations on the sea ice off north-eastern Newfoundland and in the northern Gulf of St. Lawrence during April and/or May. Following the moult, seals disperse and eventually migrate northward. Small numbers of harp seals may remain in southern waters throughout the summer while a portion of the population remains in the Arctic (*C-NLOPB, 2014*).

Hooded Seal (*Cystophora cristata*)

Populations of hooded seal are considered secure in the SEA region; a recent study estimated the population at approximately 592,100 individuals (*C-NLOPB, 2014*). The species has been assessed by COSEWIC as 'Not at Risk'.

Adult hooded seals can reach a length of approximately 2.0 metres for females and 2.6 metres for males. They have a very short breeding season and congregate to breed on pack ice in mid-March. The largest whelping concentration in the Northwest Atlantic occurs off the coast of southern Labrador or northern Newfoundland (the 'Front'), as well as in the Davis Strait and the Gulf of St. Lawrence. After breeding, they move to moulting areas off Greenland.

Hooded seals feed in the Canadian Arctic and Greenland during the summer months, migrating to the Gulf of St. Lawrence in December and January and leaving the area in April to May. Their diet includes a variety of fish species, including cod, haddock, herring and mackerel. Crustaceans, krill, squid, shrimp and other invertebrates are also taken.

Hooded seals are highly pelagic; it is not uncommon to see them outside of their normal range. They are relatively common in the SEA Area in the winter and spring, and small numbers may be found in the summer as well (*Andersen et al., 2012, Lesage et al., 2007*, *C-NLOPB, 2014*).

Grey Seal (*Halichoerus grypus*)

Adult grey seals can grow to a length of approximately 1.6 to 2.0 metres for females and 2.5 to 3.3 metres for males.

Populations of grey seal are considered secure in the region of the Study Area. The Canadian population is estimated at 250,000 individuals and grey seals have been assessed by COSEWIC as 'Not at Risk'.

Grey seals give birth between September and March, with peak pupping occurring in January. Their diet includes a variety of fish species, including capelin, sand lance, herring and Atlantic cod. They are largely demersal and benthic feeders (*C-NLOPB, 2014*).

Grey seal Inhabit cold temperate to sub-Arctic areas in North Atlantic waters over the continental shelf. The largest colony of grey seals is found off Nova Scotia. They have been recorded year-round in the SEA Area, however, are primarily present in the summer months (*Lesage et al., 2007*).

North Atlantic Right Whale (*Eubalaena glacialis*)

Concentrated in the western North Atlantic, the North Atlantic right whale is considered to be the most endangered large whale in the world, with approximately 300 to 350 individuals remaining (*C-NLOPB, 2014*). The species has 'Endangered' COSEWIC status and is listed as 'Endangered' on SARA Schedule 1 (Table 4.6).

An Adult North Atlantic right whale averages 13 to 16 metres in length and 40,000 to 70,000 kilogrammes in weight. The mean age at first reproduction is ten years for females and is likely similar for males. Females typically give birth every three to five years**, with** a likely gestation period of over a year. North Atlantic Right whales are plankton feeders, with primary prey being the copepod *Calanus finmarchicus*, which they capture by filtering seawater through the baleen plates in their mouths.

North Atlantic Right whales are generally found in waters with surface temperatures ranging from 8 to 15 degrees Celsius, in areas that are 100 to 200 metres deep. Shifts in the distribution and abundance of their primary prey items can dramatically affect right whale distribution within their range. Right whales are only rarely sighted **in the vicinity of** the Study Area, with a peak occurrence between August and October (Table 4.8) (*C-NLOPB, 2014*). **Within the Fisheries and Oceans Canada Marine Mammals Sightings Database (2015) there is only one sighting located just within the study are and approximately 50 km to the west of the project area (Figure 4.28).**

North Atlantic Right Whales are known to aggregate in five areas off the US coast in response to seasonal changes. In Canada, the North Atlantic Right Whale is known to occur in the Bay of Fundy from June to November and the Roseway Basin from July to November; both areas lie to the south of Newfoundland (*C-NLOPB, 2014*). The sightings data (Figure 4.28) indicate that the North Atlantic Right Whale is rare near the study area. However, given the fact that so few individuals are left, the individual sighting could suggest that the western area of the study area may be an important area for the species although this is not conclusive from the available data. More research is needed to determine the most important areas for this endangered species.

Humpback Whale (*Megaptera novaeangliae*)

In Canada, **Humpback Whale** are found on both the east and west coasts and belong to separate populations. The range of the Western North Atlantic population of Humpback Whales extends north to Labrador. This Western North Atlantic population was assessed by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) and was designated as Not at Risk.

Humpback whales are highly migratory, with seasonal movements between temperate to arctic feeding areas and low-latitude breeding areas. In the North Atlantic, **there are** six distinct feeding areas: Gulf of Maine, Gulf of St Lawrence, Newfoundland and Labrador, West Greenland, Iceland and North Norway. **Bettridge *et al.* (2015) report that Humpback whales in the Newfoundland region belong to a population that breeds in the West Indies whose range includes the Atlantic margin of the Antilles region and the coast of Venezuela (*Bettridge et al.,2015*).** Humpback whales are often sighted singly or in groups of two or three, except during breeding and feeding times, where groups can be as large as 15 individuals. Humpback whales feed on small schooling fish and krill. They often feed cooperatively in groups.

Adult humpback whales average 13 to 16 metres in length with females growing larger than males. The average age at sexual maturity is nine years. Calving, occurs between January and April after a gestation of approximately 12 months. The inter-calving interval for humpback whales is approximately two years.

Humpback whales are considered to be relatively common within the Study Area. **There have been many sightings across the study area although offshore sightings are not as common as sightings in coastal/inshore waters (Figure 4.28)** (*C-NLOPB, 2014*). **Although specific occurrence data is limited, the abundance of Humpback Whales off southern and eastern Newfoundland has been estimated at 1,427 individuals, although this is a preliminary estimate as it has not been corrected for perception biases (***Lawson and Gosselin, 2009,* In: *C-NLOPB, 2014***). Further research is therefore needed to provide estimates of abundance taking into account the limitations of sightings data methods.**

Blue Whale (*Balaenoptera musculus*)

The blue whale is widely distributed throughout the world's oceans and occurs in coastal, shelf and oceanic waters. The Atlantic Population, occurring in the Study Area, is listed as 'Endangered' on SARA Schedule 1.

An adult blue whale can reach up to 30 metres in length. The species reaches sexual maturity at between 5 and 15 years old for both sexes. The mating and calving season occurs from late fall to mid-winter in Northern hemisphere, with a gestation period of 10 to 11 months. Females have an inter-calving interval of 2 to 3 years.

In the western North Atlantic, blue whales occur in the Gulf of St. Lawrence and east of Nova Scotia in spring, summer and fall and off southern Newfoundland in winter. Blue whale usually occurs alone or in small groups. Distribution during feeding seasons is largely dependent on the areas of high concentrations of krill (euphausiids), their primary prey. The North Atlantic population of blue whales was severely depleted by whaling, and sightings of this species anywhere within its range are quite uncommon. Within the Study Area, blue whale is thought to occur **from** October to April (Table 4.8) (*C-NLOPB, 2014*).

Lesage *et al.* (2016) used satellite telemetry to track 24 individuals in eastern Canada. Whales were tagged between August and November off the Gaspé Peninsula in the Gulf of St. Lawrence and St. Lawrence Estuary. Three of the tagged blue whales showed movement offshore with two travelling into the waters around the New England seamounts and one individual in 2013 passing through offshore waters south of the Grand Banks (*Lesage et al., 2016*).

The Fisheries and Oceans Canada Marine Mammals Sightings Database (2015) does hold records of sightings of this species however they are all further inshore; there are no sightings of the species across the study area (Figure 4.28). The closest sightings lie further towards Newfoundland approximately 100 km to the west. As only four sightings of Blue whale were made during aerial surveys conducted during 2007 (*Lawson and Gosselin, 2009,* In: *C-NLOPB, 2014*), no estimates of abundance of this species have been made.

Fin Whale (*Balaenoptera physalus*)

Fin whale are widely distributed in all the world's oceans but typically occur in temperate and polar regions. The Atlantic population is listed as 'Special Concern' by SARA (Schedule 1) and COSEWIC.

The fin whale is one of the fastest whales on earth and can sustain speeds of up to 37 kilometres per hour and burst speeds of over 40 kilometres per hour. Adult fin whales average 18 to 20 metres in length and reach sexual maturity at 6 to 7 years for males and 7 to 8 years for females. Mating and calving generally occurs in temperate waters during winter, before the whales migrate to northern latitudes during the summer to feed. The primary prey of the fin whale is small schooling fish such as capelin, as well as krill.

Fin whale typically occur in coastal and shelf waters, as well as in oceanic waters. They have been observed alone and in pairs but groups of up to 20 individuals are often seen on feeding grounds. The fin whale is common in the Grand Banks and the Study Area, particularly during the summer months, and its distribution is associated with the presence of abundant food supply (e.g. capelin) (Table 4.8, Figure 4.28) (*C-NLOPB, 2014*). **Figure 4.28 shows sightings of Fin whale within the study area however there are far more sightings of the species in waters further inshore off the coasts of Newfoundland and Labrador. An abundance estimate of the species has been made based on surveys conducted off Southern and Eastern Newfoundland in 2007 at 890 individuals. However, this estimate is preliminary as it has not been corrected for perception effects (*Lawson and Gosselin, 2009,* In: *C-NLOPB, 2014*).**

During the summer months it is known that fin whales occur around the Gulf of St. Lawrence and the nearshore and offshore waters of Newfoundland and Labrador. Although the winter distribution is less well known, there have been sightings throughout the year of fin whale off Nova Scotia and Newfoundland. Recent species distribution modelling efforts have suggested that fin whale prefer deep cold waters and their periodic abundance offshore eastern Newfoundland is potentially linked to the seasonal aggregations of capelin species (*DFO, 2016*).

Sei Whale (*Balaenoptera borealis*)

Sei whale can reach up to 18 metres in length. They reach sexual maturity at between 5 and 15 years of age. The species has a gestation period of between 10.5 to 12 months. Mating and calving typically occur during winter months. Sei whale generally feed on copepods, euphausiids, and small fish.

The Atlantic population **is** considered 'Data Deficient' by COSEWIC. The species migrate between tropical **and** subtropical latitudes in winter and temperate and subpolar latitudes in summer, staying mainly in water temperatures of eight to 18 degrees Celsius. Winter distribution seems to

be widely dispersed and is not fully mapped; summer distribution is highly variable, but in the western North Atlantic it is generally north of southern Nova Scotia.

Sei whale typically occur in offshore, pelagic habitats; appear to be associated with the continental shelf edge in the northwest Atlantic. Although it has a relatively wide distribution overall, this species is considered uncommon in the Eastern Newfoundland Offshore Area and the Study Area (Table 4.8, Figure 4.28) (*C-NLOPB, 2014*)**. There is a single sighting record of this species within the study area according to the Fisheries and Oceans Canada Marine Mammals Sightings Database (2015) (Figure 4.28). There are more sightings records located to the west of the study area towards the coasts of Newfoundland and Labrador, however there are also other sightings records to the north and north-east of the study area. Sightings therefore appear rather sporadic suggesting quite a widespread distribution. During aerial surveys conducted off the coasts of Newfoundland and Labrador in 2007 just one record of sei whale was captured, therefore no abundance estimates were made based on this study (*Lawson and Gosselin, 2009,* In: *C-NLOPB, 2014*).**

More recently, the Southeast Fisheries Science Centre (SEFSC) aerial and boat based surveys from 2011 are considered the best available for the abundance estimate of sei whale in the Nova Scotia region at 357 individuals. However, this estimate must be considered conservative because the complete known range of this stock was not surveyed, and because of uncertainties regarding population structure and whale movements between the surveyed and un-surveyed areas (*NOAA, 2016a*).

Minke Whale (*Balaenoptera acutorostrata*)

The common minke whale North Atlantic subspecies (hereafter referred to as minke whale) adults average seven to ten metres in length, **which makes it** the smallest of the baleen whales. Minke whale are assessed as 'Not at Risk' by COSEWIC and minke whale populations are considered more secure than other baleen whales. Both male and female whales reach sexual maturity at about seven to eight years. The gestational period for minke whale is 10 to 11 months, with calves birthed every two years on average.

The preferred prey items of the minke whale are sand lance and capelin, although other small schooling fishes, copepods, and krill also likely make up a large part of their diet.

Very little information is available on winter distribution of minke whale, however, the species has been reported along the western North Atlantic south of 40 degrees latitude, **which is well outside the study area**. Minke whale migrate northward from calving grounds during spring and summer. They are a relatively solitary species; usually seen individually or in small groups of two or three. Larger groups have been observed in areas of concentrated feeding (*C-NLOPB, 2014*).

Mink whales that occur in Newfoundland belong to what is referred to as the Canadian East Coast Stock. Minke whale appear to prefer shallow water (less than 200 metres). They are commonly observed on the Grand Banks and within the Study Area in the spring and summer, associated with the presence of their prey species (*Piatt et al., 1989*) (*C-NLOPB, 2014*) (Figure 4.28). **The Fisheries and Oceans Canada Marine Mammals Sightings Database (2015) holds several records of sightings of this species across the study area (Figure 4.28). Based on the aerial surveys conducted offshore Newfoundland and Labrador in 2007, the abundance estimate for Minke whale is 1,315 individuals. However, as with all data from these 2007**

surveys, the abundance estimates are considered preliminary as they have not been corrected for the limitations of sightings surveys (perception effects) (*Lawson and Gosselin, 2009,* In: *C-NLOPB, 2014*).

More recently, abundance estimates were made based upon aerial and boat-based surveys conducted most recently in 2011 by SEFSC which estimated that Canadian East Coast Stock at 2,591 individuals (*NOAA, 2016b*).

Sperm Whale (*Physeter macrocephalus*)

The sperm whale has a worldwide distribution and is the largest of the toothed whales, growing to a length of approximately 20.5 metres. The species is considered to be 'Not at Risk' by COSEWIC.

Adults reach reproductive maturity at between 7 and 13 years of age and have a gestation period of 14 to 16 months. The interval between births is typically three to six years. Sperm whale routinely dive to depths of hundreds of meters and may occasionally dive as deep as 3,000 metres. Their primary prey item is squid (*C-NLOPB, 2014*).

Sperm whale range as far north and south as the edges of the polar pack ice, although they are most abundant in tropical and temperate waters where temperatures are higher than 15 degrees Celsius. Distribution is linked to social structure; adult females and juveniles generally occur in tropical and subtropical waters, whereas adult males are commonly alone often occurring in higher latitudes outside of the breeding season. They are generally distributed over large areas that have high secondary productivity and steep underwater topography (*C-NLOPB, 2014*).

Sperm whales were observed in small numbers in the waters off Eastern and Southern Newfoundland during aerial surveys conducted in the summer of 2007 (two and nine individuals, respectively **(*Lawson and Gosselin, 2009,* In: *C-NLOPB, 2014*). Due to the limited numbers observed no abundance estimates for this species were made. Sperm whale have also been sighted across the Study Area quite widely according to the Fisheries and Oceans Canada Marine Mammals Sightings Database (2015) (Figure 4.29) (*C-NLOPB, 2014*). Sightings records of sperm whale are much more numerous off the coast of Labrador to the north of the study area and in the wider vicinity of the Newfoundland Ridge and Newfoundland Basin over 400 kilometres to the south of the study area (Figure 4.29).**

The most recent estimate for the population of sperm whale is based on surveys from 2011 at 2,288 individuals, although this figure is potentially an underestimate as it was not corrected for the long dive times of this species. It should also be noted that this estimate is one for a select region, with sightings generally concentrated around the continental shelf edge. Currently, there is no estimate for the total population of sperm whales in the Western North Atlantic as a whole (*NOAA, 2015a*).

Northern Bottlenose Whale (*Hyperoodon ampullatus*)

Adult Northern bottlenose whales grow to approximately ten metres in length. Their pronounced beak is white on males and grey on females.

The Davis Strait-Baffin Bay-Labrador Sea population is listed by COSEWIC as a species of 'Special Concern', while localized Scotian Shelf populations are considered 'Endangered' by SARA

(Schedule 1) and COSEWIC. The Scotian Shelf population is believed to be non-migratory, while the Labrador population migrates north to south seasonally.

The Labrador population Northern Bottlenose whale mate and give birth during April. Females reach reproductive age at between 8 to 13 years. Single offspring are produced every two years. The primary prey item of the Northern bottlenose whale is squid (*C-NLOPB, 2014*).

Northern bottlenose whales Live in deep water areas of the North Atlantic and are rarely found in waters less than 800 metres deep. They are capable of remaining submerged for over an hour (*C-NLOPB, 2014*).

There are two areas of northern bottlenose whale abundance in the western North Atlantic: Davis Strait off northern Labrador and "the Gully" on the Scotian Shelf. Northern bottlenose whales are known to occur in the Grand Banks and within the Study Area, and 42 individuals were sighted in the waters off Eastern and Southern Newfoundland during aerial surveys conducted in 2007 (*Lawson and Gosselin, 2009*). **There are two sightings of the species located within the centre of the study area (Figure 4.29). The Scotian Shelf population of Northern Bottlenose whale is estimated as 164 individuals but there are no estimations of the total number of Northern bottlenose whales in the Northwest Atlantic (*COSEWIC, 2011*).**

Individuals of this species that are found in this area are considered to be of either the Labrador (Davis Strait) population or the endangered Scotian Shelf population, although the latter is considered to be less wide-ranging (*COSEWIC 2011*, In: *C-NLOPB, 2014*).

Recent research based upon acoustic and visual detections collected by Dalhousie University researchers during survey cruises in the summers of 2015 and 2016 has highlighted the presence of a previously unknown population of Northern bottlenose whale around the area of the Sacksville spur, an undersea sediment drift bordering the Flemish Pass east of Newfoundland. 50 -200 individuals were observed in the summer of 2016 (*Gillis, 2016*). The research expeditions suggest that there is a third main area of abundance of this species offshore Newfoundland.

Killer Whale (*Orcinus orca*)

Killer whale are large members of the dolphin family. Adult male killer whales can reach a length of 6 to 8 metres while females can reach a length of 5 to 7 metres. Males reach sexual maturity at about 13 years, and females at 14 to 15 years. Calving occurs from autumn to spring, with an average inter-calving period of approximately five years. Killer whales have a wide range of prey species including marine mammals, fish and squid.

Killer whales are globally fairly abundant and have been observed in all oceans of the world. They prefer warm waters but have been reported in cold waters as well and are not known to be reliably migratory. The greatest abundance of killer whales is found within 800 kilometres of major continents and they often travel in close-knit matrilineal groups of a few to tens of individuals (*C-NLOPB, 2014*). **Based on observation records of killer whale in eastern Canada from 1758 to 2012, sightings of the species are most common from June to September and sightings have increased over the last decade. However, there are insufficient data to make estimates of abundance for killer whales in the Newfoundland and Labrador areas (*NOAA, 2015b*).**

The Northwest Atlantic / Eastern Arctic population is assessed as being of 'Special Concern' by COSEWIC. Killer whales occur year-round in small numbers within the SEA and Study Area (Figure 4.29) (*Lien et al., 1988*). **There are two records of Killer whale within the study area (Figure 4.29) with other records being notable near to the Newfoundland and Labrador coasts. Killer whales are known to have quite a wide distribution worldwide.**

Long-finned Pilot Whale (*Globicephala melas*)

Atlantic long-finned pilot whale are members of the dolphin family. Adult long-finned pilot whales reach a length of approximately 3.5 to 4.5 metres, with males somewhat larger than females. Calving occurs year-round, but typically during the summer months. Calves have a gestation period of 12 to 15 months.

Long-finned pilot whales feed primarily on squid but known to consume octopus, cuttlefish and some fish species as well (*C-NLOPB, 2014*).

Widely distributed throughout the world's oceans, and abundant throughout the North Atlantic as far north as 70 degrees north, long-finned pilot whale is considered 'Not at Risk' by COSEWIC.

There is no evidence for marked north-south migration, but long-finned pilot whales may migrate inshore or offshore seasonally in response to prey availability.

During aerial surveys conducted in summer of 2007, ten observations totalling 65 individual long-finned pilot whales were recorded off Southern Newfoundland, although none were observed in the Eastern Newfoundland Offshore Area (*Lawson and Gosselin, 2009*, *C-NLOPB, 2014*). **The Fisheries and Oceans Canada Marine Mammals Sightings Database (2015) holds numerous records of Atlantic long-finned Pilot whale across the survey area (Figure 4.29). The aerial surveys conducted in 2007 encountered 10 observations of the species totalling 65 individuals (*Lawson and Gosselin, 2009,* In: *C-NLOPB, 2014*). A more recent abundance estimates of 5,636 individuals for North Atlantic waters (waters from central Virginia to the lower Bay of Fundy) was made based on aerial and boat-based surveys conducted in 2011. However, it is likely that this underestimates the population as the surveys did not include areas of the Scotian shelf where the highest densities of Atlantic long-finned pilot whales were previously observed in the summer of 2006 (*NOAA, 2016c*).**

Sowerby's Beaked Whale (*Mesoplodon bidens*)

Sowerby's beaked whale is a medium sized whale growing up to 5.5 metres long with a grey coloured back and paler belly. They have a small head with a long narrow beak, small triangular and relatively long dorsal fins. Their tail flukes do not have a centre notch. Their diet consists mainly of squid and deep-water fishes (*C-NLOPB, 2014*).

Sowerby's beaked whale is the most northerly of the beaked whales and has been found on the east and west side of the north Atlantic. They are distributed through the North Atlantic from cool to warm temperate waters, they are found both on the continental shelf and offshore. Relatively little is known about the Sowerby's beaked whale and they are rarely seen. They tend not to approach vessels and have a weak blow. There is no data on seasonal movements of the species and the social structure is poorly understood. Sightings and stranding have been of small groups of fewer than ten individuals (*C-NLOPB, 2014*).

As very little is known about the species, it is very difficult to understand any major conservation issues. According to COSEWIC and SARA Schedule 1 this species is of special concern (*C-NLOPB, 2014*).

During the aerial surveys conducted of the coasts of Newfoundland and Labrador in 2007, no observations were made of Sowerby's beaked whale (*Lawson and Gosselin, 2009* In: *C-NLOPB, 2014*). The Fisheries and Oceans Canada Marine Mammals Sightings Database (2015) also does not hold any records of this species. There are currently no population estimates available for this species (*DFO, 2017*). Sowerby's beaked whale is known to prefer deeper waters (over 1,000 metres) and therefore has potential presence across the study area. All confirmed sightings and stranding of this species off Newfoundland have been in summer months, although this may well be due to poor sighting conditions at other times of year (*C-NLOPB, 2014*).

<u>Small Dolphin Species</u>

Five dolphin species may be found in the Study Area: 1) Atlantic white-sided dolphin, 2) Bottlenose dolphin, 3) Common dolphin 4) Striped dolphin and 5) White-beaked dolphin. According to the Fisheries and Oceans Canada Marine Mammals Sightings Database (2015) these species have been sighted in the wider region of the study area (Figure 4.30). Risso's dolphin also have the potential to be present.

All **these** species have been assessed by COSEWIC and populations were considered 'Not at Risk'. Atlantic white-sided dolphins are considered abundant throughout their range **and have the most numerous sightings records across the study area (Figure 4.30).**

Diet for most small dolphin species consists of a variety of small schooling fishes and squid; Risso's dolphin feeds almost exclusively on squid.

All species occur in temperate to warm waters in the North Atlantic. The Atlantic white-sided dolphin and white-beaked dolphin also inhabit sub-Arctic portions of the North Atlantic. The short-beaked dolphin also inhabits southern waters off the coast of Venezuela and the Gulf of Mexico. Seasonal migration patterns for these species are poorly understood.

Small dolphin species are most commonly found in groups of 30 to 70 individuals; however, larger groups numbering several hundred individuals are also observed. Small dolphin species often associate and feed with large baleen whales and are known to form mixed dolphin species groups.

All the above small dolphin species have the potential to be present across the study area. (*C-NLOPB, 2014*). Based on the aerial surveys off the coast of Newfoundland and Labrador conducted in 2007, abundance estimates were possible for three species: Atlantic white-sided dolphin – 1,507 individuals; white-beaked dolphin – 1,842 individuals and common dolphin - 576 individuals. However, these estimates are considered preliminary as the numbers have not been normalised for perception limitations (*Lawson and Gosselin, 2009,* In: *C-NLOPB, 2014*).

More recently, data from aerial and boat-based surveys in 2011 provide further estimates of the abundance of the Western North Atlantic stocks of the following species: Atlantic White-sided dolphin 48,819 individuals (*NOAA, 2016d*), Bottlenose dolphin 77,532 individuals (*NOAA, 2016e*), Common dolphin 173,486, derived from the above 2007 surveys (*NOAA, 2016f*), Striped dolphin 54,807 individuals (*NOAA, 2014*) Risso's dolphin 15,197 individuals (*NOAA, 2016g*).

Bottlenose dolphin and Risso's dolphin both tend to be more common in more tropical waters. Neither species was identified during the aerial surveys conducted in 2007, however the Fisheries and Oceans Canada Marine Mammals Sightings Database (2015) does hold some records of bottlenose dolphin (Figure 4.30).

Harbour Porpoise (*Phocoena phocoena*)

The harbour porpoise is small compared to other cetaceans, growing to a length of 1.2 to 1.4 metres. The species is most commonly observed near the coast and will enter small bays and estuaries.

Harbour porpoise in the **Northwest Atlantic population** have been divided into three different subpopulations: The Bay of Fundy/Gulf of Maine, the Gulf of St. Lawrence and the Newfoundland populations. The boundaries between these sub-populations are not well defined as there is some genetic overlap.

Most mature females reproduce each year after they reach sexual maturity at 3.5 years old. The gestational period is 10 to 11 months. Harbour porpoises feed on small schooling fish. Harbour porpoise are found in shelf waters throughout the northern hemisphere, usually in waters colder than 17 degrees Celsius. They are usually seen in small groups of one to three animals often including at least one calf (*C-NLOPB, 2014*).

Harbour porpoise are present in northern coastal waters during the summer months. Off Eastern Newfoundland, harbour porpoises are most likely to be found in the shallower waters of inshore areas (*C-NLOPB, 2014*). **Based on the aerial surveys conducted off the coast of Newfoundland and Labrador in 2007, abundance is estimated at 1,195 individuals. However again this estimate is considered preliminary as the estimates have not been corrected for perception limitations (*Lawson and Gosselin, 2009,* In: *C-NLOPB, 2014*). Although harbour porpoise is known to be more numerous inshore, they do have the potential to be present in the study area as the Fisheries and Oceans Canada Marine Mammals Sightings Database (2015) holds many records of the species in the wider area (Figure 4.30).**

Turtles

There are three species of sea turtle that occur within the Study Area; leatherback turtle, loggerhead turtle and Kemp's Ridley turtle.

Leatherback

The Atlantic population of leatherback turtles is listed as 'Endangered' under Schedule 1 of SARA. The leatherback is the largest living turtle, measuring up to 2.19 metres in length. Leatherbacks nest on open beaches in the tropics. Females lay an average of six clutches per season. The preferred prey for leatherbacks is jellyfish and other gelatinous organisms.

Leatherbacks range throughout the Atlantic, Pacific and Indian oceans. In Atlantic Canadian waters they are present from April to December and most numerous from July to September. They are predominantly pelagic, typically inhabiting coastal shelf waters to a depth of less than 200 metres (*C-NLOPB, 2014*).

Population estimates for leatherbacks in the North Atlantic range from 34,000 to 94,000 individuals, and they are thought to be a regular (albeit uncommon) part of the Newfoundland

marine fauna in the summer and fall (*COSEWIC, 2012b; Goff and Lien, 1988*). **While the size of the seasonal foraging population specifically in Atlantic Canada is not known, sightings data suggest that the population in Canadian Atlantic waters numbers in the thousands (*COSEWIC, 2012b*).** The south coast of Newfoundland, the Placentia Bay area, is a relatively high-use habitat for this species (*Templeman, 2007; COSEWIC, 2012b*).

Loggerhead

The loggerhead is the largest hard-shelled turtle in the world, typically reaching 0.85 to 1.0 metre in length. Loggerheads nest in the southern United States and in tropical areas, laying four clutches per season, and will go two to three years between breeding seasons. Their main prey is crustaceans, molluscs and jellyfish (*C-NLOPB, 2014*). **The loggerhead turtle is considered 'Endangered' under Schedule 1 of SARA.**

Loggerheads are the most abundant sea turtle in North American waters. They wander widely in their range from coastal areas to more than 200 kilometres from shore. In Eastern Canada, they are seldom found in nearshore waters. Loggerheads are less common than leatherbacks in Eastern Canadian waters (*Breeze et al., 2002*). **Off Newfoundland the greatest concentrations are found over the Grand Banks where they tend to prefer the warmer waters. Loggerhead turtle therefore have the potential to be present across the study area particularly in the south.**

Kemp's Ridley

Kemp's Ridley is the smallest sea turtle, at 0.6 to 0.7 metres in length. They are only rarely found in Canadian waters and they are considered an accidental visitor. The species is considered 'Critically Endangered' by the IUCN.

Kemp's Ridley turtles nest exclusively in the Gulf of Mexico **and breeding and nesting occurs almost exclusively on three beaches in Mexico (*NFMS, 2011*)** where they lay an average of 2.5 clutches per season. Sex determination of marine turtle hatchlings is temperature dependent (*C-NLOPB, 2014*).

Adult Kemp's Ridley turtles rarely range beyond the Gulf of Mexico, but juveniles can be found as far north as Newfoundland. The number of Kemp's Ridley turtles that visit the Eastern Newfoundland Offshore Area is unknown, but this species is likely to be extremely rare in the Study Area.

References

Bettridge, S., C.S. Baker, J.B. Barlow, P.J. Clapham, M. Ford, D. Gouveia, D.K., Nattila, R.M. Pace, P.E. Rosel, G.K. Silber, and P.R. Wade. 2015. NOAA Technical Memorandum NMFS: Status Review of the Humpback Whale (Megaptera novaeangliae) under the Endangered Species Act. NOAA-TM=NMFS-SWFSC-540.

Committee on the Status of Endangered Wildlife in Canada (COSEWIC) (2011), COSEWIC Assessment and Status Report on the Northern Bottlenose Whale Hyperoodon ampullatus in Canada. Committee on the Status of Endangered Wildlife in Canada, Ottawa, ON. 31 pp.

DFO (Fisheries and Oceans Canada) (2016a), Management Plan for the fin whale (Balaenoptera physalus), Atlantic population in Canada [proposed], Species at Risk Act Management Plan Series, DFO, Ottawa, ON. iv +37 pp.

DFO (Fisheries and Oceans Canada) (2016b), Recovery Strategy for the Northern Bottlenose Whale, (Hyperoodan ampullatus), Scotian Shelf population, in Atlantic Canadian Waters [Final]. Species at Risk Act Recovery Strategy Series. Fisheries and Oceans Canada, Ottawa, ON. vii + 70 pp.

DFO (Fisheries and Oceans Canada) (2017), Management Plan for the Sowerby's Beaked Whale (Mesoplodon bidens) in Canada. Species at Risk Act Management Plan Series. Fisheries and Oceans Canada, Ottawa. iv + 46 pp.

Gillis, M. (2016), Rare bottlenose whales discovered off N.L. already in jeopardy. Article in CBC News. Published Nov 30, 2016. Available at: <http://www.cbc.ca/news/canada/newfoundland-labrador/bottlenose-whales-under-threat-from-seismic-blasting-1.3872342?campaign_id=A100>.

Lawson, J.W. and Gosselin, J.F. (2009), Distribution and preliminary abundance estimates for cetaceans seen during Canada's marine megafauna survey - a component of the 2007 TNASS. DFO Can. Sci. Advis. Sec. Res. Doc. 2009/031. Vi + 28 pp.

NFMS (National Marine Fisheries Service), U.S. Fish and Wildlife Service, and SEMARNAT (2011), BiNational Recovery Plan for the Kemp's Ridley Sea Turtle (Lepidochelys kempii), Second Revision. National Marine Fisheries Service. Silver Spring, Maryland 156 pp. + appendices.

National Oceanic and Atmospheric Administration (NOAA) (2014), Striped Dolphin (Stenella coeruleoalba): Western North Atlantic Stock. [Internet, available: <http://www.nmfs.noaa.gov/pr/sars/2013/ao2013_stripeddolphin-wna.pdf>].

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National Oceanic and Atmospheric Administration (NOAA) (2016c), Long-Finned Pilot Whale (Globicephala melas melas): Western North Atlantic Stock. [Internet, available: <http://www.fisheries.noaa.gov/pr/sars/pdf/stocks/atlantic/2015/f2015_lfpilot.pdf>].

National Oceanic and Atmospheric Administration (NOAA) (2016d), Atlantic White-Sided Dolphin (Lagenorhynchus acutus): Western North Atlantic Stock. [Internet, available: <http://www.nmfs.noaa.gov/pr/sars/pdf/stocks/atlantic/2015/f2015_whiteside.pdf>].

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National Oceanic and Atmospheric Administration (NOAA) (2016f), Short-Beaked Common Dolphin (Delphinus delphis): Western North Atlantic Stock. [Internet, available: <http://www.fisheries.noaa.gov/pr/sars/pdf/stocks/atlantic/2015/f2015_rissos.pdf>].

National Oceanic and Atmospheric Administration (NOAA) (2016g), Risso's Dolphin (Grampus griseus): Western North Atlantic Stock. [Internet, available: <http://www.fisheries.noaa.gov/pr/sars/pdf/stocks/atlantic/2015/f2015_rissos.pdf>].

*"**Section 4.6.3 Species at Risk, page 4-40** - as noted above it is felt that the Species at Risk VEC should be discussed in its own section and include fin fish, marine mammals and sea turtle Species at Risk. This section makes no reference to the role, purpose and information available within the various Recovery Strategies, Action Plans and/or Management Plans that have been developed for Species at Risk – all of which are available from the Species at Risk public registry. This section requires amendment accordingly specifically noting the recent development of an Action Plan for the Northern Bottlenose Whale (Hyperoodon ampullatus), Scotian Shelf population and a Management Plan for the Sowerby's Beaked Whale (Mesoplodon bidens). Also, it is not clear to what extent data gaps associated with the species at risk VEC noted within the Eastern Newfoundland Offshore SEA have been acknowledged / identified / addressed and whether any new information has been brought to bear in the description provided in Section 4.6.3. For example, information on presence/ likelihood of occurrence of northern bottlenose whales from the Scotian Shelf population which has come out of surveys completed in 2016 by Dalhousie University in the Flemish Cap / Flemish Pass areas. This section should be clarified and amended accordingly."*

Response:

Noted. The following action / management plans could not have been referenced as these reports were not published at the time of EA submission.

- Management Plan for the Sowerby's Beaked Whale (Mesoplodon bidens) in Canada, published in 2017
- Action Plan for the Northern Bottlenose Whale (Hyperoodon ampullatus), Scotian Shelf population, in Atlantic Canadian waters- published in 2017.

*"**Page 3-40 of Addendum** - This comment has not been adequately addressed. Relevant information from Management Plans, Recovery Strategies, and Action Plans should be described, including from documents published after the submission of the EA Report. Additionally, how data*

gaps from the Eastern Newfoundland Offshore SEA have been taken into account should be described."

Response:

Section 4.6.3 Species at Risk should be updated as per the below (updated text is provided in Bold)

4.6.3 Species at Risk

Within the Eastern Newfoundland Offshore Area, five marine mammal species are federally listed as being at risk (blue whale - Atlantic population, North Atlantic right whale, Sowerby's beaked whale, northern bottlenose whale (Scotian Shelf population), and fin whale (Atlantic population), as well as one sea turtle species (leatherback turtle - Atlantic population) (*SARA, 2016)*. In addition to federal listing, COSEWIC has assessed four additional populations as being of conservation concern but with no formal protection under SARA (northern bottlenose whale - Davis Strait population, killer whale - Northwest Atlantic and Eastern Arctic populations, harbour porpoise - Northwest Atlantic population, and loggerhead sea turtle - Atlantic Ocean population). The harbour porpoise is listed on Schedule 2 of SARA but is not subject to the same legal protections as Schedule 1 species. The Kemp's ridley turtle species is not federally listed but is considered by the IUCN to be critically endangered.

An Action Plan for the North Atlantic Right Whale came into effect in 2016 (*DFO, 2016*). The Action Plan sets out to contribute to the recovery goal for the species (as set out in the recovery strategy: "*To achieve an increasing trend in population abundance over three generations*". For the North Atlantic right whale, the two most important threats were recognised as vessel strikes and entanglement in fishing gear. The Action Plan places a priority on addressing objective 2 of the recovery strategy; "*Reduce mortality and injury as a result of fishing gear interactions*" (*DFO, 2016*).

A Management Plan for the Sowerby's beaked whale is also now in effect (*DFO, 2017a*). The management plan describes several anthropogenic threats to Sowerby's Beaked whale of which exposure to acute noise is recognised as the most significant due to the potential for physiological harm and potential for behavioural disturbance. The main two objectives of the Management Plan for Sowerby's beaked whale are to: 1) Maintain a stable Sowerby's beaked whale population throughout its range in Atlantic Canadian waters and 2): Quantify and mitigate the effects of identified threats on the population. The objectives are to be achieved via three conservation measures: 1) Research and monitoring, 2) Management and 3) Engagement and public outreach (*DFO, 2017a*). Mitigation measures for Marine Mammal and Wildlife Protection, including the measures to be taken to minimise disturbance from noise are described in Section 5.6.5 of the EA report. Polarcus' full commitment to the marine mammal observation programme also described in section 5.6.5 of the EA will add to the knowledge base of marine mammal sightings data in the area, which will contribute to conservation measure 1 of the Management Plan for Sowerby's Beaked whale.

An Action Plan for the Northern bottlenose whale Scotian Shelf population (under the Species at Risk Act), has been produced (*DFO, 2017b*). The Action Plan sets out to achieve recovery of the population and "*to achieve a stable or increasing population and to maintain, at a*

***minimum, current distribution*". The Action Plan goes onto define a series of 24 recovery measures (*DFO, 2017b*).**

A Management Plan for fin whale was brought into effect in 2017 (*DFO 2017c*). There are several factors noted within the Management Plan and those of most concern was related to noise pollution from seismic exploration and general navigation. The overall objective of the present management plan is to ensure that anthropogenic threats within Canadian waters do not cause a decline of the population or a reduction of the currently known distribution range in Canada. As mentioned above for Sowerby's Beaked whale, mitigation measures for minimising disturbance from noise are given in section 5.6.5 of the EA report. The marine mammal observation programme coupled with the mitigation measures detailed within section 5.6.5 (based on the Statement of Canadian Practice with respect to the Mitigation of Seismic Sound in the Marine Environment), will mitigate the risks to marine mammals from injury and disturbance to acceptable levels.

A Recovery Strategy for the leatherback sea turtle has been in effect since 2006 (*Atlantic Leatherback Turtle Recovery Team, 2006*). The recovery strategy identifies measures to be taken to promote the recovery of the Atlantic leatherback turtle populations. The ultimate recovery goal is to "*achieve the long-term viability of the leatherback turtle populations frequenting Atlantic Canadian waters*". A key challenge in the recovery strategy of the Atlantic leatherback turtle is lack of information regarding the species' biology, distribution, habitat preferences and threats to the populations (*Atlantic Leatherback Turtle Recovery Team, 2006*).

Marine mammal and turtle species at risk which may occur within the Study Area are summarized in Table 4.6.

<u>References</u>

Atlantic Leatherback Turtle Recovery Team (2006), Recovery Strategy for Leatherback Turtle (Dermochelys coriacea) in Atlantic Canada. Species at Risk Act Recovery Strategy Series. Fisheries and Oceans Canada, Ottawa, vi + 45 pp.

Fisheries and Oceans Canada (DFO) (2016), Action Plan for the North Atlantic Right Whale (Eubalaena glacialis) in Canada: Fishery Interactions [Proposed]. Species at Risk Act Action Plan Series. Fisheries and Oceans Canada, Ottawa. v + 35 pp.

Fisheries and Oceans Canada (DFO) (2017a), Management Plan for the Sowerby's Beaked Whale (Mesoplodon bidens) in Canada. Species at Risk Act Management Plan Series. Fisheries and Oceans Canada, Ottawa. iv + 46 pp.

Fisheries and Oceans Canada (DFO) (2017b), Action Plan for the Northern Bottlenose Whale (Hyperoodon ampullatus), Scotian Shelf population, in Atlantic Canadian waters. Species at Risk Act Action Plan Series. Fisheries and Oceans Canada, Ottawa. iv + 37 pp.

Fisheries and Oceans Canada (DFO) (2017c), Management Plan for the fin whale (Balaenoptera physalus), Atlantic population in Canada, Species at Risk Act Management Plan Series, DFO, Ottawa, iv +38 p.

The way in which data gaps from the Eastern Newfoundland Offshore SEA have been taken into account has been described in the response to ***Section 5.5 Effects Assessment, page 5-8 of EA Report and page 3-11 of this Addendum*** on pages 7 and 8 above.

"Section 4.7.1 Ecologically and Biologically Significant Areas, page 4-44 *– with respect to the 1st paragraph we no longer reference the Placentia Bay Grand Banks Large Ocean Management Area as it is now considered to be part of the Newfoundland and Labrador Shelves Bioregion. As such it is felt that the first sentence should be reworked to indicate that "A number of EBSAs have been identified in the Newfoundland and Labrador Bioregion (Templeman 2007, DFO 2013b)". With respect to the second sentence it should be amended to note that EBSAs are more than important areas for marine mammals and turtle species, they are also geographically or oceanographically discrete areas that provide important services to one or more species/populations of an ecosystem or to the ecosystem as a whole, compared to other surrounding areas or areas of similar ecological characteristics".*

Response:

A number of EBSAs have been identified in the Newfoundland and Labrador Bioregion (Templeman 2007, DFO 2013b). These EBSAs are identified as geographically or oceanographically discrete areas that provide important services to one or more species/populations of an ecosystem or to the ecosystem as a whole, compared to other surrounding areas or areas of similar ecological characteristics. Among the criteria for the identification, evaluation and selection of these important areas was their importance to marine mammals and seabirds in terms of biodiversity, density and importance for reproduction and survival.

"Section 4.7.1.1 EBSA Within the Study Area, page 4-45 *– only three EBSA have been identified / described by DFO within the project study area; the Northeast Shelf and Slope, the Virgin Rocks, and the Orphan Spur. The Orphan Knoll and the Slopes of the Flemish Cape and Grand Bank are coral and sponge and/or seamount closures that have been identified by NAFO and may be better suited to include within Section 4.7.2 Other Protected Areas. It is felt that these sections should be amended accordingly."*

Response:

Noted. It is acknowledged that a cross reference to Section 4.3 Deep-water corals and sponges could have been added to Section 4.7.2; however, the presence of coral and sponge and/or seamount closures has been presented in the EA and considered during the assessment process.

"Section 4.7.2 Other Protected Areas, page 4-47 *– as noted above it is felt that this section should be amended to include the noted NAFO coral and sponge closures and seamount closures areas. This section should also note that Ecological Risk Assessments (ERA) designed to evaluate the risk posed by bottom contact fisheries on significant coral and sponge communities have been carried out on a number of offshore areas identified in the above noted 2016 CSAS report (2016/093) including Tobin's Point. The areas covered by the ERA are being proposed as fisheries closures and extensive consultations on each area are currently underway."*

Response:

Noted. It is acknowledged that a cross reference to Section 4.3 could have been added to Section 4.7.2. NAFO coral and sponge closures and seamount closures areas are presented in Figure 4.1. It is acknowledged that there are areas covered by the ERA that are subsequently being proposed as fisheries closures.

"Section 4.7.2 Other Protected Areas, page 4-47, 2nd paragraph, first line *– the proponent should also indicate that MPAs may also protect important fish and marine mammal habitat and endangered aquatic species. The 2nd line of this paragraph should be amended to reflect that the correct name for the noted MPA is the "Eastport MPA" rather than the "Eastport Duck Island MPA" as written. With respect to the 4th paragraph as noted above the Placentia Bay Grand Banks Large Ocean Management Area is currently acknowledged to be a part of the Newfoundland and Labrador Shelves Bioregion and it was never considered an "offshore protected area". As such it is felt that this paragraph should be amended accordingly."*

Response:

We propose the following edits to the paragraphs in question in Section 4.7.2 Other Protected Areas:

An Oceans Act Marine Protected Area (MPA) is a protective designation that protects fish and marine mammal habitat, endangered aquatic species and the health of marine ecosystems and their resources. The Eastport MPA site is currently the only MPA located in Eastern Newfoundland (Figure 4.31), and therefore there are no designated sites within or close to the Study Area. The Eastport site protects two marine and coastal areas of the Eastport Peninsula *(DFO, 2013d).*

The Placentia Bay Grand Banks Large Ocean Management Area (LOMA), which covers NAFO areas 3LNOPsPn, and therefore the Grand Banks, Flemish Cap, and Orphan Knoll is within the vicinity of the study area. This area was identified because it possesses important living and non-living marine resources, areas of high biological diversity and productivity and increasing development pressures and competition for ocean space and resources. In addition, Representative Marine Areas (RMAs) are identified by Parks Canada for each of their 29 marine regions. Four preliminary RMAs exist within the Grand Banks marine region, of which two are offshore and within the Study Area (Figure4.31). Hydrocarbon exploration and exploitation are prohibited within National Marine Conservation Areas (*Parks Canada, 2008*).

"Section 4.8.1.1 Commercial Fishing Locations and Effort, page 4-47 to 4-64 *- the figure provided on page 4-48 requires a number and title. Also, with respect to description of commercial fishing locations and effort a portion of the study area is located outside of the 200-mile EEZ. In these areas proponents are encouraged to utilize NAFO catch data and information that may be available to describe commercial fishing / landings. It is not clear if this section makes use of such data this should be clarified, and the section amended if necessary. It is also that in addition to the information presented (e.g. see Section 4.8.1.2 Table 4.7) this section should provide additional information including catch weight by species and value".*

Response:

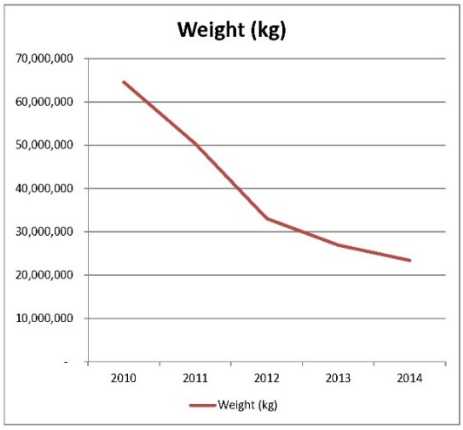
In the provided EA report, the Figure on page 4-48 is referenced as Figure 4.32 with the title "NAFO subdivision", a formatting error has allowed the title to be on a different page to the figure. Page 4-47 acknowledges the repartition of jurisdiction: "The Government of Canada has jurisdiction over fish stocks and fishing activities within a 200-nautical mile limit and for sedentary species across the entire continental shelf. Beyond that 200-mile limit, the North Atlantic Fisheries Organization (NAFO) manages groundfish activities and other resources".

Section 4.8 presents the output of DFO catch landings data and DFO was the source for commercial fishing locations. It is acknowledged that this may not be clear to the reader.

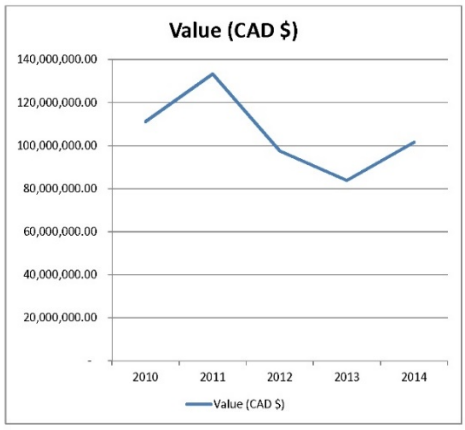
The total catch weight and value by species from NAFO data for the years 2010 to 2014 in relation to the study area is presented as follows.

Year	Weight (kg)	Value (CAD $)
2010	64,542,895	111,149,913.85
2011	50,344,786	133,244,275.60
2012	33,064,150	97,466,424.21
2013	26,912,258	83,761,775.98
2014	23,395,345	101,514,889.69
Total	**198,259,434**	**527,137,279.33**
Average	**39,651,887**	**105,427,456**

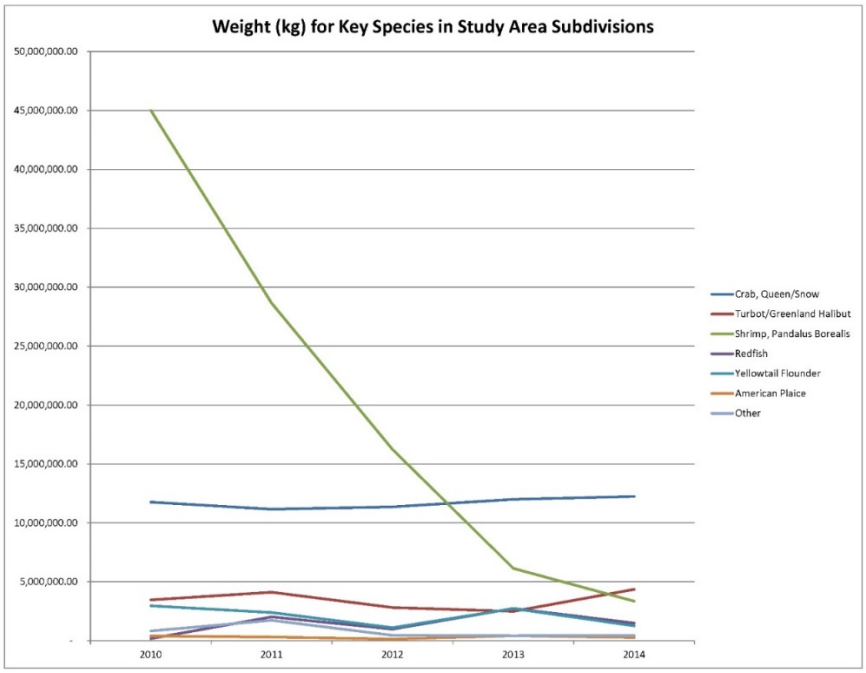
Table:
Fish Harvest by Weight and Value (All species, 2010-2014, All Study Area NAFO Subdivisions)

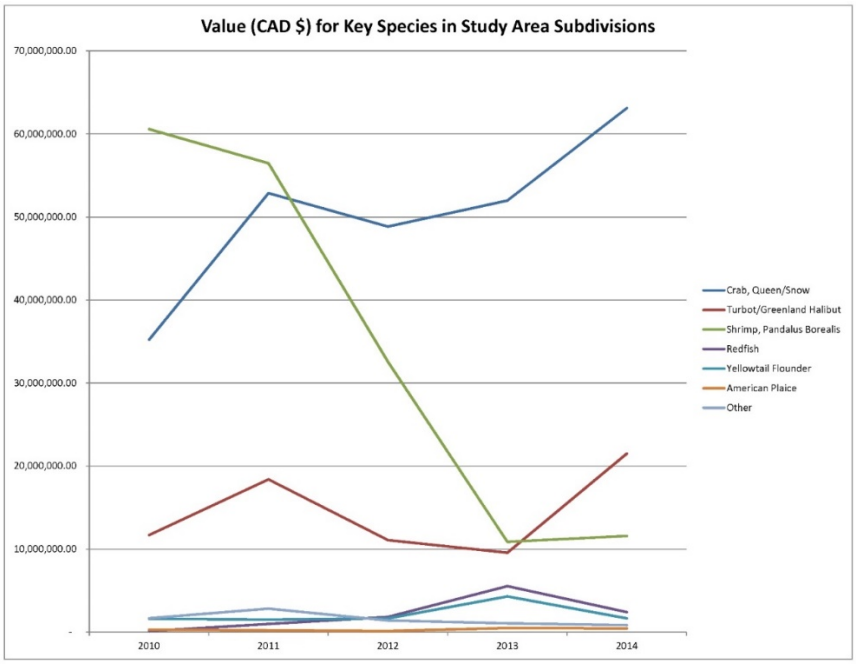


Graph:
Fish Harvest by Weight (All species, 2010-2014, All Study Area NAFO Subdivisions)

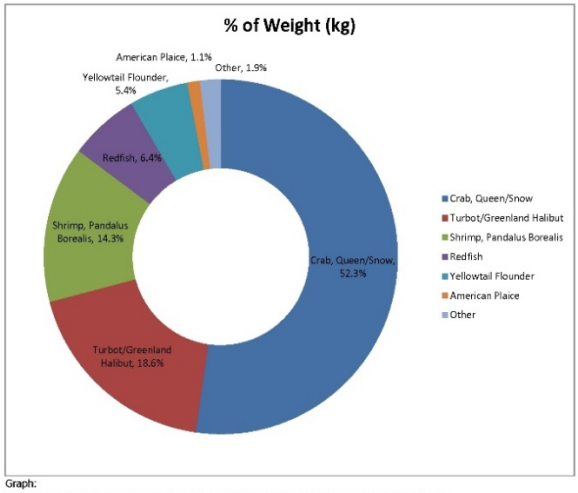


Graph:
Fish Harvest by Value (All species, 2010-2014, All Study Area NAFO Subdivisions)


Weight (kg) for Key Species in Study Area Subdivisions
50,000,000.00
45,000,000.00
40,000,000.00
35,000,000.00
30,000,000.00
25,000,000.00
20,000,000.00
15,000,000.00
10,000,000.00
5,000,000.00
-
2010
2011
2012
2013
2014
Crab, Queen/Snow
Turbot/Greenland Halibut
Shrimp, Pandalus Borealis
Redfish
Yellowtail Flounder
American Plaice
Other

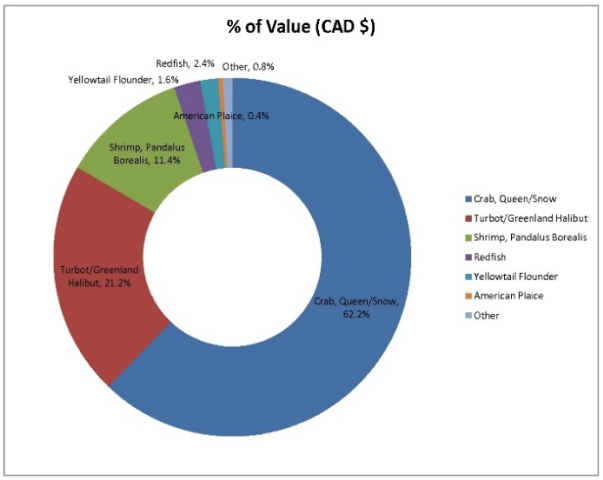

Value (CAD $) for Key Species in Study Area Subdivisions
70,000,000.00
60,000,000.00
50,000,000.00
40,000,000.00
30,000,000.00
20,000,000.00
10,000,000.00
-
2010
2011
2012
2013
2014
Crab, Queen/Snow
Turbot/Greenland Halibut
Shrimp, Pandalus Borealis
Redfish
Yellowtail Flounder
American Plaice
Other

Species	% of Weight (kg)
Crab, Queen/Snow	52.3%
Turbot/Greenland Halibut	18.6%
Shrimp, Pandalus Borealis	14.3%
Redfish	6.4%
Yellowtail Flounder	5.4%
American Plaice	1.1%
Other	1.9%



Graph:
Fish harvests by weight (kg), by species (2014, All Study Area NAFO Subdivisions)

Species	% of Value (CAD $)
Crab, Queen/Snow	62.2%
Turbot/Greenland Halibut	21.2%
Shrimp, Pandalus Borealis	11.4%
Redfish	2.4%
Yellowtail Flounder	1.6%
American Plaice	0.4%
Other	0.8%



Graph:
Fish harvests by value (CAD $), by species (2014, All Study Area NAFO Subdivisions)

"Section 4.8 Fisheries and Other Ocean users, page 4-47 *– this section requires mention of recreational, traditional and aboriginal fisheries that may occur in or near the project study area.*

Response:

Noted. Propose that the following text is included in Section 4.8.

Recreational Fisheries

Recreational fisheries in Newfoundland are presented in Section 4.3.4.4 of the Eastern Newfoundland SEA (C-NLOPB 2014). In 2017, the Newfoundland and Labrador recreational groundfish fishery will be open for a total of 46 days, beginning with the first weekend in July and ending in the beginning of October (DFO 2017). The recreational groundfish fishery occurs in all NAFO Divisions around Newfoundland, including 2GH, 2J3KL, 3Ps, 3Pn and 4R, with the exception of the Eastport and Gilbert Bay Marine Protected Areas (MPA) (DFO 2017). None of these NAFO Divisions overlap with the Study Area and therefore recreational fisheries will not be found within the Study Area.

Traditional and Aboriginal Fisheries

According to the Eastern Newfoundland SEA (C-NLOPB 2014), there are no known Aboriginal fisheries that occur within the Study Area.

*"**Page 3-45 of Addendum** - It is incorrect to state that "None of these NAFO Divisions overlap with the Study Area and therefore recreational fisheries will not be found within the Study Area". Based*

on Figure 4.32 in the EA Report, there is overlap between NAFO Divisions 3KL and the Study Area. Consequently, recreational fishing can occur within the Study Area; however, it is probably minimal. The statement that "there are no known Aboriginal fisheries that occur within the Study Area" is also incorrect. Although there are no communal Food, Social and Ceremonial Indigenous fisheries currently permitted in the Study Area, all Indigenous groups in the DFO NL Region have communal commercial licences providing access to the Study Area. Additionally, there are Indigenous groups outside the DFO NL Region that hold licences (swordfish) that are permitted access to the Study Area. Response should be updated accordingly."

Response:

The response provided in the Addendum for Recreational Fisheries and Aboriginal Fisheries should be updated as follows (new text is provided in Bold)

Recreational Fisheries

Recreational fisheries in Newfoundland are presented in Section 4.3.4.4 of the Eastern Newfoundland SEA (*C-NLOPB 2014*). In 2017, the Newfoundland and Labrador recreational groundfish fishery will be open for a total of 46 days, beginning with the first weekend in July and ending in the beginning of October (DFO 2017). The recreational groundfish fishery occurs in all NAFO Divisions around Newfoundland, including 2GH, 2J, 3KL, 3Ps, 3Pn and 4R, with the exception of the Eastport and Gilbert Bay Marine Protected Areas (MPA) (*DFO, 2017*). **Therefore, recreational fishing can potentially occur within the Study Area however, given the distance offshore is likely to be minimal.**

Traditional and Aboriginal Fisheries

According to the Eastern Newfoundland SEA (C-NLOPB 2014), there are no known Aboriginal fisheries that occur within the Study Area. **However, there are communal fishing licences issued to indigenous groups for Food, Social and Ceremonial (FSC) purposes under the Aboriginal Fisheries Strategy (AFS) of 1992. A significant part of the AFS is the ability to transfer fishing quotas to indigenous groups under the Allocation Transfer Program. Following a review of the AFS the Aboriginal Aquatic Resource and Oceans Management (AAROM) program was established. The goal of AAROM is to help Aboriginal groups to participate effectively in advisory and decision-making processes used for aquatic resource and oceans management (*FOC, 2012*). There are many indigenous groups in the region and many of these groups hold AFS fishing licences. The indigenous group Acadia First Nation holds several commercial-communal licences, including for gaspereau, clams, crab, eel, groundfish, herring, lobster, mackerel, sea scallop, swordfish, and tuna, issued by the DFO (*MMNN, 2015*). The permitted area for swordfish does overlap with the study area, therefore this fishery could potentially be encountered.**

References

Fisheries & Oceans Canada (FOC) (2012), Aboriginal Aquatic Resource and Oceans Management Program, [Internet, available: <http://www.dfo-mpo.gc.ca/fm-gp/aboriginal-autochtones/aarom-pagrao/index-eng.htm >].

Mi'kmaq Maliseet Nations News (MMNN) (2015), Acadia First Nation's Commercial Fishery Continues to Grow, [Internet, available: <http://www.mmnn.ca/2015/10/acadia-first-nations-commercial-fishery-continues-to-grow/>].

"Section 4.8.1.3 Commercial Fishing Gear, page 4-64 *- the description provided is not adequate and would benefit from additional details / information e.g. species associated with each gear type; catch statistics associated with each gear type; type of fisheries / fish species associated with each gear used by month."*

Response:

Noted. Propose that Section 4.8.1.3 could include a new table that presents the total study area catch weight by gear type (fixed vs mobile) per species (see Table 4-7 below). Propose Section 4.8.1.3 reads as follows.

Various types of fishing gear are used to harvest fish and shellfish offshore Eastern Newfoundland. Both mobile and fixed gear types are utilized during commercial fishing Figure 4.48 and Figure 4.49), with predominant gear types in the region consisting of bottom otter trawls, shrimp trawls, gillnets, longlines, and pots. Shrimp trawls are the most commonly used gear type.

Catches of Greenland Halibut and Snow Crab dominate the total fixed gear catch, accounting for 7.76% and 23.91% of landings in the study area from the years 2010 to 2014. Catches of Northern Shrimp account for the highest percentage (34.38%) of landings associated with mobile gear in the study area from the years 2010 to 2014, followed by Greenland Halibut (4.48%) (see new proposed Table 4-7 below).

Fixed gear types are most commonly used during the spring and summer months and are concentrated within the southwest and northwest edge of the Study Area Figure 4.48). Conversely, mobile gear types are used all year-round offshore Newfoundland and within the southwest and northwest edge of the Study Area, with a peak utilization during the summer months (Figure 4.49). As mobile gear types are used all year round they accounted for 60.10% of the total landings compared to 39.9% of total fixed gear landings from the years 2010 to 2014 (see new proposed Table 4-7 below).

Relevant information on previous location of fixed gear is provided by season to cover the proposed survey period (Figure 4.48). This will enable Polarcus to plan their operations accordingly and use this information as part of their decision-making process. To present this data per month will have a limited added value to the impact assessment and decision-making process.

New proposed Table 4-7 Total study area catch weight by gear type (fixed vs mobile) per species (DFO commercial landings database, 2010 – 2014).

Table 4-7 Total study area catch weight by gear type (Fixed vs Mobile) per species

Species	Fixed Gear		Mobile Gear	
	mt	% of Total	mt	% of Total
Atlantic Cod	0.4	0.17%	6.4	2.57%
Haddock	0.0	0.03%	0.0	0.62%
Redfish	23.4	2.98%	26.3	3.37%
Atlantic Halibut	0.1	0.84%	0.3	2.50%
American Plaice	0.0	0.24%	0.8	4.28%
Yellowtail Flounder	-	0.00%	5.9	2.85%
Greysole/Witch	1.3	1.15%	3.7	3.24%
Greenland Halibut	1,073.0	7.76%	619.7	4.48%
Skate	0.0	1.04%	-	0.00%
Pollock	-	0.00%	-	0.03%
White Hake	0.0	0.04%	-	0.00%
Cusk	-	0.03%	-	0.00%
Monkfish (American Angler)	-	0.00%	-	0.00%
Roughhead Grenadier	2.2	1.66%	1.3	0.94%
Striped/Wolffish	0.0	0.01%	0.0	0.01%
Atlantic Herring	0.0	0.01%	0.1	0.05%
Mackerel	-	0.00%	0.0	0.01%
Argentine	-	0.00%	0.0	0.12%
Capelin	-	0.00%	0.0	0.05%
Mako Shark	-	0.00%	-	0.00%
Stimpson'S Surf Clam	-	0.00%	0.1	0.08%
Sea Scallop	-	0.00%	0.0	0.00%
Whelk	0.0	0.00%	-	0.00%
Cockle	-	0.00%	1.0	0.10%
Icelandic Scallop	-	0.00%	0.0	0.01%
Northern Shrimp	-	0.00%	31,105.7	34.38%
Snow Crab	13,826.9	23.91%	-	0.00%
Pink Shrimp	-	0.00%	0.0	0.01%
Clams, Stimpson'S Surf, Mantle	-	0.00%	0.0	0.05%
Groundfish Heads	-	0.00%	0.5	0.37%
Subtotal	**14,927.4**	**39.90%**	**31,771.9**	**60.10%**
Grand Total (mt)				**46,699.3**

"Section 5.3 Valued Environmental Components, page 5-6 *– with respect to the Fish and Fish Habitat VEC the description requires addition of pelagic fish to the description / characterization of the Fish and Fish Habitat VEC provided in the 1st bullet. This would be consistent with the information presented within Table 5.2 which identifies potential interactions between project activities and pelagic fish".*

Response:

Noted. Acknowledge that the 1st bullet point in the EA should include reference to pelagic species.

"Section 5.2.2 Stakeholder Consultations, page 5-6, first sentence *- on page 5-6 refers to the "Freshwater Habitat Section" (of DFO) it is felt that this is an error and needs to be amended to refer to the "Fisheries Protection Program" of DFO, rather than the Freshwater Habitat Section".*

Response:

Noted. Acknowledge the more appropriate reference would be to the "Fisheries Protection Program" of DFO, rather than the Freshwater Habitat Section".

"Section 5.5.1 Identification of Interactions, page 5-10, Table 5-2 *– this table does not include the Species at Risk VEC. The note at the bottom of the table is odd and not acceptable. Table 5.2 should be amended to include the Species at Risk VEC."*

Response:

Noted. Propose Table 5-2 is amended to include Species at Risk VEC and the note is removed.

Table 5-2. Potential Interactions between Project Activities and VECs

Project Activities	Fish and Fish Habitat VEC					Fisheries and Other Ocean Users VEC			Seabirds VEC	Marine Mammals VEC and Sea Turtles VEC				Species at Risk VEC	Sensitive Areas VEC
	Water and Sediment Quality	Eggs and Larvae	Juveniles	Pelagic Fish	Bottom dwelling fish	Mobile Invertebrates and Fishes (e.g. gillnet	Sedentary Benthic Invertebrates (e.g. crab	Research Surveys (e.g. trawls and crab pots		Toothed Whales	Baleen Whales	Seals	Sea Turtles		
Underwater Noise															
Airgun Array															
Seismic Vessel															
Supply / Support															
Physical Presence of:															
Seismic Vessel															
Supply Vessel															
Helicopter[4]															
Onshore[5] facilities															
Vessel Lights															
Sanitary/Domestic Waste															
Liquid Waste															
Atmospheric Emissions															
Garbage[6]															
Unplanned Events															
Other Projects and Activities															
Offshore Oil and Gas Activities															
Fisheries															
Marine Transportation															

4 Crew change will occur via ship to ship transfer, helicopters will only be used in the event of an emergency situation.

5 There will be no new onshore facilities as existing infrastructure will be used.

6 Not applicable as garbage will be brought onshore

"Section 5.6.7 Monitoring, page 5-14 *– it is felt that an important component of project related monitoring and follow up includes monitoring to assess compliance with project specific mitigation and regulatory commitments/obligations. It may be necessary to add same to the 1st sentence of the 2nd paragraph in this section."*

Response:

Noted. This comment is referring to Section 5.5.7. We propose the paragraph in question reads as follows:

However, there will be a need for monitoring (See Section 5.6.5) during the Project to ensure effects are as predicted within the assessment and to assess compliance with project specific mitigation and regulatory commitments/obligations. The on-board monitoring to assess compliance with project specific mitigation and regulatory commitments/obligations will be carried out by the qualified MMO's permanently on board. If observations during project activities indicate evidence of an unanticipated effect on a VEC or an accidental release of fuel, then there may be the need for follow-up monitoring and other actions. The need for such actions will be assessed in consultation with the C-NLOPB.

"Section 5.6 Mitigation Measures, page 5-15 *– the last part of the 3rd bullet should read "…Marine Environment (DFO 2008 available from the DFO website as well as from the above noted CNLOPB Geophysical, Geological, Environmental, and Geotechnical Program Guidelines)."*

Response:

Noted. We propose the 3rd bullet reads as follows:

- DFO's Statement of Practice with respect to the Mitigation of Seismic Sound in the Marine Environment (DFO 2008 available from the DFO website as well as from the above noted C-NLOPB Geophysical, Geological, Environmental, and Geotechnical Program Guidelines);

"Section 5.6.4 Fishing Gear Damage Program, page 5-20, 4th bullet *- it should be noted that in accordance with Sections 26 and 27 of the Fishery (General) Regulations CFV numbers have been replaced with Vessel Registration Numbers (VRN). The 4th (and other similar bullets with reference to CFV number (see page 5-17)) should be amended accordingly".*

Response:

Noted. It is proposed reference to CFV numbers will be removed where relevant and replaced with VRN.

"Section 5.6.5 Marine Mammal / Wildlife Protection, page 5-21 *– this section should also reference / note the Marine Mammal Regulations (under the Fisheries Act). While these regulations are currently undergoing amendment, it should be noted that Schedule 11 of the proposed amended Marine Mammal Regulations (MMR) provide approach distances for marine mammals based on species, vehicle (vessel, aircraft, etc), area and timing. Given that the proposed seismic survey(s) are scheduled to run from 2017 to 2022 it is recommended that the proponent*

be aware of any potential implications that may arise if any proposed amendments to MMR are accepted during the timeframe covered by the proposed survey program".

Response:

Noted. Polarcus continues to monitor applicable environmental legislation and regulations that are relevant to its activities and will plan and implement the various components and activities that are associated with this Project in compliance with the relevant provisions of the *Fisheries Act* and *Marine Mammal Regulations* as current at the time.

"Section 5.6.5 Marine Mammal / Wildlife Protection, page 5-21, 2nd paragraph, last line *- the link for the noted ESRF report has not been provided, the last line should add the following link* http://www.esrfunds.org/sites/www.esrfunds.org/files/pdf/publications/Report156.pdf*"*

Response:

Noted. We propose the last line reads as follows:

The report is available on the internet at the following link: (http://www.esrfunds.org/sites/www.esrfunds.org/files/pdf/publications/Report156.pdf").

"Section 5.8.1 Fish and Fish Habitat VEC, page 5-28 to 5-29 *– 1st sentence on top of page 5-28 it is felt that this sentence would be clearer if it read "…physical (e.g. injury or mortality), physiological (e.g. primary and secondary stress responses), or behavioural…" With respect to Table 5-7 on page 5-28, should the SEL cum of >216 dB re 1µPa2 for recoverable injury be lower than the peak SPL of >213 dB re 1 µPa this should be clarified. With respect to the 3rd sentence 2nd paragraph on page 5-29 "There is no recorded evidence that energy sources have killed or caused injuries during seismic survey operations (Turnpenny and Nedwell, 1994)." Is there a more recent reference supporting / refuting this statement, if so it should be noted".*

Response:

Noted. We propose the first sentence on top of page 5-28 reads as follows:

The effect of noise on fish may be either physical (e.g. injury or mortality), physiological (e.g. primary and secondary stress responses), or behavioural, and criteria for the assessment of both of these impacts are discussed below.

Propose Table 5-7 is presented as follows:

Table 5.7 Thresholds for Impulsive Noise Exposure to Fish (adopted from Popper et al., 2014)

Type of Fish	Mortality and Potential Mortal Injury	Impairment	
		Recoverable Injury[1]	Temporary Threshold Shift (TTS)
Type 1 - no swim bladder (particle	>219 re 1uPa2 (SEL cum) >213 dB re 1uPa (SPL peak)	>216 dB re 1uPa^2 (SEL $_{cum}$) or	>186 dB re 1uPa^2 (SEL $_{cum}$)

Type of Fish	Mortality and Potential Mortal Injury	Impairment	
		Recoverable Injury[1]	Temporary Threshold Shift (TTS)
motion detection)		>213 dB re 1uPa (SPL $_{peak}$)	
Type 2 - Swim bladder is not involved in hearing (particle motion detection)	210 re 1uPa2 (SEL cum) >207 dB re 1uPa (SPL peak)	>203 dB re 1uPa^2 (SEL $_{cum}$) or >207 dB re 1uPa (SPL $_{peak}$)	>186 dB re 1uPa^2 (SEL $_{cum}$)
Type 3 - Swim Bladder involved in hearing (primarily pressure detection)	207 re 1uPa2 (SEL cum) >207 dB re 1uPa (SPL $_{peak}$)	203 dB re 1uPa^2 (SEL $_{cum}$) or >207 dB re 1uPa (SPL $_{peak}$)	186 dB re 1uPa^2 (SEL $_{cum}$)

Note 1: Recoverable injury: injuries, including hair cell damage, minor internal or external hematoma, etc. None of these injuries are likely to result in mortality. Note: that the same peak levels are used both for mortality and recoverable injury since the same SEL ss was used throughout the pile driving studies. Thus, the same peak level was derived (Halvorsen et al. 2011).

The addition of SEL cum figures to the column titled "Mortality and Potential Mortal Injury" allows values to be directly comparable across the columns of Table 5-7.

A more recent reference supporting / refuting this statement is not available.

"Section 5.8.1 Fish and Fish Habitat VEC, page 5-29 to 5-32 *– the 1st and 4th sentences of 4th paragraph require suitable references. With respect to Figure 5.1 on page 5-30 the term "On Axis" should be defined. The 1st sentence of 2nd paragraph (Underwater Noise page 5-32) requires a suitable reference. Also, it should be clarified is the noise level (i.e. 190 dB re 1 µPa") peak SPL or SEL and how was it determined that stunning "may occur" at this distance, if it is based on modelling this should be noted accordingly."*

Response:

We propose the 4th paragraph in question reads as follows:

A considerable amount of research (*Popper and Clarke, 1976; Scholik and Yan, 2001; Amoser and Ladich, 2003; Amoser et al., 2004; Smith et al., 2004a and 2004b, McCauley et al., 2003*) has been conducted on the effects of offshore seismic surveys (including various sound types and intensities) and other anthropogenic activities on marine fish. This has included scientific research, monitoring studies and anecdotal reports of observed reactions by various fish species. Although overall knowledge and understanding of the effects of seismic and other anthropogenic noise on marine fish and invertebrates remain incomplete in some areas, the effects of seismic activities and other noise sources have been documented in a variety of fish and invertebrate species in numerous studies. It should be noted, however, that many of the studies occur within a laboratory setting with captive animals, and the documented effects

may not replicate natural conditions (*Popper and Clarke, 1976 and Pearson et al., 1992)*. An overview of the research and studies on seismic noise and fish is presented below broken down by the possible effect it may have on the Fish and Fish Habitat VEC.

The term "On axis" from the Figure 5.1 page 5-30 should read Sound Pressure Level (dB re 1µPa associated with seismic survey airgun array. Propose this text is added to Figure 5.1.

We propose *Underwater Noise page 5-32 paragraph* in question reads as follows:

Transient stunning of fish species (noise greater than 190 dB re 1µPa SPL) may occur within 630 metres of the acoustic energy source when operating at full power (see Figure 5-2). This impact is therefore localized to the vicinity of the survey vessel during operations.

"Section 5.8.4 Marine Mammals and Sea Turtles VEC, Acoustic Masking, page 5-43 *- with respect to the first sentence in the 3rd paragraph "… given the frequency range of the seismic sound source (between 10 and 200 hertz) …." it is felt that the frequency range provided should be consistent with other sections in the report. For example, Section 2.4.1 Underwater Noise (page 2-11) "The noise generated by these processes tends to be of low frequency in the range of <1 to 250 hertz…", and "…the sound from seismic operations is primarily low frequency (between <1 to 200 hertz) …." is also on page 5-45. There should be consistency or clarification on what is being discussed with respect to frequency range and all other measures of sound energy".*

Response:

Noted. The frequency range being discussed should be between 10 and 200 hertz.

"Section 5.8.5 Species at Risk VEC, page 5-49 to 5-51 *– as noted in an earlier comment Table 5.2 (page 5-10) does not include the Species at Risk VEC, as such both the first sentence of Section 5.8.5 and (as previously noted) Table 5.2 must be amended accordingly. This section should also be amended to include a discussion of the interactions for each Species at Risk, since not all species will have the same potential interactions. With respect to the bullets on page 5-50 it is felt that the listing should include the population names for the species at risk where applicable e.g. Blue whale (Atlantic population)."*

Response:

Noted. See page 3-48 above for proposed Table 5.2.

It is felt that the potential project interactions are reflected for the species at risk and if species were to be presented individually there would be a lot of unnecessary repetition without adding value to the section.

Noted. Population names for the relevant species at risk are provided as follows:

- White shark (Atlantic population), and northern, spotted, and Atlantic wolffish;
- Harlequin Duck (Eastern population), Barrow's Goldeneye (Eastern population), Ivory Gull, Red Knot (*rufa subspecies*), Piping Plover (*melodus subspecies*), Peregrine Falcon, Olive-sided Flycatcher, and Short-eared Owl.

- Blue whale (Atlantic population), north Atlantic right, northern bottlenose, Sowerby's beaked whales (Scotian Shelf population), fin whale (Atlantic population) and killer whales; harbor porpoise; and
- Leatherback (Atlantic population) and loggerhead sea turtle.

"Section 5.8.5 Species at Risk VEC Environmental Effects Assessment, page 5-50 *– The last sentence of the 2nd paragraph in this section indicates "The mitigation measure of ramping-up the airgun array (over a minimum 20 min period) is expected to minimize the potential for impacts on these marine mammals and turtles". While this is an important measure there are additional measures discussed in the Mitigations Section of the EA including adherence to the "CNLOB Guidelines" and the DFO "Statement of Canadian Practice with respect to the Mitigation of Seismic Sound in the Marine Environment". This paragraph requires amendment accordingly. The last sentence on page 5-50 requires amendment the table reference should be Table 5-14 rather Table 5-10."*

Response:

We propose the paragraphs in question read as follows:

As per the detailed effects assessment in Section 5.8.4, the predicted effect of the Project on the Blue, north Atlantic right, northern bottlenose, Sowerby's beaked, fin and killer whales; harbor porpoise; and leatherback and loggerhead sea turtles are not significant. The mitigation measures presented in Section 5.6.5 are expected to minimize the potential for impacts on these marine mammals and turtles.

A summary of the predicted (residual) environmental effects of the project on the Species at Risk VEC is provided in Table 5.14.

*"**Page 3-48 of Addendum** - Atmospheric emissions should be noted for potential interactions with the Species at Risk VEC considering that interactions are noted for sea turtles in Table 5-2 and potential negative effects of atmospheric emissions are noted for the Species at Risk VEC in Table 5-14 of the EA Report."*

Response:

Table 5-2 should be amended to include potential interactions between Atmospheric Emissions and the Species at Risk VEC as below.

Table 5-2 Potential Interactions between Project Activities and VECs

Project Activities	Fish and Fish Habitat VEC					Fisheries and Other Ocean Users VEC			Seabirds VEC	Marine Mammals VEC and Sea Turtles VEC				Species at Risk VEC	Sensitive Areas VEC
	Water and Sediment	Eggs and Larvae	Juveniles	Pelagic Fish	Bottom dwelling fish	Mobile Invertebrates and Fishes (e.g.	Sedentary Benthic Invertebrates (e.g.	Research Surveys (e.g. trawls and crab		Toothed Whales	Baleen Whales	Seals	Sea Turtles		
Underwater Noise															
Airgun Array															
Seismic Vessel															
Supply / Support															
Physical Presence of:															
Seismic Vessel															
Supply Vessel															
Helicopter[7]															
Onshore[8] facilities															
Vessel Lights															
Sanitary/Domestic Waste															
Liquid Waste															
Atmospheric Emissions															
Garbage															
Unplanned Events															
Other Projects and Activities															
Offshore Oil and Gas Activities															
Fisheries															
Marine Transportation															

7 Crew change will occur via ship to ship transfer, helicopters will only be used in the event of an emergency situation.

8 There will be no new onshore facilities as existing infrastructure will be used.

Page 3-52 of the Addendum *- Because project activities could potentially have greater effects on Species at Risk, it is still felt that this section should be amended to include a discussion of the interactions for each Species at Risk. Errors in population names were also noted in the response and should be corrected as follows:*

- *Populations for Northern bottlenose whale are Scotian Shelf and Davis Strait-Baffin Bay-Labrador Sea;*
- *There is no population for Sowerby's beaked whale;*
- *Northwest Atlantic/Eastern Arctic population should be noted for Killer whale; and*
- *Northwest Atlantic population should be noted for Harbour porpoise."*

Response:

Section 5.8.5 Species at Risk VEC should be updated as per the below (Bold text indicates new/updated text). Errors in the population names noted above have been included in the response below and in the updated species accounts above on pages 30 to 38.

5.8.5 Species at Risk VEC

The interactions between the Project activities and the Species at Risk VEC are summarized in Table 5.2. The following sections discuss the project activities that will interact with the Species at Risk VEC and include an assessment of the potential effects of these interactions.

An overview of species considered at risk under *SARA* and/or by COSEWIC that are likely or may occur in the Study Area was provided in Section 4.4.2, Section 4.5.1 and Section 4.6.3. No critical habitat has been defined for the Study Area. As discussed in previous sections and presented in **Table 4.4, Table 4.5 and Table 4.6**, *SARA* species of relevance to the Study Area include:

- White shark, and northern, spotted, and Atlantic wolfish **(Table 4.4);**
- Barrow's Goldeneye, Harlequin Duck, Ivory Gull, Piping Plover, Red Knot (rufa subspecies), Peregrine Falcon, Olive-sided Flycatcher, and Short-eared Owl **(Table 4.5**);
- Blue whale, north Atlantic right whale, northern bottlenose whale, fin whale, Sowerby's beaked whale, and harbour porpoise **(Table 4.6)**; and
- Leatherback turtle **(Table 4.6).**

Potential Environmental Effects and Existing Knowledge

Species not currently designated on Schedule 1 of *SARA* but listed on Schedule 2 or 3 or being considered for addition to Schedule 1 (as per their current COSEWIC listing of *endangered, threatened* or *special concern*), are not included in the Species at Risk VEC here but have been assessed in the relevant VEC in Sections 5.8.1 (Fish), 5.8.3 (Seabirds) and 5.8.4 (Marine Mammals and Sea Turtles) of this EA. If species not currently designated on Schedule 1 of *SARA* do become listed on this legal list during the remainder of the life of the Project (2014–2018), the Proponent will re-assess these species considering the prohibitions of *SARA* and any recovery strategies or

action plans that may be in place. Possible mitigation measures as they relate to Species at Risk will be reviewed with DFO and Environment Canada.

Environmental Effects Assessment

Fish and Fish Habitat VEC

The potential environmental aspects of the project likely to interact with white shark and wolffish include underwater sound emissions from the airgun array, the seismic vessel itself, the supply and escort vessels, the echo sounder and the side scan sonar equipment. Other environmental aspects of the project like to impact this VEC include domestic waste, atmospheric emissions and accidental releases. Vessel lighting at night also has the potential to interact with the white shark.

Interaction with white shark, although possible, is unlikely as the species is not common in offshore Canadian waters, including the study area (*C-NLOPB, 2014*). Wolffish species all have the potential for presence over the Study Area and therefore have the potential to interact with the project, particularly through the effects of underwater sound. The three species prefer a range of depths (*C-NLOPB, 2014*) so interactions with the species at various depths in the water column is possible.

As per the detailed effects assessment in Section 5.8.1, physical effects of the Project on the various life stages of wolf-fishes and the white shark will range from negligible to low over a duration of less than one month, within an area of <1 square kilometer and are predicted to be not significant (Table 5.14). The mitigation measures employed as part of the project (described in section 5.6.5 of the EA) of **ramp-up/soft start of** the airgun array (over a minimum 20 min period) are expected to minimize the potential for impacts on wolffish and the white shark.

Seabird VEC

Potential environmental aspects of the project likely to impact seabird species include underwater sound emissions from the airgun array, the seismic vessel itself, the supply and escort vessels, the echo sounder and the side scan sonar equipment. The presence of the seismic equipment and vessel itself also has the potential to interact with seabirds. Other environmental aspects of the project like to impact this VEC include domestic waste, atmospheric emissions, helicopter flights and accidental releases from the project. Vessel lighting at night also has the potential for interaction with seabird species.

Barrow's Goldeneye (Special Concern under SARA) moults and winters off the coast of eastern Canada along with other Goldeneye species (often the Common Goldeneye). The birds are known to congregate offshore in shipping areas (*C-NLOPB, 2014*). This species therefore is not so likely to physically interact with the project as it is not likely that operations will take place in the winter.

The Harlequin Duck (Special Concern under SARA) is often found along coastal areas of eastern Canada in the winter when they moult and breed (*C-NLOPB, 2014*). This species therefore has a greater potential to interact with the project as it is more likely to be present offshore during summer months.

The Ivory Gull (Endangered under SARA) winters offshore, occurring in small numbers offshore eastern Newfoundland and breeds in the far north of the Newfoundland and Labrador areas (*C-NLOPB, 2014*). The species is not found that often in offshore waters, with winter being the most likely time to encounter this species offshore. This species is therefore not as likely to interact with the project as the operations will take place during the summer months.

Piping Plover (Endangered under SARA) commonly nest in coastal areas from April to September and prefer sandy shorelines. They are regularly encountered in the southern and southwestern part of Newfoundland, notably the Grand Bay West to Cheeseman Provincial Park Important Bird Area (IBA) and Shallow Bay and Western Brook Beach in the Gros Morne IBA (*C-NLOPB, 2014*). Due to their coastal nesting and breeding behaviour in the summer this species is less likely to interact with the project.

The Red Knot (rufa subspecies) (Endangered under SARA) has been sighted in several Newfoundland coastal locations. It generally spends time during the fall migration (from August to October) in open coastal inlets such as mud flats, sand flats and salt marshes (*C-NLOPB, 2014*). They are a migratory species so their presence across the Study Area is possible, but is unlikely due to the low population numbers.

The Peregrine Falcon (Special Concern under SARA) migrates along the Newfoundland coast during the fall and preys on aggregations of migrating shorebirds (*C-NLOPB, 2014*). It is known that the peregrine falcon can forage great distances and therefore has the potential to be present offshore and interact with the project.

The Olive-sided Flycatcher (Threatened under SARA) is known to frequent boreal forest and coastal wetlands. The species migrates to south and central America to overwinter (*C-NLOPB, 2014*). The species is not likely to be found offshore given that the time it spends in the eastern Newfoundland area is mostly spent in coastal areas, and therefore it is unlikely to interact with the project.

The Short-eared Owl (Special Concern under SARA) occurs in low numbers in coastal areas of Newfoundland where it nests in coastal grasslands and salt marshes. This suitable habitat occurs over much of coastal south-eastern Newfoundland and sightings of the species have been made mainly in June and July (*C-NLOPB, 2014*). Given the species habitat is for coastal areas of Newfoundland it is unlikely that short-eared owl will be encountered across the Study Area and therefore has limited potential to interact with the project.

As per the detailed effects assessment in Section 5.8.3, the predicted effect of the Project **on seabirds** is not significant. **As described above, many species are unlikely to occur in the Study Area during the summer** when seismic surveys are likely to be conducted. In addition, foraging behavior (and location of foraging areas) would not likely expose them to underwater sound from the Project. Furthermore, these bird species are not known to be prone to stranding on vessels. The mitigation measure of monitoring the seismic vessel for stranded birds that will be released and ramping-up the airgun array **during the soft-start period** will minimize the potential for impacts on these species.

Marine Mammals and Sea Turtles VEC

The potential interactions with the project with marine mammal species and sea turtles include interactions with sound; interactions with sound from the airgun array, seismic vessel itself, supply and escort vessels, echo sounder and side scan sonar equipment are all possible. There are also potential interactions with domestic waste, atmospheric emissions, helicopter presences and accidental releases from the project.

The Blue whale Atlantic population (Endangered under SARA schedule 1) is widely distributed throughout the world's oceans, although sightings across the Study Area are non-existent, with sightings recorded further inshore (there is one sightings record approximately 100 kilometres to the west of the Study Area). There is the potential for presence of this species across the Study Area and hence the potential for interaction, however given that there are no previous sightings over the Study Area, it is considered that the potential for interaction is low.

North Atlantic Right whale (Endangered under SARA schedule 1) are known to occur in Canada in the Bay of Fundy from June to November and the Roseway Basin from July to November; both areas lie to the south of Newfoundland. There is only one previous sighting over the Study Area of this species. Although interaction is considered unlikely due to the limited number of individuals, the species does have the potential to be present and interact with the project.

The Northern bottlenose whale (Davis Strait-Baffin Bay-Labrador Sea population of Special Concern under COSEWIC; Scotian Shelf Populations Endangered under SARA schedule 1). There are two previous sightings of Northern bottlenose whale within the Study Area. Gillis (2016) also reports the finding of a potential third population of the species at Sacksville Spur bordering the Flemish pass. The species does have the potential to be located within the Study Area and therefore has the potential to interact with the project activities.

The Fin whale Atlantic population (Special Concern under SARA schedule 1) is known to occur around the Gulf of St. Lawrence and the nearshore and offshore waters of Newfoundland and Labrador. There have been sightings throughout the year of fin whale off Nova Scotia and Newfoundland. Although sightings records of the species are far more numerous further inshore, there are sightings records of the species across the Study Area. The species is potentially present across the Study Area and therefor has the potential to interact with the project.

There is relatively little known about the Sowerby's beaked whale (Special Concern under SARA) and they are rarely seen. There is no data on seasonal movements of the species and the social structure is poorly understood. Sightings and stranding have been of small groups of fewer than ten individuals (*C-NLOPB, 2014*). Sowerby's Beaked whale is known to prefer deeper waters (over 1,000 m) and therefore has potential presence across the study area. Although there are no previous sightings, a lack of sightings data does not directly translate into a lack of presence and therefore the species is potentially present across the Study Area, although in limited numbers. There species therefore has the potential to interact with the project.

The harbour porpoise (Threatened under SARA schedule 2) Northwest Atlantic population have been divided into three different subpopulations: The Bay of Fundy/Gulf of Maine, the Gulf of St. Lawrence and the Newfoundland populations. Although harbour porpoise is much more numerous inshore (sightings records are much more abundant over inshore waters) they do

have the potential to be present in the Study Area as there are a number of records of the species in the wider area. Harbour porpoise therefore have the potential to interact with the project.

The loggerhead turtle (Endangered under SARA schedule 2) is seldom found in nearshore waters in Eastern Canada. Off Newfoundland the greatest concentrations are found over the Grand Banks where they tend to prefer the warmer waters. Loggerhead turtles therefore have the potential to be present across the study area particularly in the south (although in limited numbers) and therefore have the potential to interact with the project activities.

As per the detailed effects assessment in Section 5.8.4, the predicted effect of the Project on **marine mammals and sea turtles** is not significant. **The mitigation measures employed as part of the project (described in section 5.6.5 of the EA)** of **ramp-up/soft start of** the airgun array (over a minimum 20 min period) is expected to minimize the potential for impacts on these marine mammals and turtles, **along with the Statement of Canadian Practice with respect to the Mitigation of Seismic Sound in the Marine Environment (refer to section 5.6.5).**

A summary of the predicted (residual) environmental effects of the Project on the Species at Risk VEC is provided in Table 5-14.

"Accurate population names should be provided when describing species at risk throughout the document (see examples below):

- *Northern Bottlenose whale: Davis Strait-Baffin Bay-Labrador Sea population (paragraph 2, page 42 of Addendum 2).*
- *Fin Whale: Atlantic population (paragraph 1, page 43 of Addendum 2; bullet 3, page 47 of Addendum 2).*
- *Leatherback Sea Turtle: Atlantic population (paragraph 2, page 43 of Addendum 2; bullet 4, page 47 of Addendum 2).*
- *Northern Bottlenose Whale: Scotian Shelf population (bullet 3, page 47 of Addendum 2).*
- *Blue Whale: Atlantic population (bullet 3, page 47 of Addendum 2).*
- *White Shark: Atlantic population (bullet 1, page 47 of Addendum 2; paragraph 5, page 47 of Addendum 2)".*

Response:

Paragraph 2, page 42 of Addendum 2 should be amended to read (blue text denotes edits/additions):

Within the Eastern Newfoundland Offshore Area, five marine mammal species are federally listed as being at risk (blue whale - Atlantic population, North Atlantic right whale, Sowerby's beaked whale, northern bottlenose whale (Scotian Shelf population), and fin whale (Atlantic population), as well as one sea turtle species (leatherback turtle - Atlantic population) (*SARA, 2016)*. In addition to federal listing, COSEWIC has assessed four additional populations as being of conservation concern but with no formal protection under SARA (northern bottlenose whale - Davis Strait-

Baffin Bay-Labrador Sea population, killer whale - Northwest Atlantic and Eastern Arctic populations, harbour porpoise - Northwest Atlantic population, and loggerhead sea turtle - Atlantic Ocean population). The harbour porpoise is listed on Schedule 2 of SARA but is not subject to the same legal protections as Schedule 1 species. The Kemp's ridley turtle species is not federally listed but is considered by the IUCN to be critically endangered.

Paragraph 1, page 43 of Addendum 2 should be amended to read (blue text denotes edits/additions):

A Management Plan for fin whale Atlantic population was brought into effect in 2017 (*DFO 2017c*). There are several factors noted within the Management Plan and those of most concern was related to noise pollution from seismic exploration and general navigation. The overall objective of the present management plan is to ensure that anthropogenic threats within Canadian waters do not cause a decline of the population or a reduction of the currently known distribution range in Canada. As mentioned above for Sowerby's Beaked whale, mitigation measures for minimising disturbance from noise are given in section 5.6.5 of the EA report. The marine mammal observation programme coupled with the mitigation measures detailed within section 5.6.5 (based on the Statement of Canadian Practice with respect to the Mitigation of Seismic Sound in the Marine Environment), will mitigate the risks to marine mammals from injury and disturbance to acceptable levels.

Paragraph 2, page 43 of Addendum 2 should be amended to read (blue text denotes edits/additions):

A Recovery Strategy for the leatherback sea turtle Atlantic population has been in effect since 2006 (*Atlantic Leatherback Turtle Recovery Team, 2006*). The recovery strategy identifies measures to be taken to promote the recovery of the Atlantic leatherback turtle populations. The ultimate recovery goal is to "*achieve the long-term viability of the leatherback turtle populations frequenting Atlantic Canadian waters*". A key challenge in the recovery strategy of the leatherback turtle Atlantic population is lack of information regarding the species' biology, distribution, habitat preferences and threats to the populations (*Atlantic Leatherback Turtle Recovery Team, 2006*).

Bullet 3, page 47 of Addendum 2 should be amended to read (blue text denotes edits/additions):

- Blue whale Atlantic population, north Atlantic right whale, northern bottlenose whale Scotian Shelf population, fin whale Atlantic population, Sowerby's beaked whale, and harbour porpoise Northwest Atlantic population (Table 4.6); and

Bullet 4, page 47 of Addendum 2 should be amended to read (blue text denotes edits/additions):

- Leatherback turtle Atlantic population and loggerhead turtle (Table 4.6).

Bullet 1, page 47 of Addendum 2 should be amended to read (blue text denotes edits/additions):

- White shark Atlantic population, and northern, spotted, and Atlantic wolfish (Table 4.4);

Paragraphs 4 and 5 on page 47 of Addendum 2 and paragraph 1 of page 48 of Addendum 2 should be amended to read (blue text denotes edits/additions):

The potential environmental aspects of the project likely to interact with white shark Atlantic population and wolffish include underwater sound emissions from the airgun array, the seismic vessel itself, the supply and escort vessels, the echo sounder and the side scan sonar equipment. Other environmental aspects of the project like to impact this VEC include domestic waste, atmospheric emissions and accidental releases. Vessel lighting at night also has the potential to interact with the white shark Atlantic population.

Interaction with white shark Atlantic population, although possible, is unlikely as the species is not common in offshore Canadian waters, including the study area (*C-NLOPB, 2014*). Wolffish species all have the potential for presence over the Study Area and therefore have the potential to interact with the project, particularly through the effects of underwater sound. The three species prefer a range of depths (*C-NLOPB, 2014*) so interactions with the species at various depths in the water column is possible.

As per the detailed effects assessment in Section 5.8.1, physical effects of the Project on the various life stages of wolf-fishes and the white shark Atlantic population will range from negligible to low over a duration of less than one month, within an area of <1 square kilometre and are predicted to be not significant (Table 5.14). The mitigation measures employed as part of the project (described in section 5.6.5 of the EA) of ramp-up/soft start of the airgun array (over a minimum 20 min period) are expected to minimize the potential for impacts on wolffish and the white shark Atlantic population.

"Response to "Page 3-40 of Addendum" (pages 42-43 of Addendum 2) *- Recovery Strategies are available for the North Atlantic Right Whale, Northern Bottlenose Whale (Scotian Shelf population), and Blue Whale (Atlantic population), and should be described".*

Response:

Pages 42-43 of Addendum 2 should be revised as follows (blue text denotes edits/additions):

4.6.3 Species at Risk

Within the Eastern Newfoundland Offshore Area, five marine mammal species are federally listed as being at risk (blue whale - Atlantic population, North Atlantic right whale, Sowerby's beaked whale, northern bottlenose whale (Scotian Shelf population), and fin whale (Atlantic population), as well as one sea turtle species (leatherback turtle - Atlantic population) (*SARA, 2016)*. In addition to federal listing, COSEWIC has assessed four additional populations as being of conservation concern but with no formal protection under SARA (northern bottlenose whale - Davis Strait population, killer whale - Northwest Atlantic and Eastern Arctic populations, harbour porpoise - Northwest Atlantic population, and loggerhead sea turtle - Atlantic Ocean population). The harbour porpoise is listed on Schedule 2 of SARA but is not subject to the same legal protections as Schedule 1 species. The Kemp's ridley turtle species is not federally listed but is considered by the IUCN to be critically endangered.

A recovery strategy for the North Atlantic Right Whale is in force (*Species at Risk Public Registry, 2014*). The recovery strategy defines the key objectives of the strategy as the reduction of mortality and injury due to vessel strikes and fishing gear interactions, to reduce injury and disturbance as a result of vessel presence or exposure to contaminants and other forms of habitat degradation, to monitor populations and threats, to increase understanding of life history characteristics, low reproductive rate, habitat and threats to recovery, to support and promote collaboration and recovery and finally to develop and implement education and stewardship activities that promote recovery (*Species at Risk Public Registry, 2014*). An Action Plan for the North Atlantic Right Whale came into effect in 2016 (*DFO, 2016*). The Action Plan sets out to contribute to the recovery goals for the species (as set out in the recovery strategy: "*To achieve an increasing trend in population abundance over three generations*"). For the North Atlantic right whale, the two most important threats were recognised as vessel strikes and entanglement in fishing gear. The Action Plan places a priority on addressing objective 2 of the recovery strategy; "*Reduce mortality and injury as a result of fishing gear interactions*" (*DFO, 2016*).

A Management Plan for the Sowerby's beaked whale is also now in effect (*DFO, 2017a*). The management plan describes several anthropogenic threats to Sowerby's Beaked whale of which exposure to acute noise is recognised as the most significant due to the potential for physiological harm and potential for behavioural disturbance. The main two objectives of the Management Plan for Sowerby's beaked whale are to: 1) Maintain a stable Sowerby's beaked whale population throughout its range in Atlantic Canadian waters and 2): Quantify and mitigate the effects of identified threats on the population. The objectives are to be achieved via three conservation measures: 1) Research and monitoring, 2) Management and 3) Engagement and public outreach (*DFO, 2017a*). Mitigation measures for Marine Mammal and Wildlife Protection, including the measures to be taken to minimise disturbance from noise are described in Section 5.6.5 of the EA report. Polarcus' full commitment to the marine mammal observation programme also described

in section 5.6.5 of the EA will add to the knowledge base of marine mammal sightings data in the area, which will contribute to conservation measure 1 of the Management Plan for Sowerby's Beaked whale.

A recovery strategy for the northern bottlenose whale Scotian Shelf population has been in force since 2010 (*Species at Risk Public Registry, 2010*). The key objectives of this strategy are: to improve understanding of northern bottlenose whale ecology, including critical habitat requirements, carrying capacity, breeding, trophic interactions, links with other populations and sources of mortality; to improve understanding of the population size, trend and distribution; to improve understanding of and monitor anthropogenic threats, including fishing gear interactions, petroleum development, noise, and contaminants, and develop management measures to reduce threats where necessary; and to engage with stakeholder and the public in recovery action through education and stewardship (*Species at Risk Public Registry, 2010*). An Action Plan for the northern bottlenose whale Scotian Shelf population (under the Species at Risk Act), has been produced (*DFO, 2017b*) and implements the recovery strategy. The Action Plan sets out to achieve recovery of the population and "*to achieve a stable or increasing population and to maintain, at a minimum, current distribution*". The Action Plan goes onto define a series of 24 recovery measures to fulfil the objectives of the recovery strategy (*DFO, 2017b*).

A Management Plan for fin whale was brought into effect in 2017 (*DFO, 2017c*). There are several factors noted within the Management Plan and those of most concern was related to noise pollution from seismic exploration and general navigation. The overall objective of the present management plan is to ensure that anthropogenic threats within Canadian waters do not cause a decline of the population or a reduction of the currently known distribution range in Canada. As mentioned above for Sowerby's Beaked whale, mitigation measures for minimising disturbance from noise are given in section 5.6.5 of the EA report. The marine mammal observation programme coupled with the mitigation measures detailed within section 5.6.5 (based on the Statement of Canadian Practice with respect to the Mitigation of Seismic Sound in the Marine Environment), will mitigate the risks to marine mammals from injury and disturbance to acceptable levels.

A recovery strategy for the blue whale north-west Atlantic population has been in place since 2009 (*DFO, 2009*). The overall goal of the recovery strategy is to achieve a population level of 1,000 mature individuals. Three main objectives are identified in the recovery strategy: to undertake a long term assessment of the species to better understand their population structure, their range and critical habitat; implementing control and follow up measures for activities that could disrupt recovery, including the reduction of anthropogenic noise, protecting food resources, reducing disturbance from anthropogenic activities, reducing collision risk and toxic contamination; and finally to increase the knowledge of threats to recovery of the blue whale in Canadian waters in order to determine the true impact of the threats and identify effective mitigation measures (*DFO, 2009*). The recovery strategy states that an action plan will also be developed for the species, which is currently out for consultation and introduces a series of 36 measures to achieve the recovery objectives (*Species at Risk Public Registry, 2018*).

A Recovery Strategy for the leatherback sea turtle has been in effect since 2006 (*Atlantic Leatherback Turtle Recovery Team, 2006*). The recovery strategy identifies measures to be taken to promote the recovery of the Atlantic leatherback turtle populations. The ultimate recovery

goal is to "*achieve the long-term viability of the leatherback turtle populations frequenting Atlantic Canadian waters*". A key challenge in the recovery strategy of the Atlantic leatherback turtle is lack of information regarding the species' biology, distribution, habitat preferences and threats to the populations (*Atlantic Leatherback Turtle Recovery Team, 2006*).

Marine mammal and turtle species at risk which may occur within the Study Area are summarized in Table 4.6.

References

Atlantic Leatherback Turtle Recovery Team (2006), Recovery Strategy for Leatherback Turtle (Dermochelys coriacea) in Atlantic Canada. Species at Risk Act Recovery Strategy Series. Fisheries and Oceans Canada, Ottawa, vi + 45 pp.

Fisheries and Oceans Canada (DFO) (2009), Recovery strategy for the blue whale (Balaenoptera musculus), Northwest Atlantic population, in Canada. Species at Risk Act Recovery Strategy Series. Fisheries and Oceans Canada, Ottawa, 62 pp.

Fisheries and Oceans Canada (DFO) (2016), Action Plan for the North Atlantic Right Whale (Eubalaena glacialis) in Canada: Fishery Interactions [Proposed]. Species at Risk Act Action Plan Series. Fisheries and Oceans Canada, Ottawa. v + 35 pp.

Fisheries and Oceans Canada (DFO) (2017a), Management Plan for the Sowerby's Beaked Whale (Mesoplodon bidens) in Canada. Species at Risk Act Management Plan Series. Fisheries and Oceans Canada, Ottawa. iv + 46 pp.

Fisheries and Oceans Canada (DFO) (2017b), Action Plan for the Northern Bottlenose Whale (Hyperoodon ampullatus), Scotian Shelf population, in Atlantic Canadian waters. Species at Risk Act Action Plan Series. Fisheries and Oceans Canada, Ottawa. iv + 37 pp.

Fisheries and Oceans Canada (DFO) (2017c), Management Plan for the fin whale (Balaenoptera physalus), Atlantic population in Canada, Species at Risk Act Management Plan Series, DFO, Ottawa, iv +38 p.

Species at Risk Public Registry (2010), Recovery Strategy for the Northern Bottlenose Whale (Hyperoodon ampullatus), Scotian Shelf population, in Atlantic Canadian Waters, [Internet, available: <http://www.registrelep-sararegistry.gc.ca/document/doc1863f/ind_e.cfm>].

Species at Risk Public Registry (2014), Recovery Strategy for the North Atlantic Right Whale (Eubalaena glacialis) in Canadian Waters, [Internet, available: <http://www.sararegistry.gc.ca/default.asp?lang=en&n=717856D0-1>].

Species at Risk Public Registry (2018), Action plan for the Blue Whale (Balaenoptera musculus), Northwest Atlantic population, in Canada (Proposed), [Internet, available: <https://www.registrelep-sararegistry.gc.ca/document/default_e.cfm?documentID=3332>].

"Response to "Page 3-52 of the Addendum" (Marine Mammals and Sea Turtles VEC, pages 49-50 of Addendum 2) *- Leatherback Sea Turtle (Atlantic population) should be described as it is listed as Endangered under Schedule 1 of SARA".*

Response:

The paragraphs under Marine Mammals and Sea Turtles VEC on pages 49-50 of Addendum 2 should be amended as follows (blue text denotes edits/additions):

Marine Mammals and Sea Turtles VEC

The potential interactions with the project with marine mammal species and sea turtles include interactions with sound; interactions with sound from the airgun array, seismic vessel itself, supply and escort vessels, echosounder and side scan sonar equipment are all possible. There are also potential interactions with domestic waste, atmospheric emissions, helicopter presences and accidental releases from the project.

The Blue whale Atlantic population (Endangered under SARA schedule 1) is widely distributed throughout the world's oceans, although sightings across the Study Area are non-existent, with sightings recorded further inshore (there is one sightings record approximately 100 kilometres to the west of the Study Area). There is the potential for presence of this species across the Study Area and hence the potential for interaction, however given that there are no previous sightings over the Study Area, it is considered that the potential for interaction is low.

North Atlantic Right whale (Endangered under SARA schedule 1) are known to occur in Canada in the Bay of Fundy from June to November and the Roseway Basin from July to November; both areas lie to the south of Newfoundland. There is only one previous sighting over the Study Area of this species. Although interaction is considered unlikely due to the limited number of individuals, the species does have the potential to be present and interact with the project.

The Northern bottlenose whale (Davis Strait-Baffin Bay-Labrador Sea population of Special Concern under COSEWIC; Scotian Shelf Populations Endangered under SARA schedule 1). There are two previous sightings of Northern bottlenose whale within the Study Area. Gillis (2016) also reports the finding of a potential third population of the species at Sacksville Spur bordering the Flemish pass. The species does have the potential to be located within the Study Area and therefore has the potential to interact with the project activities.

The Fin whale Atlantic population (Special Concern under SARA schedule 1) is known to occur around the Gulf of St. Lawrence and the nearshore and offshore waters of Newfoundland and Labrador. There have been sightings throughout the year of fin whale off Nova Scotia and Newfoundland. Although sightings records of the species are far more numerous further inshore, there are sightings records of the species across the Study Area. The species is potentially present across the Study Area and therefor has the potential to interact with the project.

There is relatively little known about the Sowerby's beaked whale (Special Concern under SARA) and they are rarely seen. There is no data on seasonal movements of the species and the social structure is poorly understood. Sightings and stranding have been of small groups of fewer than ten individuals (*C-NLOPB, 2014*). Sowerby's Beaked whale is known to prefer deeper waters (over 1,000 m) and therefore has potential presence across the study area. Although there are no

previous sightings, a lack of sightings data does not directly translate into a lack of presence and therefore the species is potentially present across the Study Area, although in limited numbers. There species therefore has the potential to interact with the project.

The harbour porpoise (Threatened under SARA schedule 2) Northwest Atlantic population have been divided into three different subpopulations: The Bay of Fundy/Gulf of Maine, the Gulf of St. Lawrence and the Newfoundland populations. Although harbour porpoise is much more numerous inshore (sightings records are much more abundant over inshore waters) they do have the potential to be present in the Study Area as there are several records of the species in the wider area. Harbour porpoise therefore have the potential to interact with the project.

The loggerhead turtle (Endangered under SARA schedule 1) is seldom found in nearshore waters in Eastern Canada. Off Newfoundland the greatest concentrations are found over the Grand Banks where they tend to prefer the warmer waters. Loggerhead turtles therefore have the potential to be present across the study area particularly in the south (although in limited numbers) and therefore have the potential to interact with the project activities.

The leatherback sea turtle Atlantic population (Endangered under Schedule 1 of SARA) are a regular but uncommon part of the Newfoundland marine fauna in the summer and fall, and although there are no specific population data for Atlantic Canadian waters, the sightings data suggest that the population maybe in the thousands. The population estimates for the north Atlantic as a whole range from 34,000 to 94,000 individuals. It is possible therefore that leatherback turtle may be encountered across the project area, although not in significant numbers.

As per the detailed effects assessment in Section 5.8.4, the predicted effect of the Project on marine mammals and sea turtles is not significant. The mitigation measures employed as part of the project (described in section 5.6.5 of the EA) of ramp-up/soft start of the airgun array (over a minimum 20 min period) is expected to minimize the potential for impacts on these marine mammals and turtles, along with the Statement of Canadian Practice with respect to the Mitigation of Seismic Sound in the Marine Environment (refer to section 5.6.5).

A summary of the predicted (residual) environmental effects of the Project on the Species at Risk VEC is provided in Table 5-14.

***"Appropriate designations/listings should be provided throughout the document (see examples below)**:*

- *Harbour Porpoise (Northwest Atlantic population) should be described as Special Concern under COSEWIC (Response to "Pages 3-32 to 3-39 of Addendum" (page 38 of Addendum 2)); because this population of Harbour Porpoise is not listed under SARA, it should be removed from the list of SARA species of relevance (Response to "Page 3-52 of the Addendum" (bullet 3, page 47 or Addendum 2)).*
- *Loggerhead Sea Turtle is listed as Endangered under Schedule 1 of SARA and should be included in the list of federally listed species on page 42 of Addendum 2 (paragraph 1) and page 47 of Addendum 2 (bullet 4). Its listing should also be corrected to Schedule 1 (paragraph 4, page 50 of Addendum 2)".*

Response:

The description of harbour porpoise (Northwest Atlantic Population) on pages 38 and 39 of Addendum 2 should be updated as follows (edited/changed text included in blue):

Harbour Porpoise (*Phocoena phocoena*)

The harbour porpoise is small compared to other cetaceans, growing to a length of 1.2 to 1.4 metres. The species is most commonly observed near the coast and will enter small bays and estuaries.

Harbour porpoise in the Northwest Atlantic population have been divided into three different subpopulations: The Bay of Fundy/Gulf of Maine, the Gulf of St. Lawrence and the Newfoundland populations. The boundaries between these sub-populations are not well defined as there is some genetic overlap.

Most mature females reproduce each year after they reach sexual maturity at 3.5 years old. The gestational period is 10 to 11 months. Harbour porpoises feed on small schooling fish. Harbour porpoise are found in shelf waters throughout the northern hemisphere, usually in waters colder than 17 degrees Celsius. They are usually seen in small groups of one to three animals often including at least one calf (*C-NLOPB, 2014*).

Harbour porpoise are present in northern coastal waters during the summer months. Off Eastern Newfoundland, harbour porpoises are most likely to be found in the shallower waters of inshore areas (*C-NLOPB, 2014*). Based on the aerial surveys conducted off the coast of Newfoundland and Labrador in 2007, abundance is estimated at 1,195 individuals. However again this estimate is considered preliminary as the estimates have not been corrected for perception limitations (*Lawson and Gosselin, 2009,* In: *C-NLOPB, 2014*). Although harbour porpoise is known to be more numerous inshore, they do have the potential to be present in the study area as the Fisheries and Oceans Canada Marine Mammals Sightings Database (2015) holds a number of records of the species in the wider area (Figure 4.30).

Harbour porpoise (Northwest Atlantic population) are of special concern under COSEWIC, but do not have formal protection under SARA Schedule 1; although the harbour porpoise is listed in Schedule 2 of SARA, the species is not subject to the same legal protections afforded to SARA Schedule 1 species.

Bullet 3 on page 47 of Addendum 2 should be amended to read:

- Blue whale, north Atlantic right whale, northern bottlenose whale, fin whale and Sowerby's beaked whale (Table 4.6); and

In addition, paragraph 4 on page 50 of Addendum 2 should be deleted.

Page 42 of Addendum 2 (paragraph 1) should be amended to read (blue text denotes edits/additions):

Within the Eastern Newfoundland Offshore Area, five marine mammal species are federally listed as being at risk (blue whale - Atlantic population, North Atlantic right whale, Sowerby's beaked whale, northern bottlenose whale (Scotian Shelf population), and fin whale (Atlantic population),

as well as two sea turtle species (leatherback turtle - Atlantic population, and loggerhead turtle) (*SARA, 2016*). In addition to federal listing, COSEWIC has assessed four additional populations as being of conservation concern but with no formal protection under SARA (northern bottlenose whale - Davis Strait population, killer whale - Northwest Atlantic and Eastern Arctic populations, harbour porpoise - Northwest Atlantic population, and loggerhead sea turtle - Atlantic Ocean population). The harbour porpoise is listed on Schedule 2 of SARA but is not subject to the same legal protections as Schedule 1 species. The Kemp's ridley turtle species is not federally listed but is considered by the IUCN to be critically endangered.

Bullet 4 on page 47 of Addendum 2 should be amended to read (blue text denotes edits/additions):

- Leatherback turtle and loggerhead turtle (Table 4.6).

Paragraph 4 on page 50 of Addendum 2 should be amended to read (blue text denotes edits/additions):

The loggerhead turtle (Endangered under SARA schedule 1) is seldom found in nearshore waters in Eastern Canada. Off Newfoundland the greatest concentrations are found over the Grand Banks where they tend to prefer the warmer waters. Loggerhead turtles therefore have the potential to be present across the study area particularly in the south (although in limited numbers) and therefore have the potential to interact with the project activities.

3.4 Fish, Food and Allied Workers (FFAW)

"Section 5.6.2 Communications and Liaison, page 5-16 *-It is important to note that the Fisheries Liaison Officer is best placed on the seismic survey vessel, not the guard vessel, where s/he can work most effectively. This is considered an industry best practice in the Newfoundland and Labrador region, as discussed on page 5-19".*

Response:

Noted. Polarcus will keep with best industry practice in the Newfoundland and Labrador region.

"Section 5.6.2 Communications and Liaison, page 5-17 *- Note that VMS data is provided by Fisheries and Oceans Canada, not FFAW/Unifor. Please revise the text to reflect this. It is recommended that the company consult with DFO on the availability of this information as discussed on page 2-2".*

Response:

We propose the paragraph in question reads as follows:

Information Exchange. Obtain detailed and up-to-date information about the fisheries likely to be active in specific parts of the Project Area at specific times.

Mapping of past fish harvesting activities (see Section 4.8) are a valuable planning tool, but exact times and locations change somewhat from year to year. To be accurate, the information flow about current fishing activities will need to be a continuing process that is

updated as fishing seasons open and close, and as quotas are taken. This information will be accessed through continuing information exchanges with the relevant fishing organizations on a regular basis, including through the mechanisms described below, such as the FLO, direct contacts with representatives of the Newfoundland fisheries organizations, and with DFO (for fisheries survey/research information and access VMS.). Operational details of these communications will be finalized with the relevant organizations as the fishing season information and plans are known.

Noted. Polarcus will consult with DFO on the availability of this information.

"Section 5.6.3 Fisheries Avoidance, page 5-19 *- It should be noted that the post-season crab survey is a collaborative program between DFO and FFAW/Unifor and as such should also involve communication with FFAW/Unifor. The survey is undergoing changes in terms of the location and number of survey stations. However, changes have not been confirmed for 2017. It is therefore crucial that the seismic company maintain effective communication with FFAW/Unifor and DFO to receive accurate information on the post-season crab survey going forward."*

Response:

Avoidance of Fisheries Science Surveys. As with the commercial fishery, those involved in DFO and joint DFO/Industry research surveys will need to exchange detailed locational information with those involved in the seismic surveying. For previous NL surveys, a temporal and spatial separation plan has been implemented (on DFO advice) to ensure that seismic operations did not interfere with the research survey. Seismic surveys will be scheduled, to the extent possible, to reduce potential for impact or interference with Fisheries and Oceans Canada (DFO) science surveys. Spatial and temporal logistics should be determined with DFO to reduce overlap of seismic operations with research survey areas, and to allow an adequate temporal buffer between seismic survey operations and DFO research activities. The post-season crab survey is a collaborative program between DFO and FFAW/Unifor and Polarcus will ensure that FFAW/Unifor are included in the two way exchange of detailed locational information regarding the seismic survey and the latest changes in terms of the location and number of survey stations for the crab surveys.

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