Polarcus UK Ltd

Environmental Assessment Eastern Newfoundland 2D/3D/4D Seismic Survey Program 2016 – 2022

Addendum 2: Responses to comments received on 06.04.18

Date: **June 2018**

Prepared for Polarcus UK Ltd.

By RPS

June 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 based on 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 was submitted addressing those comments in February 2018.

Since that time, further comments from the C-NLOPB were received on 06.04.18. This addendum document intends to address the general and specific comments that have been raised as part of the review process.

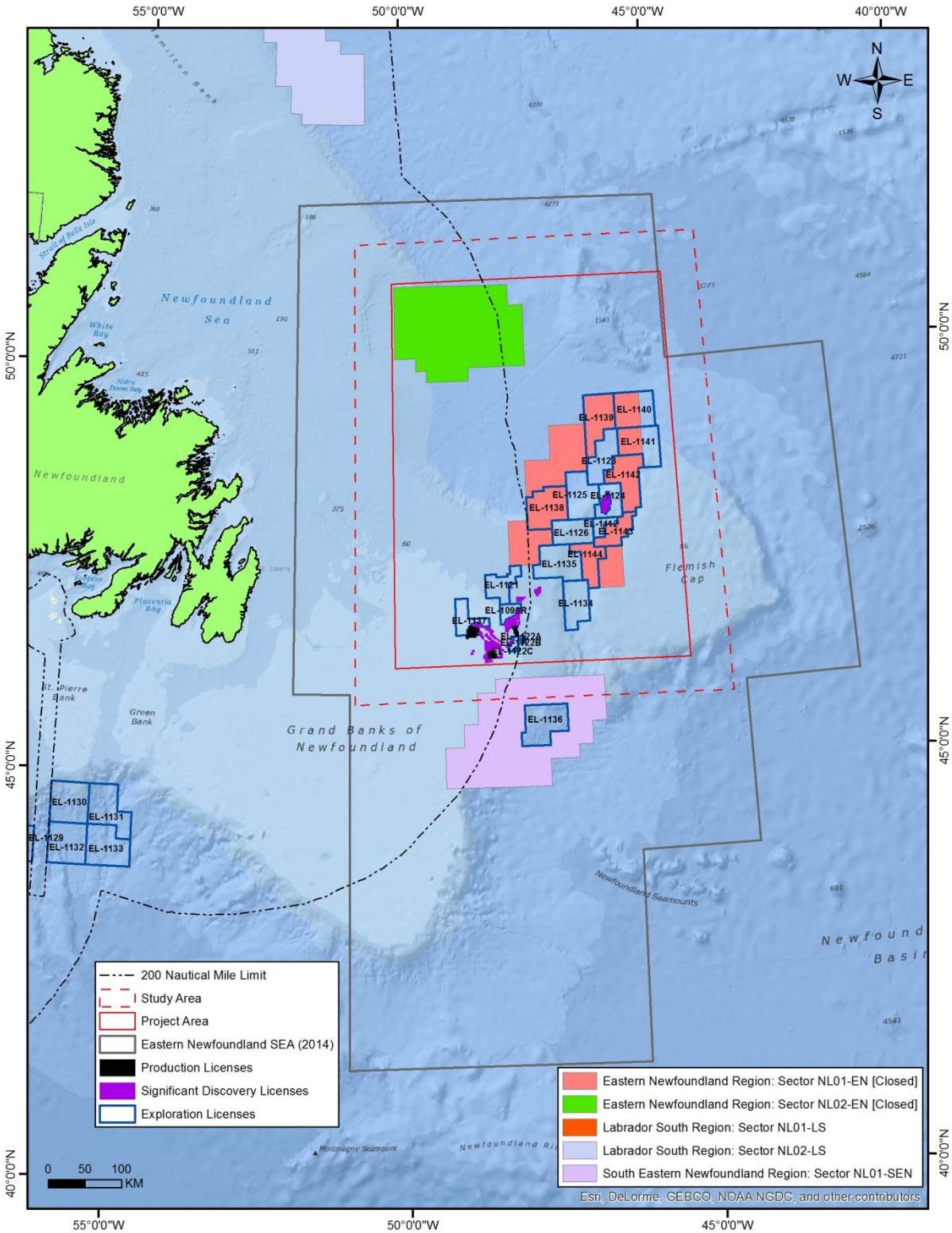


Figure 1.1. Eastern Newfoundland Project Area and Study Area

2 General Comments

2.1 Canada-Newfoundland and Labrador Offshore Petroleum Board

"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 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.

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

"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.

2.4 Fish, Food and Allied Workers (FFAW)

"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.

3 Specific Comments

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

*"**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).

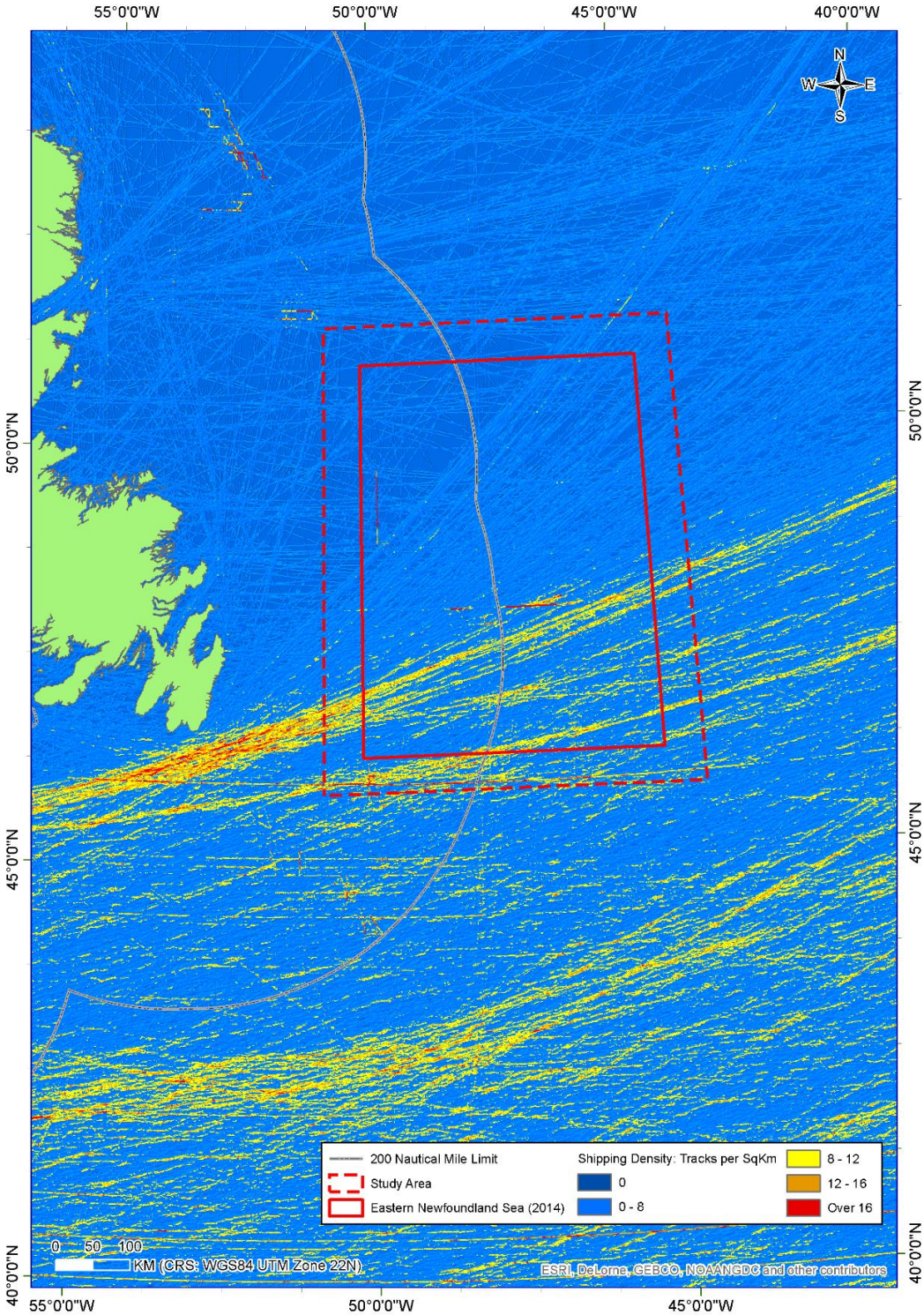


Figure 1.2. Commercial Shipping Traffic Density near the Study Area

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.

3.2 Fisheries and Oceans Canada (DFO)

*"**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.

*"**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.

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	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%

Precipitation Type	Percentage Occurrence		
	Flemish Cap	Northern Grand Banks	Orphan Basin
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***

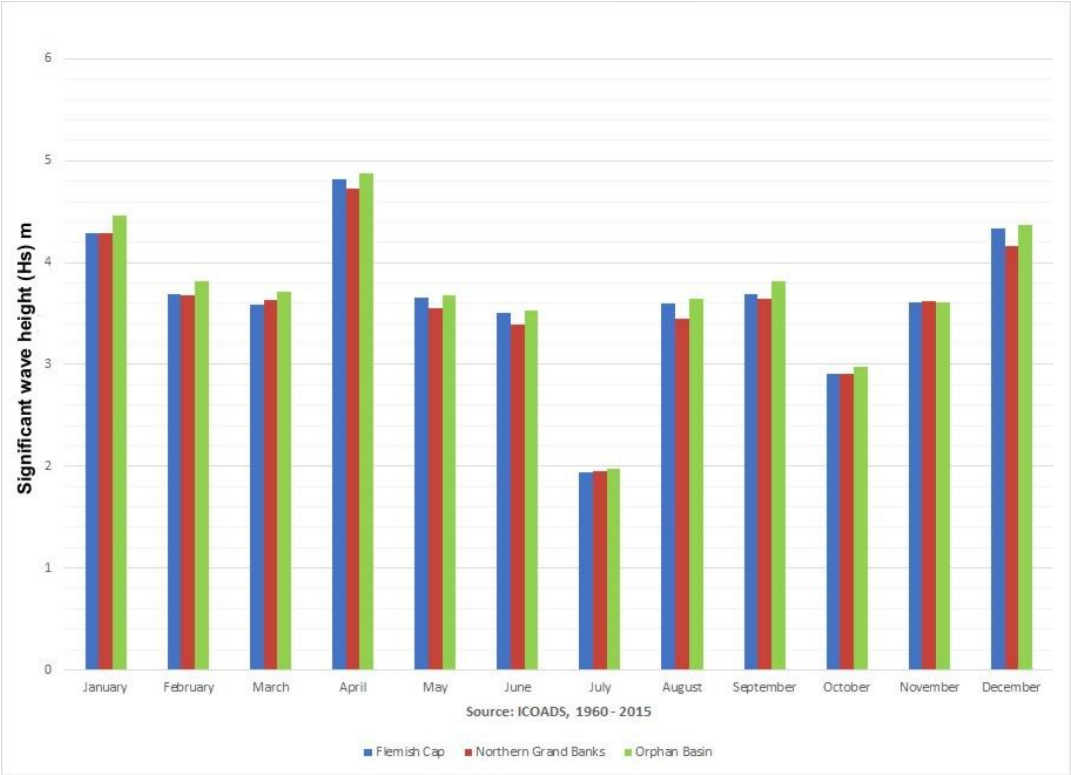
Figure 3.5 in the EA Addendum does not describe tropical storm systems. Figure 3.5 in the EA Addendum is correctly described by its caption in the EA Addendum: *Frequency of occurrence for selected precipitation types within the Study Area*. This is a new figure to be added to the EA report and does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

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.



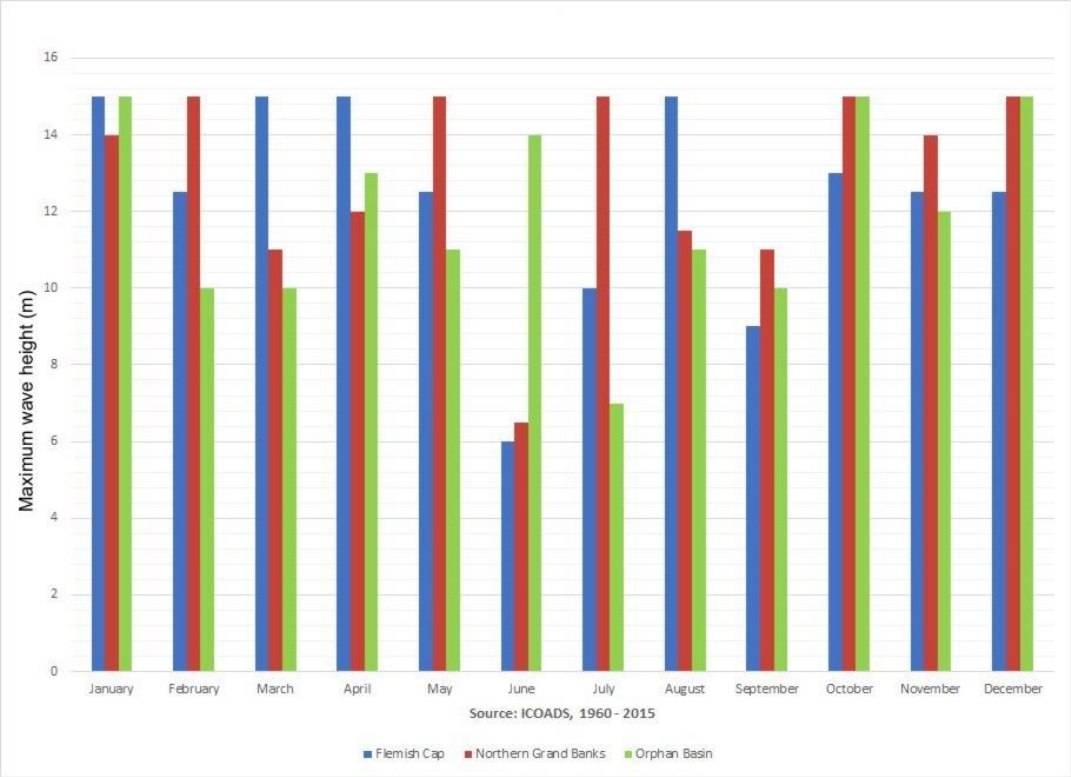


Figure 3.6 Significant wave height (Hs) and maximum wave heights for the Study Area

*"**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:

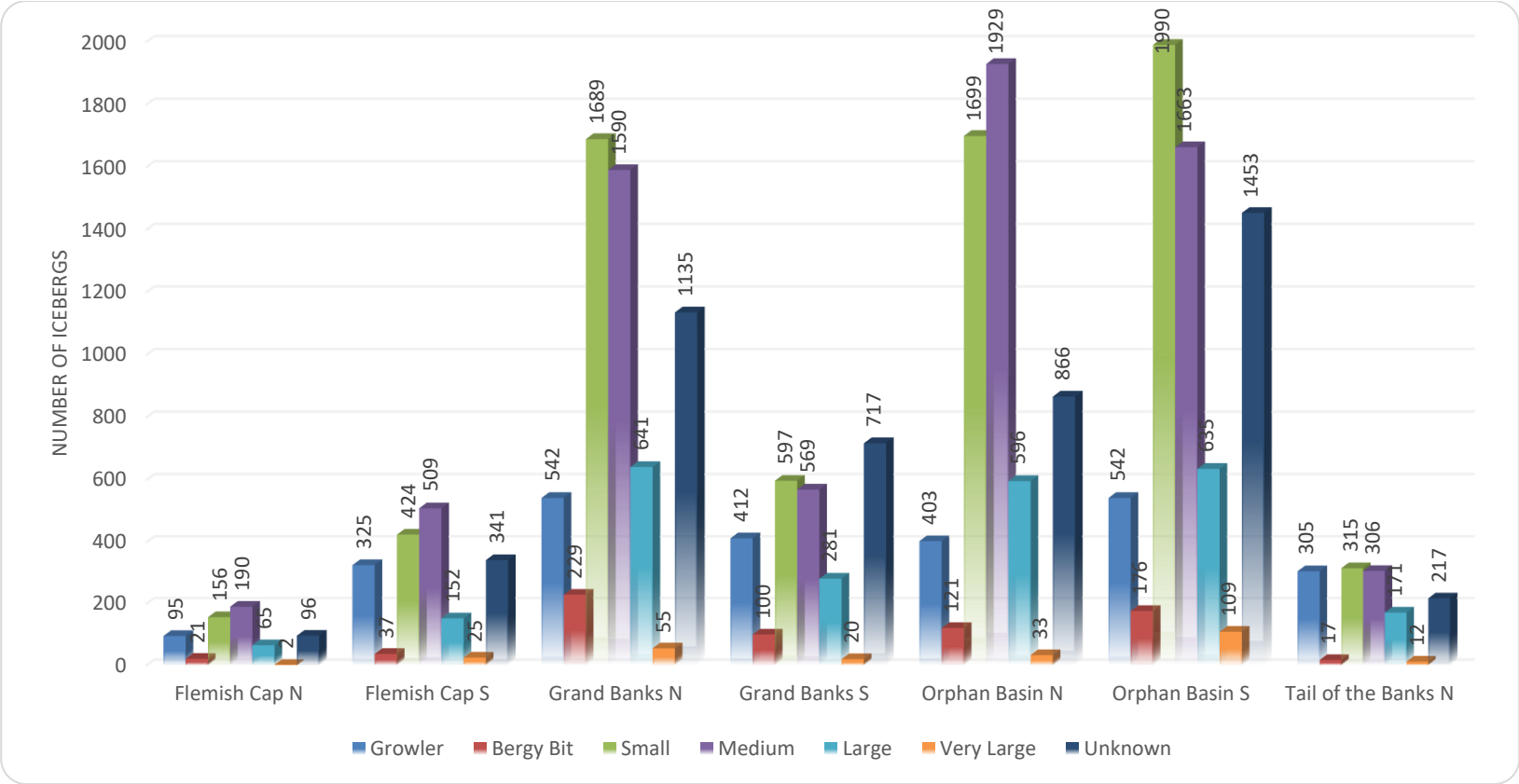


Figure 3.7. Iceberg Numbers Recorded across the Study Area (NRC-PERD Iceberg Sighting Database [1889 to 2012])

*"**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

Data	Section	Eastern Newfoundland SEA (August 2014)	Polarcus Project-Based EIA	Data Source
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.
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.

*"**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*).

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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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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*)).

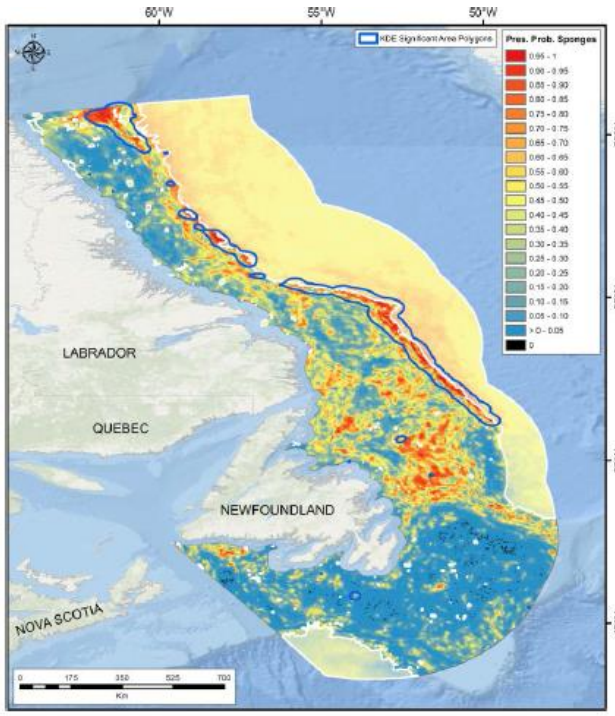
Kenchington *et al.* (2016) have conducted species distribution modelling in eastern Canada in an attempt to delineate significant benthic area for corals and sponges. A suite of historical data sources, including trawls and survey data were used in the work. Kernel density analysis was utilised in order 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).

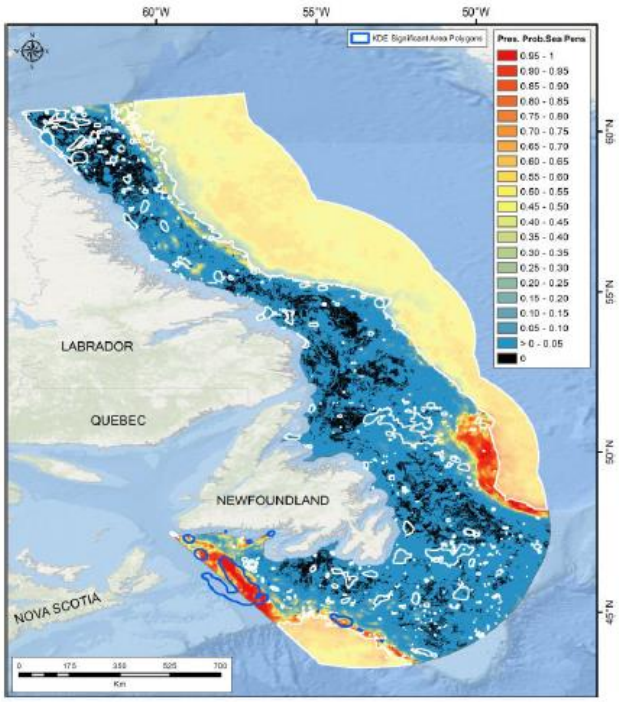
For large Gorgonian corals, the highest predicted presence probability of large gorgonian corals occurred on the edge of Saglek Bank and slope in northern Labrador. Moderate large gorgonian coral presence probability was predicted along the Labrador Slope (see Figure 1.3). For small Gorgonian corals 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*).

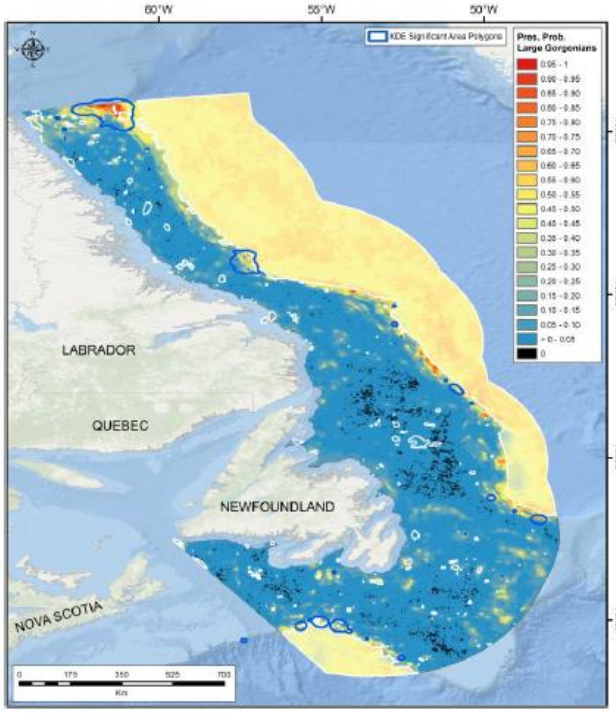
Thirty-two species of sponge have been observed in the region of the study area (*Murillo et al., 2012*; *Beazley et al., 2013a*; *Knudby et al., 2013*; *Beazley & Kenchington, 2015*). Sponges commonly associate with shelf and slop areas in the region as many species have wide depth ranges (from between 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*).



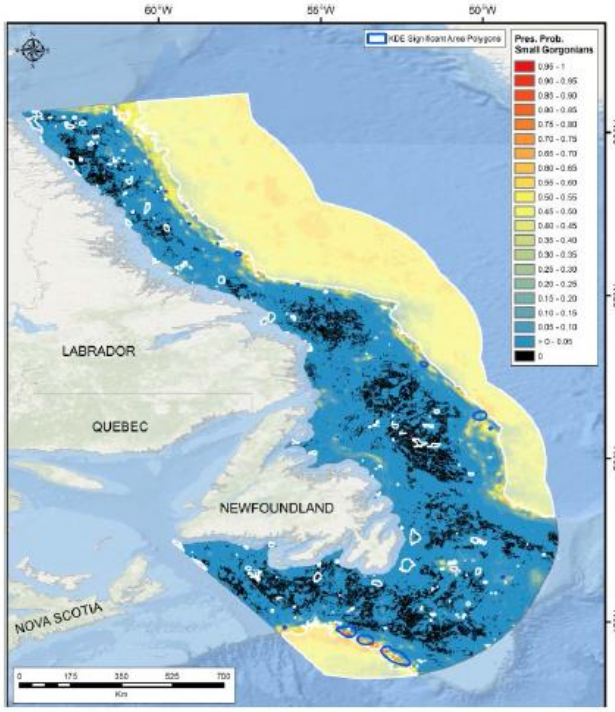
Predictions of presence probability of sponges based on a RF model on unbalanced presence and absence sponge catch data collected from DFO multispecies and shrimp trawl surveys and Spanish trawl surveys conducted in the Newfoundland and Labrador Region between 1995 and 2015. White lines indicate areas 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)

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*"**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*).

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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.

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Response

The remainder of the comments are addressed by the below changes. The species accounts provided in the Addendum are included below, with **bold** text showing where changes/edits have been made.

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*).

Small Dolphin Species

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.

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*"**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.

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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.

*"**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 >].

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*"**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	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															
Helicopter1															
Onshore2 facilities															
Vessel Lights															
Sanitary/Domestic Waste															
Liquid Waste															

[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.

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	Sedentary Benthic Invertebrates (e.g.	Research Surveys (e.g. trawls and crab		Toothed Whales	Baleen Whales	Seals	Sea Turtles		
Atmospheric Emissions															
Garbage3															
Unplanned Events															
Other Projects and Activities															
Offshore Oil and Gas Activities															
Fisheries															
Marine Transportation															

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.

[3] Not applicable as garbage will be brought onshore

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 echosounder 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, 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 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.