



Ephesus Prospect ROV Survey (2019-2024)

Environmental Assessment Report

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Abbreviations

The Accord Acts	<i>Canada-Newfoundland and Labrador Atlantic Accord Implementation Act and the Canada-Newfoundland and Labrador Atlantic Accord Implementation Newfoundland and Labrador Act</i>
BIO	Bedford Institute of Oceanography
BP	BP Canada Energy Group ULC
CBD	Conference of the Parties to the Convention on Biological Diversity
C-NLOPB	Canada-Newfoundland and Labrador Offshore Petroleum Board
COSEWIC	Committee on the Status of Endangered Wildlife in Canada
CRA	commercial, recreational, or Aboriginal
CWS	Canadian Wildlife Service
DFO	Fisheries and Oceans Canada
EA	environmental assessment
EBSA	Ecologically and Biologically Significant Area
ECCC	Environment and Climate Change Canada
EEZ	Economic Exclusion Zone
EL	Exploration Licence
FFAW-Unifor	Fish, Food and Allied Workers-Unifor
FSC	food, social and ceremonial
HSSE	Health, safety, security and environment
IBA	Important Bird Area
MARPOL	International Convention for the Prevention of Pollution from Ships
MBCA	<i>Migratory Birds Convention Act, 1994</i>
NAFO	Northwest Atlantic Fisheries Organization
NRCan	Natural Resources Canada
The Project	Ephesus Prospect ROV Survey
ROV	remotely operated vehicle
SARA	<i>Species at Risk Act</i>
SBA	Significant Benthic Area
VC	Valued Component

1.0 INTRODUCTION

BP Canada Energy Group ULC (BP) is proposing to conduct an exploration drilling program on Exploration Licences (ELs) 1145, 1146, 1148, and 1149 in the Orphan Basin offshore Newfoundland and Labrador with an initial well planned for 2020. To characterize benthic conditions and support planning and mitigation of the drilling program, BP is planning a visual survey of the seafloor using a remotely operated vehicle (ROV) at potential drilling locations within ELs 1145, 1146, and/or 1148 in 2019 (Ephesus Prospect ROV Survey; the Project).

Separate environmental assessment and authorization processes are being carried out for BP's proposed exploration drilling program. The Project requires an authorization as an environmental program from the Canada-Newfoundland and Labrador Offshore Petroleum Board (C-NLOPB) pursuant to section 138 of the *Canada-Newfoundland and Labrador Atlantic Accord Implementation Act* and section 134 of the *Canada-Newfoundland and Labrador Atlantic Accord Implementation Newfoundland and Labrador Act* (the Accord Acts).

This document is an environmental assessment report (EA Report) that has been prepared to fulfill environmental assessment requirements of the C-NLOPB as part of the activity authorization process. It has been prepared in accordance with scoping guidelines developed by the C-NLOPB (C-NLOPB 2019) and submitted in accordance with the Geophysical, Geological, Environmental and Geotechnical Program Guidelines (C-NLOPB 2018).

2.0 PROJECT DESCRIPTION

2.1 Purpose of the Project

BP is proposing to conduct an ROV video survey of the seafloor at potential drilling locations on ELs 1145, 1146, and/or EL 1148 to confirm the presence/absence of sensitive biological communities (corals and sponges) to inform wellsite planning and mitigation measures for future proposed exploration drilling in West Orphan Basin. ELs 1145, 1146, and 1148 are located within the Northeast Newfoundland Slope Closure marine refuge, which was designated as a fisheries closure in December 2017 to protect corals and sponges from bottom-contact fishing. BP has committed to gathering baseline benthic data at each prospective wellsite prior to spudding the well to understand potential site sensitivities and opportunities for reducing potential adverse environmental effects on corals and sponges.

In order to characterize the benthic environment and inform well planning and mitigation for the proposed drilling program that is scheduled to commence with an initial well in 2020 (pending authorization), BP is proposing to conduct an ROV video survey in 2019. Video data collected during the ROV survey will be used to improve an understanding of benthic conditions in the area and inform discussions around well planning and mitigation for future exploration drilling.

2.2 Project Location

The Project would be conducted at potential drilling locations within ELs 1145, 1146, and/or 1148. Specific survey locations are not yet known, but they will represent a relatively small footprint (approximately 11 km² per survey) within the total acreage of these ELs. Table 2.1 lists the corner point coordinates of these ELs and Figure 2.1 shows the location of ELs 1145, 1146, and 1148 within which the ROV survey would occur (i.e., the Project Area). The Study Area includes a 10 km buffer to provide a contiguous boundary around the ELs and also would accommodate any vessel turning area requirements. The Regional Area includes the Orphan Basin as delineated by North Atlantic Fisheries Organization (NAFO) Areas 3Kg, 3Ld, 3Le, and a portion of 3Kk (Figure 2.1).

Table 2.1 Project Area and Study Area Coordinates

WGS 84		NAD83 UTM ZONE22N	
X	Y	X	Y
EL 1145			
50° 8' 56.147" W	50° 41' 59.782" N	560103.1846	5616803.318
49° 49' 26.133" W	50° 41' 59.737" N	583054.6569	5617116.165
49° 49' 26.119" W	50° 46' 59.731" N	582907.6413	5626382.154
49° 34' 26.109" W	50° 46' 59.718" N	600530.9452	5626691.874
49° 34' 26.139" W	50° 31' 59.721" N	601065.5559	5598894.312
49° 31' 26.135" W	50° 31' 59.599" N	604609.054	5598959.852
49° 31' 26.136" W	50° 29' 59.595" N	604682.7346	5595253.476
49° 28' 26.133" W	50° 29' 59.590" N	608228.6342	5595325.013
49° 28' 26.137" W	50° 27' 59.592" N	608304.7243	5591618.864
49° 26' 56.135" W	50° 27' 59.657" N	610078.8697	5591657.638
49° 26' 56.152" W	50° 18' 59.659" N	610426.4625	5574980.007
49° 31' 26.157" W	50° 18' 59.599" N	605087.0801	5574869.57
49° 31' 26.160" W	50° 15' 59.599" N	605197.2239	5569310.408
50° 8' 56.202" W	50° 15' 59.800" N	560654.2526	5568620.87
EL 1146			
49° 34' 26.109" W	50° 46' 59.718" N	600530.9452	5626691.874
48° 50' 56.068" W	50° 46' 59.690" N	651636.3469	5627927.42
48° 50' 56.086" W	50° 35' 59.685" N	652228.3931	5607543.814
48° 55' 26.091" W	50° 35' 59.663" N	646921.1644	5607391.765
48° 55' 26.098" W	50° 32' 59.664" N	647076.6998	5601832.726
48° 59' 56.104" W	50° 32' 59.469" N	641763.9186	5601680.676
48° 59' 56.111" W	50° 29' 59.470" N	641913.6924	5596121.625
49° 8' 56.117" W	50° 29' 59.711" N	631276.3438	5595853.031
49° 8' 56.127" W	50° 20' 59.708" N	631691.6047	5579175.647

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WGS 84		NAD83 UTM ZONE22N	
X	Y	X	Y
49° 14' 56.130" W	50° 20' 59.480" N	624577.8072	5578996.378
49° 14' 56.133" W	50° 18' 59.481" N	624664.9457	5575290.365
49° 26' 56.152" W	50° 18' 59.659" N	610426.4625	5574980.007
49° 26' 56.135" W	50° 27' 59.657" N	610078.8697	5591657.638
49° 28' 26.137" W	50° 27' 59.592" N	608304.7243	5591618.864
49° 28' 26.133" W	50° 29' 59.590" N	608228.6342	5595325.013
49° 31' 26.136" W	50° 29' 59.595" N	604682.7346	5595253.476
49° 31' 26.135" W	50° 31' 59.599" N	604609.054	5598959.852
49° 34' 26.139" W	50° 31' 59.721" N	601065.5559	5598894.312
EL 1148			
48° 59' 33.632" W	50° 16' 59.499" N	643006.9211	5572045.583
48° 29' 56.121" W	50° 16' 59.453" N	678179.521	5573109.158
48° 29' 56.170" W	49° 59' 59.479" N	679234.6286	5541612.216
48° 44' 33.676" W	49° 59' 59.515" N	661768.1882	5541057.395
48° 44' 56.199" W	49° 49' 59.501" N	661877.11	5522515.39
49° 32' 33.720" W	49° 49' 59.684" N	604799.3325	5521109.013
49° 32' 56.191" W	50° 0' 59.682" N	603955.4018	5541482.691
49° 14' 56.184" W	50° 0' 59.514" N	625446.9283	5541937.799
49° 14' 33.676" W	50° 3' 59.533" N	625764.0856	5547507.71
49° 11' 56.175" W	50° 3' 59.662" N	628894.8472	5547586.279
49° 11' 56.169" W	50° 5' 59.659" N	628805.5849	5551292.053
49° 8' 56.168" W	50° 5' 59.734" N	632381.1544	5551381.833
49° 8' 56.159" W	50° 8' 59.727" N	632243.4547	5556940.468
49° 7' 26.159" W	50° 8' 59.736" N	634029.3926	5556985.347
49° 7' 26.153" W	50° 10' 59.733" N	633936.2938	5560691.143
49° 2' 56.151" W	50° 10' 59.642" N	639290.4435	5560825.758
49° 2' 56.145" W	50° 12' 59.640" N	639193.5694	5564531.572
49° 1' 26.144" W	50° 12' 59.571" N	640977.0644	5564576.435
49° 1' 26.142" W	50° 13' 59.569" N	640927.988	5566429.336
Study Area			
50° 13' 57.351" W	50° 50' 24.419" N	554032.9	5632326
48° 24' 33.121" W	50° 48' 49.928" N	682509.3	5632326
48° 26' 24.257" W	49° 46' 58.603" N	684277.1	5517642
50° 11' 54.353" W	49° 47' 14.541" N	557698.7	5515298

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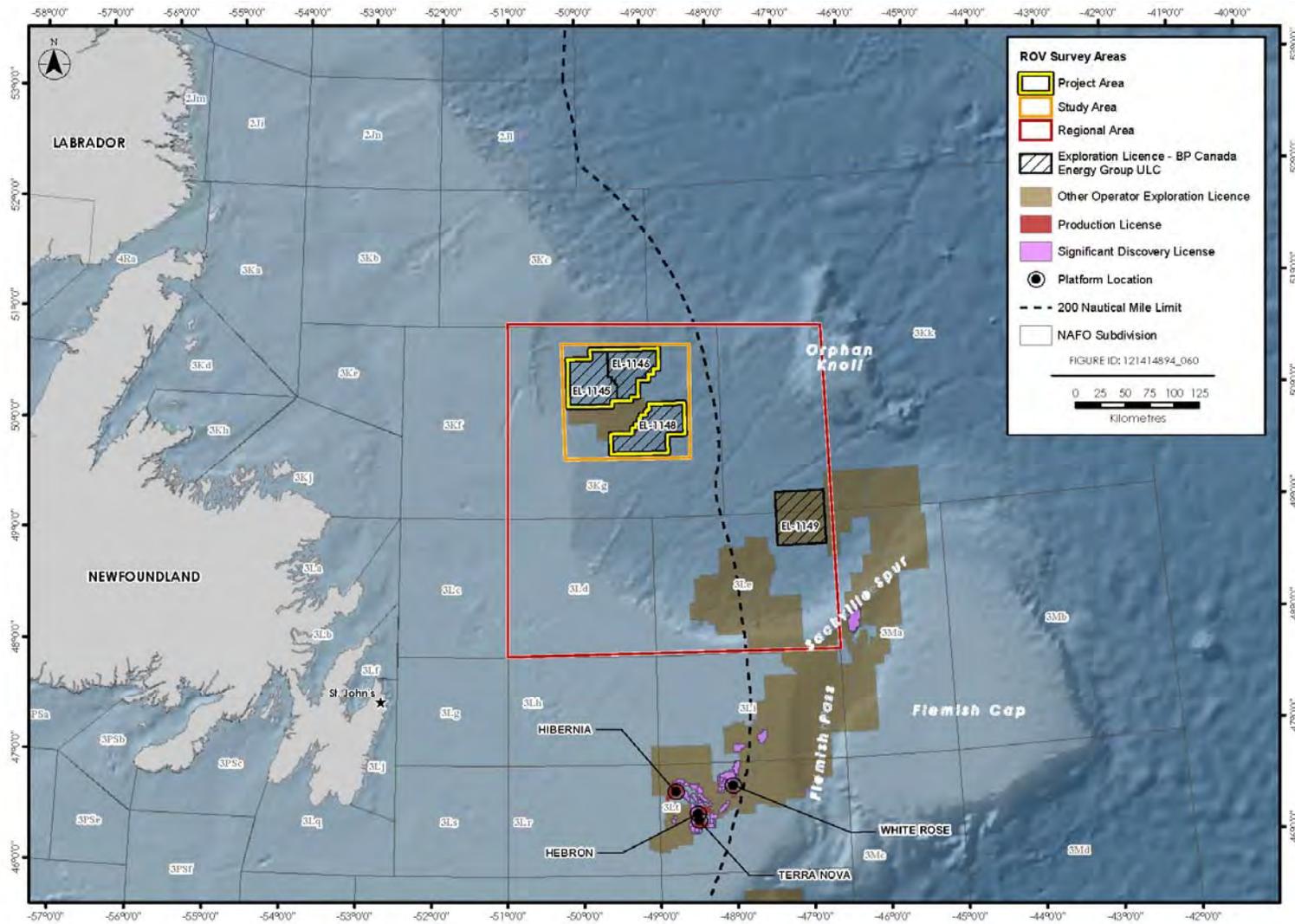


Figure 2.1 Project Location

In advance of the survey, BP will identify specific survey locations within these ELs which will represent prospective wellsite locations for exploration drilling, as well as potential delineation and relief well locations in proximity to the prospective drilling targets. However, BP recognizes the importance of keeping the survey locations flexible (within the ELs) and adaptive to enable adjustment or alteration based on field data.

2.3 Schedule

The Project is planned to be conducted between May and October 2019 pending authorization from the C-NLOPB, although it is possible that ROV video surveys could be conducted within ELs 1145, 1146, and/or 1148 between 2019 and 2024 during the May to October timeframe. It is estimated that a survey would take approximately 7-10 days to complete, with operations occurring throughout a 24-hour period. Given the length of the ROV survey (approximately 7-10 days), it is expected to be completed in a single mobilization, the only exception being weather or mechanical downtime.

2.4 Project Components and Activities

2.4.1 Operation of a Survey Vessel

BP will contract a survey vessel with suitable systems on board and procedures in place to meet the operational requirements to safely conduct the work. The survey vessel will be equipped with dynamic positioning, be capable of working in harsh offshore conditions, and will have the necessary equipment, protocols and procedures in place to comply with the *Canada Shipping Act*, the International Convention for the Prevention of Pollution from Ships (MARPOL) and any other applicable standards. The vessel will be inspected and approved for operation by the C-NLOPB before beginning any Project-related work.

The survey vessel will be mobilized from an existing shorebase in the St. John's region. Once the vessel has arrived at a pre-determined survey location (prospective wellsite), it will use dynamic positioning to remain on station at each location during the ROV survey.

Through the operation of the survey vessel, the Project will generate sound emissions (underwater and atmospheric), atmospheric emissions (light and air), and solid and liquid waste discharges. Liquid waste discharges (e.g., grey water, sewage, bilge water, deck drainage) will be managed in accordance with the requirements of MARPOL and the *Canada Shipping Act*. Solid and domestic waste will be collected onboard the vessel and collected dockside by an approved waste contractor for recycling/disposal at an existing onshore waste management facility in accordance with applicable regulatory requirements.

2.4.2 ROV Video Survey

The seabed video survey will use an ROV to conduct video transects along the seabed, in an eight-legged radial pattern from each prospective wellsite to be surveyed (refer to Figure 2.2). Each transect leg will be approximately 600 m. Depending on distance between stations within the Project Area, ROV transects between centre-points will be considered.

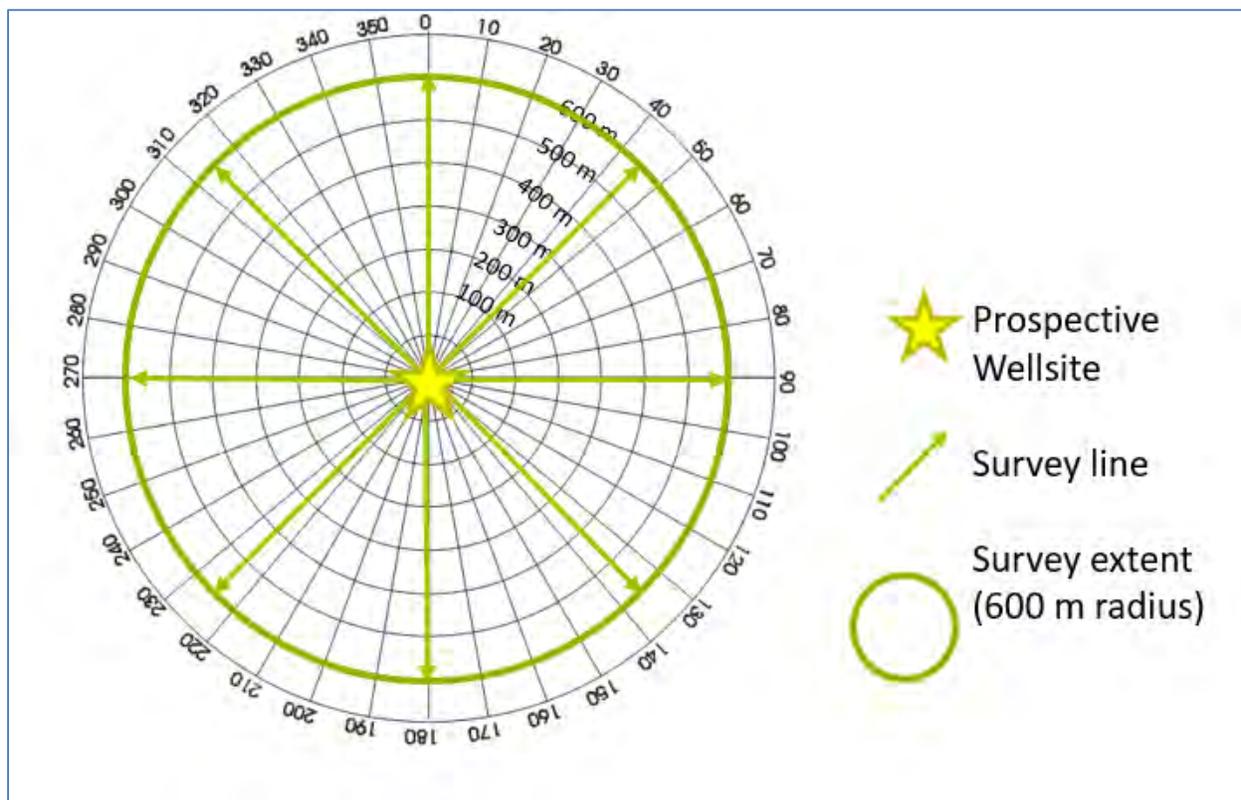


Figure 2.2 ROV Survey Plan

A video camera system capable of collecting high-definition video data will be mounted on a work-class ROV. The ROV will be lowered into the water from the survey vessel and will be operated from the survey vessel by a qualified ROV operator. The ROV will be flown at a predetermined height to maximize field of view while still maintaining resolution for identification of small-scale seafloor features. A laser measurement device will be used to determine the dimensions of seafloor features (e.g., corals, sponges). The ROV position will be recorded and tagged to the video such that the approximate location of features will be possible.

Marine biologists will be present onboard the ship during all operations to identify, in real time, species and features of interest and modify the survey plan as necessary. This may include, among other activities, stopping for further investigation of species, zooming in to investigate small-scale seafloor features and deviating from the line plan to investigate features in greater detail.

The ROV will be equipped with an imaging/obstacle avoidance sonar device which is mounted to the top of the ROV. This is a standard ROV tool which provides advance warning of any obstacles beyond the range of the ROV camera to assist with safe operation of the ROV.

Although the focus of the survey will be on identifying sensitive environmental features, BP representatives onboard will also make note of anthropogenic features (e.g., subsea cables) and other potential geohazards that could be present in the vicinity of prospective wellsites and potentially affect wellsite planning.

2.5 Project Logistics and Personnel

BP is in the process of procuring a qualified contractor to supply the survey vessel and conduct the ROV survey. In addition to the vessel crew (which depends on the size of the vessel and could range from 25-40 persons), it is anticipated that there could be an additional 8-10 persons onboard including BP representatives and marine biologists who will be present to identify in real time species and features of interest and modify the survey plan as necessary. It is anticipated that the marine mammal/sea turtle observer and seabird observer would be filled by a single person qualified to perform both sets of duties.

Logistical and support activities for the survey will depend on the contracted survey company. It is anticipated that the vessel would use existing shore-based facilities in the St. John's region to mobilize for the survey. Given the length of the ROV survey (approximately 7-10 days), it is expected to be completed in a single mobilization, the only exception being weather or mechanical downtime. Resupply and crew changes are not anticipated to be required.

3.0 INDIGENOUS AND STAKEHOLDER CONSULTATION

As part of Indigenous and stakeholder engagement that BP has been conducting for the Orphan Basin Exploration Drilling Program, including meetings with Indigenous groups and fisheries stakeholders in the fall of 2018, BP communicated the intent to conduct an ROV survey prior to drilling to investigate for sensitive benthic environmental features.

In January 2019, BP emailed One Ocean, Fish, Food and Allied Workers-Unifor (FFAW-Unifor), Ocean Choice International, the Association of Seafood Producers, and Groundfish Enterprise Allocation Council to provide an update that BP was planning on conducting an ROV survey in 2019, prior to mobilization for the drilling program in 2020. In February 2019, BP emailed an update on the ROV survey to Indigenous groups in Newfoundland and Labrador, Nova Scotia, Prince Edward Island, New Brunswick and Quebec with whom BP has been engaging for the Newfoundland Orphan Basin Exploration Drilling Program.

No concerns have been raised to BP regarding the ROV survey to date either through face to face meetings or through email correspondence, although BP has been asked by some Indigenous groups whether the results of the surveys will be public. BP has responded that the survey will contain information regarding prospective well locations which are confidential. However, BP will communicate general results during the regular course of engagement on the Newfoundland Orphan Basin Exploration Drilling Program. In advance of the proposed ROV survey, BP will also continue to communicate timing and general location of the survey to Indigenous groups and commercial fisheries stakeholders.

4.0 EXISTING ENVIRONMENT

4.1 Physical Environment

The Project Area is located in the Orphan Basin, which is part of a complex network of connected basins and sub-basins offshore Newfoundland and Labrador. The Orphan Basin is bounded by the Newfoundland Shelf to the west, the Flemish Cap to the south, and the Orphan Knoll to the northeast (Campbell 2005). Water depths in the Project Area range from 970 m to 2,400 m.

4.1.1 Oceanographic Conditions

The Labrador Current is the dominant current in the Regional Area. It is composed of the West Greenland, Baffin Island, and Irminger Currents. The Labrador Current originates from the Hudson Strait at 60°N and flows southward over the Labrador and Newfoundland Shelf and Slope to the tail end of the Grand Banks at 43°N (Lazier and Wright 1993).

The Labrador Current becomes two branches on the southern Labrador Shelf; an inshore branch with approximately 15% of the transport, and an offshore branch with approximately 85% of the transport (Lazier and Wright 1993). The main branch of the offshore Labrador Current typically flows along the Continental Slope between 300 and 1,500 m (Lazier and Wright 1993). The inshore branch generally has a weaker flow and is not well defined (Lazier and Wright 1993). The offshore branch has mean surface water velocities that typically range from 25 to 50 cm/s, while those of the inshore branch are weaker and range from 5 to 20 cm/s (Fissel and Lemon 1991; Lazier and Wright 1993; Colbourne 2000).

The currents on the Newfoundland Slope are highly variable, which results in seasonal and interannual variations in velocity and transport in the Labrador Current. The upper waters of the Labrador Current are typically stronger in the fall and winter and weaker in spring (Lazier and Wright 1993; Han and Tang 1999; Han and Li 2004). Lazier and Wright (1993) found seasonal variations in circulation in the upper 400 m, but no significant variations were found deeper than the 1,000 m level.

Moored current measurements in the Orphan Basin have been carried out by the Bedford Institute of Oceanography (BIO) with two moorings (WOB_1 and WOB_2) measuring currents between May 1991 and May 1992. Both mooring sites are close to EL 1148 in the Study Area. Mean and maximum current speeds at these two locations are provided in Table 4.1.

Table 4.1 Mean and Maximum Current Speeds at Two Moorings in the Orphan Basin

Mooring	Latitude	Longitude	Period	Depth (m)	Mean Current Speed (cm/s)	Maximum Current Speed (cm/s)	Month of Maximum Current Speed	Predominant Current Direction
WOB_1	49.7485N	49.7465W	May 1991 to Nov 1991	200	11.7	30.7	October	S-SE
WOB_1	49.7485N	49.7465W	May 1991 to Nov 1991	400	9.1	22.0	September	S-SE

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Mooring	Latitude	Longitude	Period	Depth (m)	Mean Current Speed (cm/s)	Maximum Current Speed (cm/s)	Month of Maximum Current Speed	Predominant Current Direction
WOB_1	49.7485N	49.7465W	May 1991 to Nov 1991	900	8.2	19.7	May	S-SE
WOB_2	49.7467N	49.7388W	Nov 1991 to May 1992	400	7.6	23.2	December	S-SE
WOB_2	49.7467N	49.7388W	Nov 1991 to May 1992	900	7.4	23.1	April	S-SE

Within the Regional Area and surrounding areas, the largest seas are typically found the furthest offshore, usually during the winter season. Extra-tropical storms dominate the wave climate of the Regional Area, primarily from October through March, although severe storms may occur outside of these months. Storms of tropical origin may occur during the early summer and early winter, but most often occur from late August through October. Hurricanes are usually reduced to tropical storm strength or evolve into extra-tropical storms by the time they reach the Regional Area, but they are still capable of producing storm force winds and high waves.

Wind and wave climate statistics for the Project Area were extracted from the MSC50 North Atlantic wind and wave climatology database. The descriptions below are based on a subset of MSC50 data from 1985 to 2015 for grid points 16684, 17322, and 17427 in the Project Area. The dominant direction of the combined significant wave height is from the west during fall and winter. During the months of March and April, the wind wave remains predominantly westerly while the swell begins to come from a southerly direction, which results in the vector mean direction of the combined significant wave heights being southwesterly. There is a mean southwesterly direction for the combined significant wave heights during the summer months. During the months of September and October, the wind wave will veer to the west and become a dominant component of the combined significant wave height.

Significant wave heights in the Project Area peak during the winter months and have a mean monthly significant wave height in January ranging from 4.4 to 4.6 m. The lowest significant wave heights occur in the summer, with July having a mean monthly significant wave height of 1.7 m.

Combined significant wave heights of 10.0 m or more occurred in each month between September and April, with the highest waves occurring during the months of December and January. The maximum significant wave heights tend to peak during the winter months, although a tropical system could pass through the area and produce high wave heights during any month of the year. Seasonal and annual maximum combined significant wave heights are shown below in Table 4.2.

Table 4.2 Maximum Combined Significant Wave Heights (m) in the Project Area

Period	Maximum Combined Significant Wave Heights (m) ¹
Winter	15.1
Spring	11.7
Summer	7.2

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Fall	12.8
Annual	15.1
Notes: ¹ Maximum combined significant wave height based on maximum of MSC50 Grid Points 16684, 17322, and 17427	

4.1.2 Ice Conditions

The Study Area, like other parts of the eastern Newfoundland offshore area, are subject to seasonal intrusions of sea ice and icebergs. Statistics from the Canadian Ice Service (1981 to 2010) indicate the Study Area is primarily affected by sea ice from early January through the beginning of July, with the highest frequency of sea ice observed in March (Environment Canada 2011). Icebergs can be present in the Study Area any month of the year, with peak sightings between the months of March and May (National Snow and Ice Data Centre 2015).

4.1.3 Weather Conditions

The Study Area experiences weather conditions typical of a marine environment, with surrounding areas having a moderating effect on temperature. Marine climates generally experience cooler summers and milder winters than continental climates and have a smaller annual temperature range. Marine climates also tend to be humid, resulting in reduced visibilities, low cloud heights, and substantial amounts of precipitation.

The Project Area experiences winds predominantly from the southwest to west throughout the year. There is a strong annual cycle in the wind direction; west to northwest winds are prevalent during the winter months and southwest winds are predominant during the summer months. The mean strength of the westerly flow is stronger in the winter months than the summer months.

The mean and maximum wind speeds at MSC50 grid points in the Project Area are shown in Table 4.3. The seasonal and annual percentage frequencies of wind direction at MSC50 grid points in the Project Area are provided in Table 4.4. In terms of percentage frequency of wind speeds, strong winds were most common (approximately 37.7% of the time), followed by moderate winds (approximately 34.7% of the time).

Table 4.3 Mean and Maximum Wind Speeds (m/s) in the Project Area

Period	Mean and Maximum Wind Speeds (m/s) ¹	
	Mean	Maximum
Winter	12.17	32.8
Spring	9.29	29.9
Summer	6.70	22.5
Fall	9.72	33.1
Annual	9.46	33.1

Notes: ¹Wind speeds based on the average and maximum speeds of MSC50 Grid Points 16684, 17322, and 17427

Table 4.4 Seasonal and Annual Percentage Frequency of Wind Direction in the Project Area

Period	Seasonal and Annual Percentage Frequency of Wind Direction ¹							
	NE	E	SE	S	SW	W	NW	N
Winter	4.3	5.3	6.7	10.2	16.6	30.0	19.2	8.6
Spring	8.8	7.0	8.2	13.0	17.2	17.3	16.6	11.7
Summer	5.2	6.3	9.0	19.2	28.2	14.4	11.3	13.8
Fall	5.2	4.5	6.5	13.4	20.5	22.2	19.5	10.3
Annual	5.9	5.8	7.6	14.0	20.6	20.9	16.6	11.1

Notes: ¹Percentage frequency of wind direction based on an average of MSC50 Grid Points 16684, 17322, and 17427

During the summer, periods of southerly winds with mild conditions are typical with infrequent occurrence of extended storm conditions. The main storm track is through the Gulf of St. Lawrence, or the Island of Newfoundland.

Precipitation may come in three forms in the Study Area: liquid precipitation (including drizzle and rain); freezing precipitation (freezing drizzle and freezing rain); and frozen precipitation (snow, snow pellets, snow grains, ice pellets, hail, and ice crystals). Rain and drizzle may occur at any time of the year but is most likely to occur when there are southerly or southwesterly winds. Snow and rain are possible any time from October through June, and snow is accompanied by winds from any direction. Freezing rain frequently persists for days in the spring along the east coast of Canada and is most common with easterly or northeasterly winds.

Thunderstorms and hail have the potential to occur year-round, although hail is most likely to occur in the winter, and thunderstorms are most likely to occur in the summer. Thunderstorms occur relatively infrequently over the Regional Area, although they may occur in any month of the year. Hail only occurs during severe thunderstorms.

Lightning occurs year-round in offshore Newfoundland. Lightning strikes are stronger during the winter months. Lightning is most commonly produced in thunderstorms and is usually accompanied by thunder.

Lightning can pose a safety risk to personnel and can potentially affect electronic systems on the survey vessel.

Visibility in the eastern Newfoundland offshore area is most favorable in the fall and winter and is most frequently restricted in the summer and spring. The eastern Newfoundland offshore area experiences some of the highest occurrences of marine fog in North America (Amec 2014). Horizontal visibility may be reduced by any of the following phenomena: fog, mist, haze, smoke, liquid precipitation, freezing precipitation, frozen precipitation, and blowing snow.

Obscuration to visibility in the Regional Area is highest during the month of July, most of which is in the form of advection fog, although frontal fog can also contribute to visibility reduction. Reduction in visibility is relatively low during fall and winter and is mainly attributed to the passage of low-pressure systems. In fall, fog is the main cause of reduced visibilities, and in winter, the main cause is snow. The lowest occurrence of reduced visibility occurs in November, when, on average, the air temperature has decreased below the sea surface temperature and it is not yet cold enough for snow.

Storm systems known as weather bombs are known to occur frequently in the Orphan Basin. These are formed by a rapid deepening of an extratropical cyclonic low-pressure area. These storm systems develop in the warm waters off Cape Hatteras, North Carolina, and move northeast across the Grand Banks and Orphan Basin.

The hurricane season in the North Atlantic Basin normally extends from June through November, although tropical storm systems occasionally occur outside this period. The strongest winds typically occur during the winter months and are associated with mid-latitude pressure systems, although storm-force winds may occur at any time of the year because of tropical systems. There has been a substantial increase in the number of hurricanes that have developed within the Atlantic Basin in the last 15 years. Because of the increase in tropical activity in the Atlantic Basin, there has also been an increase in tropical storms or their remnants entering the Canadian Hurricane Centre Response Zone.

4.1.4 Geological Stability

Eastern Canada is located within a relatively stable area of the North American Plate, where there has been a relatively low level of recorded seismic activity (Amec 2014). There are approximately 450 earthquakes that occur each year in Eastern Canada, and the majority of these have magnitudes between two and three (Amec 2014). The Seismicity Hazard Map of Canada (NRCan 2016) indicates that the Regional Area has been classified as having a low to moderate seismic hazard.

Analysis has indicated that there is a major risk of a landslide every 20,000 years, and risk of a minor one every few thousand years in any given area in the Eastern Canada offshore. Most of the large failures observed on the seabed date back more than 10,000 years during periods of glaciation when large amounts of sediment were deposited onto the slope of the continental shelf (NRCan 2013).

As Project activities are of short duration (approximately 7-10 days), the probability of a major seismic event (and potential for related tsunami or submarine landslide) occurring during the life of the Project is low. If a seismic event did occur during the Project, it would be unlikely to affect Project activities.

4.2 Marine Fish and Shellfish

The eastern Newfoundland offshore area is a highly-productive ecosystem, and many marine fish species are known to occur in Newfoundland and Labrador waters (Templeman 2010; Amec 2014). The occurrence of these species is based on their physiological and life history requirements; their presence may vary according to habitat, environmental conditions, and life history stage (Amec 2014). Within the Study Area, habitats transition from Newfoundland slope to abyssal. These Newfoundland slope areas support regionally important areas of biodiversity and marine productivity and are used by fish and invertebrate species of commercial, cultural, and/or ecological value including commercial, recreational or Aboriginal (CRA) fishery species. The abundance and distribution of these fish and invertebrate species depend on their linkages with other species across fish habitats and interactions with the physical parameters of the marine environment.

At least 60 species of phytoplankton, 160 species of zooplankton, and 30 species of ichthyoplankton may occur in the Orphan Basin based on historical studies (Movchan 1963; Buchanan and Foy 1980a, 1980b; Buchanan and Browne 1981; Tremblay and Anderson 1984, in LGL Limited 2003). Phytoplankton in the Orphan Basin is likely dominated by microflagellates and diatoms, at least during the summer months (LGL Limited 2003). The distribution of macroalgae and marine plants is predominantly limited to areas reached by sunlight, as they are reliant on photosynthesis to produce energy; however, some types of marine algae (e.g., coralline algae) occur at greater depths (Amec 2014).

There is a high abundance and diversity of structure-forming benthic invertebrate species that occur in the Orphan Basin and in surrounding areas, including corals, sponges, and sea pens (Amec 2014). Within the Regional Area, corals and sponges are present on the Northeast Newfoundland Shelf and Slope, and are also found in the Flemish Pass and Flemish Cap adjacent to the Regional Area. The Orphan Knoll, partially located within the Regional Area and approximately 125 km to the northeast of the Project Area, is a biologically rich and complex area, with corals (including stony corals) and sponges observed on the flanks of the knoll and surrounding seamounts using a ROV (NAFO 2017).

Fisheries and Oceans Canada (DFO) has defined a large Significant Benthic Area (SBA) for sea pens that encompasses the edge of the Northeast Newfoundland Shelf, including the far western portion of the Project Area and EL 1145, and small portions of ELs 1146 and 1148. There are additional SBAs for small and large gorgonian corals surrounding the Project Area along the Northeast Newfoundland Slope. The Northeast Newfoundland Slope Closure is a marine refuge designated by DFO which is closed to bottom contact fishing to protect corals and sponges in this area and encompasses all of ELs 1145, 1146, and 1148. Figure 4.1 shows existing DFO research data for corals and sponges in the Regional Area.

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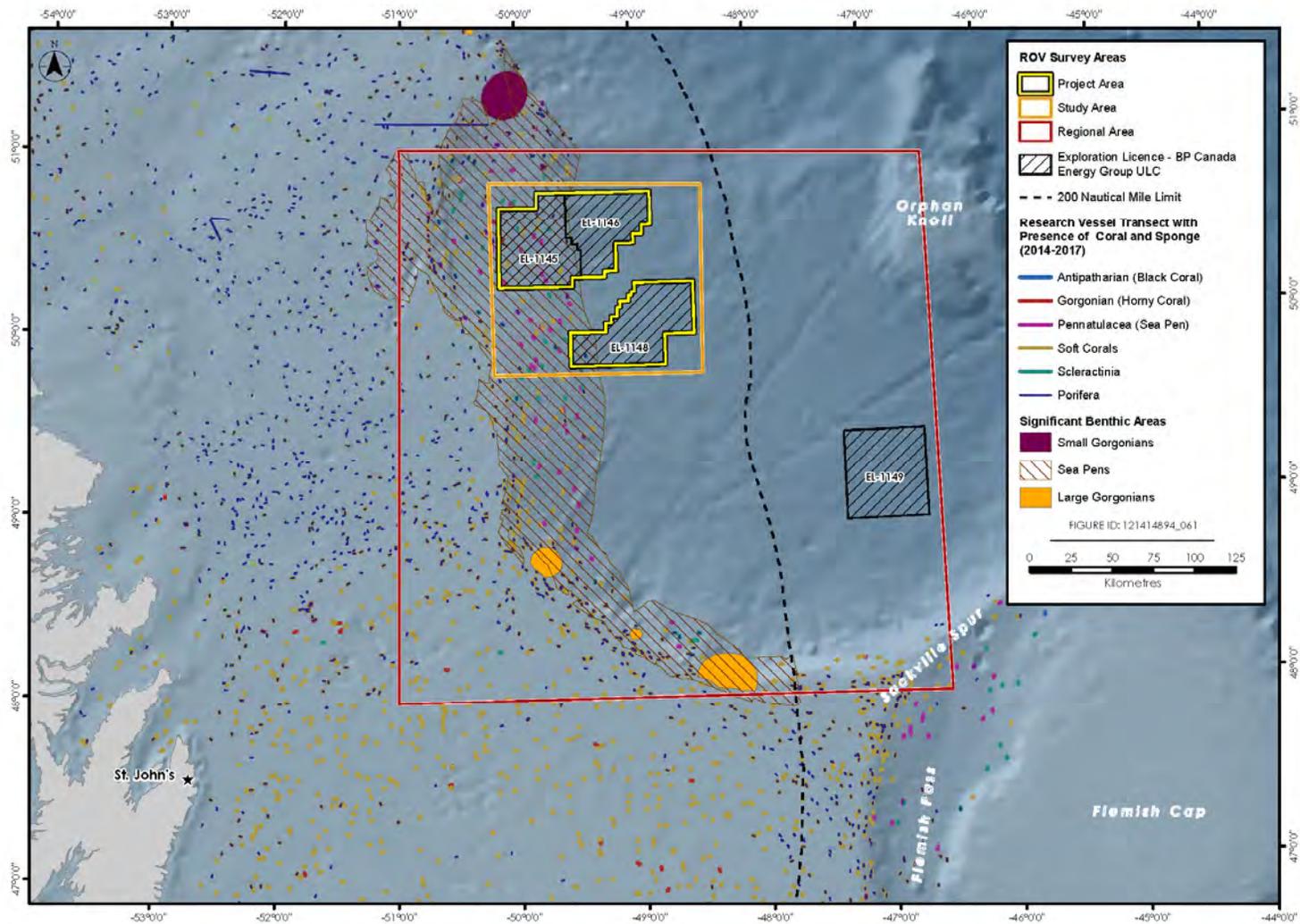


Figure 4.1 Corals and Sponges

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The benthic or demersal species that inhabit the continental slope and abyssal habitats in the Study Area are not yet well studied. Emerging continental slope fisheries for grenadiers, Greenland halibut, and redfish are resulting in additional pressures for other continental slope species found within the Study Area such as blue hake, roughhead grenadier, roundnose grenadier, skate species and synphobranchid eels (Devine et al. 2006). Pelagic species include resident (capelin and lanternfish) and migratory (tunas, swordfish, and several shark species) species. The most abundant fish species found in the Study Area (based on 2015-2016 DFO research vessel survey data) include: redfish; Greenland halibut; roughhead grenadier; roundnose grenadier; witch flounder; and northern wolffish. These species would be expected to be present in the Study Area year-round.

A summary of spawning seasons and known spawning areas for fish species with a high potential to be found in the Study Area is provided in Table 4.5.

Table 4.5 Spawning Periods and Locations for Fish with High Potential to be Found in the Study Area

Common Name	Scientific Name	Spawning Time												Known Spawning Locations
		J	F	M	A	M	J	J	A	S	O	N	D	
Deepwater redfish	<i>Sebastes mentella</i>													April-May southern Labrador shelf, Newfoundland shelf and Grand Banks, March-April Flemish Cap ¹
Greenland Halibut	<i>Reinhardtius hippoglossoides</i>													Spawning thought to occur in the deep waters (650-1000 m) of the Davis Strait ^{2,3}
Northern wolffish	<i>Anarhichas denticulatus</i>													Spawns in deep water on the continental slope, subsequently returning to the shelf ⁴
Roundnose grenadier	<i>Coryphaenoides rupestris</i>													Spawning occurs throughout the year throughout the species range ⁵
Roughhead grenadier	<i>Macrourus berglax</i>													Southern and southeastern slopes of the Grand Bank ⁶
Witch Flounder	<i>Glyptochepalus cynoglossus</i>													Labrador shelf, and northwestern Newfoundland shelf ⁷

Note: Shading indicates spawning periods.
 Sources: ¹ Vaskov 2005, ² DFO 1993, ³ Bowering & Nedreaas, 2000, ⁴ Shelvelev and Kuz'michev 1990 in Committee on the Status of Endangered Wildlife in Canada (COSEWIC) 2001; ⁵ COSWEIC 2008a; ⁶ COSEWIC 2007; ⁷ Bowering W.R. 1989.

There are several fish species at risk that may occur in the Study Area (refer to Section 4.5). The Northern Grand Banks encompasses an area designated as proposed critical habitat for northern and spotted wolffish; both species are listed under the *Species at Risk Act* (SARA) Schedule 1 as threatened (refer to Section 4.5).

Within the waters offshore Newfoundland and Labrador, including waters within the Regional Area, commercial fishing occurs for several different species, including species that Indigenous groups may hold commercial communal licenses to harvest. Species harvested for commercial communal purposes offshore eastern Newfoundland include capelin, groundfish, herring, mackerel, seal, shrimp, snow crab, tuna, and whelk. Species harvested by Indigenous groups for food, social, and ceremonial (FSC) purposes include, but are not limited to, gaspereau, trout, Atlantic salmon, bass, mackerel, eel, shad, groundfish (e.g., flounder, halibut, pollock), Arctic char, smelt, blue shark, herring, mussel, clams, periwinkle, soft-shell clams, squid, tomcod, quahaug, razor clams, lobster, crab, and scallops. Many FSC species are harvested in the inshore and/or freshwater systems. However, some species are anadromous and can potentially migrate through the Regional Area and/or Project Area. Two migratory fish species in particular have been highlighted during Indigenous engagement as being of concern due to potential interaction with Project activities: American eel; and Atlantic salmon. The American eel has been identified as important to Aboriginal rights-based, Treaty rights-based, and commercial fisheries, particularly to the Mi'kmaq peoples (Denny and Kavanagh 2018). Atlantic salmon have traditionally been a staple food for Indigenous peoples, although today, due to a lack of abundance and concern for local populations, it is often reserved for special occasions (Denny and Fanning 2016).

4.3 Marine and/or Migratory Birds

The highly productive Grand Banks and adjacent waters are known to support large numbers of seabirds in all seasons (Lock et al. 1994; Fifield et al. 2009). Several million seabirds nest along the coasts of the eastern and northeastern Newfoundland, and forage on the Grand Banks and adjacent areas during and following the nesting season. There are also many non-breeding seabirds that could be in the Regional Area during the summer months. During this time most of the world's population of great shearwater and large numbers of sooty shearwater nesting in the South Atlantic are thought to migrate to Newfoundland waters. Leach's storm-petrels traverse the continental shelf to forage for nestlings in deep waters off the shelf in areas such as the Orphan Basin, which is the nearest deep-water area to the largest nesting colony in the world of this species at Baccalieu Island. During the winter months, seabirds from the Arctic and subarctic of eastern Canada, and from Greenland, gather in the waters off eastern Newfoundland. Of those seabirds, the non-breeding, sub-adults, especially northern fulmar and black-legged kittiwake, could be present in the Regional Area year-round. Waterfowl nest in coastal Newfoundland in relatively small numbers but winter in coastal waters in large numbers (Lock et al. 1994). However, they occur away from the coast generally only as vagrants in small numbers. Some species of Arctic-nesting shorebirds (plovers and sandpipers) undertake trans-oceanic flights during fall migration from eastern North America to South America (Williams and Williams 1978; Richardson 1979), so some passage offshore through the Regional Area may be expected. During summer, the Grand Banks also host species that migrate from nesting areas in the South Atlantic, including globally important numbers of great shearwater, large numbers of sooty shearwater, and smaller numbers of Wilson's storm-petrel, and south polar skua.

Figures 4.2 and 4.3 and Table 4.6 show the presence and relative abundance of marine and/or migratory birds in the Regional Area.

Several coastal areas have been designated as Important Bird Areas (IBAs), which have been designated internationally to recognize sites of national and international importance to birds and generally include areas where large concentrations of seabirds nest, stage, or overwinter. There are 21 IBAs in eastern Newfoundland. Some of these IBAs are also designated federal Migratory Bird Sanctuaries or provincial Seabird Ecological Reserves. Project activities are not predicted to interact with any IBAs.

4.4 Marine Mammals and Sea Turtles

Twenty-four marine mammal species are known to occur within or near the Study Area, including 19 species of cetaceans (whales, dolphins, and porpoises) and five species of pinnipeds (seals). Most marine mammals use the area seasonally. The region likely represents important foraging habitat for many marine mammals. Three species of sea turtles may also potentially occur within or near the Study Area, although their presence would be rare.

Figures 4.4 and 4.5 show marine mammal observations in the Regional Area compiled from the DFO sightings database (1947 to 2015) for baleen whales and toothed whales, respectively. While marine mammal sightings occur year-round in the Regional Area, they are more common in the Study Area during the months of June-September. However, the appearance of concentrations in certain areas and during certain times may be a monitoring bias artifact of the survey effort in these areas compared to elsewhere. Conversely, low sighting numbers in other areas and during other times may, at least in part, be attributable to a lack or absence of survey effort. Overall, the summer is an important period for cetaceans and sea turtles in waters offshore Newfoundland, where many migratory species come to feed before returning to more southern latitudes for the winter. Pinnipeds may be more common during winter and spring. As shown by the observations depicted in Figure 4.6, sea turtle presence in the Regional Area is considered a rare occurrence.

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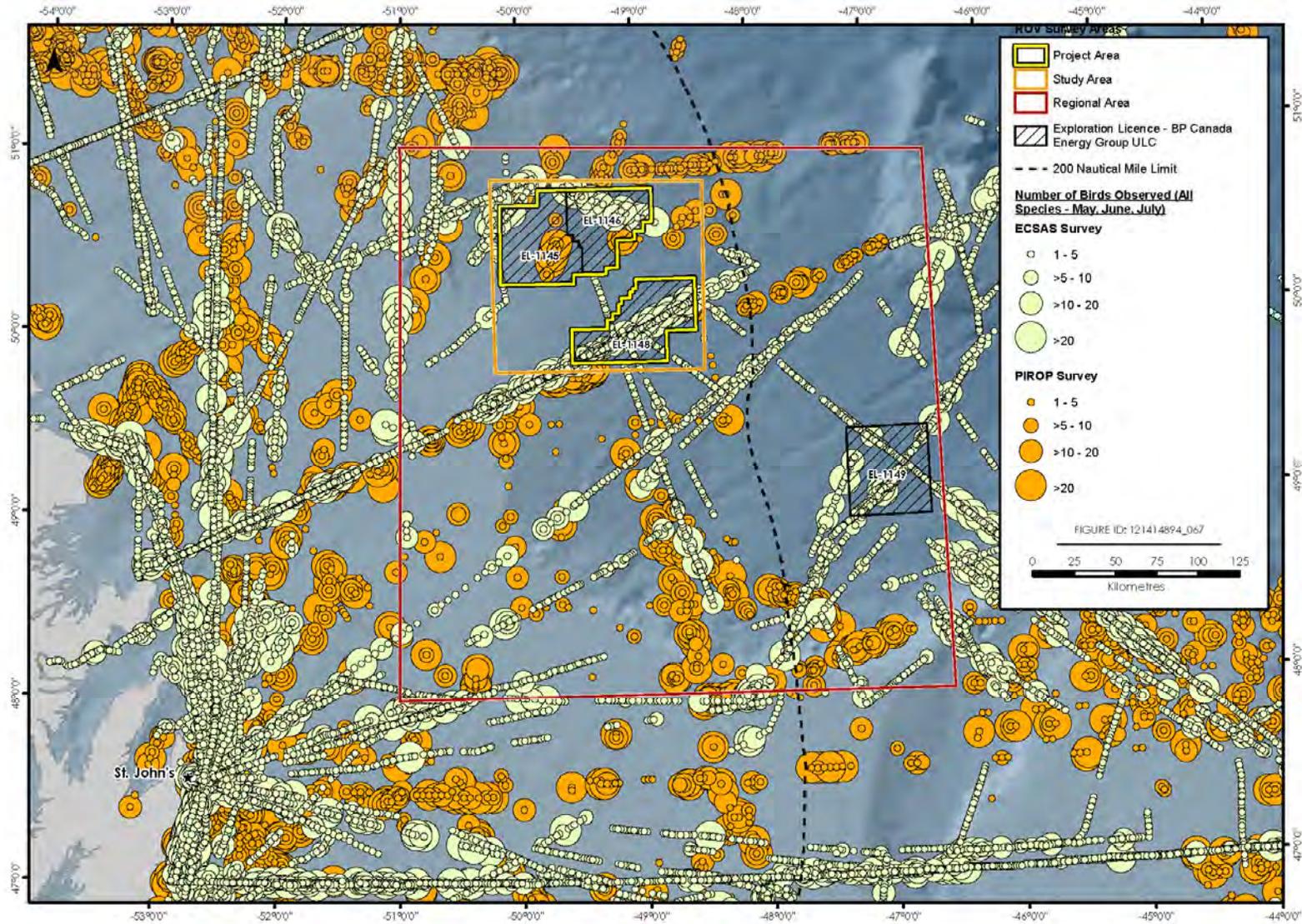


Figure 4.2 Seasonal Distribution of Marine and/or Migratory Birds in the Regional Area – May, June, July

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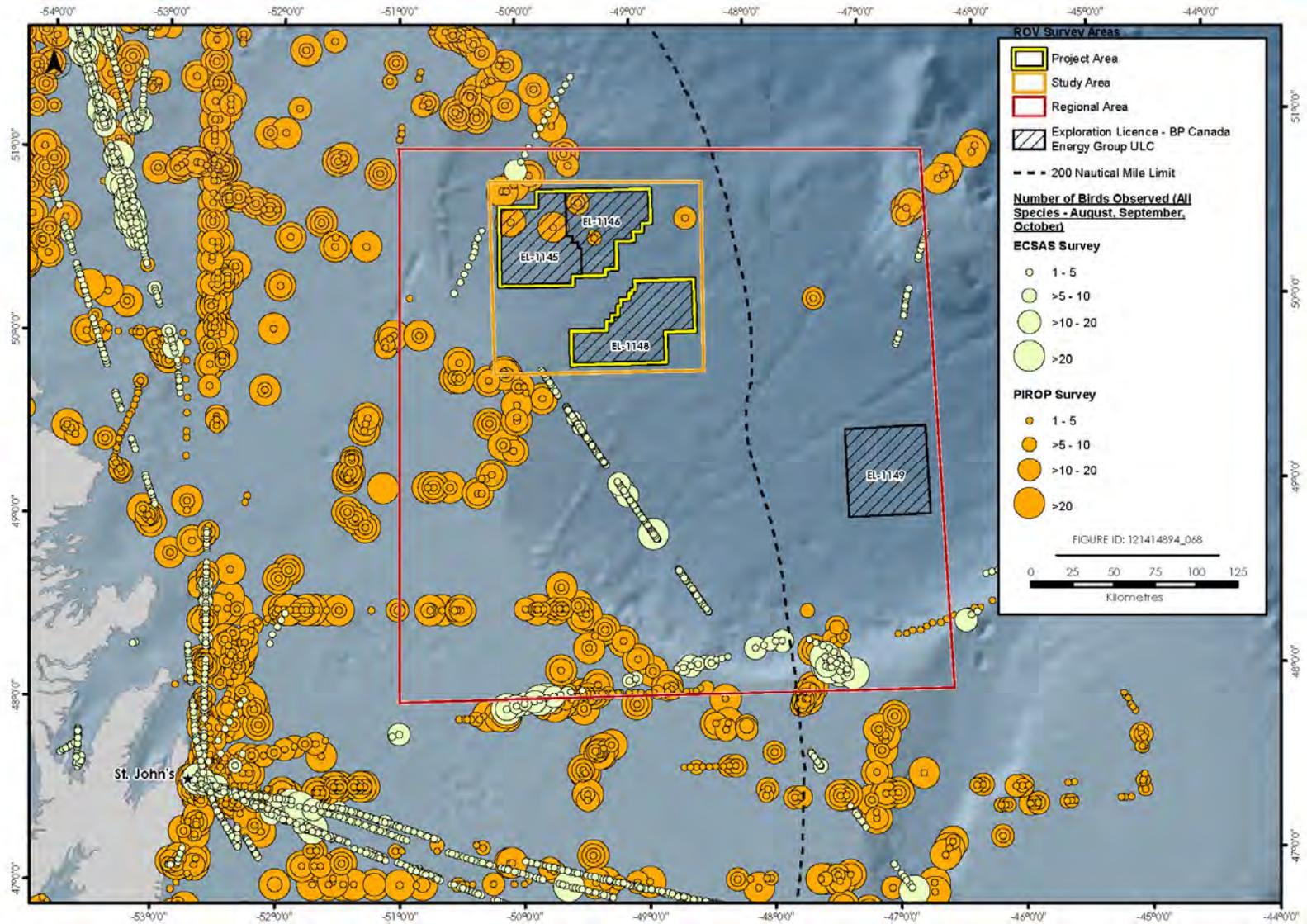


Figure 4.3 Seasonal Distribution of Marine and/or Migratory Birds in the Regional Area – August, September, October

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Table 4.6 Summary of Seasonal Presence of Marine-associated Birds in the Study Area

Presence and Relative Abundance												
Common Name	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sep.	Oct.	Nov.	Dec.
Ducks, Geese, and Swans												
Waterfowl (passage migrants)			VS	VS					VS	VS		
Plovers and Sandpipers												
Shorebirds (passage migrants)							S	S	S	S		
Phalaropes												
Red-necked phalarope					S	S	S	S	S			
Red phalarope					S	S	S	S	S	S		
Gulls and Terns												
Black-legged kittiwake	C	C	C	C	C	C	C	C	C	C	C	C
Ivory gull	VS	VS	VS	VS								
Sabine's gull					VS	VS		VS	VS			
Ross's gull	VS	VS	VS	VS	VS					VS	VS	VS
Herring gull	U	U	U	U	U	S	S	S	S	S	S	S
Iceland Gull	S	S	S	S						S	S	S
Lesser black-backed gull					VS	VS	VS	VS	VS	VS	VS	VS
Glaucous gull	S	S	S	S						S	S	S
Great black-backed gull	U	U	U	U	U	S	S	U	C	C	U	U
Arctic tern					S	S	S	S	S			
Skuas and Jaegers												
Great skua					S	S	S	S	S	S		
South polar skua					S	S	S	S	S	S		
Pomarine jaeger				S	S	S	S	S	S	S		
Parasitic jaeger					S	S	S	S	S	S		
Long-tailed jaeger					S	S	S	S	S			
Auks, Murres, Puffins, and Guillemots												
Dovekie	C	C	C	C	U	VS	VS	VS	S	C	C	C
Common murre	S-U	S-U	S-U	C	C	C	C	C	C	C	C	C

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Presence and Relative Abundance												
Common Name	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sep.	Oct.	Nov.	Dec.
Thick-billed murre	C	C	C	C	C	S-U	S-U	S-U	U-C	C	C	C
Razorbill				S	S	S	S	S	S	S	S	
Atlantic puffin				S	S	S	S	S	U	U	U	U
Fulmarine Petrels, Shearwaters, and Gadfly Petrels												
Northern fulmar	C	C	C	C	C	C	C	C	C	C	C	C
Great shearwater					U	C	C	C	C	C	S	
Sooty shearwater					S	S-U	S-U	S-U	S-U	S-U	S	
Manx shearwater					S	S	S	S	S	S		
Cory's shearwater							VS	VS	VS			
Bermuda petrel		VS	VS	VS	VS							
Zino's petrel				VS	VS	VS	VS	VS	VS	VS		
Desertas petrel	VS	VS	VS								VS	VS
Storm-Petrels												
Leach's storm-petrel					U-C	C	C	C	C	C	S	
Band-rumped storm-petrel					VS	VS	VS	VS				
Wilson's storm-petrel							S	S	S	S		
Gannets												
Northern gannet				S	S	S	S	S	S	S		
Cormorants												
Great and double-crested cormorants				VS	VS				VS	VS		
Landbirds												
Landbirds (vagrant migrants)				VS	VS			VS	VS	VS		
Notes: Bolded species have conservation designation (see Section 4.5). C = Common, present daily in moderate to high numbers; U = Uncommon, present daily in small numbers; S = Scarce, present, regular in very small numbers; VS = Very Scarce, very few individuals or absent. Blank spaces indicate not expected to occur in that month.												

Table 4.7 Marine Mammals and Sea Turtles with Reasonable Likelihood of Occurrence in the Study Area

Species	Study Area		Habitat
	Occurrence	Season	
North Atlantic Right Whale	Rare	Summer	Coastal, shelf & pelagic
Humpback Whale	Common	Year-round, but mostly May-Sep	Coastal & banks
Minke Whale	Common	Year-round, but mostly May-Oct	Coastal, shelf, & banks
Sei Whale	Uncommon	May–Nov	Pelagic
Fin Whale	Common	Year-round, but mostly summer	Shelf breaks, banks & pelagic
Blue Whale	Uncommon	Year-round	Coastal & pelagic
Sperm Whale	Common	Year-round, but mostly summer	Slope, canyons & pelagic
Northern Bottlenose Whale	Uncommon	Year-round	Slope, canyons & pelagic
Sowerby’s Beaked Whale	Rare	Year-round	Slope, canyons & pelagic
Striped Dolphin	Rare	Summer	Shelf & pelagic
Atlantic Spotted Dolphin	Rare	Summer	Shelf, slope & pelagic
Short-beaked Common Dolphin	Common	Summer	Shelf & pelagic
White-beaked Dolphin	Common	Year-round, but mostly Jun-Sep	Shelf & pelagic
Atlantic White-sided Dolphin	Common	Year-round, but mostly summer-fall	Coastal & shelf
Common Bottlenose Dolphin	Rare	Summer	Coastal & pelagic
Risso’s Dolphin	Rare	Year-round	Continental slope
Killer Whale	Uncommon	Year-round	Coastal & pelagic
Long-finned Pilot Whale	Common	Year-round, but mostly spring-fall	Shelf break, pelagic & slope
Harbour Porpoise	Uncommon	Year-round, but mostly spring-fall	Coastal, shelf & pelagic
Harp Seal	Common	Year-round, but mostly winter-spring	Pack ice & pelagic
Hooded Seal	Common	Year-round, but mostly winter-spring	Pack ice & pelagic
Grey Seal	Uncommon	Year-round, but mostly summer	Coastal & shelf
Ringed Seal	Uncommon	Winter-spring	Landfast ice with snow cover
Bearded Seal	Uncommon	Year-round	Coastal, shallow & ice edge
Leatherback Sea Turtle	Rare	Apr to Dec	Shelf & pelagic
Loggerhead Sea Turtle	Rare	Summer and fall	Pelagic
Green Sea Turtle	Rare	Summer	Pelagic
Note: Bolded species have conservation designations (see Section 4.5).			

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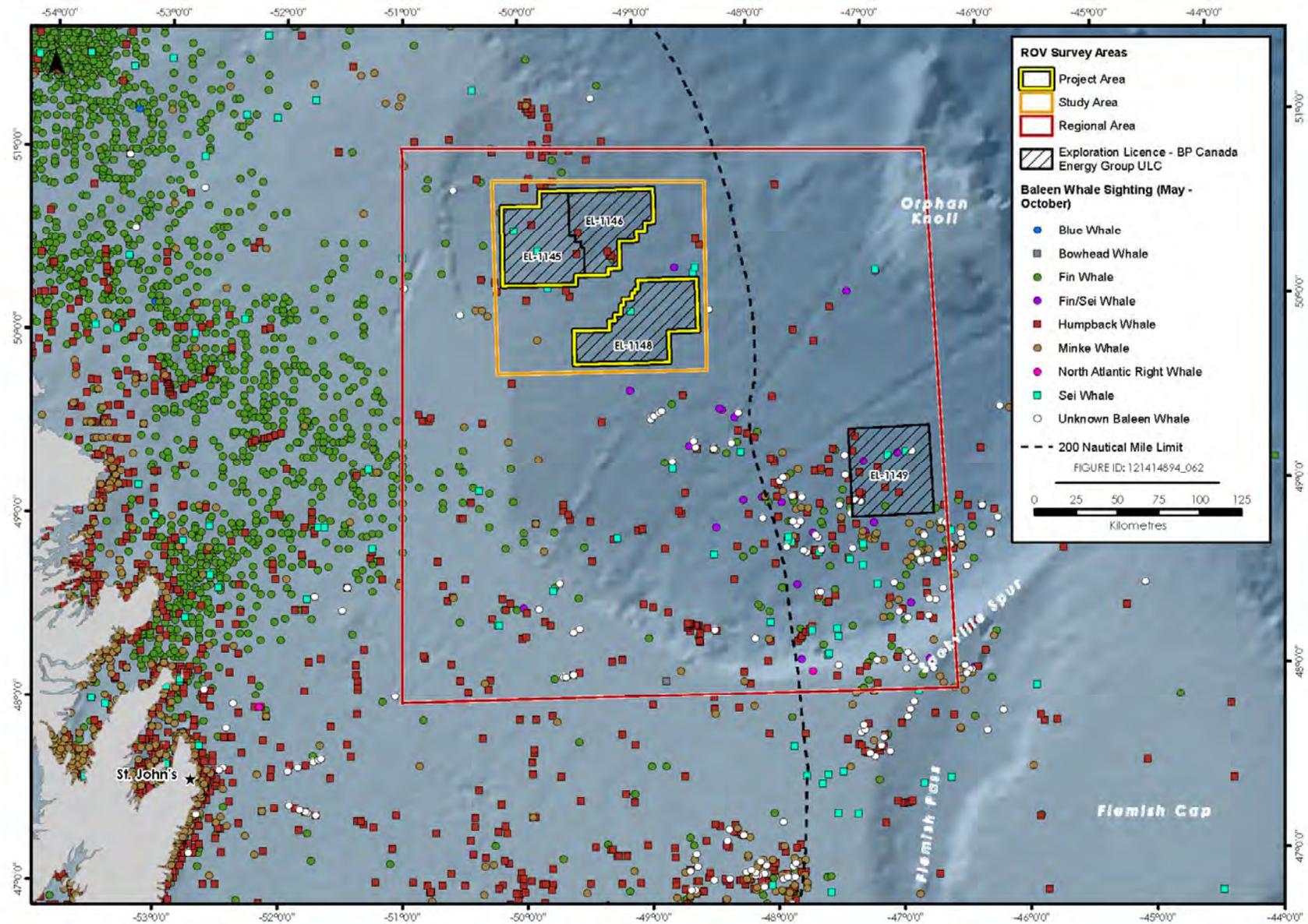


Figure 4.4 Baleen Whale Sightings (May to October) (Compiled from DFO Sightings Database 1947-2015)

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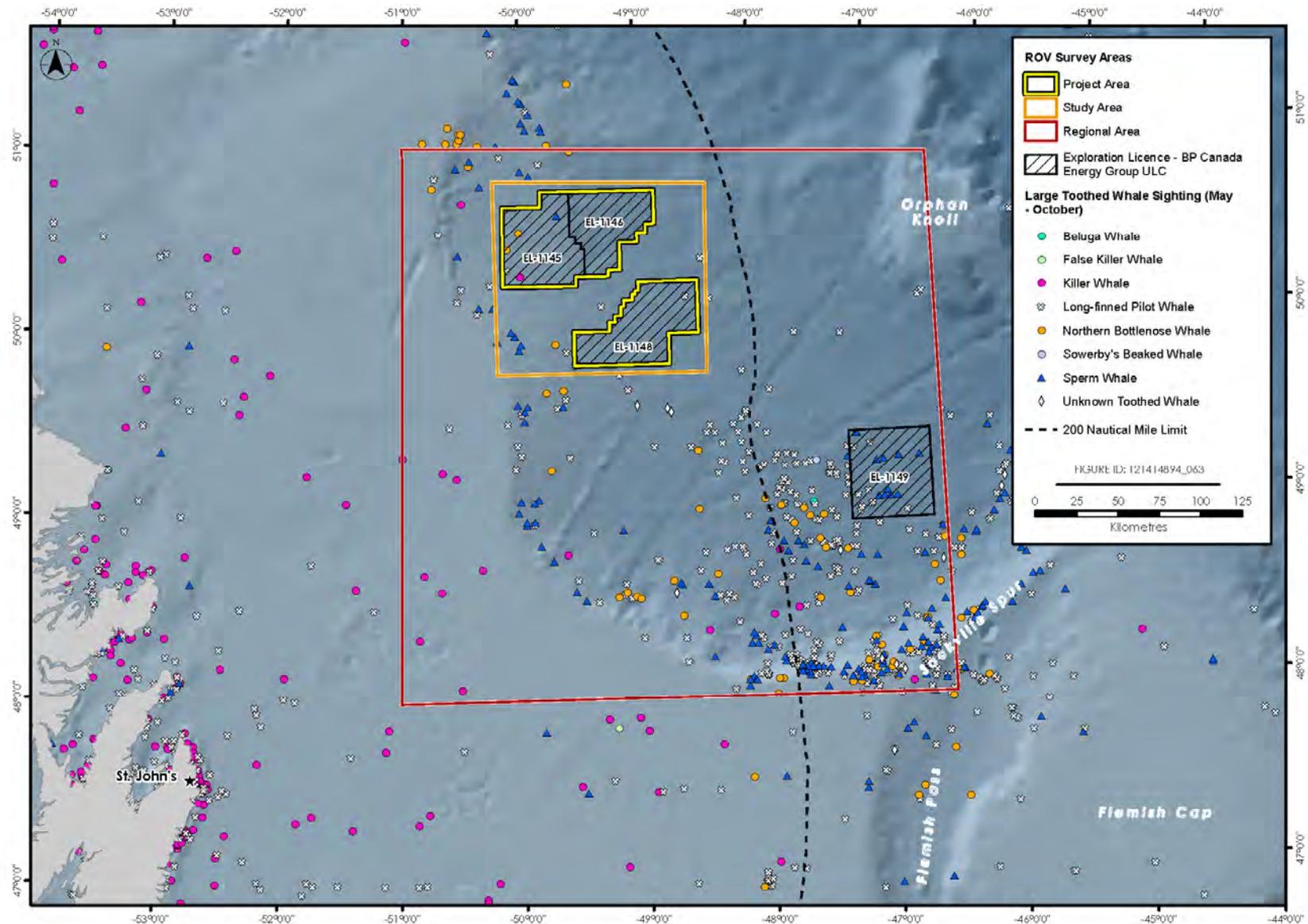


Figure 4.5 Toothed Whale Sightings (May to October) (Compiled from DFO Sightings Database 1947-2015)

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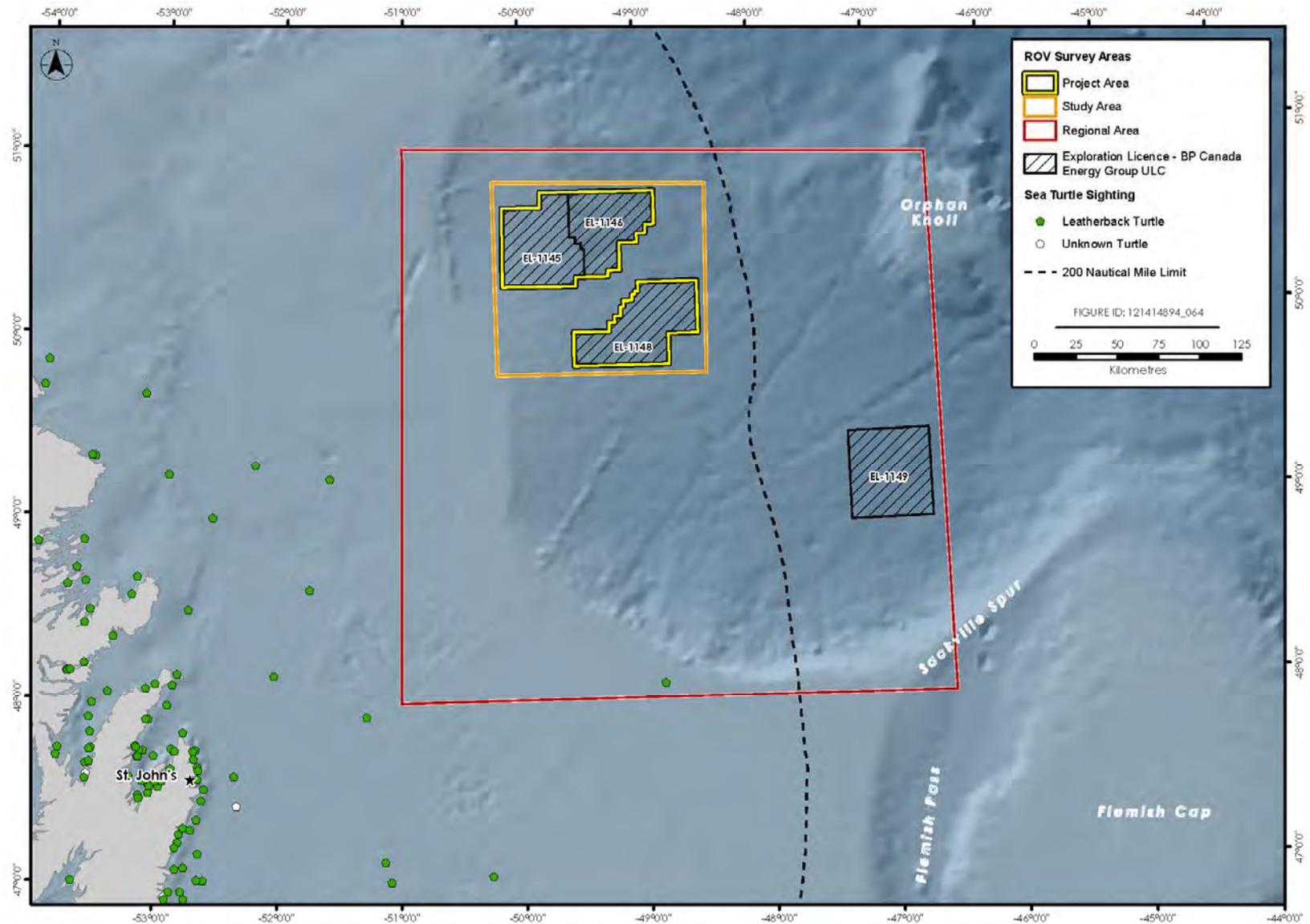


Figure 4.6 Sea Turtle Sightings (May to October) (Compiled from DFO Sightings Database 1947-2015)

4.5 Species at Risk

There are several fish, bird, mammal, and sea turtle species designated at risk that have the potential to occur in the Regional Area or Study Area (refer to Table 4.8) although for most, occurrence in the Study Area and/or Project Area would be uncommon.

Table 4.8 Species at Risk listed under SARA and/or under Consideration by COSEWIC with Potential to Occur within the Study Area

Common Name	Scientific Name	SARA Schedule 1 Status	COSEWIC Designation
Marine Fish			
Acadian redfish	<i>Sebastes fasciatus</i>	Not Listed	Threatened
American eel	<i>Anguilla rostrata</i>	Not Listed	Threatened
American plaice (Newfoundland and Labrador population)	<i>Hippoglossoides platessoides</i>	Not Listed	Threatened
Atlantic bluefin tuna	<i>Thunnus thynnus</i>	Not Listed	Endangered
Atlantic cod (Newfoundland and Labrador population)	<i>Gadus morhua</i>	Not Listed	Endangered
Atlantic halibut	<i>Hippoglossus hippoglossus</i>	Not Listed	Not at Risk
Atlantic salmon (South Newfoundland population)	<i>Salmo salar</i>	Not Listed	Threatened
Atlantic salmon (Gaspé-Southern Gulf of St. Lawrence)	<i>Salmo salar</i>	Not Listed	Special Concern
Atlantic salmon (Outer Bay of Fundy)	<i>Salmo salar</i>	Not Listed	Endangered
Atlantic salmon (Eastern Cape Breton)	<i>Salmo salar</i>	Not Listed	Endangered
Atlantic salmon (Nova Scotia Southern Upland)	<i>Salmo salar</i>	Not Listed	Endangered
Atlantic salmon (Quebec Eastern North Shore population)	<i>Salmo salar</i>	Not Listed	Special Concern
Atlantic salmon (Quebec Western North Shore population)	<i>Salmo salar</i>	Not Listed	Special Concern
Atlantic salmon (Anticosti Island population)	<i>Salmo salar</i>	Not Listed	Endangered
Atlantic wolffish	<i>Anarhichas lupus</i>	Special Concern	Special Concern
Basking shark (Atlantic population)	<i>Cetorhinus maximus</i>	Not Listed	Special Concern
Bigeye tuna	<i>Thunnus thynnus</i>	Not Listed	Not Listed
Blue shark (Atlantic population)	<i>Prionace glauca</i>	Not Listed	Not at Risk
Common lumpfish	<i>Cyclopterus lumpus</i>	Not Listed	Threatened
Cusk	<i>Brosme brosme</i>	Not Listed	Endangered

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Common Name	Scientific Name	SARA Schedule 1 Status	COSEWIC Designation
Deepwater redfish (Northern population)	<i>Sebastes mentella</i>	Not Listed	Threatened
Northern wolffish	<i>Anarhichas denticulatus</i>	Threatened	Threatened
Porbeagle shark	<i>Lamna nasus</i>	Not Listed	Endangered
Roughhead grenadier	<i>Macrourus berglax</i>	Not Listed	Special Concern
Roundnose grenadier	<i>Coryphaenoides rupestris</i>	Not Listed	Endangered
Shortfin mako shark (Atlantic population)	<i>Isurus oxyrinchus</i>	Not Listed	Special Concern
Smooth skate (Funk Island Deep Population)	<i>Malacoraja senta</i>	Not Listed	Endangered
Spotted wolffish	<i>Anarhichas minor</i>	Threatened	Threatened
Thorny skate	<i>Amblyraja radiata</i>	Not Listed	Special Concern
White shark (Atlantic population)	<i>Carcharodon carcharias</i>	Endangered	Endangered
Winter skate (Eastern Scotian Shelf – Newfoundland population)	<i>Leucoraja ocellata</i>	Not Listed	Endangered
Marine Birds			
Red-necked phalarope	<i>Phalaropus lobatus</i>	Not Listed	Special Concern
Ivory gull	<i>Pagophila eburnea</i>	Endangered	Endangered
Ross's gull	<i>Rhodostethia rosea</i>	Threatened	Threatened
Marine Mammals			
North Atlantic right whale	<i>Eubalaena glacialis</i>	Endangered	Endangered
Fin whale	<i>Balaenoptera physalus</i>	Special Concern	Special Concern
Blue whale	<i>Balaenoptera musculus</i>	Endangered	Endangered
Northern bottlenose whale	<i>Hyperoodon ampullatus</i>	Endangered ^a / Not Listed ^b	Endangered ^a / Special Concern ^b
Sowerby's beaked whale	<i>Mesoplodon bidens</i>	Special Concern	Special Concern
Killer whale	<i>Orcinus orca</i>	Not Listed	Special Concern
Harbour porpoise	<i>Phocoena phocoena</i>	Not Listed	Special Concern
Sea Turtles			
Leatherback sea turtle	<i>Dermochelys coriacea</i>	Endangered	Endangered
Loggerhead sea turtle	<i>Caretta caretta</i>	Endangered	Endangered
Notes: a Scotian Shelf population. b Davis Strait-Baffin Bay-Labrador Sea population.			

A summary describing the distribution, habitat and ecology of Species at Risk as listed on SARA Schedule 1 which could potentially occur in the Study Area is provided in Table 4.9.

Table 4.9 Distribution/Habitat/Ecology of SARA Schedule 1 Species at Risk Which Could Potentially Occur in the Study Area

Species	Distribution / Habitat / Ecology
Marine Fish	
Atlantic wolffish (Special Concern)	<p>The Atlantic wolffish is widely distributed across the North Atlantic with the centre of its western Atlantic distribution off the coast of northeast Newfoundland. Offshore Newfoundland, it is found in nearshore waters up to 918 m and is most frequently found in water depths of 150 m to 350 m (DFO 2018a). Unlike northern and spotted wolffish, it has been found in shallower waters on the southern Grand Banks (DFO 2018a). Although larvae are pelagic, adult Atlantic wolffish are relatively sedentary. However, the species can conduct short (few km) seasonal migrations between offshore waters and shallow waters (<120 m deep) for spawning (which occurs in September) (COSEWIC 2012a; DFO 2018a).</p> <p>A Management Plan has been proposed by DFO for the Atlantic wolffish (DFO 2018a).</p>
Northern wolffish (Threatened)	<p>The Northern wolffish inhabits boreal and subarctic waters on both sides of the North Atlantic and in the Arctic. It is most abundant on the shelf off northeastern Newfoundland and in the Labrador Sea, with highest densities at temperatures between 2°C and 5°C. While northern wolffish has been found in water depths ranging from 38 to 1,504 m, it is found mainly between 500 and 1,000 m water depth. Spawning occurs from September through November (COSEWIC 2012b)</p> <p>A Recovery Strategy has been proposed by DFO for the northern wolffish that includes proposed critical habitat designation. This proposed critical habitat for northern wolffish overlaps with the Study Area (DFO 2018a).</p>
Spotted wolffish (Threatened)	<p>Spotted wolffish are found on both sides of the North Atlantic and in the Arctic Ocean. They typically occupy water depths between 200 and 750 m on the continental shelf or in deep trenches. Mating likely occurs in the summer and fertilization is internal. Eggs are deposited on the bottom. Larvae are pelagic; juveniles and adults occupy bottom water (COSEWIC 2012c).</p> <p>A Recovery Strategy has been proposed by DFO for the spotted wolffish that includes proposed critical habitat designation. This proposed critical habitat for spotted wolffish occurs within the Regional Area (DFO 2018a).</p>
White shark (Endangered)	<p>The white shark is found in sub-polar to tropical seas of both hemispheres. In Atlantic Canada, it has been recorded from the Northeast Newfoundland Shelf to the Bay of Fundy. Canadian waters represent the northern fringe of the white shark’s range. In the water column it can be found from just below the surface to just above the bottom, down to depths of least 1,200 m. Possible white shark pupping areas in the Atlantic Ocean have been identified in the Mid-Atlantic Bight (COSEWIC 2006a).</p>
Marine and/or Migratory Birds	
Ross’s gull (Threatened)	<p>Ross’s gulls nesting in the Canadian Arctic that have been tagged with geolocators and satellite transmitters have been tracked to a wintering area that reaches from the Labrador Sea to Orphan Basin (Maftei et al. 2015). As a result, this species may be expected to be present in very small numbers in the Regional Area during winter. This species is not likely to be encountered during Project activities due to the planned timing of the survey (May to October).</p> <p>A Recovery Strategy (Environment Canada 2007) has been prepared for this species, although critical habitat has not yet been identified.</p>

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Species	Distribution / Habitat / Ecology
Ivory gull (Endangered)	<p>Ivory gulls nesting in the Canadian Arctic and Greenland and fitted with satellite transmitters wintered from Baffin Bay to the Northeast Newfoundland Shelf (Gilg et al. 2010; Spencer et al. 2016). Individuals from those two nesting populations comprise most of the world’s population, so this wintering area has global importance for this species. Ivory gulls were recorded twice during bird surveys at the Bay de Verde Wellsite in the winter of 2014-2015 (Statoil 2015). Ivory gull can be expected to occur in small numbers in the Regional Area during periods when sea ice is present (i.e., late winter and early spring). It probably occurs irregularly south of 50°N among the ice pack during heavier ice years.</p> <p>A Recovery Strategy (Environment Canada 2014) identified critical habitat for Ivory Gull at breeding colonies in Nunavut. Additional critical habitat is to be identified in a future Action Plan for the species.</p>
Marine Mammals	
Blue whale (Endangered)	<p>The blue whale is the largest animal on the planet and is found in all oceans of the world. Blue whales became severely depleted during industrial whaling and still occur at relatively low densities in the North Atlantic. It has been estimated that 400-600 whales may be found in the western North Atlantic (Waring et al. 2011). There are no sightings of blue whales in the Study Area based on the DFO sightings database (1947-2015).</p> <p>The latest proposed Action Plan for the Northwest Atlantic population of the blue whale (DFO 2018b) recommends recovery objectives intended to increase knowledge of the population, its habitat and threats, and implement measures to mitigate threats (e.g., underwater sound, vessel collisions, spills). No critical habitat has yet been defined for the Northwest Atlantic blue whale.</p>
North Atlantic right whale (Endangered)	<p>In the western North Atlantic, the right whale can be found from Florida to Newfoundland and the Gulf of St. Lawrence. Two-thirds of the North Atlantic population can be found on the Scotian Shelf and Bay of Fundy in summer and fall, with smaller numbers reported in the Gulf of St. Lawrence (COSEWIC 2013). In spite of being the first whale to receive total international protection from hunting in 1937, the population size of North Atlantic right whales remains low. The current best estimate is 451 animals and this number has been declining since 2010 (Pace et al. 2017; Pettis et al. 2017). Between June and September 2017, 12 dead North Atlantic right whales were reported in the Gulf of St. Lawrence. Necropsies were performed on seven of the whales and it was determined that the cause of death was blunt trauma in four instances and drowning as a result of entanglement in two instances. The cause of death could not be determined in the case of one whale for which post-mortem decomposition was very advanced (Daoust et al. 2017). In addition to these mortalities, additional entanglements were reported within the same timeframe (Daoust et al. 2017). The North Atlantic right whale would be considered a rare visitor to the Regional Area, with one recorded sighting of two individual right whales south of the Regional Area in the DFO sightings database near the Flemish Cap.</p> <p>A Recovery Strategy (DFO 2014) and proposed Action Plan (DFO 2016a) to achieve objectives in the recovery strategy have been developed for the North Atlantic right whale in Atlantic Canada waters. Critical habitat for this species has been designated in the Grand Manan Basin (Bay of Fundy) and Roseway Basin (off southwestern Nova Scotia).</p>

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Species	Distribution / Habitat / Ecology
Fin whale (Special Concern)	<p>Fin whales are found in all the oceans of the world, except the Arctic Ocean. Fin whales breed and calve in winter at lower latitudes (DFO 2017a). The North Atlantic population inhabits eastern Canadian coastal waters, mostly in summer (DFO 2017a). Fin whales are expected to be common throughout the Study Area and Regional Area, particularly between June and August.</p> <p>In 2017, DFO released a Management Plan for the fin whale (DFO 2017a).</p>
Northern bottlenose whale (Scotian Shelf population) (Endangered)	<p>The northern bottlenose whale is found only in the North Atlantic, primarily in offshore waters. The Scotian Shelf population of northern bottlenose whale is the only endangered population. Individuals from this population are found regularly between the Gully, Shortland Canyon, and Haldimond Canyon offshore Nova Scotia (DFO 2016b).</p> <p>There have been sightings of northern bottlenose whale recorded in the Project Area in the DFO sightings database between May and September. However, it is likely that these individuals sighted are associated with the Davis Strait-Baffin Bay-Labrador Sea population (which is not listed on SARA Schedule 1). Northern bottlenose whales from the endangered Scotian Shelf population are expected to be uncommon in the Study Area.</p> <p>A recovery strategy was amended, and an action plan was proposed for the Scotian Shelf population of northern bottlenose whale, updating critical habitat measures (DFO 2016b, 2017b).</p>
Sowerby's beaked whale (Special Concern)	<p>To date, there is little information known on Sowerby's beaked whale in the waters of offshore Newfoundland and Labrador. The majority of information that has been gathered is based on strandings records (Lien and Barry 1990, in Husky 2012). Sowerby's beaked whales are also relatively difficult to detect at sea due to their short surface durations, apparent offshore distribution, and barely detectable blows (Hooker and Baird 1999a, in Husky 2012). They have most often been observed in deep waters and continental shelf edges or slopes (Kenney and Winn 1987, in Husky 2012; COSEWIC 2006b) and presumably make deep dives to forage on medium to large-bodied squid (COSEWIC 2006b).</p> <p>There is one sighting of four Sowerby's beaked whales in the Regional Area in the DFO sightings database (Figure 4.5). The sighting of four individuals was made during a seismic survey in Orphan Basin in September 2005 (Moulton et al. 2006). There are also several stranding records for Newfoundland and Labrador (DFO 2017c). It is considered rare in the Study Area.</p> <p>In 2017, DFO released a management plan for Sowerby's beaked whale (DFO 2017c).</p>
Sea Turtles	
Leatherback sea turtle (Endangered)	<p>Leatherback turtles outfitted with satellite telemetry tags and vessel-based sightings have been reported in the offshore waters off Nova Scotia and Newfoundland (Stewart et al. 2013; Dodge et al. 2014; Archibald and James 2016; Chambault et al. 2017). As of 2006, there were an estimated 34,000-94,000 adult leatherback sea turtles throughout the North Atlantic (TEWG 2007). While the size of the seasonal foraging population in Atlantic Canada is not known, sightings data suggest that the population in Canadian Atlantic waters numbers in the thousands (COSEWIC 2012d). Archibald and James (2016) suggested that Canadian waters may have the highest density of foraging leatherbacks anywhere throughout their range.</p> <p>Although critical habitat has not yet been designated for this species in Atlantic Canadian waters (ALTRT 2006), areas previously identified as important foraging habitat have now been identified in the proposed recovery strategy as critical habitat areas for leatherbacks (DFO 2016c). Three proposed critical habitat areas have been identified:</p>

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Species	Distribution / Habitat / Ecology
	<p>(1) the Southwestern Scotian Slope Area, (2) the Gulf of St. Lawrence-Laurentian Channel Area, and (3) the Placentia Bay Area (DFO 2016c). The main threat facing leatherback sea turtles in Canadian waters is bycatch in fisheries, although globally, the species is threatened by ship strikes, marine debris, and oil and gas exploration (COSEWIC 2012d). Hamelin et al. (2017) reported several incidental captures of leatherback sea turtles in fishing gear in the waters off Newfoundland, including on the Grand Banks.</p> <p>There are no sightings of leatherback turtles within the Study Area and only one recorded sighting in the Regional Area (Figure 4.6). However, some leatherback sea turtles have been observed to the south and west of the Regional Area. Occurrence of leatherback sea turtles in the Study Area would be considered rare.</p>
<p>Loggerhead sea turtle (Endangered)</p>	<p>The loggerhead sea turtle is widely distributed in the Atlantic, Pacific, and Indian Oceans. Nesting populations along the southeast United States and Caribbean coast of Mexico can be found in Atlantic Canada, primarily in offshore waters (COSEWIC 2010). There are no sightings of loggerhead turtles within the Project/Study/Regional Area in the DFO sightings database. Occurrence of loggerhead sea turtles in the Project Area would be considered rare.</p> <p>No Management Plan or Recovery Strategy has been published for the loggerhead sea turtle.</p>

There is no designated critical habitat within the Study Area or Regional Area, however, the Northern Grand Banks encompasses an area designated as *proposed* critical habitat for northern and spotted wolffish. The proposed northern wolffish critical habitat overlaps the Study Area along a portion of the Northeast Newfoundland Slope (refer to Figure 4.7).

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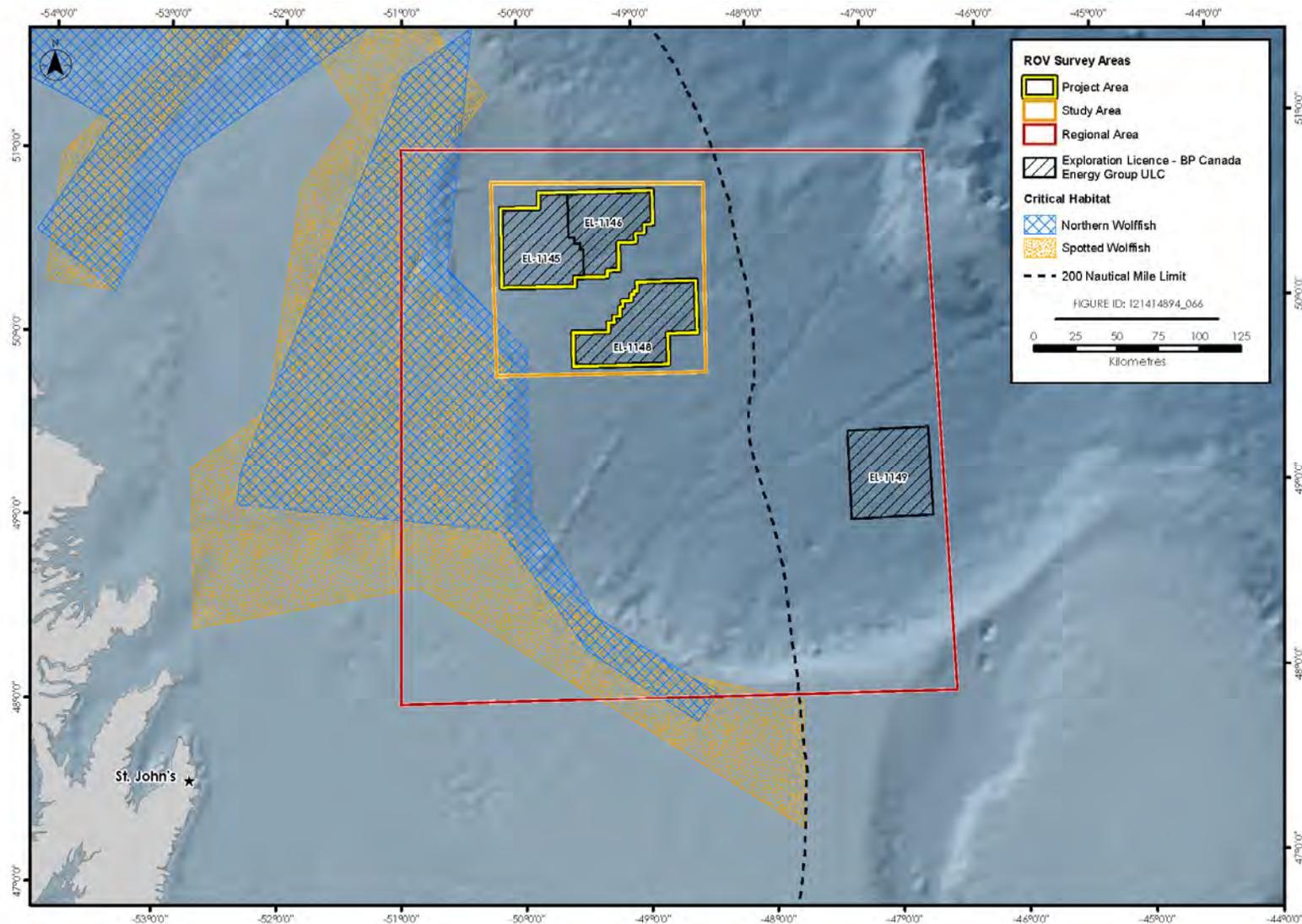


Figure 4.7 Proposed Critical Habitat for Northern and Spotted Wolffish

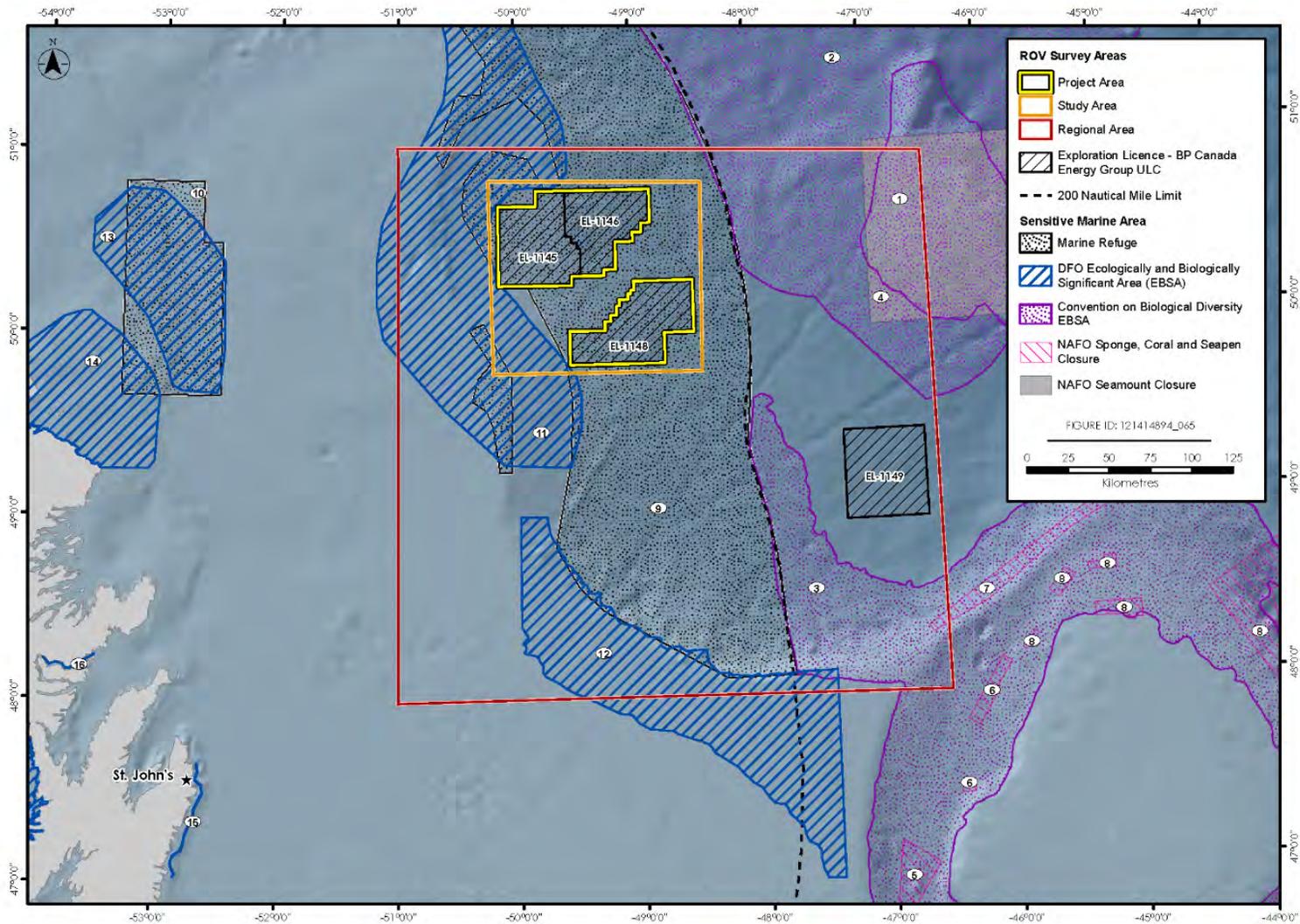
4.6 Sensitive Areas

There are several areas in Newfoundland and Labrador waters that are protected under federal, provincial or international legislation or programs because they are considered to be important for ecological, historical, or socio-economic reasons. Within the Regional Area, these sensitive areas include Ecologically and Biologically Significant Areas (EBSAs) and a *Fisheries Act* marine refuge (refer to Figure 4.8 and Table 4.10).

Table 4.10 Sensitive Areas within or Adjacent to the Regional Area

Number	Name	Special Area Type
1	Orphan Knoll	CBD Identified EBSA
2	Seabird Foraging Zone in the Southern Labrador Sea	CBD Identified EBSA
3	Slopes of the Flemish Cap and Grand Bank	CBD Identified EBSA
4	Orphan Knoll	NAFO Seamount Closure
5	Flemish Pass / Eastern Canyon	NAFO Sponge, Coral and Seapen Closure
6	Northwest Flemish Cap	NAFO Sponge, Coral and Seapen Closure
6	Northwest Flemish Cap	NAFO Sponge, Coral and Seapen Closure
7	Sackville Spur	NAFO Sponge, Coral and Seapen Closure
8	Northwest Flemish Cap	NAFO Sponge, Coral and Seapen Closure
8	Northwest Flemish Cap	NAFO Sponge, Coral and Seapen Closure
8	Northwest Flemish Cap	NAFO Sponge, Coral and Seapen Closure
8	Northwest Flemish Cap	NAFO Sponge, Coral and Seapen Closure
8	Northeast Flemish Cap	NAFO Sponge, Coral and Seapen Closure
9	Northeast Newfoundland Slope	Marine Refuge
10	Funk Island Deep	Marine Refuge
11	Orphan Spur	DFO EBSA
12	Northeast Shelf and Slope	DFO EBSA
13	Notre Dame Channel	DFO EBSA
14	Fogo Shelf	DFO EBSA
15	Eastern Avalon	DFO EBSA
16	Smith Sound	DFO EBSA

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Note: Refer to Table 4.10 for key.

Figure 4.8 Sensitive Areas

EBSAs have been identified by DFO to emphasize marine areas with high ecological or biological activity relative to their surrounding environment (DFO 2005). Outside Canada's exclusive economic zone (EEZ), the Conference of the Parties to the Convention on Biological Diversity (CBD) has identified additional EBSAs. The Project Area overlaps with only one EBSA – the Orphan Spur EBSA (4,688 km² co-occurrence, or 22% of the total area of the Orphan Spur EBSA). The Orphan Spur EBSA is recognized as having a high concentration of corals as well as high densities of sharks and species of conservation concern (e.g., northern, spotted and striped wolffish, skates, roundnose grenadier, American plaice, redfish). Within the greater Regional Area, potential transit route of the survey vessel (one planned round trip for the survey) would intersect the Northeast Shelf and Slope EBSA, which is recognized as having high aggregations of Greenland halibut and spotted wolffish, and concentrations of cetaceans, pinnipeds, and corals (Amec 2014).

The Northeast Newfoundland Slope Closure marine refuge is the only marine refuge within the Regional Area and it intersects with the Project Area (24,460 km² of co-occurrence, or 44% of the total area of the marine refuge). This marine refuge was designated in December 2017 and closed to bottom contact fishing to help prevent damage to corals and sponges.

4.7 Fisheries and Other Ocean Users

Commercial fishing activity occurs in the waters of offshore Newfoundland and Labrador, including areas that overlap the Study Area and larger Regional Area. The large portion of commercial fishing activity occurs on the Grand Banks, and along the continental shelf break. This includes areas of the shelf break that overlap with the Study Area.

The Project Area and Study Area are both contained within NAFO Unit Area 3Kg. The larger Regional Area encompasses 3Kg, 3Ld, 3Le, and a portion of 3Kk. DFO maintains jurisdiction over commercial fish species within Canada's 200 nm EEZ and all sedentary species that occur across the extent of Canada's continental shelf. Outside of the EEZ, NAFO holds jurisdiction over commercial fishing activity for several species and manages the conservation of other environmental features like corals and sponges.

Key fisheries species harvested in the Project Area (3Kg) between 2012 and 2016 included Greenland halibut, snow crab, shrimp, and redfish. Table 4.11 displays publicly available data for landings weight between 2012 and 2016, in order to help distinguish the more common fisheries occurring within the Regional Area during this period. Until the early 1990s, the commercial fisheries in the Regional Area were dominated by groundfish (e.g., Atlantic cod, redfish, American plaice). Since the moratoria declared in 1992, northern shrimp, snow crab and turbot have become the principal harvest in the Regional Area (96% to 99%), with small amounts of roughhead grenadier, sea scallop, and redfish comprising the remainder (LGL Limited 2005, 2009, 2012).

Table 4.11 Offshore Harvest by Species within Unit Areas 3Kg, 3Ld, 3Le, and 3Kk, 2012 to 2016, Annual Weight (t)

Species	2012	2013	2014	2015	2016	Total	Percent of Total
Turbot/Greenland Halibut	2181	1845	1843	1510	1847	9226	44
Crab, Queen/Snow	1143	1373	1253	1434	2984	8188	39
Shrimp, <i>Pandalus Borealis</i>	1676	1372	361	222	78	3710	18
Redfish	14	10	1	1	2	27	<0.1
Grenadier, Roughhead	7	0	0	0	0	7	<0.1
Halibut – Atlantic	0	0	0	0	0	2	<0.01
Skate	1	0	0	0	0	1	<0.01
Greysole/Witch Flounder	1	0	0	0	0	1	<0.01
American Plaice	0	0	0	0	0	0	0
Heads, Groundfish	0	0	0	0	0	0	0
Cod, Atlantic	0	0	0	0	0	0	0
Capelin	0	0	0	0	0	0	0
Herring, Atlantic	0	0	0	0	0	0	0
Argentine	0	0	0	0	0	0	0
Shrimp, <i>Pandalus Montagu</i>	0	0	0	0	0	0	0
Mackerel	0	0	0	0	0	0	0
Catfish (Striped /Wolfish)	0	0	0	0	0	0	0
Shark, Mako	0	0	0	0	0	0	0
Shark, Unspecified	0	0	0	0	0	0	0
Note: '0' denotes species had been fished although due to confidentiality reasons, data has been suppressed. Source: DFO 2018c							

Snow crab and northern shrimp constitute most landings, in offshore Newfoundland and Labrador, and internationally. Other prominent species harvested include groundfish such as Greenland halibut, Atlantic halibut, deepwater redfish, and flounder. Within the Project Area, domestic commercial fishing activity appears to be focused primarily on groundfish species, along with northern shrimp and snow crab.

Most of these species are fished using bottom trawls for groundfish, and modified trawls designed for shrimp harvesting. Snow crab are harvested using fixed crab pots that are laid on the seabed and marked at the surface by a buoy. Snow crab fishing occurs during late spring and into the summer months, usually from April to August. Other fisheries are typically year-round, with most fishing taking place in the summer months due to relatively higher productivity.

Figure 4.9 shows commercial fisheries harvesting locations in the Regional Area for the months of May to October based on 2012 to 2016 landings data from DFO. Figures 4.10 and 4.11 shows the harvesting locations for fixed gear and mobile gear, respectively, during the same period.

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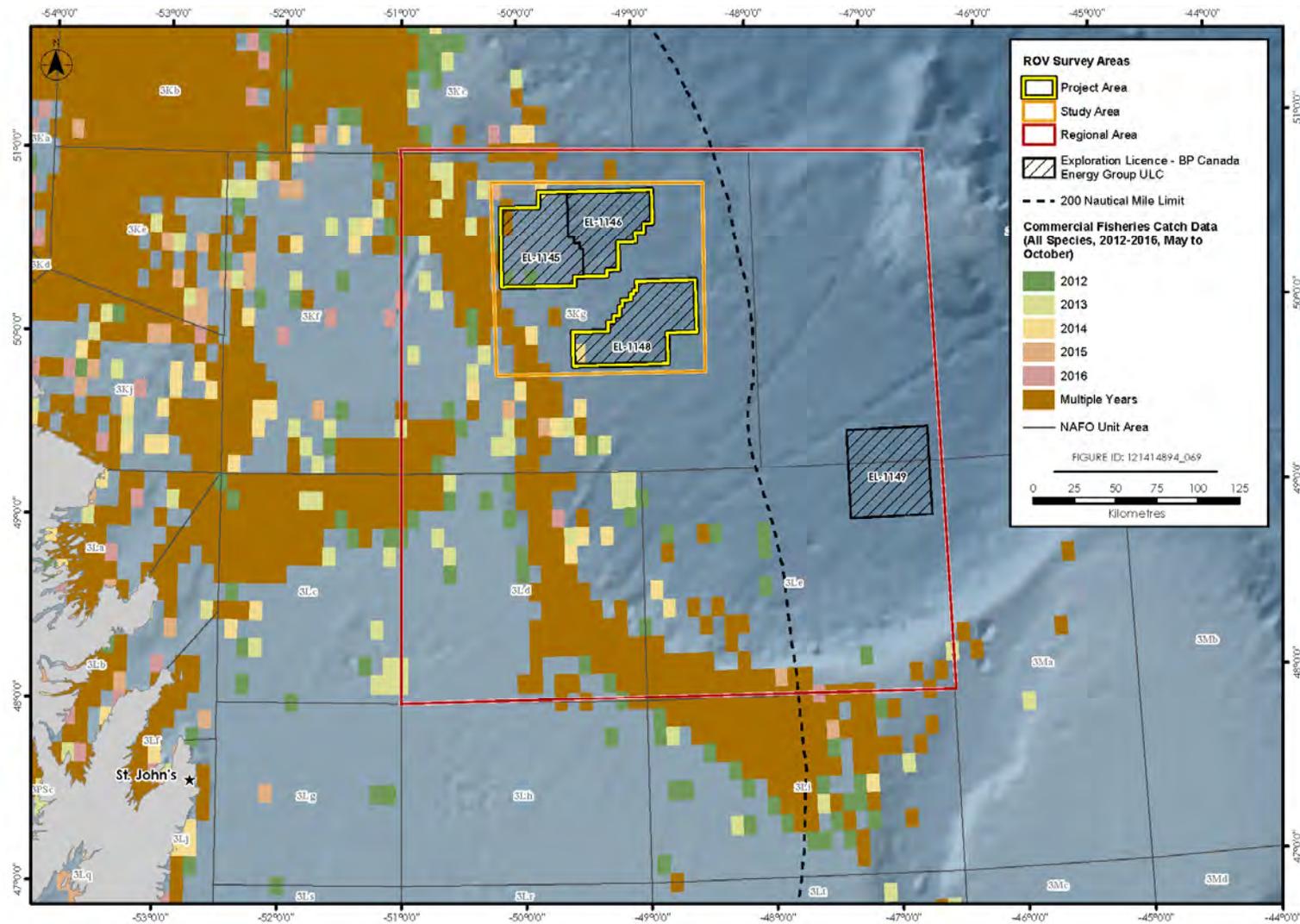


Figure 4.9 Domestic Harvesting Locations, All Species (May to October 2012-2016)

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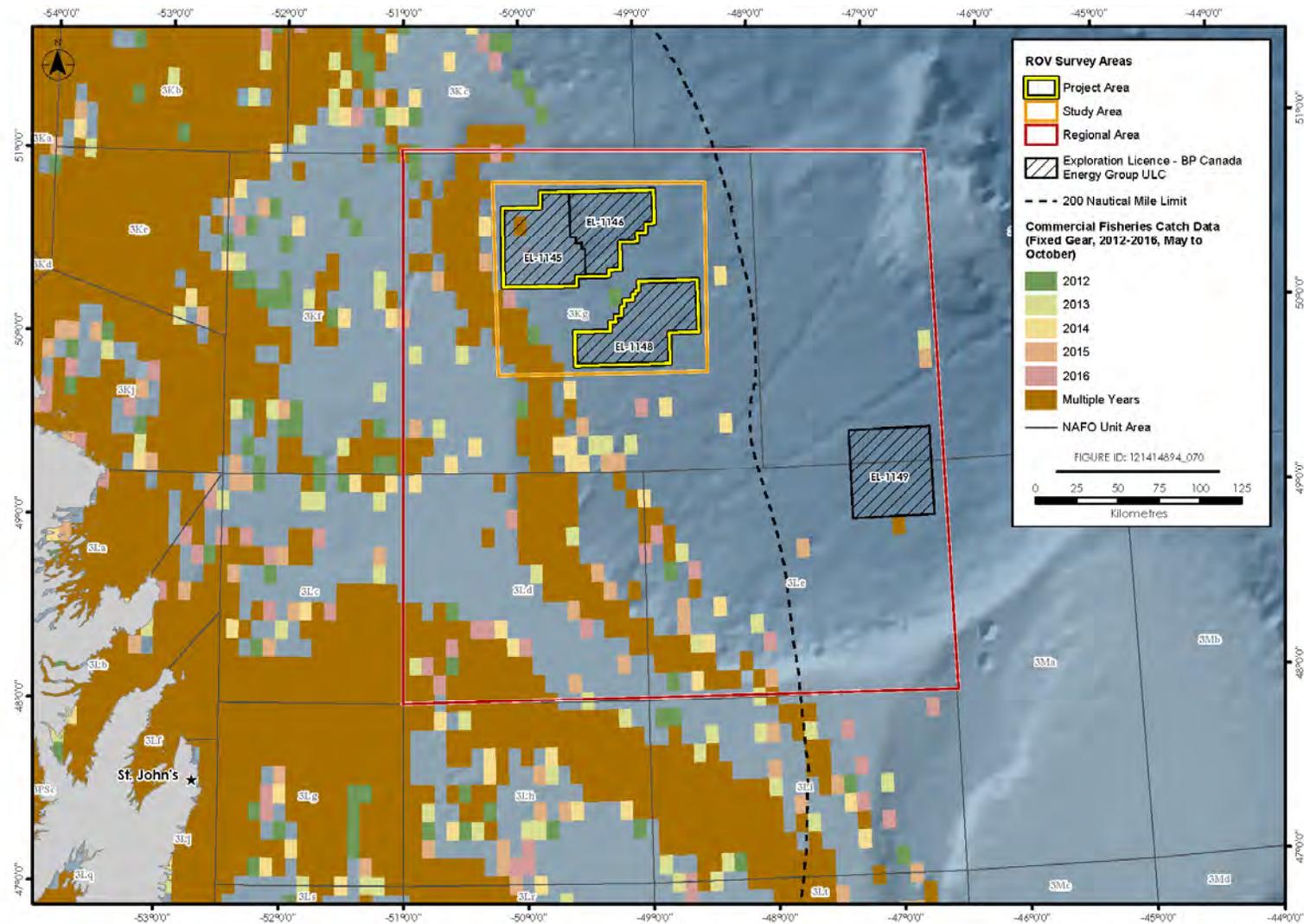


Figure 4.10 Domestic Harvesting Locations – Fixed Gear (May to October 2012-2016)

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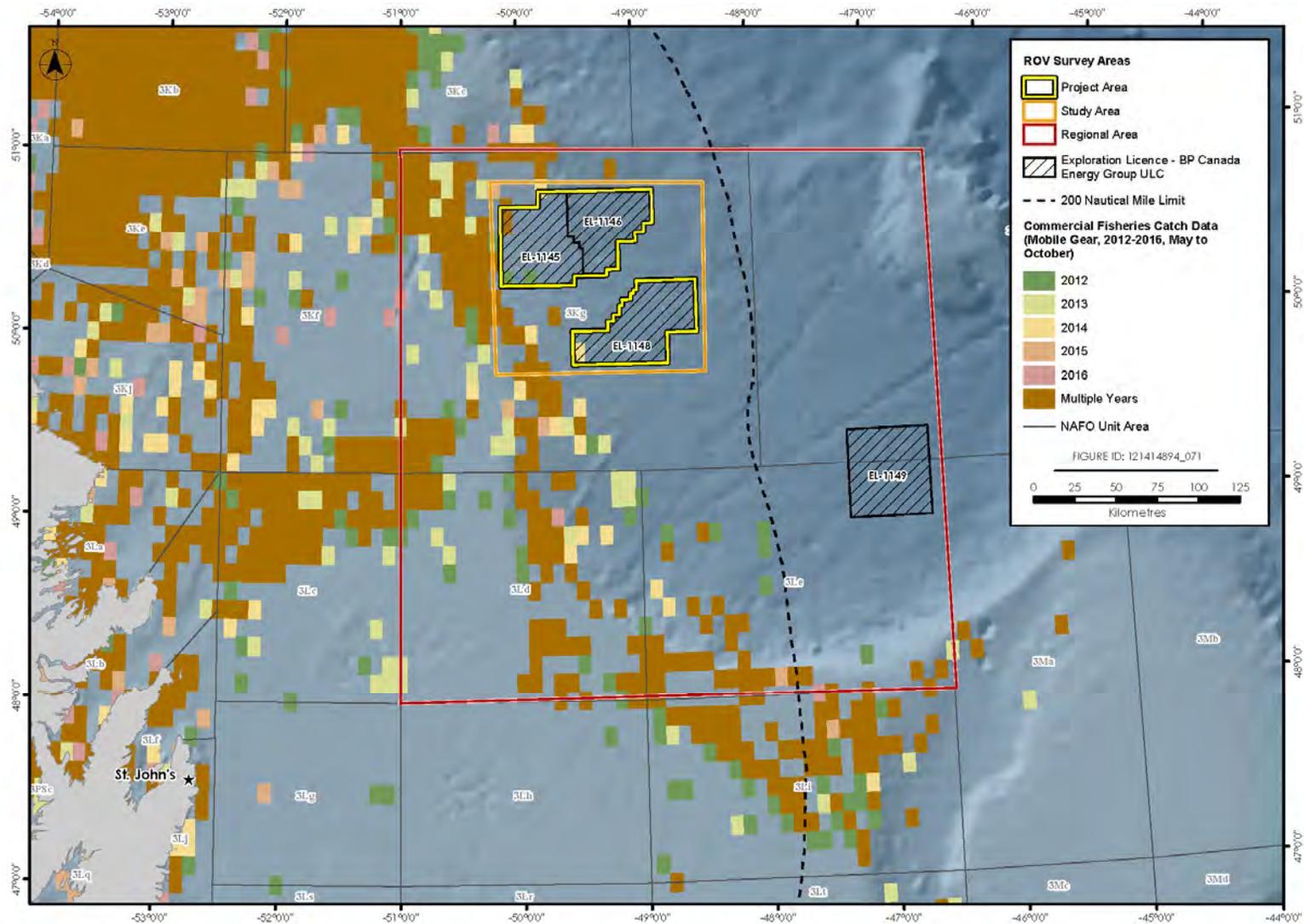


Figure 4.11 Domestic Harvesting Locations – Mobile Gear (May to October 2012-2016)

The Project Area (ELs 1145, 1146, and 1148) overlaps with a marine refuge area, the Northeast Newfoundland Slope Closure. Within this area, bottom contact fishing activity has been prohibited.

BP is not aware of any FSC fishing or harvesting occurring within the Project Area, but is aware of the potential presence of species in the Project Area that may be harvested by Indigenous peoples outside the Project Area, including Atlantic salmon, American eel, swordfish, and tuna. Birds and seals that could occur in the Project Area may also be harvested by Indigenous peoples for FSC purposes.

In addition to commercial fisheries, other ocean uses in the Regional Area include: marine research; marine transportation (e.g., shipping, marine tourism, small craft harbours); other offshore oil and gas exploration; military operations; and existing subsea infrastructure (e.g., subsea cables). There are no registered aquaculture operations in or near the Project Area. Marine research activities taking place in the waters offshore Newfoundland relate primarily to biophysical research being carried out by DFO and fishing industry partners. St. John's Harbour is one of the busiest ports on the east coast of Newfoundland, with the oil and gas industry historically accounting for the largest number of vessels entering the harbour.

Oil and gas is a well-established industry in the province, with exploration activities beginning in the 1960s and production activities occurring since 1997. There are currently four producing oil fields on the Grand Banks of Newfoundland: Hibernia; Terra Nova; White Rose; and Hebron. Exploration drilling and geophysical surveys (e.g., seismic) continue to be a large component of offshore oil and gas related activity for the province.

5.0 ENVIRONMENTAL ASSESSMENT METHODS

This EA Report has been prepared to meet requirements in the Scoping Document (C-NLOPB 2019) and has been scoped appropriately to correlate with the level of predicted environmental interaction, focusing on key issues and potential effects.

5.1 Valued Components

Based on the Scoping Document (C-NLOPB 2019), the Valued Components (VC), as presented in Table 5.1 have been identified as requiring assessment of potential environmental effects.

Table 5.1 Selection of VCs and Scoping Considerations

VC	VC Rationale and Scoping Considerations
Marine Fish and Fish Habitat	<p>Marine Fish and Fish Habitat includes fish and invertebrates (including corals and sponges) as well as essential (spawning, feeding, overwintering) habitat that may be affected by Project activities.</p> <p>Marine Fish and Fish Habitat was selected as a VC in consideration of the ecological value provided to marine ecosystems, the socio-economic and cultural importance of fisheries resources, the potential for interactions with Project activities, regulatory considerations, and requirements in the Scoping Document.</p> <p>The survey vessel will generate emissions including underwater sound and light emissions, and effluent discharges (in accordance with MARPOL) which could potentially result in sensory disturbance and localized water quality effects. Accidental events (e.g., diesel spill) could potentially result in injury or mortality to fish and degradation of fish habitat.</p>
Marine and/or Migratory Birds	<p>Marine and/or Migratory Birds includes oceanic, neritic and littoral zone seabirds, waterfowl, loons, grebes, and shorebirds protected under the <i>Migratory Birds Convention Act, 1994</i> (MBCA) and additional marine-associated birds not protected under the MBCA (i.e., cormorants).</p> <p>Marine and/or Migratory Birds was selected as a VC due to their ecological value to marine and coastal ecosystems, the economic and cultural importance of recreational and subsistence hunts, vulnerability to artificial light attraction, vulnerability to oil on water, regulatory considerations, and requirements in the Scoping Document.</p> <p>The survey vessel will be operating on a 24-hour basis and therefore will require night lighting, which could attract birds and potentially lead to strandings. Effluent discharges from the vessel (including sewer and /or food waste) could also potentially attract birds.</p>
Marine Mammals and Sea Turtles	<p>The Marine Mammal and Sea Turtle VC includes baleen whales, toothed whales, dolphins, porpoises, seals, and sea turtles that could potentially be affected by Project activities.</p> <p>Marine mammals and sea turtles were selected as a VC in recognition of important habitat for these species in the offshore waters of Newfoundland and Labrador, the cultural and recreational value placed on these species by Indigenous peoples and the general public, the potential vulnerability of marine mammals to underwater sound and vessel movement, regulatory considerations, and requirements in the Scoping Document.</p> <p>Marine mammals and sea turtles may experience sensory disturbance as a result of underwater sound emissions from the survey vessel or be at risk of collision with the survey vessel resulting in injury or mortality.</p>
Species at Risk	<p>The Species at Risk VC includes species listed on Schedule 1 of SARA and species assessed as at risk by the COSEWIC. There are various fish, bird, mammal, and sea turtle species at risk that could occur in the Regional Area and potentially be affected by Project activities. There is no designated critical habitat for species at risk in the Regional Area, although critical habitat for the northern and spotted wolffish has been proposed on the Northern Grand Banks, including along a portion of the Northeast Newfoundland Slope, which overlaps with the Project Area.</p> <p>Species at Risk were selected as a VC in recognition of their ecological value to marine ecosystems, vulnerability to disturbance, regulatory considerations, and requirements in the Scoping Document.</p> <p>Potential interactions between Species at Risk and Project activities are as described previously for marine fish, marine and/or migratory birds, and marine mammals and sea turtles.</p>
Sensitive Areas	<p>The Sensitive Areas VC includes areas designated as being of special interest due to their ecological and/or conservation value. This VC includes but is not limited to protected areas designated under federal legislation (e.g., <i>Oceans Act, Fisheries Act</i>) as well as EBSAs. Of particular relevance to this VC is the Northeast Newfoundland Slope closure, which is a marine refuge closed to bottom contact fishing to protect corals and sponges and overlaps the Project Area.</p>

VC	VC Rationale and Scoping Considerations
Fisheries and Other Ocean Users	<p>Fisheries and Other Ocean Users is considered a VC because of the commercial and cultural importance fishing has for the province of Newfoundland and Labrador, and the importance of other ocean activities such as offshore research, subsea communications, military training, and shipping activities that occur in offshore waters.</p> <p>Project activities have limited potential to interact with fisheries and other ocean users provided that the location and timing of survey activities is communicated in advance with fisheries stakeholders and other ocean users to avoid space conflicts and a compensation program is implemented in the unlikely event of gear and/or vessel damage as an accidental event.</p>

5.2 Boundaries

5.2.1 Spatial Boundaries

Section 2.2 describes the spatial boundaries of the Project, including corner coordinates of the ELs within which specific survey locations would be located. Since survey locations would be contained within these ELs, the ELs represent the Project Area. A 10 km buffer has been added to delineate a contiguous Study Area; this buffer would also accommodate movement of the survey vessel between Project Area locations. A larger Regional Area is delineated to provide context for physical, biological, and socio-economic components assessed within this EA Report. Figure 2.1 shows the location of spatial boundaries considered in this EA Report.

5.2.2 Temporal Boundaries

The Project is planned to be conducted between May and October 2019 pending authorization from the C-NLOPB, although it is possible that ROV video surveys could be conducted within ELs 1145, 1146, and/or 1148 between 2019 and 2024 during the May to October timeframe. It is estimated that a survey would take approximately 7-10 days to complete.

5.3 Project Interactions

BP is proposing to conduct a video survey of the seabed using an ROV operated from a survey vessel. Key interactions relate to underwater sound, light emissions and discharges from the survey vessel, risk of collision of a marine mammal or sea turtle with the survey vessel, and accidental spill of diesel fuel from the vessel. The conduct of the video survey by the ROV is predicted to have minimal environmental interactions, with the exception of underwater sound and light emissions, which could potentially result in localized attraction or avoidance by benthic fish species. Potential Project-VC interactions are identified in Table 5.2.

Table 5.2 Project-VC Interaction

Activity	Marine Fish and Fish Habitat	Marine and/or Migratory Birds	Marine Mammals and Sea Turtles	Species at Risk	Sensitive Areas	Fisheries and Other Ocean Users
Operation of a Survey Vessel	X	X	X	X	X	X
Seabed Video Survey	X	-	X	X	X	-
Accidental Hydrocarbon Release from Survey Vessel	X	X	X	X	X	X
Notes: "X" means potential interaction "- " means interaction not likely						

5.4 Significance Criteria

Significance criteria establish a threshold beyond which a residual environmental effect (after mitigation has been applied) will cause a change that will alter the status or integrity of a VC beyond an acceptable level. Where pre-established standards or thresholds do not exist, significance criteria have been defined qualitatively and justifications for the criteria provided. For this EA Report, significance criteria for each VC is provided in Table 5.3.

Table 5.3 VC Significance Criteria

VC	Significance Criteria
Marine Fish and Fish Habitat	A significant adverse residual effect on Marine Fish and Fish Habitat is defined as a Project-related environmental effect that: <ul style="list-style-type: none"> causes a detectable decline in abundance or change in distribution of fish populations within the Regional Area, such that a natural recruitment may not re-establish the population(s) to its original level within one generation.
Marine and/or Migratory Birds	A significant adverse residual environmental effect on Marine and/or Migratory Birds is defined as a Project-related environmental effect that: <ul style="list-style-type: none"> causes a detectable decline in abundance or change in the spatial and temporal distribution of marine and migratory birds within the Regional Area, such that natural recruitment may not re-establish the population(s) to its original level within one generation.
Marine Mammals and Sea Turtles	A significant adverse residual environmental effect on Marine Mammals and Sea Turtles is defined as a Project-related environmental effect that: <ul style="list-style-type: none"> causes a detectable decline in abundance or change in the spatial and temporal distribution of marine mammals and sea turtles within the Regional Area, such that natural recruitment may not re-establish the population(s) to its original level within one generation.
Species at Risk	A significant adverse residual effect on Species at Risk is defined as a Project-related environmental effect that: <ul style="list-style-type: none"> results in a non-permitted contravention of any of the prohibitions stated in sections 32 to 36 of SARA.

VC	Significance Criteria
Sensitive Areas	<p>A significant adverse residual effect on Sensitive Areas is defined as a Project-related environmental effect that:</p> <ul style="list-style-type: none"> alters the valued habitat physically, chemically or biologically, in quality or extent, to such a degree that there is a decline in abundance lasting more than one generation of key species (for which the special area was designated) or a change in community structure, beyond which natural recruitment (reproduction and immigration from unaffected areas) would not sustain the population or community in the sensitive area and would not return to its original level within one generation.
Fisheries and other Ocean Users	<p>A significant adverse residual effect on Fisheries and Other Ocean Users is defined as a Project-related environmental effect that results in:</p> <ul style="list-style-type: none"> an adverse change in fishing activity (including traditional, commercial, recreational and Indigenous/subsistence) in the Study Area including overall timing and intensity, resulting in a measurable reduction in overall activity levels of fishing activity, and/or the economic returns gained from commercial fishing activities due to reduction in quality or quantity of fish landings, for one or more fishing seasons. Can include uncompensated damage to fishing gear; or an adverse change in other ocean uses such as marine-based research or military training, including location and timing of these activities, that results in a measurable reduction in the quality or applicability of these activities over multiple years.

6.0 ENVIRONMENTAL EFFECTS ASSESSMENT

6.1 Routine Project Activities

6.1.1 Operation of a Survey Vessel

As indicated in Table 5.2, operation of a survey vessel has the potential to interact all six identified VCs.

The survey vessel will generate sound and light emissions, air emissions, and effluent discharges which could potentially result in short-term sensory disturbance and localized water quality effects.

Air emissions and effluent discharges from the vessel will be in accordance with the *Canada Shipping Act*, MARPOL and any other applicable standards for the prevention of pollution at sea and are not expected to result in adverse environmental effects on any of the VCs.

The survey vessel will be operating on a 24-hour basis and therefore will require night lighting which could attract birds and potentially lead to strandings. However, lighting on the survey vessel will be kept to a minimum at night to the extent that it does not affect crew/vessel safety. Routine systematic checks will be conducted daily on the survey vessel for stranded birds. Handling and documentation of stranded birds will be done in accordance with the Procedures for Handling and Documenting Stranded Birds Encountered on Infrastructure Offshore Atlantic Canada (ECCC 2016). A Live Seabird Salvage permit will be acquired from Canadian Wildlife Service (CWS) prior to operations and any stranded birds (or mortalities) will be reported to CWS in accordance with the permit.

Marine fish, mammals and sea turtles (including species at risk) may experience sensory disturbance as a result of underwater sound emissions from the survey vessel. However, the short-term contribution of

underwater sound from the survey vessel is expected to be minimal compared to ongoing vessel activity (e.g., shipping and fisheries) occurring in the region. Although the specific vessel to be used for the survey has not yet been selected, it is assumed for the purpose of this assessment it could potentially be a platform supply vessel or construction vessel generating underwater sound source levels of approximately 188.6 dB re 1uPa @ 1 m rms SPL.

Baleen whales (e.g., North Atlantic right whale, fin whale, blue whale) are believed to be more sensitive to sound at low frequencies predominantly produced by vessels than are toothed whales (e.g., northern bottlenose whale, Sowerby's beaked whale) (MacGillivray et al. 2014) possibly causing localized avoidance of the survey vessel. However, in some cases, whales react to underwater acoustic sounds by swimming to the surface, likely increasing risk of collision (Nowacek et al. 2004). Sound levels from vessel operation associated with the Project are not expected to be high enough to cause physical effects on marine mammals or sea turtles (including species at risk), but the operation of the vessel may present a collision risk to marine mammals and sea turtles, potentially resulting in physical injury or mortality.

The survey vessel will travel to and from the Project Area, travelling at a speed not to exceed 22 km/hour (12 knots), except as needed in the case of an emergency. At this speed, the risk of collision with marine mammals and sea turtles will be reduced. In the event that a marine mammal or sea turtle is detected in proximity to the vessel, vessel speed will be reduced to avoid collision.

The survey vessel will transit through and conduct survey activities in sensitive areas (Orphan Spur EBSA and Northeast Newfoundland Slope Closure marine refuge), although underwater sound and emissions associated with Project activities are not expected to affect these sensitive areas to the extent that the ecological value of the sensitive area and the functions it provides would be compromised.

Operation of the survey vessel has potential to interact with fisheries and other ocean users; however, the location and timing of survey activities will be communicated in advance with fisheries stakeholders and other ocean users to avoid space conflicts. The Project is not expected to cause any interruption to harvesting or research activities, impede access to fishing grounds or result in lost or reduced catch. In the unlikely event of fishing gear loss or damage due to Project activities, BP will adhere to the *Compensation Guidelines Respecting Damages Relating to Offshore Petroleum Activities* (C-NLOPB and CNSOPB 2017).

Based on the characterization of potential Project interactions with all of the VCs, taking into consideration the limited geographic and temporal scope of survey vessel operations and implementation of mitigation as discussed above and summarized in Section 7, residual environmental effects of survey vessel operation are expected to be low in magnitude, limited in geographic extent to the Study Area, short term, occur as a single event, and be reversible for all VCs. Residual environmental effects of survey vessel operation on Marine Fish and Fish Habitat, Marine and/or Migratory Birds, Marine Mammals and Sea Turtles, Species at Risk, Sensitive Areas, and Fisheries and Other Ocean Users are predicted to be not significant.

6.1.2 ROV Video Survey

The ROV will be connected to the survey vessel by a tethering cable and will generate light and sound emissions during operation. Sound emissions will be generated by the ROV acoustic positioning system of the ROV and the imaging/obstacle avoidance sonar device on the ROV. The sound emissions from the

sonar device be generated near the seafloor and be ultra-high frequency (greater than 200 kHz) and outside of the sensitive hearing range for high frequency marine mammals. Sound emissions from the acoustic positioning system will travel through the water column between the survey vessel and the ROV. There will be no transponders on the seafloor. The received sound levels will be in the range of 160 dB re 1 μ Pa rms SPL at a frequency of approximately 19-36 kHz and therefore are likely to be audible by most species. Benthic fish species, potentially including Species at Risk (northern wolffish, spotted wolffish, Atlantic wolffish, white shark), may experience sensory disturbance and avoid the ROV and/or be temporarily attracted to the light source. Light emissions are predicted to be fairly localized to the location of the ROV and both light and sound emissions will occur over a range of hours within portions of the Project Area. Given the localized nature of the emissions and short duration of the survey (hours at one survey location; 7-10 days overall for the program), the magnitude of effects on marine fish, marine mammals and sea turtles (including species at risk) is expected to be low.

The generation of underwater light and sound will result in a localized temporary change in habitat within the Orphan Spur EBSA and Northeast Newfoundland Slope marine refuge. As noted in Section 4.6, the Orphan Spur EBSA is recognized as having a high concentration of corals as well as high densities of sharks and species of conservation concern (e.g., northern, spotted and striped wolffish, skates, roundnose grenadier, American plaice, redfish). The Northeast Newfoundland Slope marine refuge has been designated to protect corals and sponges from bottom contact fishing. The localized and temporary light and sound emissions from the ROV is not predicted to physically alter the habitat to the extent that it would affect local abundance of species relying on the sensitive habitat.

Based on the characterization of potential Project interactions with all of the VCs, taking into consideration the limited geographic and temporal scope of the seabed video survey (ROV operation) residual environmental effects of the ROV video survey are expected to be low in magnitude, limited in geographic extent to the Project Area, short term, occur as a single event, and be reversible for Marine Fish and Fish Habitat, Marine Mammals and Sea Turtles, Species at Risk, and Sensitive Areas. Residual environmental effects of the ROV video survey on these VCs are predicted to be not significant. The ROV video survey is not predicted to result in any interactions with Marine and/or Migratory Birds or Fisheries and Other Ocean Users.

6.2 Accidental Events

Although unlikely to occur over the course of the Project, there is the possibility of an accidental hydrocarbon release as a result of a small on-deck spill (e.g., lubricants), the very small risk of a hydraulic leak from the ROV or vessel fuel spill.

On-deck spills would likely be in small quantities, if they occurred, and contained (e.g., spill tray) and/or cleaned up immediately. Therefore, the risk of pollution to the marine environment from an on-deck spill would be very low. The maximum volume that could leak from the ROV system would be less than 5 L. The ROV, including tether/hoses, will be visually inspected prior to survey start to confirm it is in good working order. Lubricants and hydraulic fluid consist primarily of mineral oils and would rapidly evaporate and/or disperse upon reaching the marine environment.

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Of greater risk to the marine environment would be a diesel fuel spill from the vessel. However, marine diesel also has a low viscosity and high aromatic content. Surface oil would be expected to rapidly evaporate and disperse into the water column following a release.

The survey vessel will have spill response equipment and a shipboard oil pollution emergency plan, which will outline contingency measures to be implemented in the unlikely event of a spill and reduce the risk of adverse effects on the marine environment.

As indicated in Table 5.2, a diesel spill could potentially interact with marine fish, marine and/or migratory birds, marine mammals and sea turtles, species at risk, sensitive areas, and fisheries and other ocean users. However, the spatial and temporal extent of interaction is expected to be limited given the nature of the hydrocarbons to rapidly disperse and evaporate and the ability of marine fish, marine mammals and sea turtles to avoid oil spills. Marine and/or migratory birds would be most at risk, recognizing that exposure to a small amount of hydrocarbons can result in physical injury or mortality of birds, through external exposure (e.g., oiling of feathers), inhalation (e.g., in halation of volatile hydrocarbons), or ingestion (e.g., as a result of preening oiled feathers or drinking contaminated water). Oiling of feathers can result in thermal and buoyancy deficiencies and affect flight, which can result in death from a combination of heat loss, starvation, and/or drowning (Leighton 1983). The severity of effects can depend on the species, type of oil, weather conditions, time of year, volume of the spill, and duration of exposure (Gorsline et al. 1981).

Given the limited volume and nature of hydrocarbon materials on board the survey vessel, the probability of interaction with sensitive areas is very low. Spilled diesel fuel would disperse and/or evaporate relatively quickly and would not be expected to interact with the water column or benthic environment at depth. In the event of a spill, BP will consult with ECCC-Canadian Wildlife Service for appropriate response, handling, and monitoring of marine and/or migratory birds as applicable.

Depending on the volume, location, and timing of a diesel spill, fisheries and other ocean users could potentially be affected through fouling of gear and perceived tainting of catch by petroleum hydrocarbons. It is unlikely that a diesel spill from a survey vessel would be of such magnitude that it would result in a fisheries closure. In the unlikely event of gear damage from a spill, compensation will be handled in accordance with the *Compensation Guidelines Respecting Damages Relating to Offshore Petroleum Activities* (C-NLOPB and CNSOPB 2017).

Given the nature of the hydrocarbons and implementation of a shipboard oil pollution emergency plan and a compensation plan as applicable, an accidental spill, including a diesel spill from the survey vessel, is not predicted to result in a significant adverse environmental effect on Marine Fish and Fish Habitat, Marine and/or Migratory Birds, Marine Mammals and Sea Turtles, Species at Risk, Sensitive Areas, or Fisheries and Other Users.

6.3 Effects of the Environment on the Project

Section 5.1 describes the physical environment of the Study Area. The key physical environment factors that could affect the Project are ice and weather conditions (e.g., wind/waves/visibility).

The timing of the survey window (May to October) has been selected to reduce risk of ice and severe weather. The survey vessel will avoid sea ice and icebergs (if present) and will have systems for storm tracking and weather forecasting services. Operations will be delayed/suspended if wind or wave conditions reach operating limits that could potentially affect safety of operations and/or quality of data collection.

The Safety Plan for the Project, which will be submitted as part of the Environmental Program Authorization process, will address details on operating limits and procedures for delaying/suspending operations as required to maintain safe operations.

Reduced visibility, high wind and wave conditions, and other severe and/or extreme weather conditions may delay survey activities. These conditions could also increase the potential for vessel collisions and in extreme cases, cause injury or fatality.

6.4 Cumulative Environmental Effects

Residual environmental effects from the Project could potentially interact cumulatively with effects from other past, present or likely future projects and activities in the Regional Area, including other environmental or geophysical programs, exploration drilling, fisheries, and shipping. However, the incremental contribution of Project-related effects to cumulative effects is considered to be minor or negligible given the short time frame (approximately 7-10 days) and temporary nature/reversibility of effects, limited geographic scope of Project effects, the non-intrusive nature of Project activities, and implementation of mitigation described in this report.

Operation of the survey vessel and ROV will result in a temporary, localized increase in underwater sound levels within an acoustic environment that is already dominated by sound emissions produced by shipping and seismic surveys. The survey vessel will also create potential incremental risks of vessel collision with marine mammals and sea turtles, and attraction of marine and/or migratory birds. These risks of cumulative effects will be mitigated through control of vessel speed and detection and proper management of stranded birds.

A cumulative adverse effect on fisheries and other ocean users is not predicted to occur given the limited temporal and spatial scope and non-intrusive nature of survey activities. Communication with fisheries stakeholders and other ocean users in advance of the ROV survey will also help to mitigate potential conflicts.

Environmental effects of marine discharges from the survey vessel over the 7-10 day survey period will be negligible due to adherence to the *Canada Shipping Act*, MARPOL and any other applicable standards for the prevention of pollution, including a shipboard oil pollution emergency plan. No adverse cumulative effects are therefore predicted with respect to marine water quality during routine operations. In the unlikely event of an accidental hydrocarbon release from the survey vessel, temporary and localized effects on

water quality may act in combination with other oil pollution events (e.g., illegal bilge disposal) to result in a cumulative effect on marine water quality and the biological VCs which may be present in the affected area.

With the application of proposed Project-related mitigation, residual cumulative effects on Marine Fish and Fish Habitat, Marine and/or Migratory Birds, Marine Mammals and Sea Turtles, Species at Risk, Sensitive Areas, or Fisheries and Other Users are predicted to be not significant. No additional mitigation measures beyond those in place to mitigate the Project’s direct effects are needed to address potential cumulative effects.

7.0 HEALTH, SAFETY AND ENVIRONMENTAL MANAGEMENT

BP’s health, safety, security, and environment (HSSE) goals are no accidents, no harm to people, and no damage to the environment. Safety is at the heart of everything BP does as a company, driven by leadership and applied across all operations throughout the operating management system framework. Everyone who works for BP is responsible for his or her safety and helps to ensure the safety of colleagues, partners, suppliers, and local communities.

BP’s ability to be a safe and responsible operator depends, in part, on the capability and performance of its contractors and suppliers. BP’s contract for this work will include clear and consistent information, setting out specific details of BP’s expectations. The contract will be awarded following a selection process that takes into account factors such as safety, technical quality, and cost. Contractors and subcontractors (where applicable) will be required to demonstrate conformance with BP’s requirements including HSSE standards and mitigative commitments.

Table 7.1 summarizes the mitigation and monitoring that will be implemented to reduce environmental effects associated with the Project. A report on mitigation and monitoring identified in this EA Report and undertaken during fieldwork will be submitted to the C-NLOPB within six months of completion of the field work.

Table 7.1 Mitigation and Monitoring Commitments

Interaction/Effect	Mitigation/Monitoring Commitment
Pollution Prevention and Vessel Management	
Effects on marine fish and fish habitat	BP will contract a vessel capable of working in harsh offshore conditions, and will have the necessary equipment, protocols and procedures in place to comply with the <i>Canada Shipping Act</i> , MARPOL and any other applicable standards for the prevention of pollution, including a shipboard oil pollution emergency plan.
Effects on marine and/or migratory birds	Lighting on the survey vessel will be kept to a minimum at night to the extent that it does not affect crew/vessel safety.
Effects on marine and/or migratory birds	The survey vessel will avoid transiting within 300 m of migratory bird nesting colonies during the nesting period and will comply with provincial <i>Seabird Ecological Reserve Regulations, 2015</i> to minimize disturbance to colonies.

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Interaction/Effect	Mitigation/Monitoring Commitment
Risk of vessel strike with marine mammal or sea turtle	During transit to/from the Project Area, the survey vessel will travel at vessel speed not exceeding 22 km/hour (12 knots), except as needed in the case of an emergency. In the event that a marine mammal or sea turtle is detected in proximity to the vessel, vessel speed will be reduced to avoid collision.
Risk of vessel strike with marine mammal or sea turtle	In the unlikely event of a collision with a marine mammal or sea turtle, BP will contact the Canadian Coast Guard within 24 hours following the collision.
Liaison with Fisheries and Other Ocean Users	
Interaction with fisheries and other ocean users	BP will communicate timing and location of the ROV survey to Indigenous groups and commercial fisheries stakeholders prior to mobilization.
Interaction with other ocean users (marine research)	DFO will be contacted prior to the start of the survey to determine where DFO research vessels are conducting surveys.
Interaction with other ocean users (military activities)	Department of National Defence will be contacted prior to the start of the survey to determine if/where naval exercises are being conducted to avoid interaction with naval vessels.
Interaction with fisheries and other ocean users	BP will post Notice to Shipping immediately prior to the start of the survey.
Interaction with fishing activities	In the unlikely event of fishing gear loss or damage due to Project activities, BP will adhere to the <i>Compensation Guidelines Respecting Damages Relating to Offshore Petroleum Activities</i> (C-NLOPB and CNSOPB 2017).
Wildlife Monitoring/Stranded Birds	
Effects on marine and/or migratory birds Effects on marine mammals	<p>As per the <i>Geophysical, Geological, Environmental and Geotechnical Program Guidelines</i>, a seabird and marine mammal observation program will be conducted for the duration of the ROV survey (including transit to and from the Project Area) by designated observer(s) trained in marine mammal and seabird observations. Data from these monitoring programs will be included in the EA mitigation and monitoring report submitted to the C-NLOPB within six months after termination of the field work.</p> <p>The marine mammal monitoring protocol will be conducted in accordance with Environmental Studies Research Fund (ESRF) Report #156 <i>Recommended Seabird and Marine Mammal Observation Protocols for Atlantic Canada</i> (Moulton and Mactavish 2004).</p> <p>Seabird monitoring will be conducted in accordance with the Canada Wildlife Service Eastern Canada Seabirds at Sea (ECSAS) <i>Standardized Protocol for Pelagic Seabird Surveys from Moving and Stationary Platforms</i> (Gjerdrum et al. 2012).</p>
Effects on marine and/or migratory birds	Routine systematic checks will be conducted daily on the survey vessel for stranded birds. Handling and documentation of stranded birds will be done in accordance with the <i>Procedures for Handling and Documenting Stranded Birds Encountered on Infrastructure Offshore Atlantic Canada</i> (ECCC 2016). A Live Seabird Salvage permit will be acquired from CWS prior to operations and any stranded birds (or mortalities) will be reported to CWS in accordance with the permit.

8.0 SUMMARY AND CONCLUSIONS

BP is proposing to conduct an exploration drilling program on ELs 1145, 1146, 1148, and 1149 in the Orphan Basin offshore Newfoundland and Labrador, with an initial well planned for 2020. To characterize benthic conditions and support planning and mitigation of the drilling program, BP is planning a visual survey of the seafloor using a ROV at potential drilling locations within ELs 1145, 1146, and/or 1148. The Project requires an authorization from the C-NLOPB under the Accord Acts.

The Project involves conducting video transects at prospective well locations within ELs 1145, 1146, and 1148, is planned to occur between May and October 2019 pending authorization and is expected to take 7-10 days to complete.

No significant adverse environmental effects (including cumulative environmental effects) from planned Project activities or accidental events are predicted to occur on Marine Fish and Fish Habitat, Marine and/or Migratory Birds, Marine Mammals and Sea Turtles, Species at Risk, Sensitive Areas, or Fisheries and Other Users. Project activities are not expected to contravene prohibitions of SARA.

The survey will include a marine mammal/seabird observer. Given the short duration of the Project and the unobtrusive nature of the ROV survey, there is no requirement for follow-up monitoring.

Building on Indigenous and stakeholder engagement efforts associated with their proposed exploration drilling program in the Orphan Basin, BP will continue to communicate with Indigenous groups and commercial fisheries stakeholders about the Project and address potential questions and concerns associated with the Project as they arise.

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