BHP Canada Exploration Drilling Project EL 1157 and 1158 Seabed Survey Environmental Assessment





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Abbreviations and Acronyms

AUV	Autonomous Underwater Vehicle
CBD	Convention on Biological Diversity
CIS	Canadian Ice Service
C-NLOPB	Canada-Newfoundland and Labrador Offshore Petroleum Board
COSEWIC	Committee on the Status of Endangered Wildlife in Canada
CWS	Canadian Wildlife Service
DFO	Fisheries and Oceans Canada
DP	Dynamic Positioning
EA	Environmental Assessment
EBSA	Ecologically or Biologically Significant Area
ECSAS	Canada Wildlife Service Eastern Canada Seabirds at Sea
EL	Exploration Licence
EU	European Union
FSC	Food, social, or ceremonial
HSEC	Health, Safety, Environment and Community
IUCN	International Union on the Conservation of Nature
MARPOL	The International Convention for the Prevention of Pollution from Ships
NAFO	Northwest Atlantic Fisheries Organization
NAVWARN	Navigation Warning
NOTMAR	Notice to Mariners
NRA	NAFO Regulatory Area
SAR	Species at Risk
SARA	*Species at Risk Act*
SBA	Significant Benthic Area
ROV	Remotely Operated Vehicle
RV	Research Vessel
VC	Valued Component
VSP	Vertical Seismic Profiling

1.0 INTRODUCTION

BHP Canada (BHP) is planning to conduct petroleum exploration drilling and related activities on Exploration Licences (ELs) 1157 and 1158 in the Orphan Basin, with an initial well planned as early as 2021. ELs 1157 and 1158 are in the eastern Newfoundland offshore region. BHP is planning a visual survey of the seabed using a remotely operated vehicle (ROV) or autonomous underwater vehicle (AUV) at potential drilling locations within ELs 1157 and 1158 to characterize seabed features (the "Project") including:

- Identification and location of sensitive environmental features / habitats such as aggregations of habitat-forming corals or sponges
- Evaluation of benthic species diversity and abundance at each location
- Identification of geologic features such as boulders or hardgrounds
- Identification and location of anthropogenic features, such as unexploded ordinances, wrecks, cables, and debris

These surveys will support planning and mitigation for BHP's planned drilling program. The proposed Project Area includes ELs 1157 and 1158 (and a 10 km buffer), with BHP as the operator. Well locations are not known at this time and could occur anywhere within ELs 1157 and 1158 over the life of the Project (Section 2.3). The specific location of the seabed survey(s) in a given year will be focused on the upcoming planned well location(s).

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

2.0 PROJECT DESCRIPTION

2.1 PURPOSE OF THE PROJECT

BHP is proposing a seabed survey at potential drilling locations on ELs 1157 and 1158 to characterize seabed features, including identifying aggregations of habitat-forming corals or sponges or other environmentally sensitive features. Portions of ELs 1157 and 1158 occur within the Northeast Newfoundland Slope Closure, a marine refuge area that was designated in December 2017 (DFO 2019a). This closure area is designated to protect corals and sponges and is closed to bottom-contact fishing (Fisheries and Oceans Canada [DFO] 2019). While exploration drilling is not prohibited within the marine refuge, BHP has committed to gathering baseline benthic data at prospective well locations prior to spudding the well to understand site sensitivities and opportunities for reducing potential environmental effects on corals and sponges.

BHP will plan the survey in consultation with the C-NLOPB and DFO. The results of the survey will inform discussions around well planning and mitigation for future exploration drilling.

2.2 PROJECT LOCATION

The Project Area (Table 2.1; Figure 2-1) is located within the Orphan Basin and is approximately 10,841 km². The western boundary is approximately 350 km east of St. John's, NL. Water depths within ELs 1157 and 1158 range from 1,175 to 2,575 m. The seabed survey will be conducted at potential drilling locations within ELs 1157 and/or 1158 (Table 2.1, Figure 2-1).

Table 2.1 Project Area and Project EL Vertices Coordinates

WGS 84		NAD 83 UTM Zone 22N	
X	**Y**	**X**	**Y**
Project Area			
48° 13' 37.421" W	49° 9' 8.188" N	702189.39	5448086.04
47° 9' 25.973" W	49° 7' 17.723" N	780356.16	5448086.04
47° 12' 54.481" W	48° 21' 1.773" N	780392.66	5362182.12
47° 33' 0.139" W	48° 21' 30.624" N	755545.57	5361900.85
47° 34' 10.385" W	48° 3' 33.153" N	755586.94	5328575.68
48° 40' 26.628" W	48° 5' 18.577" N	673202.41	5328752.92
48° 38' 26.731" W	48° 48' 43.771" N	673202.41	5409258.97
48° 14' 37.639" W	48° 48' 11.632" N	702378.93	5409246.33
48° 13' 37.421" W	49° 9' 8.188" N	702189.39	5448086.04
EL 1158			
48° 22' 25.973" W	48° 42' 59.674" N	693159.76	5399277.22
48° 2' 55.969" W	48° 42' 59.578" N	717062.22	5400149.16

Table 2.1 Project Area and Project EL Vertices Coordinates

WGS 84		NAD 83 UTM Zone 22N	
X	**Y**	**X**	**Y**
48° 2' 55.971" W	48° 41' 59.581" N	717133.93	5398296.89
48° 1' 25.970" W	48° 41' 59.512" N	718973.22	5398366.30
48° 1' 25.977" W	48° 37' 59.524" N	719262.32	5390957.35
47° 58' 25.976" W	48° 37' 59.523" N	722945.62	5391102.23
47° 58' 25.978" W	48° 35' 59.529" N	723092.50	5387397.83
47° 55' 25.976" W	48° 35' 59.645" N	726778.08	5387548.77
47° 55' 25.979" W	48° 33' 59.651" N	726927.31	5383844.38
47° 53' 55.978" W	48° 33' 59.680" N	728771.34	5383919.86
47° 53' 55.982" W	48° 30' 59.688" N	728996.87	5378363.28
47° 37' 25.968" W	48° 30' 59.689" N	749301.32	5379224.04
47° 37' 25.972" W	48° 22' 59.713" N	749955.40	5364407.23
47° 44' 55.982" W	48° 22' 59.473" N	740702.16	5363999.31
47° 44' 55.983" W	48° 9' 59.508" N	741722.89	5339922.01
48° 10' 26.017" W	48° 9' 59.729" N	710125.89	5338679.13
48° 10' 26.012" W	48° 15' 59.713" N	709716.94	5349792.12
48° 16' 26.016" W	48° 15' 59.597" N	702296.93	5349520.06
48° 16' 26.014" W	48° 17' 59.590" N	702165.31	5353224.42
48° 25' 26.017" W	48° 17' 59.711" N	691042.15	5352843.58
48° 25' 26.016" W	48° 18' 59.707" N	690979.95	5354695.78
48° 31' 26.018" W	48° 18' 59.591" N	683567.06	5354447.96
48° 31' 26.003" W	48° 27' 59.565" N	683028.36	5371118.34
48° 26' 56.002" W	48° 27' 59.631" N	688571.70	5371302.57
48° 26' 55.978" W	48° 40' 59.593" N	687767.73	5395382.46
48° 22' 25.977" W	48° 40' 59.679" N	693287.33	5395572.55
EL 1157			
48° 1' 25.933" W	48° 58' 59.463" N	717741.41	5429855.10
47° 56' 55.932" W	48° 58' 59.529" N	723227.85	5430075.08
47° 56' 55.934" W	48° 57' 59.532" N	723302.29	5428222.80
47° 53' 55.933" W	48° 57' 59.609" N	726961.07	5428373.49
47° 53' 55.935" W	48° 56' 59.612" N	727036.72	5426521.22
47° 44' 55.930" W	48° 56' 59.374" N	738017.19	5426973.36
47° 44' 55.929" W	48° 57' 59.371" N	737937.87	5428825.59
47° 43' 25.928" W	48° 57' 59.458" N	739767.14	5428906.96
47° 43' 25.919" W	49° 2' 59.444" N	739367.18	5438168.23
47° 38' 55.916" W	49° 2' 59.588" N	744845.97	5438412.26

Table 2.1 Project Area and Project EL Vertices Coordinates

WGS 84		NAD 83 UTM Zone 22N	
X	**Y**	**X**	**Y**
47° 38' 55.918" W	49° 1' 59.590" N	744927.84	5436560.01
47° 25' 25.912" W	49° 1' 59.554" N	761369.94	5437310.33
47° 25' 25.924" W	48° 55' 59.572" N	761893.71	5426197.38
47° 23' 55.923" W	48° 55' 59.600" N	763724.21	5426284.81
47° 23' 55.928" W	48° 52' 59.608" N	763987.65	5420728.38
47° 20' 55.925" W	48° 52' 59.607" N	767652.39	5420903.29
47° 20' 55.930" W	48° 49' 59.613" N	767919.31	5415346.88
47° 19' 25.928" W	48° 49' 59.583" N	769753.56	5415434.36
47° 19' 25.935" W	48° 43' 59.602" N	770290.48	5404321.84
47° 20' 55.937" W	48° 43' 59.632" N	768452.58	5404234.33
47° 20' 55.939" W	48° 41' 59.637" N	768630.15	5400530.12
47° 23' 55.943" W	48° 41' 59.639" N	764951.96	5400355.07
47° 23' 55.947" W	48° 35' 59.657" N	765476.88	5389242.54
47° 25' 25.950" W	48° 35' 59.629" N	763634.16	5389154.99
47° 25' 25.953" W	48° 26' 59.654" N	764414.60	5372486.32
47° 37' 25.970" W	48° 26' 59.701" N	749628.52	5371815.62
47° 37' 25.968" W	48° 30' 59.689" N	749301.32	5379224.04
47° 53' 55.982" W	48° 30' 59.688" N	728996.87	5378363.28
47° 53' 55.978" W	48° 33' 59.680" N	728771.34	5383919.86
47° 55' 25.979" W	48° 33' 59.651" N	726927.31	5383844.38
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47° 58' 25.976" W	48° 37' 59.523" N	722945.62	5391102.23
48° 1' 25.977" W	48° 37' 59.524" N	719262.32	5390957.35
48° 1' 25.970" W	48° 41' 59.512" N	718973.22	5398366.30
48° 2' 55.971" W	48° 41' 59.581" N	717133.93	5398296.89
48° 2' 55.969" W	48° 42' 59.578" N	717062.22	5400149.16
48° 5' 55.969" W	48° 42' 59.658" N	713384.90	5400010.37
48° 5' 55.939" W	48° 56' 59.618" N	712396.20	5425942.54
48° 1' 25.938" W	48° 56' 59.469" N	717886.61	5426150.50

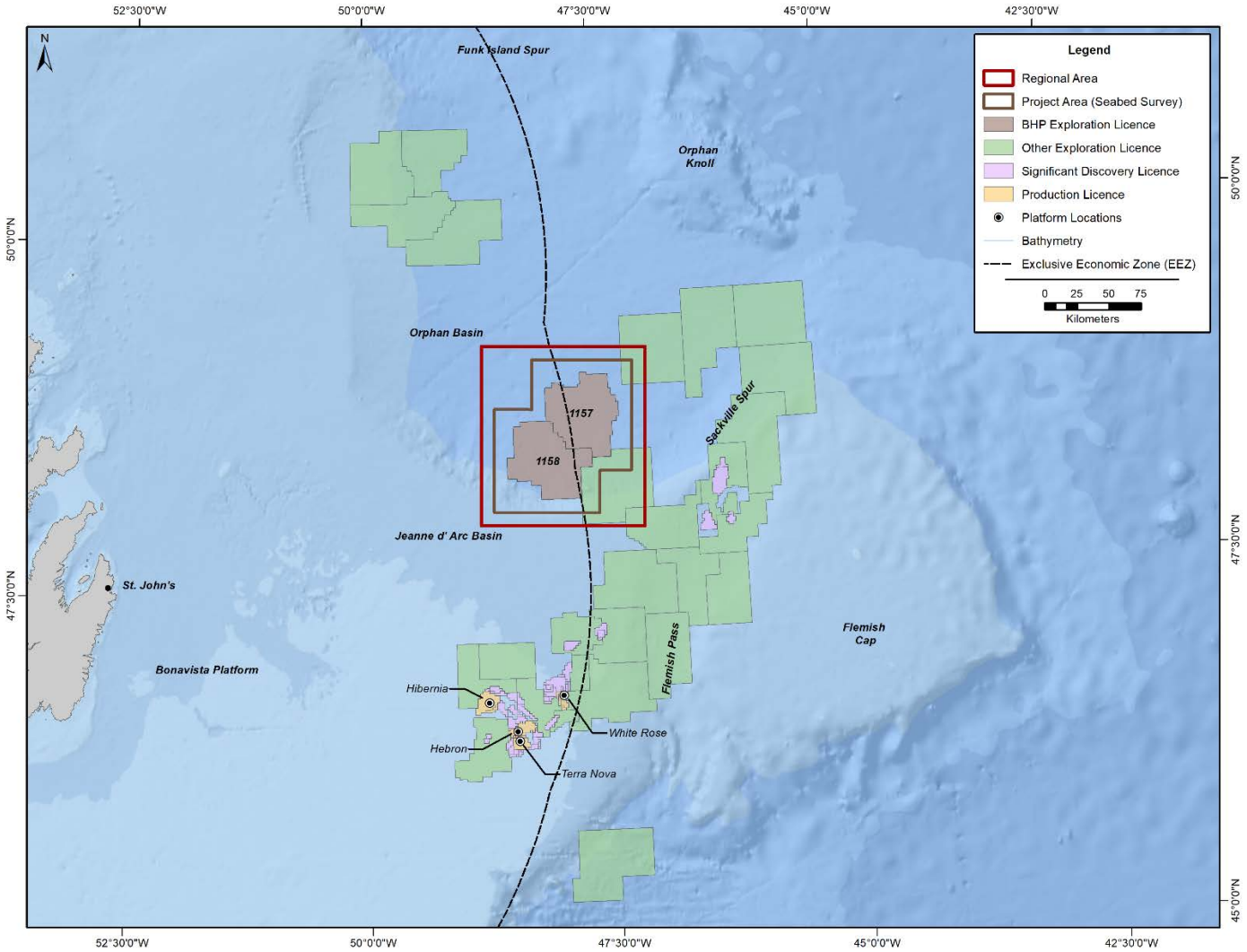


Figure 2-1 Project Location and Spatial Areas

Specific survey locations have not yet been determined, as well locations have not yet been selected, but will be located within these two ELs (Table 2.1). The exact location of the seabed surveys is kept flexible (within the Project ELs) so that BHP can adjust or alter their location based on field data. For the purposes of this document, the Project Area refers to a minimum 10 km buffer on the Project ELs and covers the area in which Project activities are to occur, including vessel turning activities. As Project activities are isolated to the Project Area, the Study Area is defined to be the same as the Project Area. Given the relatively small footprint per survey, the Regional Area is a minimum 20 km buffer on the Project Area.

2.3 SCHEDULE

The initial seabed survey is planned to be conducted within ELs 1157 and/or 1158 between May and October 2020, pending authorization from the C-NLOPB; however, seabed surveys could be conducted between 2020 and 2025 at any time of the year. Anticipated duration of each survey will be approximately 7 to 10 days. However, each survey could be as long as 30 days, depending on factors such as scope and weather conditions. An EA Update will be filed with the C-NLOPB at least 45-days prior to initiation of the survey each year that activities are planned.

2.4 PROJECT COMPONENTS AND ACTIVITIES

2.4.1 Operation of a Survey Vessel

A survey vessel will be contracted by BHP in order to complete the specified seabed surveys. The vessel will have the necessary equipment on board in order to fulfill operational and safety requirements as per the *Canada Shipping Act*, the International Convention for the Prevention of Pollution from Ships (MARPOL) and other applicable standards. The vessel will be inspected and approved for operation by the C-NLOPB before beginning Project-related work.

Mobilization of the survey vessel will occur from an existing shorebase in eastern Newfoundland. Once the vessel reaches the pre-determined prospective wellsite location, it will employ the use of dynamic positioning (DP) to maintain its position and heading during the seabed survey. Selection criteria for the survey vessel will include the capability to safely operate in the local weather and sea state conditions.

The survey vessel has the potential to interact with the environment though the following pathways:

- Underwater sound emissions
- Atmospheric emissions (light, air, and sound)
- Solid and liquid waste discharges

2.4.2 Seabed Survey

Video or photographic data will be collected during the survey using either a tethered ROV or an AUV. Both ROV and AUV are capable of conducting a visual survey of the seabed for the purpose of describing the benthic environment, specifically the presence / absence of sensitive biological communities such as corals and sponges. However, as described below, the method in which visual data is collected differs between the ROV and AUV.

An ROV is connected to the survey vessel by an umbilical and is operated remotely by a “pilot”, who follows the survey plan. The umbilical transmits real-time data to the pilot, who controls the ROV’s speed, depth, angle, and other features, such as video or photo collection. An AUV is deployed to execute a pre-programmed survey plan (location, depth, height from seabed, angle) without a real-time pilot. When the pre-programmed mission is complete, the AUV returns to a pre-defined location on the surface, where the unit can be recovered, and data downloaded for processing.

2.5 PROJECT LOGISTICS AND PERSONNEL

BHP will procure a qualified contractor to supply the survey vessel and conduct the Project. In addition to the contracted vessel crew (which will depend on the size of the vessel and could range from 25 to 40 individuals), it is anticipated that there could be an additional 8 to 10 individuals on board, including BHP representatives and marine biologists.

Logistical and support activities required for the surveys will depend on the survey company contracted, which may vary over the temporal scope of the Project. Vessels will use existing third-party shorebase facilities in eastern Newfoundland to mobilize for the survey; however, it is possible that mobilization could occur elsewhere in Atlantic Canada. Given the length of a survey (anticipated to be approximately 7 to 10 days, with the potential of extending to 30 days), it is expected that a survey will be completed in a single mobilization (apart from weather or mechanical downtime). Each survey may require separate mobilization over the temporal scope of the Project.

Resupply and crew changes are not anticipated during a single survey. However, due to contracting, survey crew may change over the life of the Project.

3.0 INDIGENOUS AND STAKEHOLDER CONSULTATION

BHP is committed to engaging with Indigenous groups and other stakeholders. As part of the Indigenous and stakeholder engagement conducted for its exploration drilling project in September, 2019 BHP has communicated the intent to conduct a seabed survey prior to drilling to identify sensitive environmental features.

The proposed survey plan, including timing and location, will be communicated to Indigenous groups and other stakeholders prior to initiation of the survey. Survey results will be shared with Indigenous groups and other stakeholders as part of BHP's overarching engagement efforts. BHP will also share seabird and marine mammal observation data collected during the survey upon request.

4.0 EXISTING ENVIRONMENT

4.1 PHYSICAL ENVIRONMENT

The Project Area is located along the Northeast Newfoundland shelf in the Orphan Basin. The closest distance of the Project ELs to St. John's is approximately 350 km, while the farthest distance is approximately 400 km. ELs 1157 and 1158 are in the southern portion of the West Orphan Basin, north of the Sackville Spur. Water depths range between 2,153 and 2,574 m in EL 1157 and 1,176 to 2,264 m in EL 1158. Along the southern boundary of the Project Area, depths range from approximately 300 to 400 m and exceed 2,700 m at the northeastern boundary.

4.1.1 Oceanographic Conditions

The cold Labrador Current dominates the general circulation over the eastern Newfoundland offshore area. The Labrador Current is divided into two streams: 1) an inshore branch that flows along the coast on the continental shelf; and 2) an offshore branch that flows along the outer edge of the Grand Banks. The Labrador Current's inshore branch tends to flow mainly in the Avalon Channel along the coast of the Avalon Peninsula, but may sometimes also spread farther out on the Grand Banks. The offshore branch flows over the upper Continental Slope at depth, and through the 1,300 m deep Flemish Pass. The offshore Labrador Current (which remains bathymetrically trapped over the upper Continental Slope) has average speeds of approximately 40 centimetres/second (cm/s), carrying approximately 85% of the total transport, mainly between the 400 and 1,200 m isobaths (Lazier and Wright 1993).

Near the Project Area (Figure 2-1), in the vicinity of the Orphan Basin, the Labrador Current divides into two branches with the main branch flowing southwards as Slope Water Current along the eastern edge of the Grand Banks and the side branch flowing up to the east-northeast, clockwise past the Sackville Spur and north-eastward around the Flemish Cap.

The Ocean Sciences Division (OSD) of DFO at the Bedford Institute of Oceanography (BIO) has completed a multi-year moored current measurement program with cross-slope coverage at eight sites in the Orphan Basin, during the period from June 2004 to May 2010 (Geshelin et al. 2006; Geshelin and Loder 2007; Loder et al. 2011; BIO 2015). Two of the mooring stations (OB-A and OB-C) are located within the Project Area. Maximum speeds at OB-A (from the first 2004 to 2005 deployment) range from 70 cm/s at 30 m, to 45 cm/s at 370 m, to 33 cm/s at 1,120 m and 31 cm/s at 1,520 m; while at OB-C, maximum current speeds range from 70 to 80 cm/s near the surface, to approximately 50 cm/s at 360 m, and 28 to 41 cm/s near-bottom.

4.1.2 Ice Conditions

Sea ice and icebergs occur within the Project Area. Although there is large variability in sea ice year to year, Canadian Ice Service (CIS) data from 1981 to 2010 indicate that sea Ice is mainly present within the Project Area from January to May (CIS 2011). Based on iceberg sightings by month from 1989 to 2018

within the Project Area, icebergs can occur between January and August, with peak activity from March to May (NRC 2019).

4.1.3 Weather Conditions

Weather conditions in the Project Area are heavily influenced by the conditions of the marine environment, which are typified by high humidity, fog and resultant low visibility, strong winds, and high amounts precipitation.

Based on three weather buoys that are located within the Project Area, wind direction is predominantly from the west-southwest and south-southwest in the spring and summer month, and from the west in fall and winter (Table 4.1). Mean wind speeds are strongest in the winter and the highest maximum wind speeds are in December and January. Overall, strong winds (between 10.8 m/s and 13.6 m/s (NOAA 2019)) and moderate winds (between 5.5 m/s and <10.8 m/s) are most common.

Table 4.1 Windspeed Information

Location	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Mean Wind Speed (m/s)													
M6014847	12.1	11.8	10.6	8.9	7.7	7.0	6.6	6.9	8.2	9.5	10.5	11.5	9.2
M6014204	11.7	11.5	10.3	8.7	7.4	6.8	6.4	6.7	8.0	9.3	10.2	11.2	9.0
M6013579	11.7	11.4	10.3	8.6	7.3	6.8	6.4	6.7	7.9	9.2	10.1	11.1	8.9
Most Frequent Direction (from)													
M6014847	W	W	W	WSW	WSW	SSW	SSW	SSW	WSW	W	W	W	WSW
M6014204	W	W	W	WSW	WSW	SSW	SSW	SSW	WSW	W	W	W	WSW
M6013579	W	W	W	WSW	WSW	SSW	SSW	WSW	WSW	W	W	W	WSW
Maximum Wind Speed (m/s)													
M6014847	33.8	29.6	30.2	25.7	25.5	23.6	18.3	22.5	28.8	29.7	27.4	30.5	33.8
M6014204	32.7	28.6	31.0	24.5	24.3	24.0	18.9	22.3	26.6	30.4	27.4	29.5	32.7
M6013579	33.5	29.9	29.2	26.3	24.8	23.7	18.5	26.9	27.9	32.2	26.7	29.2	33.5
Direction of Maximum Wind Speed (from)													
M6014847	NW	W	W	N	NW	NW	SW	NW	SE	SW	SW	NW	NW
M6014204	W	NW	NW	N	NW	NW	SW	N	SE	W	W	NW	W
M6013579	W	SW	NW	N	NW	NW	S	SE	S	S	W	NW	W
Source: based on DFO (2019b)													

Most of the observed precipitation events within the Project Area are in the form of rain, snow, and drizzle, while other precipitation types, such as mixed rain, freezing rain, and hail, occur less frequently (Table 4.2). Rain occurs approximately 8 to 17% of the time for all months of the year and is an annual occurrence 11% of the time. Snow is most likely to occur in January at 21% of the time, but may reach 5% as early as November and as late as May and is an annual occurrence 7% of the time (Table 4.2). Freezing rain and hail are relatively infrequent in this area, being generally below 1%. Thunderstorms and lightening occur infrequently.

Table 4.2 Frequency of Occurrence (%) of Precipitation and Thunderstorms (ICOADS), Project Area, 1980-2019

Month	Rain / Drizzle	Freezing Rain / Drizzle	Rain / Snow Mixed	Snow	Hail
Jan	8.3	0.6	2.7	21.2	0.4
Feb	7.8	0.0	0.3	19.8	0.8
Mar	17.4	0.0	2.6	11.4	0.0
Apr	9.0	0.0	0.4	4.5	0.7
May	13.3	0.0	0.7	4.8	0.0
Jun	10.2	0.0	0.8	0.4	0.0
Jul	9.5	0.0	0.0	0.0	0.0
Aug	9.5	0.0	0.2	0.0	0.0
Sep	11.0	0.0	0.0	0.0	0.0
Oct	14.8	0.0	0.0	0.6	0.0
Nov	14.0	0.0	0.5	5.0	0.3
Dec	9.5	0.3	1.6	11.0	0.3
Annual	11.2	0.1	0.9	7.2	0.2

Source: Based on Research Data Archive et al. (2019)

The Project Area and surrounding areas have some of the highest occurrence rates of marine fog in North America, which in these regions is commonly of the advection type. Advection fog is formed when warm moist air flows over a cold surface, such as the cold northwest Atlantic Ocean, and it can persist for days or weeks. This type of fog is most prevalent in spring and summer (Table 4.3). Visibility is affected by the presence of fog, the number of daylight hours, as well as frequency and type of precipitation.

Table 4.3 Monthly and Annual Frequencies (%) of Occurrence of Visibility (ICOADS), Project Area, 1980-2019

Month	Very Poor (<0.5 km)	Poor (0.5 – 1 km)	Fair (1 – 10 km)	Good (>10 km)
Jan	5.5	4.2	26.0	64.3
Feb	9.5	6.0	24.3	60.2
Mar	5.6	6.8	28.8	58.8
Apr	12.4	9.9	21.8	55.9
May	20.5	7.7	20.1	51.8
Jun	16.0	12.3	22.3	49.4
Jul	38.8	7.5	19.5	34.2
Aug	24.5	5.1	15.8	54.6
Sep	16.1	3.4	13.2	67.3
Oct	6.1	2.0	18.0	73.9
Nov	4.6	2.9	18.5	74.0
Dec	9.8	4.5	26.0	59.7
Annual	13.3	5.7	21.2	59.8

Source: Based on Research Data Archive et al. (2019)

Tropical systems can affect the Newfoundland offshore during the Atlantic hurricane season (June 1 to November 30), but most activity generally occurs in the late summer to early fall. During the past 30 years, there have been a total of seven storms within 100 km of the Project Area, 32 storms within 300 km and 74 within 600 km. During the same period, there have been no hurricanes within 100 km of the Project Area, four within 400 km and eight within 600 km.

4.1.4 Geological Stability

Canada's eastern continental margin is a relatively stable area of the North American Plate, and the seismic activity is relatively low (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 Project Area is classified as having a low to moderate seismic hazard (Natural Resources Canada 2019), therefore indicating that the potential for a submarine landslide is low.

4.2 MARINE FISH AND SHELLFISH

The Project Area and surrounding areas include the shelf and slope areas of the Northeast Grand Bank and the abyssal areas of the Orphan Basin. The shelf slope is an important transition area, supporting regionally important areas of biodiversity and marine productivity and are used by fish and invertebrate species. The abyssal plain supports unique assemblages of deep-sea fishes, as well as coral and sponge communities and other invertebrates.

The Project ELs and Project Area is in an area only partially covered by DFO research vessel (RV) surveys. The survey locations are selected based on several factors (i.e., water depth, habitat, accessibility) and are optimized to provide information on species distribution and abundance. Coverage of the RV surveys is usually planned to a maximum depth of approximately 1,500 m, which is substantially deeper than the maximum depth fished (approximately 700 to 800 m) (Brodie and Stansbury 2007). RV transects are conducted within Northwest Atlantic Fisheries Organization (NAFO) Divisions that are under the Jurisdiction of DFO. The NAFO Divisions are a means to divide ocean areas into units, designating fisheries management or scientific research areas (Figure 4-1). The Project is partially situated within the NAFO Regulatory Area (NRA), outside the Canadian Exclusive Economic Zone (EEZ). It is not within the NAFO fishing footprint (NAFO 2019), and therefore Spanish and European Union (EU) RV surveys are not conducted within the Project Area. Based on overlap of DFO RV survey results from 2012 to 2017, fish species that are most likely to be found within the Project Area and their associated depth zones are shown in Table 4.4.

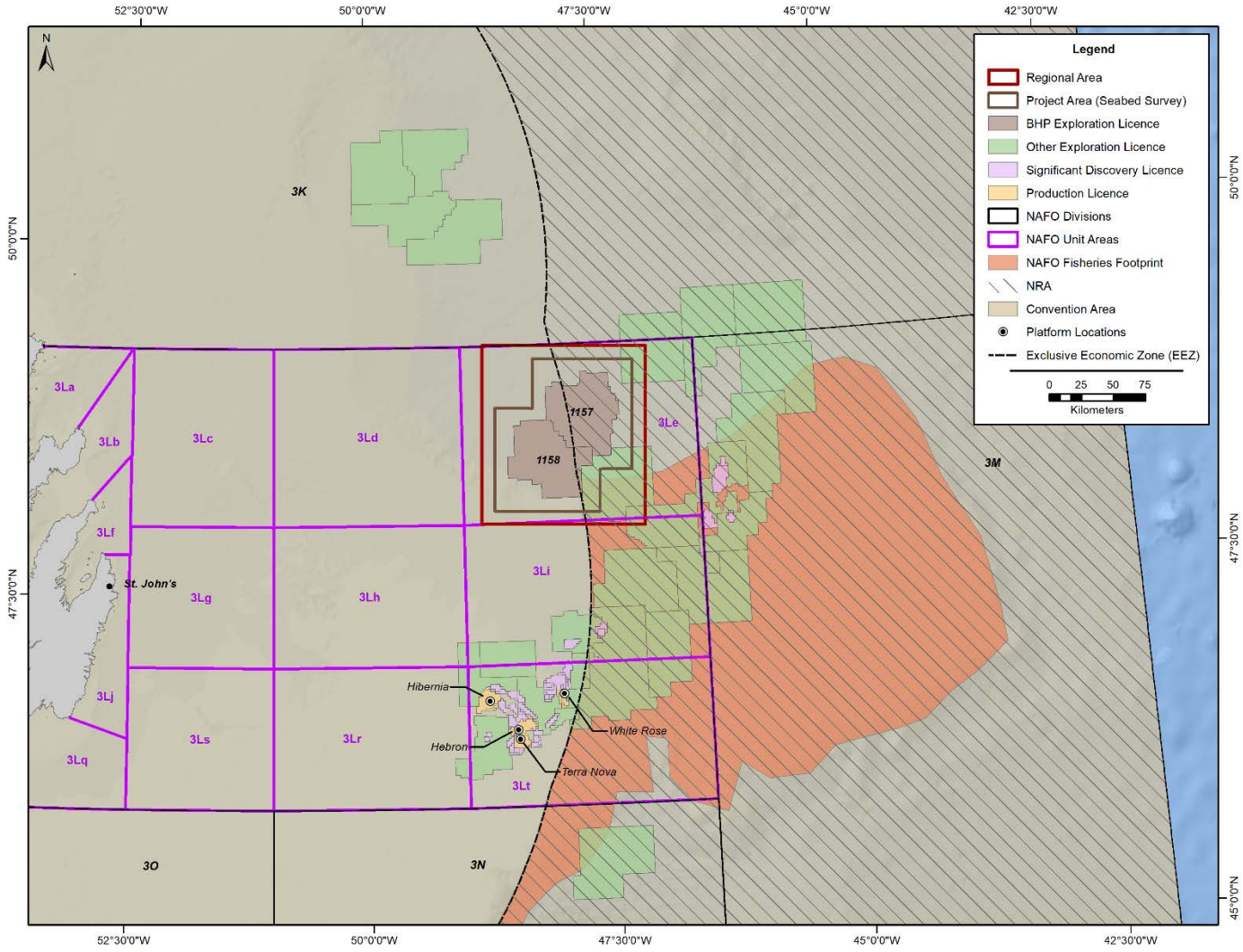


Figure 4-1 DFO and NAFO Management Areas and Jurisdiction

Table 4.4 Dominant Fish Species within the Project Area (Canadian RV surveys, 2012 to 2017)

Depth Zone	Functional Group	Common Name	Scientific Name[1]
Upper Slope (225 to 700 m) (64 trawls)	Plank-piscivore	Deepwater redfish	*Sebastes mentella*
	Planktivore	Capelin	*Mallotus villosus*
	Piscivore	Black dogfish	*Centroscyllium fabricii*
	Piscivore	Atlantic halibut	*Hippoglossus hippoglossus*
	Piscivore	Atlantic cod	*Gadus morhua*
	Large Benthivore	Thorny skate	*Raja radiata*
	Large benthivore	American plaice	*Hippoglossoides platessoides*
	Large benthivore	Roughhead grenadier	*Macrourus berglax*
	Piscivore	Greenland halibut	*Reinhardtius hippoglossoides*
	Large benthivore	Spinytail skate	*Bathyraja spinicauda*
	Large benthivore	Northern wolffish	*Anarhichas denticulatus*
	Medium benthivore	Witch Flounder	*Glyptocephalus cynoglossus*
	Medium benthivore	Common lumpfish	*Cyclopterus lumpus*
Middle Slope (701 to 1,400 m) (11 trawls)	Piscivore	Greenland shark	*Somniosus microcephalus*
	Piscivore	Greenland halibut	*Reinhardtius hippoglossoides*
	Medium Benthivore	Witch flounder	*Glyptocephalus cynoglossus*
	Large Benthivore	Roughhead grenadier	*Macrourus berglax*

[1] Taxonomic group: F – family

The waters off Newfoundland and Labrador contain a variety of species commercially harvested or used for food, social, or ceremonial (FSC) purposes by Indigenous groups. Commercial communal licences have been issued within the Project Area, as they are designated based on NAFO Divisions and include all of Division 3 (LMNOP), for capelin, groundfish, herring, mackerel, seal, shrimp, snow crab, tuna, and whelk. These fishing activities are covered further in Section 4.7. Species harvested for FSC include alewife (gaspereau), trout, Atlantic salmon, bass, American eel, shad, Arctic charr, blue shark, American lobster, and many others. Many species are harvested in freshwater, estuarine, or intertidal areas and are not present within the Project Area. However, two migratory fish species in particular, the American eel and the Atlantic salmon, have been highlighted during Indigenous engagement as being of concern. These species are catadromous and anadromous, respectively, and may migrate through the Project Area.

Benthic invertebrates, such as corals, sponges and sea pens, are an important energy source for higher order taxa, such as fish, seabirds, and marine mammals, and provide a mechanism for nutrient cycling and the completion of biochemical processes within the marine food web (C-NLOPB 2003; Barrio Froján et al. 2012; Beazley and Kenchington 2015; Murillo et al. 2016). DFO RV surveys conducted within the Regional Area during 2013 to 2017 collected soft, black, stony, and unidentified corals on the continental shelf and slope and Flemish Pass (Figure 4-2).

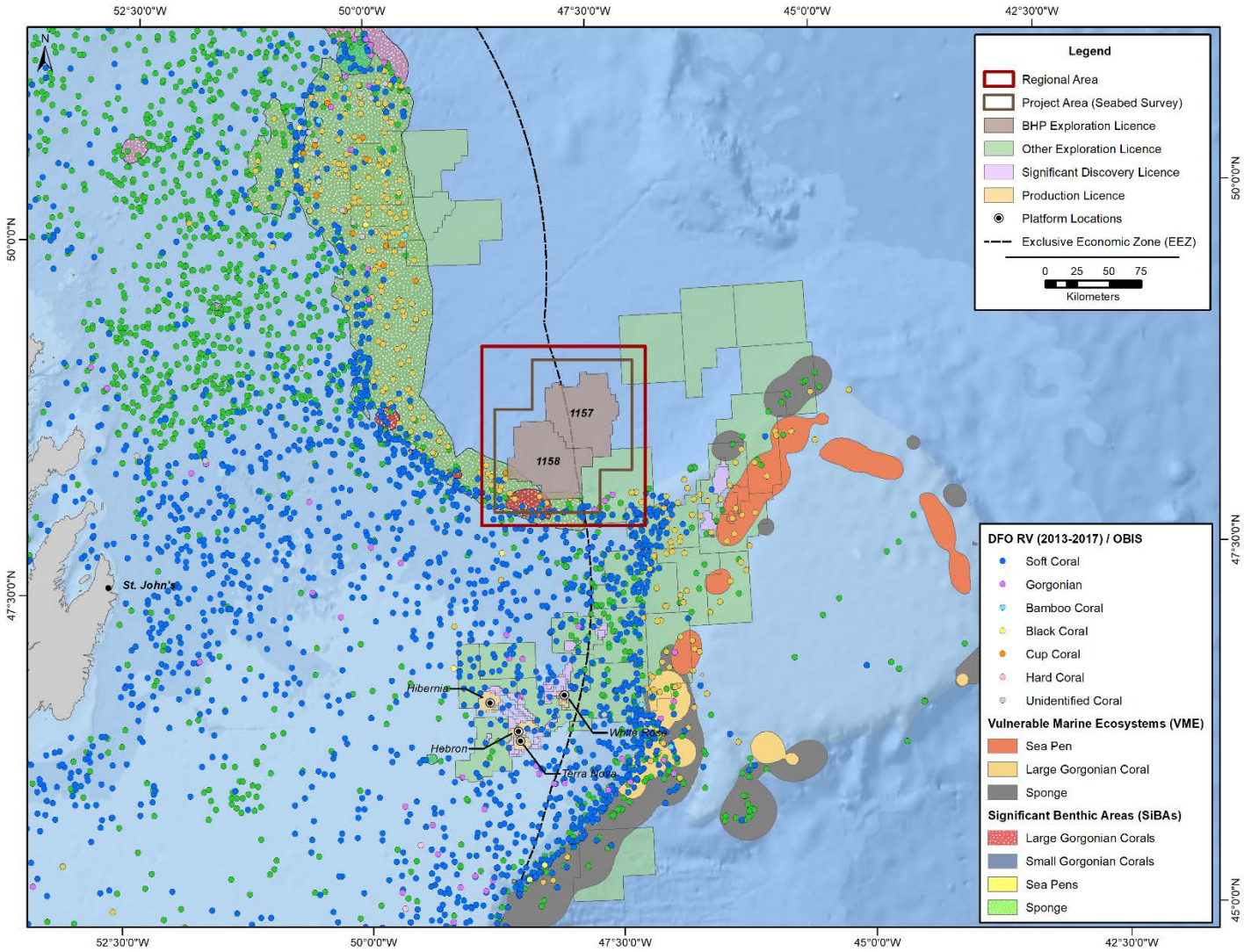


Figure 4-2 Distribution of Corals, Sea Pens and Sponges

DFO has designated some cold-water coral and sponge grounds to be Significant Benthic Areas (SBAs), while the United Nations Food and Agriculture Organization (FAO) has designated some of these areas as Vulnerable Marine Ecosystems (VMEs) (DFO 2017a). These SBAs play important roles in biogeochemical cycling, nutrient recycling, and add habitat complexity to a relatively homogenous sea floor (DFO 2017a). DFO has identified four SBA types based on the dominant taxa: sponge (phylum Porifera), sea pens (order Pennatulacea), small gorgonians (order Alcyonacea), and large gorgonians (order Alcyonacea. The Project Area overlaps with SBAs for sponges and large gorgonian corals (Figure 4-2).

Shellfish species collected from DFO RV transects from 2013 to 2017 within the Regional Area are shown in Table 4.5.

Table 4.5 Shellfish Species Collected from DFO RV Transects Conducted within the Regional Area from 2013-2017

Species	Catch Weight (t)	Mean Catch Depth (m)
Northern shrimp	0.04	77
Acanthephyra pelagica	0.01	241
Sergestes arcticus	0.01	241
Pasiphaea tarda	<0.01	345
Pink glass shrimp	<0.01	301
Atlantopandalus propinqvus	<0.01	N/A
Sergia robusta	<0.01	121
Friendly blade shrimp	<0.01	73
Pasiphaea sp.	<0.01	N/A
Norwegian shrimp	<0.01	605
Sars shrimp	<0.01	N/A
Lebbeus polaris	<0.01	N/A
Gennadas sp.	<0.01	N/A
Grooveback shrimp	<0.01	902
Krill (Euphausiid)	<0.01	278
Snow crab	<0.01	132
Toad crab (*Hyas coarctatus*)	<0.01	316

4.3 MARINE AND/OR MIGRATORY BIRDS

The marine waters off eastern Newfoundland provide a vast area of important breeding, migrating, and wintering habitat for marine and migratory birds. The strong Labrador Current causes upwelling, bringing vital mineral nutrients to the surface. The phytoplankton nourished by this upwelling form the basis for substantial biomass production, culminating in globally important numbers of seabirds in parts of the region in each season (Brown 1986; Lock et al. 1994; Fifield et al. 2009). Observations from the Canadian Wildlife Service (CWS) Eastern Canada Seabirds at Sea (ECSAS) dataset (2005-2016) are mapped for species occurrence that overlap with the Project Area for April to July (Figures 4-3 and 4-4) and August to November (Figures 4-5 and 4-6) (Bolduc et al. 2018). Table 4.6 indicates species and their relative abundance within the Project Area during different seasons.

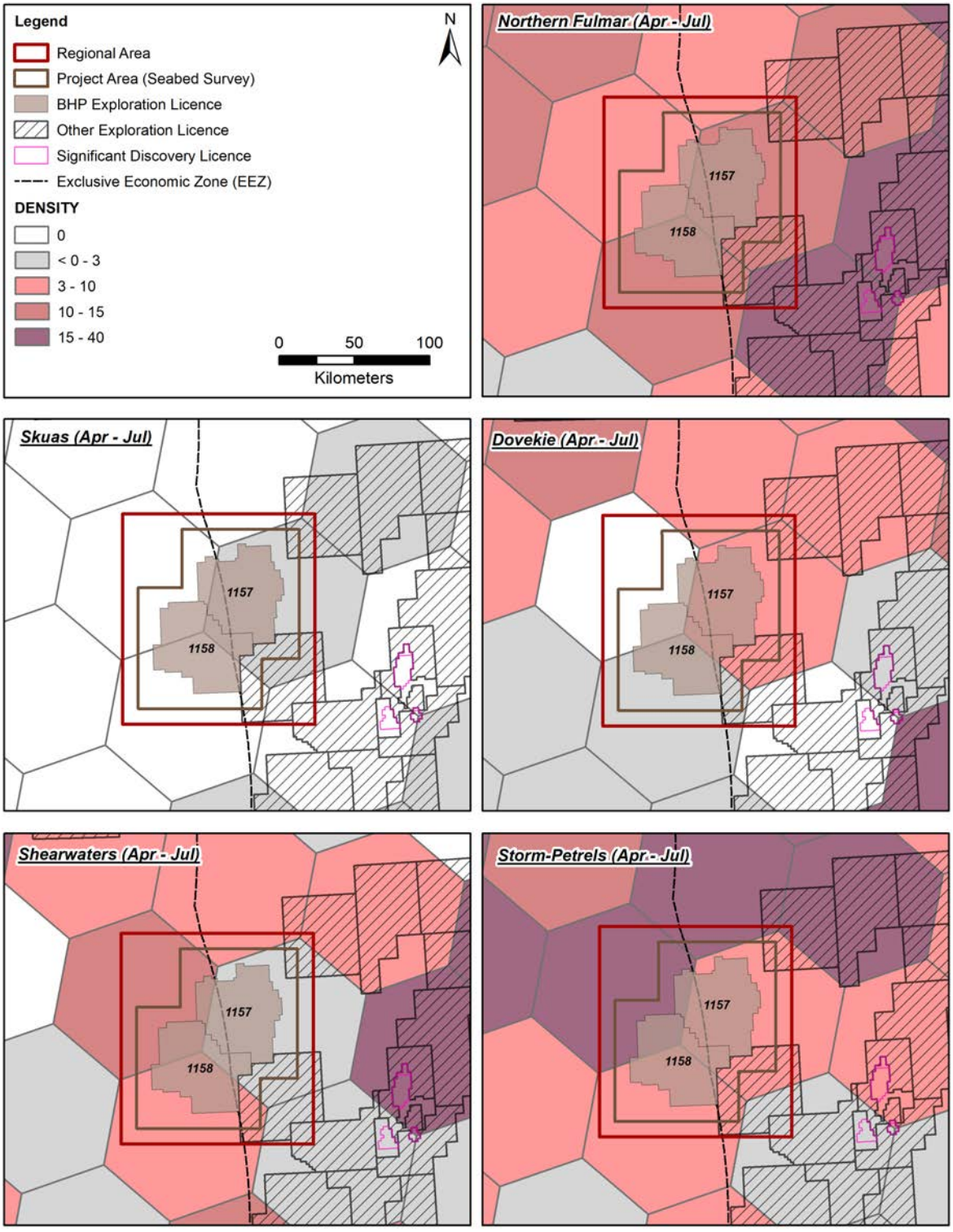


Figure 4-3 Marine Bird Observations from CWS ECSAS Dataset, April – July (northern fulmar, skuas, dovkie, shearwaters, and storm-petrels)

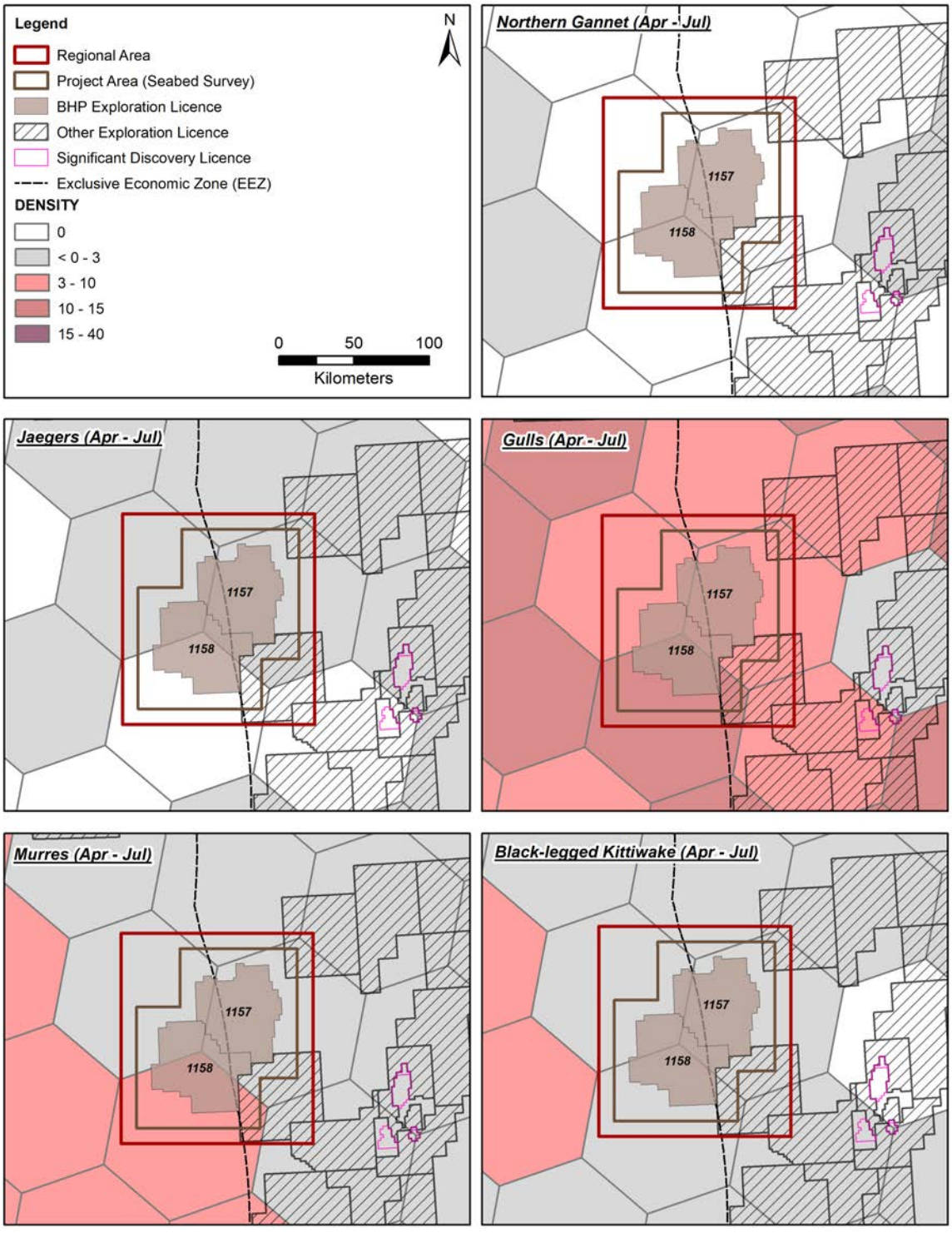


Figure 4-4 Marine Bird Observations from CWS ECSAS Dataset, April – July (northern gannet, jaegers, gulls, murres, and black-legged kittiwake)

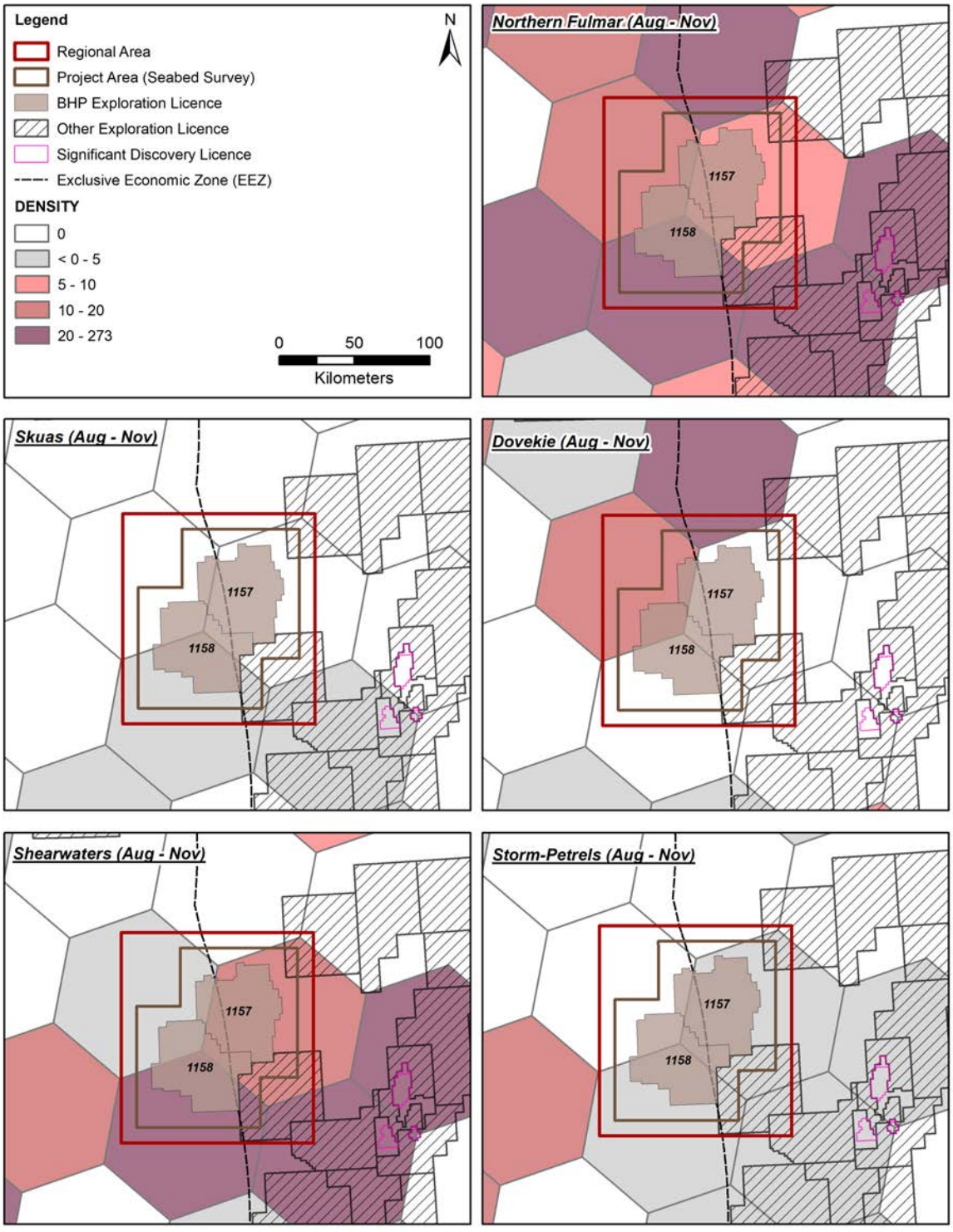


Figure 4-5 Marine Bird Observations from CWS ECSAS Dataset, August – November (northern fulmar, skuas, dovkie, shearwaters, and storm-petrels)

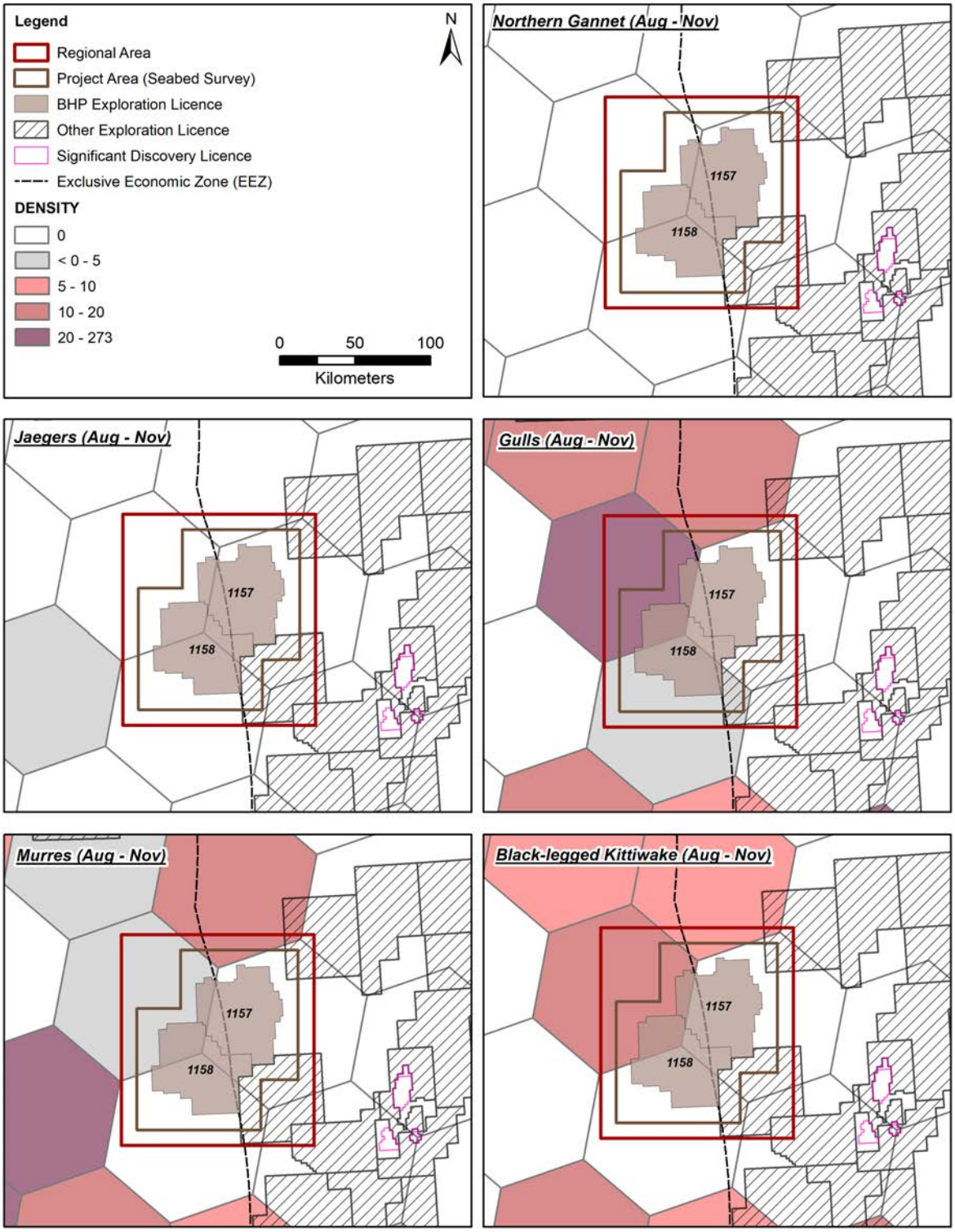


Figure 4-6 Marine Bird Observations from CWS ECSAS Dataset, August – November (northern gannet, jaegers, gulls, murres, and black-legged kittiwake)

Table 4.6 Summary of Seasonal Presence and Relative Abundance of Marine and Migratory Birds in the Project Area

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			

Table 4.6 Summary of Seasonal Presence and Relative Abundance of Marine and Migratory Birds in the Project Area

Common Name	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sep.	Oct.	Nov.	Dec.
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
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: * Species with conservation designation (see Section 6.2.4). 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.

4.4 MARINE MAMMALS AND SEA TURTLES

Twenty-eight marine mammal species could potentially occur in the Project Area, including 22 cetacean species (whales, dolphins, and porpoises) and six seal species. Seven of the cetacean species are considered to be extralimital in offshore water of NL (i.e., outside their normal ranges), but sightings / detections have been or could be made. Most marine mammals use the waters surrounding Newfoundland and Labrador seasonally; the region likely offers important foraging habitat for many species. Based on compiled data, Table 4.7 indicates species of marine mammals and sea turtles that could occur within the Project Area

Marine mammal observations within the Project Area for baleen and toothed whales are shown in Figures 4-7 and 4-8, respectively. Dolphin sightings are shown in Figure 4-9. Sightings are compiled from the DFO sightings database (1947 to 2015). Marine mammal sightings occur year-round in the Project Area; but are most common from June to September.

Figure 4-10 shows sighting of sea turtles based on sighting in the DFO database, as well as from Halpin et al. (2009). Although three species of sea turtles have been reported in the waters of Newfoundland, only the leatherback and loggerhead turtles are likely to occur near the Project Area.

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.

Table 4.7 Cetacean and Sea Turtle Sightings in the Project Area based on Compiled Data

Species	Project Area		
	Number Sightings	Number Individuals	Months Sighted
Mysticetes (Baleen)			
Fin whale	45	68	May-Oct
Sei whale	23	39	May-Oct
Humpback whale	83	148	Jan-Feb, May-Sep, Nov
Minke whale	26	34	Jan, Jun-Sep, Nov
North Atlantic right whale	1	2	Jun
Fin / sei whale	10	16	Jun-Sep
Unidentified baleen whale	47	69	May-Nov
Sperm whale	81	152	Jan-Dec
Northern bottlenose whale	24	66	May-Sep, Oct
Beluga	1	1	Jul
White-beaked dolphin	6	38	May-Jul, Oct-Nov
Atlantic white-sided dolphin	33	726	Feb, Jun-Nov
Bottlenose dolphin	5	24	May-Jun, Sep
Common dolphin	11	517	Jul, Sep-Nov

Table 4.7 Cetacean and Sea Turtle Sightings in the Project Area based on Compiled Data

Species	Project Area		
	Number Sightings	Number Individuals	Months Sighted
Striped dolphin	2	15	Aug
Killer whale	6	21	May-Aug, Oct
Long-finned pilot whale	157	2,722	May-Nov
Harbour porpoise	17	65	Jun-Jul, Sep
Unidentified dolphin	110	1,425	Mar-Nov
Unidentified toothed whale	2	4	Jul-Aug
Others			
Unidentified whale	4	7	Oct-Nov
Unidentified cetacean	103	173	Jan-Oct, Dec
Sources for marine mammals: Lawson and Gosselin (2009); Mactavish and Penney-Belbin (2018); C-NLOPB database, DFO database; Equinor Canada database. Sources for turtles: Halpin et al. (2009); DFO database.			

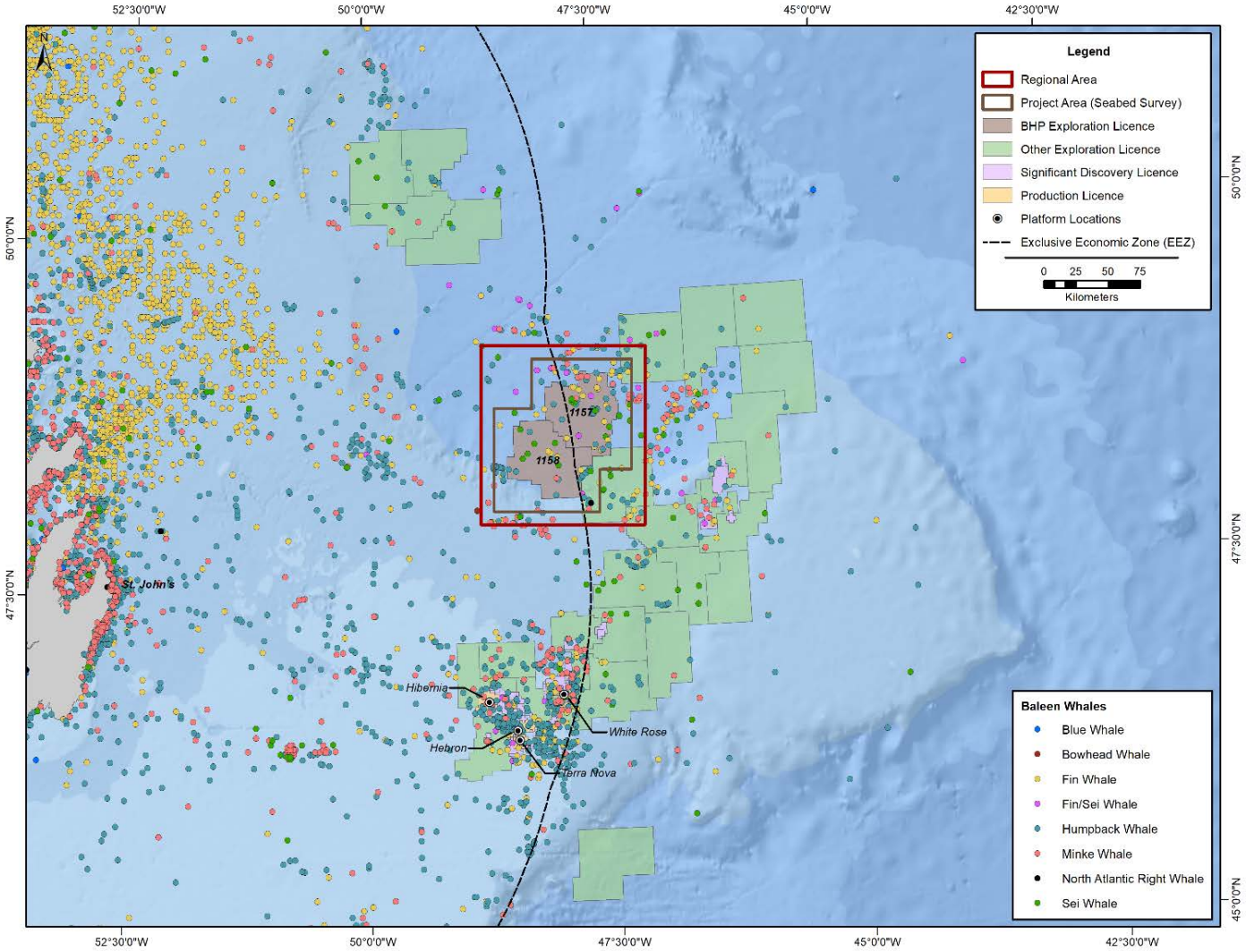


Figure 4-7 Baleen Whale Sightings

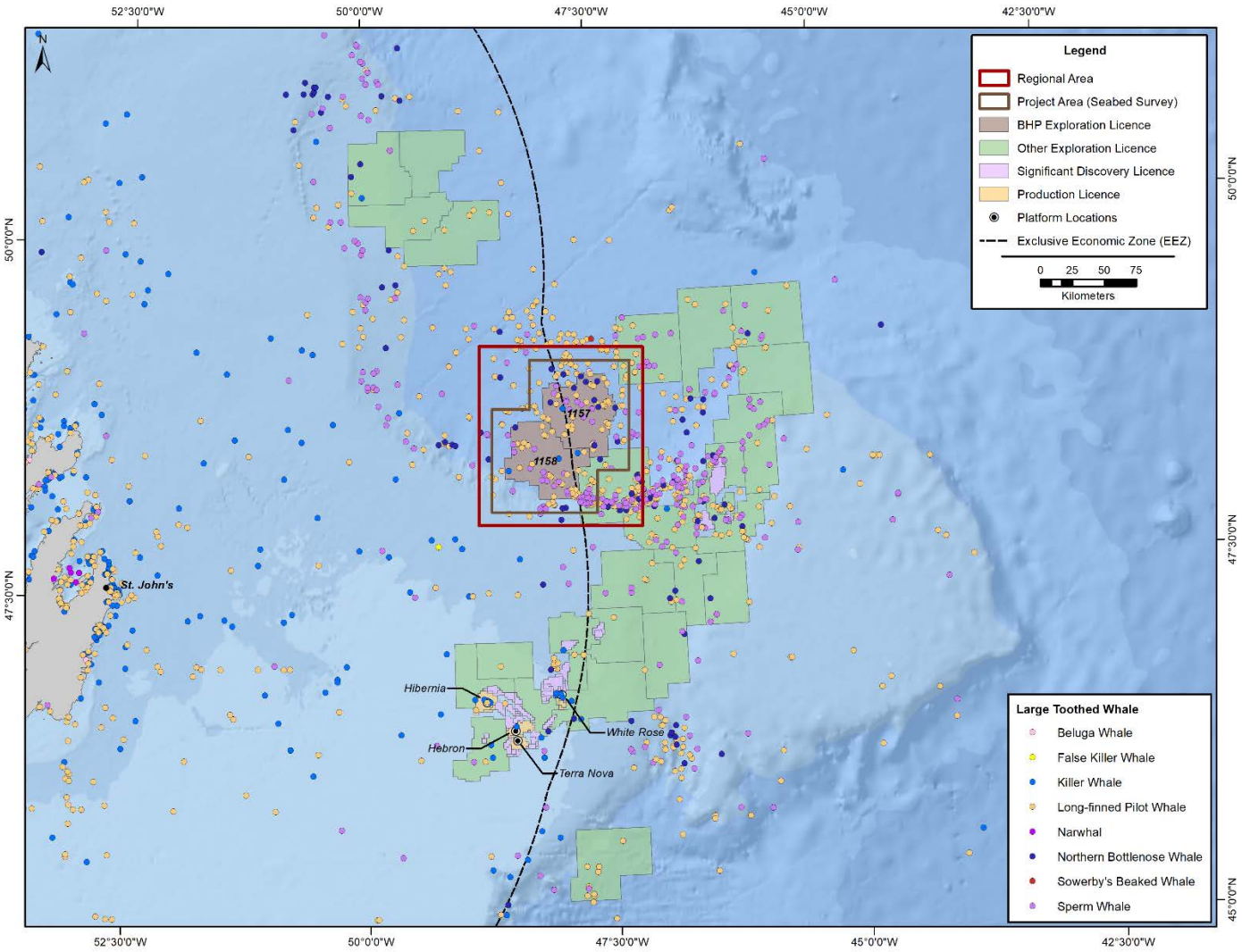


Figure 4-8 Large Toothed Whale Sightings

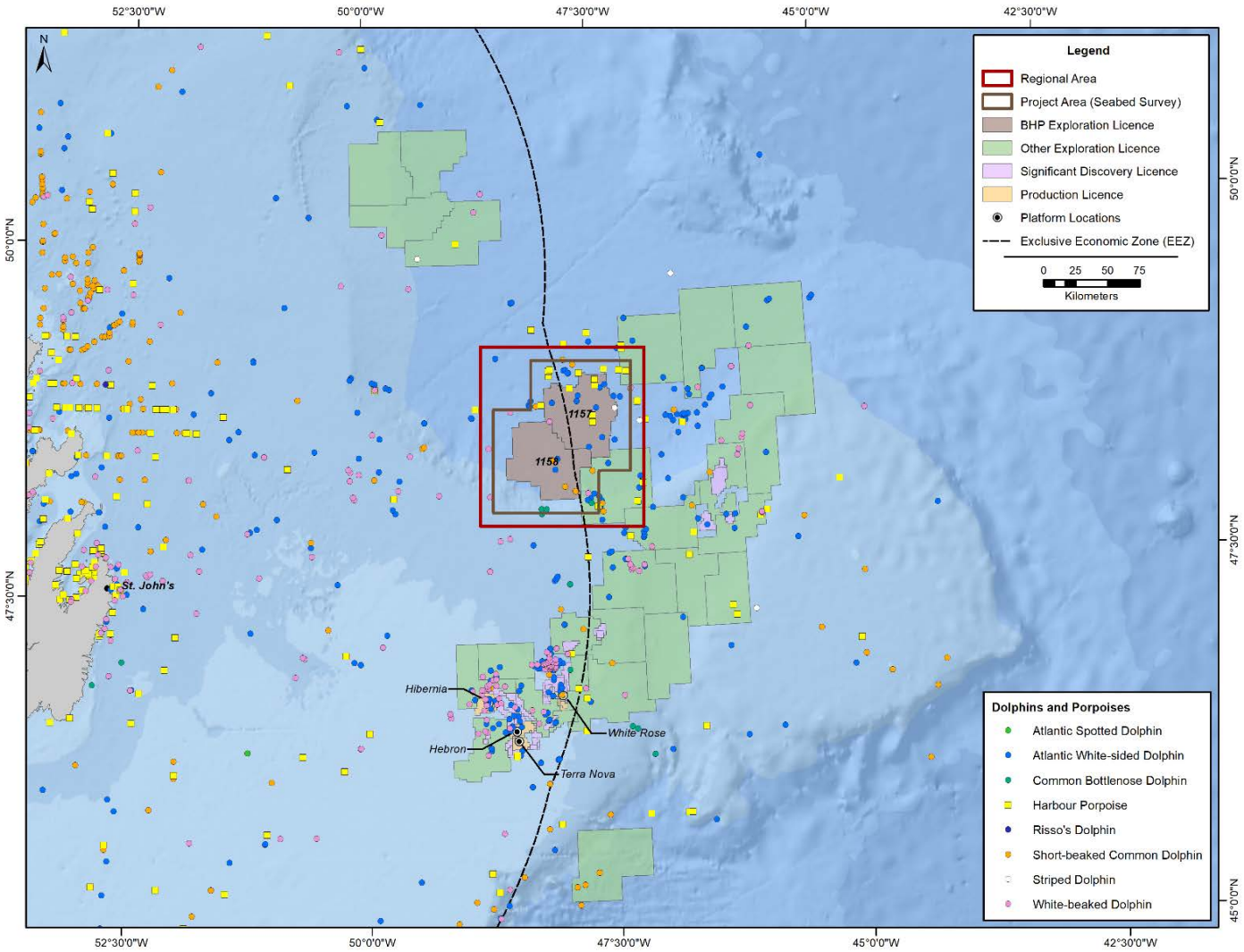


Figure 4-9 Dolphin Sightings

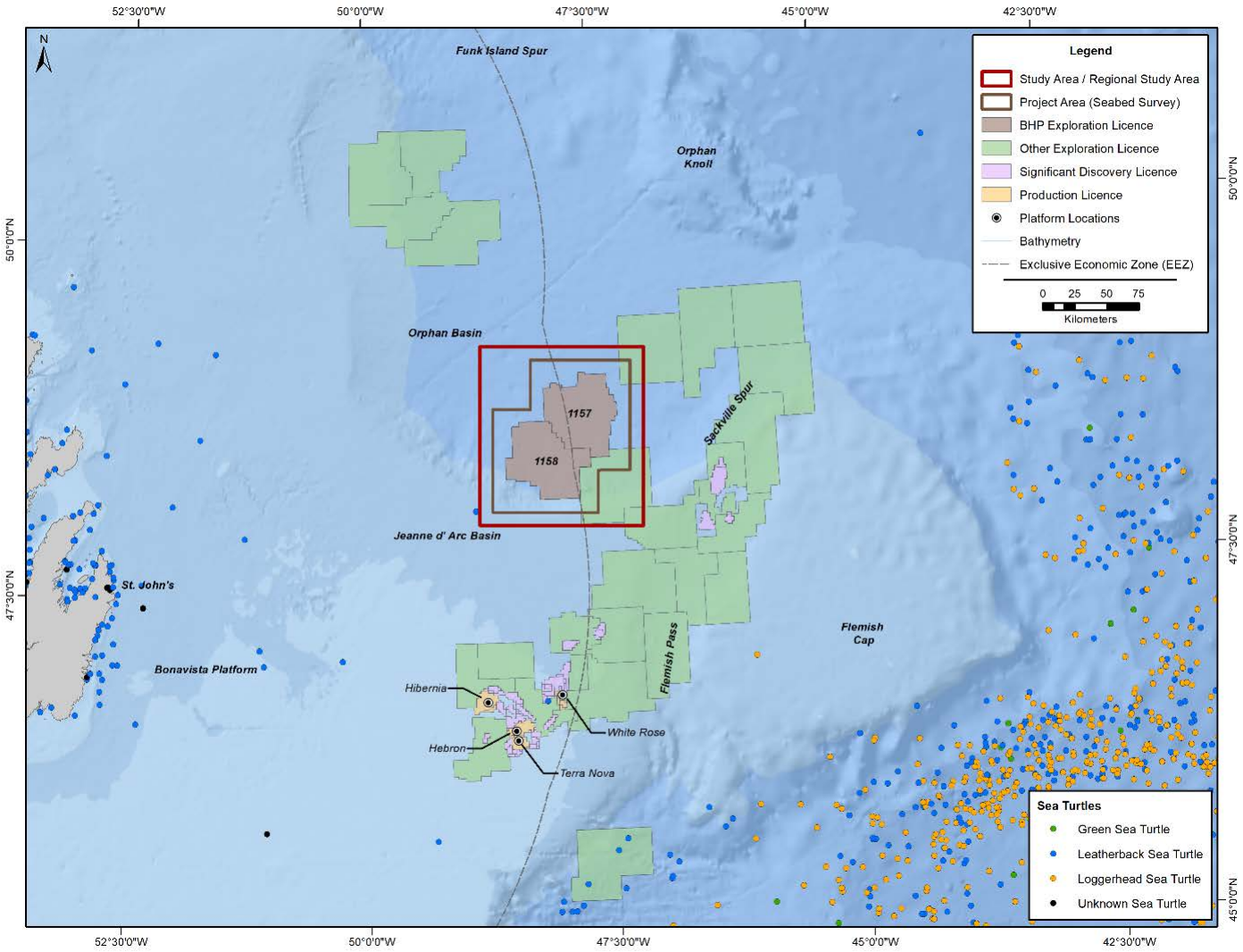


Figure 4-10 Sea Turtle Sightings

4.5 SPECIES AT RISK

Species at risk (SAR) or of conservation concern are listed in Table 4.8. This includes species designated by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) in the categories of extirpated, endangered, threatened and of special concern (Government of Canada 2014), with emphasis on species listed on Schedule 1 of the *Species at Risk Act* (SARA). Characterization of SAR also considers species listed under the Newfoundland and Labrador *Endangered Species Act* (NL ESA) as endangered, threatened or vulnerable (Government of Newfoundland and Labrador 2019), and those species identified in the International Union on the Conservation of Nature (IUCN). Table 4.9 includes a summary describing the distribution, habitat and ecology of SAR listed on SARA Schedule 1 (those highlighted in Table 4.8) that could potentially occur in the Project Area.

Table 4.8 Species at Risk that have the Potential to Occur within the Project Area and Their Status / Designation

Species	Status / Designation[1, 2]			
Common Name	**NL ESA**	**SARA**	**COSEWIC**	**IUCN**
Fish				
Acadian redfish			T	E
Albacore tuna				NT
American eel	V		T	E
American plaice			T	
Atlantic bluefin tuna			E	E
Atlantic cod			E	V
Atlantic halibut				E
Atlantic salmon			T	
			SC	
			SC	
			E	
			SC	
			SC	
			E	
			E	
			E	
				LC
Atlantic wolffish		SC	SC	
Barndoor skate				E
Basking shark			SC	V
Bigeye tuna				V
Blue shark				NT
Common lumpfish			T	
Cusk			E	

Table 4.8 Species at Risk that have the Potential to Occur within the Project Area and Their Status / Designation

Species	Status / Designation[1, 2]			
Common Name	**NL ESA**	**SARA**	**COSEWIC**	**IUCN**
Deepwater redfish			T	LC
Greenland shark				NT
Haddock				V
Little skate				NT
Northern wolffish		T	T	
Porbeagle			E	V
Roundnose grenadier			E	CE
Shortfin mako			E	V
Smooth skate			E	E
Spiny dogfish			SC	V
Spinytail skate				NT
Spotted wolffish		T	T	
Thorny skate			SC	V
White hake			T	
White shark		E	E	V
Winter skate			E	E
Marine and Migratory Birds				
Red-necked phalarope		SC	SC	
Black-legged kittiwake				V
Ivory gull	E	E	E	NT
Ross's gull		T	T	
Leach's storm-petrel				V
Bermuda petrel				E
Desertas petrel				V
Zino's petrel				E
Marine Mammals and Sea Turtles				
Blue whale		E	E	E
Fin whale		SC	SC	V
North Atlantic right whale		E	E	E
Northern bottlenose whale		E	E	DD
Sowerby's beaked whale		SC	SC	DD
Leatherback turtle		E	E	V

Note: Shaded cells indicate Schedule 1 SARA-listed species and are described in greater detail in Table 4.9

[1] Least Concern (LC), Vulnerable (V), Near Threatened (NT), Special Concern (SC), Threatened (T), Endangered (E), Critically Endangered (CE)

[2] Multiple designations refer to multiple populations or sub-populations.

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

Species	Distribution / Habitat / Ecology
Marine Fish	
Atlantic wolffish (Special Concern)	The Atlantic wolffish is found offshore Newfoundland, in nearshore waters up to 918 m and is most frequently found in water depths of 150 m to 350 m (DFO 2018a). It is widely distributed across the North Atlantic, with the centre of its western Atlantic distribution off the coast of northeast Newfoundland. The Atlantic wolffish occurs in shallower waters on the southern Grand Banks, unlike northern and spotted wolffish (DFO 2018a). The life stages of the Atlantic wolffish vary slightly, in that the larvae are pelagic but adult Atlantic wolffish are relatively sedentary. However, adult Atlantic wolffish do take part in seasonal migrations, of a few kilometres, between offshore waters and shallow waters (<120 m deep) for spawning purposes (which occurs in September) (COSEWIC 2012a; DFO 2018a). A Management Plan has been proposed by DFO for the Atlantic wolffish (DFO 2018a).
Northern wolffish (Threatened)	The distribution of the Northern wolffish spans boreal and subarctic waters on both sides of the North Atlantic and in the Arctic. The Shelf, off northeastern Newfoundland and in the Labrador Sea, hosts the highest densities, at temperatures between 2°C and 5°C. Typically, Northern wolffish are found in water depths of 500 and 1,000 m, but have been found in water depths ranging from 38 to 1,504 m. Spawning occurs from September through November (COSEWIC 2012b). A Recovery Strategy has been proposed by DFO for the Northern wolffish that includes proposed critical habitat designation. This proposed critical habitat slightly overlaps with the Regional Area and Project Area, but does not overlap with Project ELs (Figure 4-11) and is approximately 9 km from the nearest Project EL.
Spotted wolffish (Threatened)	Spotted wolffish is found in the Arctic Ocean and on both sides of the North Atlantic, in water depths between 200 and 750 m on the continental shelf or in deep trenches. Fertilization is internal and likely occurs in the summer, after which eggs are deposited on the bottom. While the larval stages are pelagic, juveniles and adults are bottom dwellers (COSEWIC 2012c). 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 slightly overlaps with the Regional Area and Project Area, but does not overlap with Project ELs (Figure 4-11).
White shark (Endangered)	The white shark has a distribution that ranges from 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, which represents the northern fringe of its range. The white shark also occupies a wide depth range, from just below the surface to just above the bottom, down to depths of least 1,200 m. The Mid-Atlantic Bight of the Atlantic Ocean has been identified as a possible white shark pupping area (COSEWIC 2006a).
Marine and/or Migratory Birds	
Red-necked phalarope (Special Concern)	Red-necked phalaropes nest in freshwater ponds in the Arctic and Subarctic, and winter in pelagic waters of the tropics and sub-tropics. During the pelagic portion of their annual cycle, these species are thought to forage primarily at areas of upwelling caused by ocean currents conflicting with shelf edges, shorelines and other currents feeding on zooplankton at the surface (Rubega et al. 2000; Tracy et al. 2002). Phalaropes occur in the Project Area as passage migrants during spring and fall (Moulton et al. 2006; Smith et al. 2014). It has not been possible to calculate densities in the Project Area or the Regional Area because they are seldom recorded during at-sea surveys due to their low density and they are often seen only in flight (Moulton et al. 2006; Bolduc et al. 2018). However, these species have been observed in small numbers off-transect from mid-May to early June and during August and September (Moulton et al. 2006). No recovery strategy or action plans for this species have been prepared yet.

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

Species	Distribution / Habitat / Ecology
Ross's gull (Threatened)	Ross's gull nests in the Canadian Arctic and have wintering areas from the Labrador Sea to the Orphan Basin. This has been established by tracking geolocators and satellite transmitters used to tag gulls (Maftei et al. 2015). Based on the northern wintering areas, this species may be present in very small numbers in the Project Area during winter, but is not likely to be encountered during Project activities due to the planned timing of the survey (May to October). A Recovery Strategy has been prepared for this species, although critical habitat has not yet been identified (Environment Canada 2007).
Ivory gull (Endangered)	Ivory gulls have two nesting locations, the Canadian Arctic and Greenland, and winter from Baffin Bay to the Northeast Newfoundland Shelf, based on studies that fitted the birds with satellite transmitters (Gilg et al. 2010; Spencer et al. 2016). Most of the world's population of Ivory gulls are comprised of individuals from those two nesting populations, so the wintering area has global importance for this species. Bird surveys at the Bay de Verde Wellsite in the winter of 2014 to 2015 reported two sightings of Ivory gulls (Statoil 2015). In late winter and early spring, when sea ice is present, Ivory gull can be expected to occur in small numbers in the Project Area and likely occurs irregularly south of 50°N among the ice pack during heavier ice years. A Recovery Strategy identified critical habitat for Ivory Gull at breeding colonies in Nunavut (Environment Canada 2014). Additional critical habitat is to be identified in a future Action Plan for the species.
Marine Mammals	
Blue whale (Endangered)	The blue whale, the largest animal on the planet, is found in all oceans of the world. During industrial whaling, Blue whales became severely depleted and remain at relatively low densities in the North Atlantic. Current estimates for the blue whale in the western North Atlantic are between 400 to 600 whales (Waring et al. 2011). Based on the DFO sightings database (1947-2015), there have been no sightings of Blue whales in the Project Area. The most recent proposed Action Plan for the Northwest Atlantic population of the blue whale (DFO 2018b) focuses on 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 blue whale.
Fin whale (Special Concern)	With the exception of the Arctic Ocean, fin whales are found in all the oceans of the world. Fin whales spend the winter months at lower latitudes, breeding and calving (DFO 2017b). The North Atlantic population inhabits eastern Canadian coastal waters (primarily in the summer) (DFO 2017b) and are therefore expected to be common throughout Project Area, particularly between June and August. In 2017, DFO released a Management Plan for the fin whale (DFO 2017b).

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

Species	Distribution / Habitat / Ecology
North Atlantic right whale (Endangered)	The right whale can be found from Florida to Newfoundland and the Gulf of St. Lawrence, in the western North Atlantic. The Scotian Shelf and Bay of Fundy hosts two-thirds of the North Atlantic population in summer and fall, with smaller numbers reported in the Gulf of St. Lawrence (COSEWIC 2013). The population size of North Atlantic right whales remains low, despite being the first whale to receive total international protection from hunting in 1937. The population has been declining since 2010 (Pace et al. 2017; Corkeron et al 2018; Pettis et al. 2018); at the end of 2017, the population size was estimated at 411 whales (Pettis et al. 2018). Twelve dead North Atlantic right whales were reported in the Gulf of St. Lawrence between June and September 2017. Necropsies were performed on seven whales, and it was determined that four whales had died due to blunt trauma and two, due to drowning as a result of entanglement. 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). Based on DFO sightings database near the Flemish Cap, the North Atlantic right whale would be considered a rare visitor to the Project Area, with one recorded sighting of two individual right whales south of the Project Area and vocalizations recorded in slope waters off southern Newfoundland (Delarue et al. 2018). 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).
Northern bottlenose whale (Scotian Shelf population) (Endangered)	The northern bottlenose whale is found only in the North Atlantic, primarily in offshore waters. The only endangered northern bottlenose whale population is the Scotian Shelf population. Individuals from this population are found regularly between the Gully, Shortland Canyon, and Haldimond Canyon offshore Nova Scotia (DFO 2016b). In the DFO sightings database between May and September, there have been sightings of northern bottlenose whale recorded in the Project Area. 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 Project Area. 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).
Sowerby's beaked whale (Special Concern)	There is a paucity of information on the occurrence of Sowerby's beaked whale in the waters of offshore Newfoundland and Labrador. Most of the available information that has been gathered is based on strandings records (Lien and Barry 1990, in Husky 2012). It is relatively difficult to detect Sowerby's beaked whales as they have short surface durations, offshore distribution, and faint 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). There is one sighting of four Sowerby's beaked whales in the Project Area in the DFO sightings database (Figure 4-8), and a 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). Sowerby's beaked whale vocalizations were detected year-round in the Project Area during August 2015 to July 2017 (Delarue et al. 2018). Just to the east of the Project Area, detections were made from spring through fall. Sowerby's beaked whale clicks were concentrated along the edge of the Scotian Shelf, and high detection rates also occurred along the shelf edge of the Grand Banks (Delarue et al. 2018). Sowerby's beaked whale is likely to be rare in the Project Area. In 2017, DFO released a management plan for Sowerby's beaked whale (DFO 2017c).

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

Species	Distribution / Habitat / Ecology
Leatherback turtle (Endangered)	Leatherback turtle's foraging behaviour and movements has recently been obtained from studies in Atlantic Canada using satellite telemetry and camera tags, as well as vessel-based sightings 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). An estimated 34,000 to 94,000 adult leatherback sea turtles are present throughout the North Atlantic, as of 2006 (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 throughout their range. 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). The Southwestern Scotian Slope Area, the Gulf of St. Lawrence-Laurentian Channel Area, and the Placentia Bay Area are the three proposed critical habitat areas that have been identified (DFO 2016c). Bycatch in fisheries is the main threat facing leatherback sea turtles in Canadian waters, 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. There are no sightings of leatherback turtles within the Project Area (Figure 4-10). However, some leatherback sea turtles have been observed to the south and west of the Project Area. Occurrence of leatherback sea turtles in the Project Area would be considered rare.
Loggerhead turtle (Endangered)	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 Area in the DFO sightings database. occurrence of loggerhead sea turtles in the Project Area would be considered rare. No Management Plan or Recovery Strategy has been published for the loggerhead sea turtle.

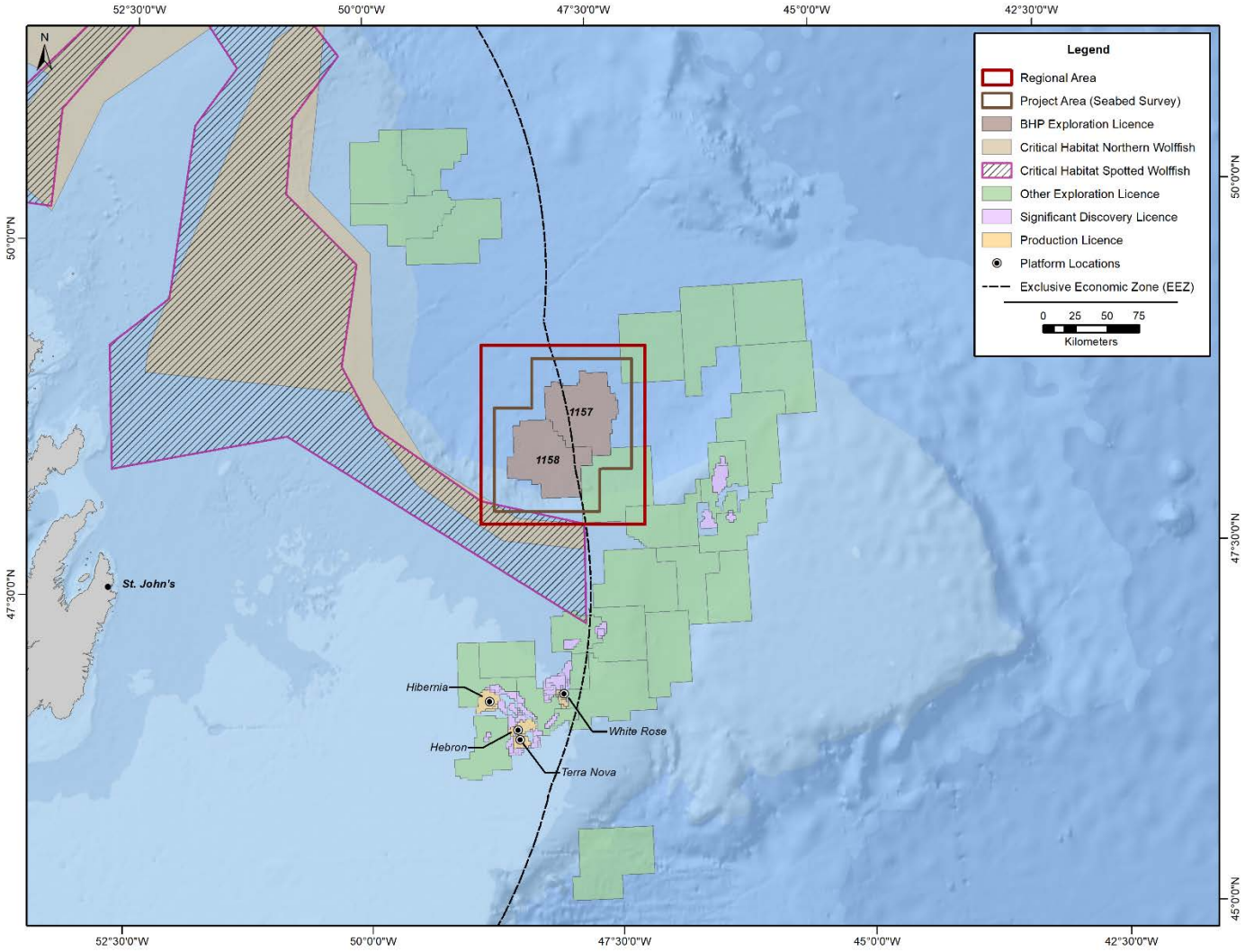


Figure 4-11 Proposed Wolffish Critical Habitat

4.6 SPECIAL AREAS

A number of marine offshore and coastal areas in Newfoundland and Labrador are protected under federal, provincial, international and / or other legislations or agreements due to their ecological, historical or socio-cultural characteristics and importance. Within the Project Area, there are four types of special area, including: a marine refuge, an Ecologically and Biologically Significant Area (EBSA), a Convention on Biological Diversity (CBD) EBSA and significant benthic areas. Special Areas that overlap with the Project Area are indicated in Table 4.10 and Figure 4-12, and their reason for designation is listed in Table 4.11.

Table 4.10 Special Areas that Overlap with the Project Area

Special Area Name	Type	Jurisdiction	Applicable Legislation
Project Area			
Northeast Newfoundland Slope	Marine Refuge	Federal	*Fisheries Act*
Slopes of the Flemish Cap and Grand Bank	CBD EBSA	International	Convention on Biological Diversity
Large Gorgonians	Significant Benthic Area	Federal	
Sea Pens	Significant Benthic Area	Federal	
Northeast Slope	EBSA	Federal	

Table 4.11 Description of Special Areas that Overlap with the Project Area

Special Area	Description / Reason for Protection
Northeast Newfoundland Slope Closure	High density of corals and sponges; has high biodiversity. Bottom contact fishing activities are prohibited to protect corals and sponges and contribute to long-term biodiversity conservation. Area: 55,353 km²
Slopes of the Flemish Cap and Grand Bank	Contains most of the aggregations of indicator species for vulnerable marine ecosystems in the NRA. Includes NAFO closures to protect corals and sponges and a component of Greenland halibut fishery grounds in international waters. A high diversity of marine taxa, including threatened and listed species, are found within the EBSA. Area: 87,817 km²
Northeast Slope	Diverse area with significant aggregations of shrimp, Greenland halibut, Atlantic wolffish northern wolffish, spotted wolffish, roughhead grenadier, witch flounder, American plaice, Atlantic cod, thorny skate, smooth skate, other fish species (including piscivores, plank-piscivores and benthivores), large gorgonian corals, sea pens, black corals, soft corals, sponges, common murre, thick-billed murre, and hooded seal.
Significant Benthic Areas	SBAs play important roles in biogeochemical cycling, nutrient recycling, and add habitat complexity to a relatively homogenous sea floor (DFO 2017a). DFO has identified four SBA types based on the dominant taxa: sponge grounds (phylum Porifera), sea pens (order Pennatulacea), small gorgonians (order Alcyonacea), and large gorgonians (order Alcyonacea)

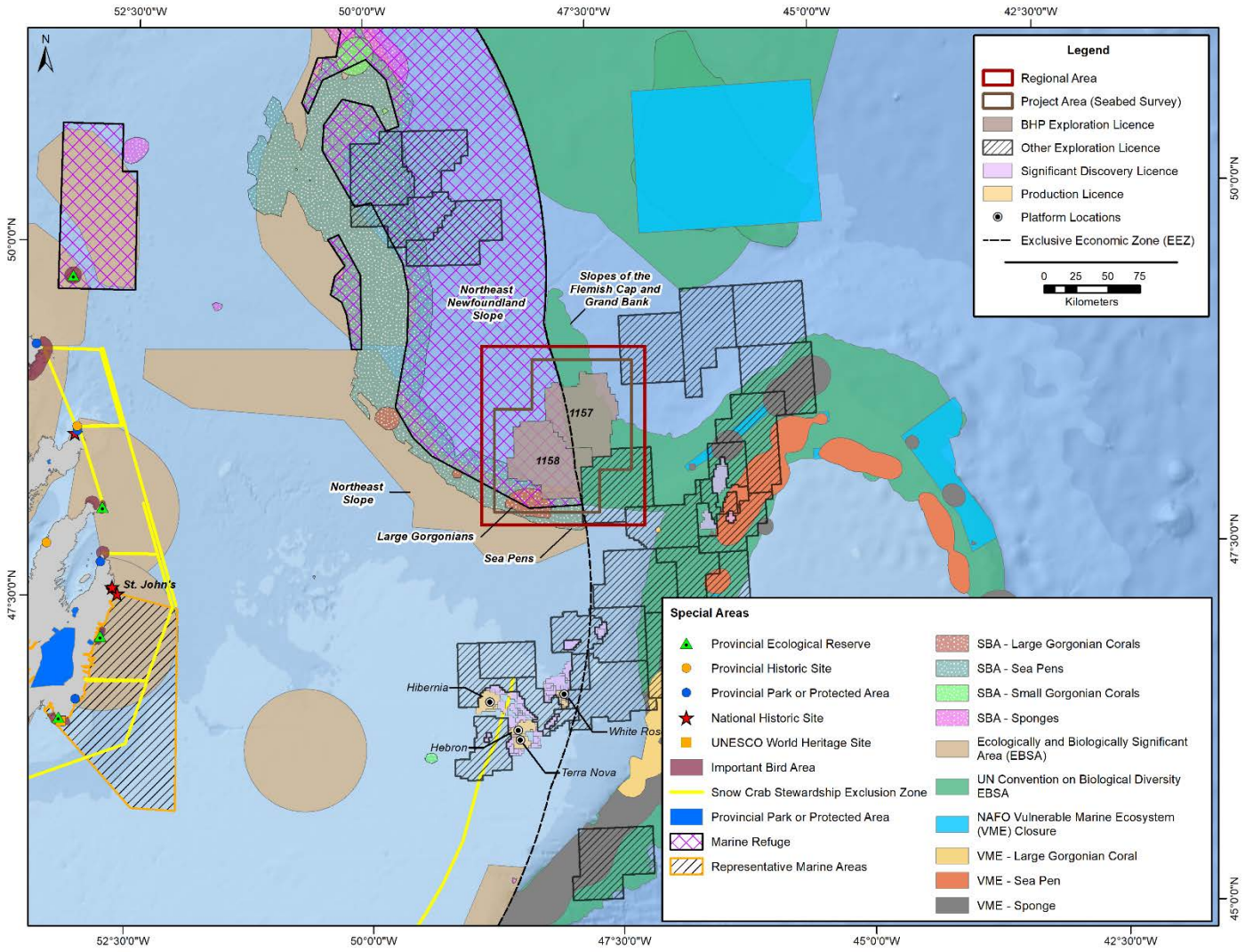


Figure 4-12 Special Areas

4.7 FISHERIES AND OTHER OCEAN USES

Commercial fishing is the principal human activity in many parts of the Newfoundland and Labrador offshore. It is important for economic, social, and cultural reasons dating from the European settlement of the region. For many centuries before that, fishing helped to sustain Indigenous populations, as it continues to do today. Commercial harvesters from other Atlantic Provinces operate in waters on and near the Grand Banks and northward at some time during the year. Beyond Canada's 200 nautical mile (370 km) EEZ, fishing enterprises from other nations harvest year-round alongside Canadian vessels within the NRA.

Most commercial fisheries within and adjacent to Atlantic Canadian waters are managed by two authorities, Canada's DFO and NAFO. DFO has management and regulatory responsibility for several fish stocks and fishing activity within much of Canada's EEZ, and for sedentary species (e.g., snow crab) throughout the Canadian continental shelf. Through the Convention on Cooperation in the Northwest Atlantic Fisheries, NAFO manages several species (straddling stocks) within much of Canada's EEZ and discrete stocks in the portion defined as the NRA: "that part of the Convention Area which lies beyond the areas in which Coastal States exercise fisheries jurisdiction" (NAFO 2004) (i.e., beyond the EEZ).

The Project Area is contained entirely within Unit Area 3Le (see Figure 4-2). Unit Area 3Le and the Project Area overlap both NRA and Canadian EEZ waters. A small portion of the southeastern Project Area (approximately 950 km²) is within an area designated by NAFO as the fisheries "Footprint", or Existing Bottom Fishing Areas - a 120,048 km² zone within the NRA where bottom fishing (e.g., otter trawling) has historically occurred.

Fishing for large pelagic species (i.e., swordfish and tunas) could occur within the Project Area. These fisheries are managed by the International Commission for the Conservation of Atlantic Tunas, which has responsibility throughout the North and South Atlantic.

Based on DFO quantity / value statistics for 2013 to 2017 for NAFO Division 3Le, key fisheries in the Project Area include Greenland halibut, northern shrimp and snow crab (Table 4.12).

Table 4.12 2013-2017 Average Quantity and Value of the Domestic Harvest within Unit Area 3Le by Species

Species	Quantity (t)	Value ($)	% of Total Quantity	% of Total Value
Turbot / Greenland Halibut*	124.0	415,311	76%	76%
Shrimp, *Pandalus borealis*	29.6	71,589	18%	13%
Crab, Queen / Snow	10.4	56,551	6%	10%
Cod, Atlantic*	-	-	0%	0%
Redfish*	-	-	0%	0%
Halibut – Atlantic*	-	-	0%	0%
American Plaice*	-	-	0%	0%
Greysole / Witch*	-	-	0%	0%
Grenadier, Roughhead*	-	-	0%	0%

Table 4.12 2013-2017 Average Quantity and Value of the Domestic Harvest within Unit Area 3Le by Species

Species	Quantity (t)	Value ($)	% of Total Quantity	% of Total Value
Herring, Atlantic	-	-	0%	0%
Mackerel	-	-	0%	0%
Argentine	-	-	0%	0%
Total	164.0	543,451	100%	100%

* Classified as groundfish species by DFO
Species names shown are those used in DFO datasets
Source: DFO 2019c

Greenland halibut are mostly fished using bottom trawls, while shrimp are fished using modified trawls. Both of these are mobile gear types. Locations of commercial fishing activity for mobile gear type with respect to the Project Area for May to October are shown in Figure 4-12. The Project Area overlaps with the Northeast Newfoundland Slopes Marine Refuge; bottom contact fishing activities have been prohibited since 2017. The Project Area also overlaps with Shrimp Fishing Area 7, which encompasses all of NAFO division 3L, and is currently closed to shrimp fishing activity as a species conservation strategy. The closure has been in effect since 2017 and is expected to carry into 2020. If northern or spotted wolffish are caught as by-catch within their designated critical habitat (Figure 4-11), then they are to be released.

Snow crab are harvested using crab pots, which are a fixed gear type. Commercial fishing activity from 2013-2017 from May to October using fixed gear is shown in Figure 4-13.

Due to the location of the Project ELs (in deep water) and the existence of closure areas that overlap with the Project ELs, minimal commercial fishing activity has occurred historically, and in 2017, there was no commercial fishing activity within the Project ELs, based on the DFO geospatial data (Table 4.13).

Table 4.13 Commercial Fishing Activity within the Project Areas for May-October (2013-2017)

Species	2013	2014	2015	2016	2017
Shrimp, *Pandalus borealis*		X			
Crab, Queen / Snow	X	X			
Redfish	X		X	X	
Greysole / Witch	X				
Turbot / Greenland Halibut	X	X	X	X	
Grenadier, Roughhead	X				
Halibut – Atlantic				X	
Cod, Atlantic	X	X	X		

X indicates presence of commercial fishing activity within the Project Area for the year indicated

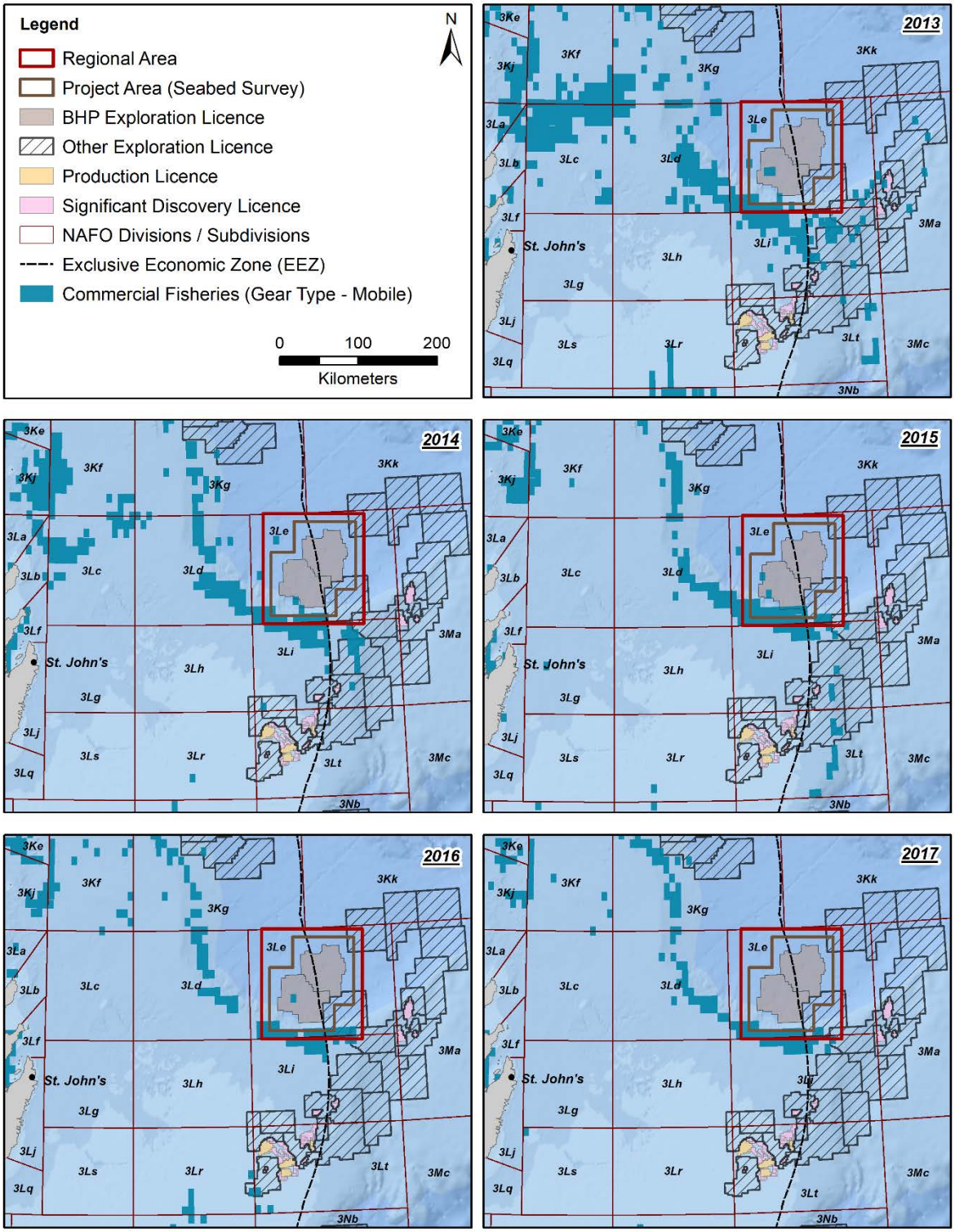


Figure 4-13 Commercial Fishing Activity, 2013-2017, May-October, Mobile Gear Types

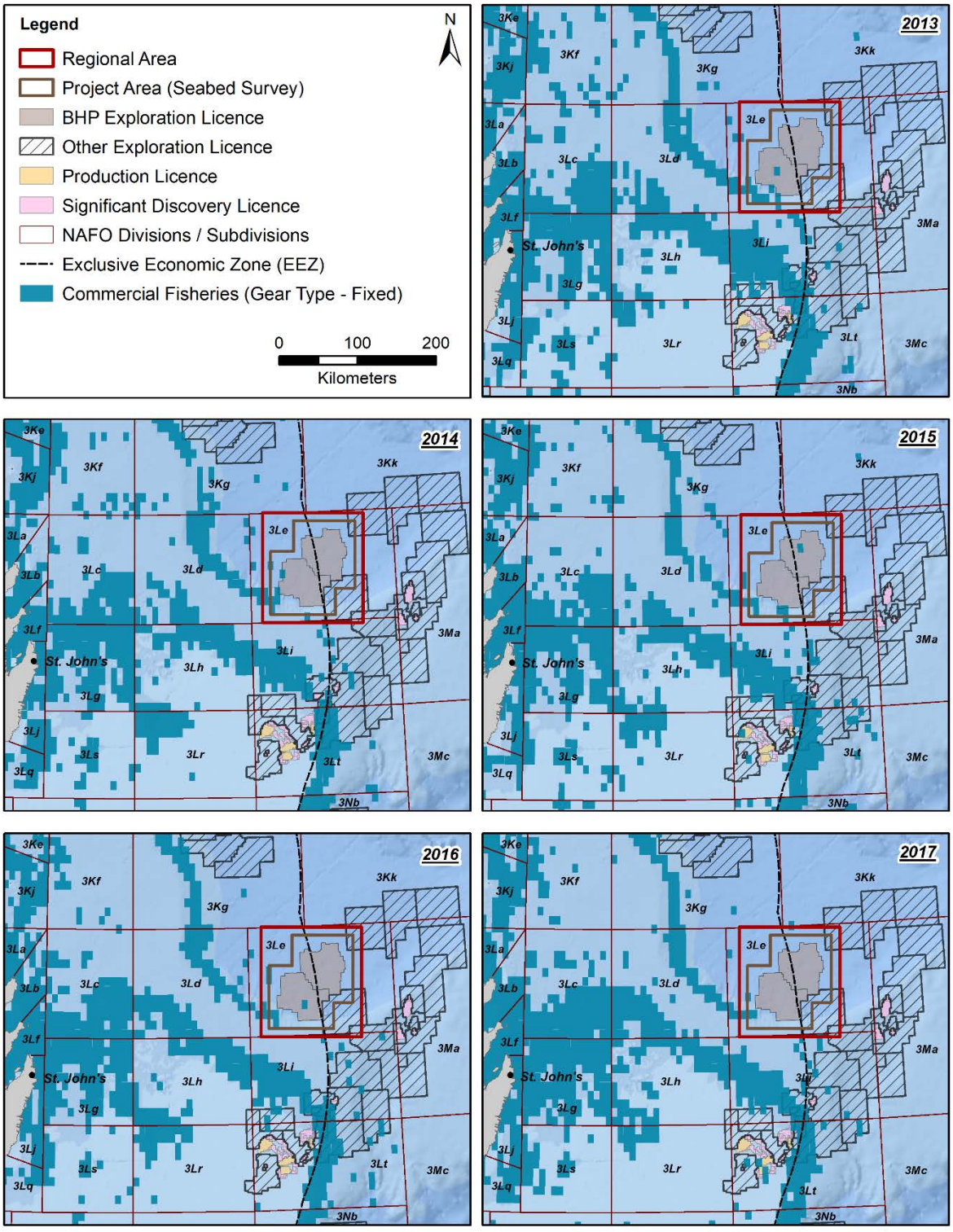


Figure 4-14 Commercial Fishing Activity, 2013-2017, May-October, Fixed Gear Types

BHP is not aware of 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.

Other ocean uses in the Project Area include marine research, marine shipping, other offshore oil and gas exploration, military operations and existing subsea infrastructure. Marine research activities taking place in the waters offshore Newfoundland primarily relate to fisheries science surveys conducted by DFO and fishing industry partners (i.e., DFO spring and fall RV surveys, post-season crab survey, and longline halibut survey).

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. The oil and gas industry has historically accounted for the largest number of vessels entering the harbour, with the exception of 2016, when vessels representing other industries accounted for more port movements than the oil and gas industry. Cruise ship visits also account for an important part of the Port of St. John's activities during the touring season.

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

Key issues as identified in the Scoping Document (C-NLOPB 2019a) are the focus of this EA Report. The Valued Components (VCs) were, in turn, identified based on the potential for interaction with the Project. The focus of this section is on key issues and potential effects.

5.1 VALUED COMPONENTS

Table 5.1 identifies the VCs that have been identified for this assessment, along with a rationale for their inclusion and considerations when defining the scope of the VCs. The Scoping Document (C-NLOPB 2019a) provided important guidance in both identifying the VCs and the issues / potential effects to be addressed for each VC.

Table 5.1 Selection of VCs and Scoping Considerations

VC	VC Rationale and Scoping Considerations
Marine Fish and Fish Habitat	The Marine Fish and Fish Habitat VC includes fish, invertebrates (including corals and sponges) and essential habitat, such as spawning, feeding and/or overwintering areas, that may be affected by Project activities. The selection of this VC considered the ecological value of Marine Fish and Fish Habitat 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. Emissions associated with the survey vessel include underwater sound, light, and effluent discharges (in accordance with MARPOL). These emissions could potentially result in sensory disturbance and localized water quality effects. An accidental event (e.g., diesel spill) could potentially result in injury or mortality to fish and degradation of fish habitat.
Marine and/or Migratory Birds	Marine and/or Migratory Birds includes oceanic, neritic and littoral zone seabirds, waterfowl, loons, grebes, and shorebirds protected under the *Migratory Birds Convention Act, 1994* (MBCA) and additional marine and migratory birds not protected under the MBCA (i.e., cormorants). The selection of this VC considered the ecological value of Marine and/or Migratory Birds 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. Night lighting aboard the survey vessel will be required because it will be in operation on a 24-hour basis. This night lighting could attract birds and lead to strandings. Birds could also be attracted to effluent discharges from the vessel (including sewer and /or food waste).

Table 5.1 Selection of VCs and Scoping Considerations

VC	VC Rationale and Scoping Considerations
Marine Mammals and Sea Turtles	Included in the Marine Mammal and Sea Turtle VC are baleen whales, toothed whales, dolphins, porpoises, seals, and sea turtles that could potentially be affected by Project activities. This VC was selected 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. Underwater sound emissions from the survey vessel may result in sensory disturbance for marine mammals and sea turtles. Marine mammals and sea turtles are also at risk of collision with the survey vessel resulting in injury or mortality.
Species at Risk	Included in the Species at Risk VC are species listed on Schedule 1 of SARA and species assessed as at risk by COSEWIC. Various fish, bird, mammal, and sea turtle species at risk that could occur in the Project Area have the potential to be affected by Project activities. There is no designated critical habitat for species at risk in the Project Area. However, there is an area on the Northern Grand Banks, which includes a portion of the Northeast Newfoundland Slope and overlaps with the Project Area, that has been proposed as critical habitat for the northern and spotted wolffish. This VC was selected in recognition of the ecological value of Species at Risk to marine ecosystems, their vulnerability to disturbance, regulatory considerations, and requirements in the Scoping Document. 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.
Special Areas	Included in the Special Areas VC are areas designated as being of special interest due to their ecological and/or conservation value, including but not limited to, protected areas designated under federal legislation (e.g., *Oceans Act*, *Fisheries Act*) as well as EBSAs. Of particular relevance to this VC is the Northeast Newfoundland Slope closure, which overlaps with the Project Area and is a marine refuge closed to bottom contact fishing to protect corals and sponges.
Fisheries and Other Ocean Users	The Fisheries and Other Ocean Users VC was selected in consideration 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. There is limited potential of interaction between Project activities 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. Additionally, in the unlikely event of gear and/or vessel damage as an accidental event, a compensation program is implemented.

5.2 BOUNDARIES

5.2.1 Spatial Boundaries

The Project spatial boundaries, including the ELs, Project Area, Study Area, and Regional Area are described in Figure 2-1. Table 2.1 includes the coordinates for the Project ELs and Project Area. The Project Area is a 10 km buffer on the Project ELs. The effects of the survey are limited and contained within the

extent of the underwater survey locations and the movement of the survey vessel and for the purposes of this document, the Project Area and the Study Area cover the same aerial extent. A Regional Area has been defined as a 20 km buffer on Project ELs.

5.2.2 Temporal Boundaries

The initial seabed survey is planned to be conducted within ELs 1157 and/or 1158 between May and October 2020 pending authorization from the C-NLOPB; however, seabed surveys could be conducted between 2020 and 2025 at any time of the year. Anticipated duration of each survey will be approximately 7 to 10 days. However, each survey could be as long as 30 days depending on factors such as scope and weather conditions.

5.3 PROJECT INTERACTIONS

Routine Project activities that have the potential to interact with VCs include operation of the survey vessel and conducting the ROV / AUV survey. There is also the potential for accidental events to occur, such as a small release of hydrocarbons (such as lube oil and hydraulic fluid from the Project survey vessel or ROV / AUV), or a marine diesel spill from the Project survey vessel. The potential for Project components to interact with VCs is indicated in Table 5.2.

Table 5.2 Interaction of Project Activities with VCs

Type of Activity	Activity	Marine Fish and Fish Habitat	Marine and/or Migratory Birds	Marine Mammals and Sea Turtles	Species at Risk	Special Areas	Fisheries and Other Ocean Users
Routine Project Activity	Operation of a Survey Vessel	●	●	●	●	●	●
	Seabed Video Survey	●	-	●	●	●	-
Accidental Event	Accidental Hydrocarbon Release from Project Survey Vessel	●	●	●	●	●	●

5.4 MITIGATION

General mitigation measures that will be implemented for the Project to reduce adverse environmental effects on VCs are as follows:

- Lighting on the survey vessel will be limited at night to the extent that it does not affect crew / vessel safety
- The seabird monitoring protocol will follow the CWS “Eastern Canada Seabirds at Sea (ECSAS) Standardized Protocol for Pelagic Seabird Surveys from Moving and Stationary Platforms” (Gjerdrum

et al. 2012). Bird observation data will be recorded per the MOBILE Eastern Canadian Seabirds at Sea (ECSAS) Database User Guide (ECCC 2018)

- Routine systematic checks will be conducted daily on the survey vessel for stranded birds and handling of stranded birds will follow "Documenting Stranded Birds Encountered on Infrastructure Offshore Atlantic Canada" (ECCC 2016)
- A Live Seabird Salvage permit will be acquired from CWS prior to operations and stranded birds (or mortalities) will be reported to CWS in accordance with the permit
- The survey vessel will avoid transiting within 300 m of migratory bird nesting colonies during the nesting period and will comply with provincial *Seabird Ecological Reserve Regulations, 2015* to reduce disturbance to colonies
- Though unlikely to be found within the Project Area, sightings of Bird Species at Risk (such as Ivory Gull and Red-necked Phalarope which have been previously observed in the Project Area) will be reported to ECCC-CWS.
- During transit to the Project Area, the survey vessel will travel at a vessel speed not exceeding 22 km/hour (12 knots), except as needed in the case of an emergency. If a marine mammal or sea turtle is detected in proximity to the survey vessel, survey vessel speed will be reduced to avoid collision.
  In the unlikely event of a collision with a marine mammal or sea turtle (i.e., incident), BHP, or it's designate / contractor will contact the Canadian Coast Guard within 24 hours following the collision. The reporting of an incident is under the jurisdiction of DFO. The Master of the survey vessel involved in the collision is responsible for reporting the incident. DFO requires that the "Marine Mammal Interaction Form" be completed following an incident and be submitted to DFO by email. If the incident involves a live mammal, DFO requires a call be placed immediately to the regional response network. The Master of the survey vessel involved in the collision will also report the incident to BHP, who will notify the C-NLOPB in accordance with the Incident Reporting and Investigation Guidelines
- The marine mammal monitoring protocol will be conducted in accordance with Environmental Studies Research Fund Report "Recommended Seabird and Marine Mammal Observation Protocols for Atlantic Canada" (Moulton and Mactavish 2004)
- There will be ongoing consultation between BHP and stakeholders, including Indigenous groups and commercial fisheries organizations. This will include identifying the location and timing of the survey as well as coordination with fishers using fixed gear in the Project Area
- BHP will provide details of the timing and location of the seabed survey to the Marine Communication and Traffic Services for broadcasting and publishing in the Navigational Warning (NAVWARN) and Notices to Mariners (NOTMAR) systems
- Project-related damage to fishing gear will be compensated through an operator program in accordance with industry best practices in the Newfoundland and Labrador offshore and the Geophysical, Geological, Environmental and Geotechnical Program Guidelines (C-NLOPB 2019b)
- The ROV / AUV, including tether / hoses, will be visually inspected prior to survey start to confirm it is in good working order
- Air emissions and effluent discharges from the survey vessel will be in accordance with the *Canada Shipping Act*, MARPOL, and other applicable standards for the prevention of pollution at sea
- Materials, including chemicals, stored on the survey vessel will be stored and secured appropriately to reduce potential for release to the environment or injury to workers

- As per the Canadian Standards Association publication, Emergency Planning for Industry CAN/CSA-Z731-95, spills or leaks, including those from machinery or fuel tanks will be promptly contained, cleaned- up and reported to the 24-hour environmental emergencies reporting system (Phone: 1-800-563-9089)
- 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

5.5 SIGNIFICANCE CRITERIA

Significance criteria are established in consideration of mitigation measures being applied and establish a threshold against which residual environmental effects can be measured for each VC. A residual environmental effect is considered significant if it:

Marine Fish and Fish Habitat

- Causes a detectable decline in either abundance or change in distribution of fish populations within the Project Area, such that natural recruitment may not re-establish the population(s) to its original level within one generation

Marine and/or Migratory Birds

- Causes a detectable decline in abundance or change in the spatial and temporal distribution of marine and migratory birds within the Project Area, such that natural recruitment may not re-establish the population(s) to its original level within one generation

Marine Mammals and Sea Turtles

- Causes a detectable decline in abundance or change in the spatial and temporal distribution of marine mammals and sea turtles within the Project Area, such that natural recruitment may not re-establish the population(s) to its original level within one generation

Species at Risk

- Results in permanent and irreversible loss of critical habitat as defined in a recovery plan or an action strategy for a listed (SAR) species such that the overall abundance, distribution, and health of that species and its eventual recovery within the Project Area is adversely affected

Special Areas

- 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 special area and would not return to its original level within one generation
- Results in permanent and irreversible loss of critical habitat (if present) as defined in a recovery plan or an action strategy

Fisheries and Other Ocean Users

- Causes an adverse change in commercial fishing activity, including overall timing and intensity, resulting in a measurable reduction in overall activity levels of commercial harvesting and/or in the net economic returns from commercial fishing because of a reduction in the quantity or quality of fish landings or increased operating expenses, for one or more fishing seasons.
- Causes an adverse change in other ocean uses, such as marine research, shipping, military exercises, other petroleum exploration or production, or in-sea infrastructure or artifacts, including changes in the location and timing of these activities resulting in a measurable reduction in their quality, value or integrity over more than a year.



BHP

6.0 ENVIRONMENTAL EFFECTS ASSESSMENT

6.1 ROUTINE PROJECT ACTIVITIES

6.1.1 Operation of Survey Vessel

Operation of the survey vessel has the potential to interact with all six VCs (Table 5.2). The survey vessel will generate sound and light emissions that could potentially result in short-term disturbance and localized water quality effects. This could cause marine fish and marine mammal and sea turtle species (including species at risk) to temporarily avoid the area while the survey is taking place. Operation of the survey vessel will also produce air emissions and effluent discharges; however, they will be managed 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 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 stranding. In addition to the mitigation measures outlined in Section 5.4, routine systematic checks will be conducted daily on the survey vessel for stranded birds. 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.

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. Sound emissions from the survey vessel are temporary and will contribute only a small amount to the existing vessel traffic in the area (i.e., marine shipping and commercial fishing).

Baleen whales are believed to be more sensitive than toothed whales to low frequency sound produced by vessels (MacGillivray et al. 2014), which may cause localized avoidance of the survey vessel. 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 survey 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. As mentioned in Section 5.4, 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 (Conn and Silber 2013). 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 special areas (see Table 4.10 above). Underwater sound and emissions associated with the survey vessel are not expected to affect the ecological and functional integrity of these special areas to the extent that their value is compromised.

Operation of the survey vessel has potential to interact with fisheries and other ocean users by causing them to reroute around the survey vessel while travelling to / from known fishing grounds or areas of

research. 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 interruption to harvest or research activities or impede access to fishing grounds. In the unlikely event of fishing gear loss or damage due to Project activities, BHP will adhere to the Compensation Guidelines outlined in the Geophysical, Geological, Environmental and Geotechnical Program Guidelines (C-NLOPB 2019b).

Based on the above characterization of potential Project interactions with each of the VCs, the limited spatial and temporal scope of survey vessel operations and implementation of mitigation, residual environmental effects of survey vessel operation are expected to be low in magnitude, short term, limited in geographic extent to the Project Area, occur as a single event, and be reversible for all VCs. Residual environmental effects of survey vessel operation for all six VCs are predicted to be not significant.

6.1.2 ROV / AUV Video Survey

As indicated in Table 5.2, the ROV / AUV survey has the potential to cause adverse environmental effects for four of the six VCs: marine fish and fish habitat; marine mammals and sea turtles; species at risk; and special areas. The ROV / AUV survey will have limited potential to interact with fisheries, as the Project activity occurs near the seabed, at depths between 1,176 and 2,574 m where fishing activity is low. The exposure of marine and migratory birds to potential interaction with ROV / AUV surveys would be limited to diving marine birds. However, there is limited potential to interact with the ROV / AUV surveys due to the short duration of submersion by diving marine birds and they do not dive to depths where they would be affected by sound directly from the ROV / AUV unit.

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 acoustic positioning system and the imaging / obstacle avoidance sonar device on both the ROV and AUV. The ultra-high frequency (greater than 200 kHz) sound emissions from the sonar device will be generated near the seafloor and is outside the sensitive hearing range for high-frequency marine mammals (i.e., pinnipeds, toothed and baleen whales).

For the ROV, sound emissions from the acoustic positioning system will travel through the water column between the survey vessel. There will be no transponders on the seafloor. The received sound levels will be in the range of 160 dB re 1µPa rms SPL at a frequency of approximately 19-36 kHz, and therefore are likely to be audible by most fish 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. The sonar systems on the AUV are operated though battery power and have similar ranges as the ROV, which have the potential to result in similar effect on fish species.

Light emissions are predicted to be fairly localized to the location of the ROV / AUV, 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), 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 special areas that overlap with the Project Area (Table 4.10). As indicated in Section 4, the Project Area overlaps with special areas that provide important habitat for SAR (i.e., northern wolffish, spotted wolffish, and white shark) and also overlaps with significant benthic areas for coral, which provide important nursing grounds and protection for fish species during different stages of development.

The presence of the coral and sea pen significant benthic areas is in part what led to the designation of the Northeast Newfoundland Slope marine refuge, and these important habitats are protected though the implementation of a ban from bottom contact fishing. Although a change in habitat will exist due to light and sound emissions from the ROV / UV, the change will be localized and is not predicted to physically alter the habitat to the extent that it would affect local abundance of species relying on the sensitive habitat. Physical interaction with habitat could occur if the AUV become disoriented or loses battery power during operation and comes to rest on the sea floor. Implementation of mitigation measure related to the AUV, including routine checks, means that these events will be rare. In the event that an AUV does come to rest on the seafloor, it will be retrieved by an ROV in a timely manner so that interactions are reduced.

Based on the characterization of potential Project interactions with all of the VCs and taking into consideration the limited spatial and temporal scope of the seabed video survey, residual environmental effects of the ROV / AUV 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 special areas. Residual environmental effects of the ROV / AUV video survey on these VCs are predicted to be not significant.

6.2 ACCIDENTAL EVENTS

Throughout the duration of the Project, there is the potential for a marine diesel spill from the survey vessel. As indicated in Table 5.2, a diesel spill could potentially interact with all six VCs. The spatial and temporal extent of interaction is expected to be limited given that marine diesel has a low viscosity and high aromatic content and surface oil would evaporate rapidly and break up into the water column following release. Effects of marine fish and marine mammals and sea turtles are expected to be minimal, as they tend to avoid oil spills.

Marine and/or migratory birds would be most at risk, as 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., inhalation 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). In the unlikely event of a spill, BHP will consult with CWS for appropriate response, handling, and monitoring of marine and/or migratory birds, for example response measures outlined in the Birds and Oil - CWS Response Plan Guidance (CWS 2017).

Given the limited volume and nature of hydrocarbon materials on board the survey vessel (including hydraulic and lubricating oils), the probability of interaction with special areas is 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.

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 Geophysical, Geological, Environmental and Geotechnical Program Guidelines (C-NLOPB 2019b).

Given the unlikely occurrence, nature of the hydrocarbons to dissipate quickly, and implementation of mitigation measures, including a shipboard oil pollution emergency plan an accidental spill, including a diesel spill from the survey vessel, is predicted to result in not significant adverse environmental effect on marine fish and fish habitat, marine and/or migratory birds, marine mammals and sea turtles, species at risk, special areas, and fisheries and other users.

6.3 EFFECTS OF THE ENVIRONMENT ON THE PROJECT

The physical environment of the Project, as outlined in Section 5.1, influences the key environmental factors that could affect the Project, which include ice and weather conditions (e.g., wind, waves, and visibility).

The survey timing, scheduled to take place between May to October, was selected to reduce risk of ice and severe weather on the Project. If sea ice and/or icebergs are present, they will be avoided by the survey vessel. As well, the survey vessel will have systems for storm tracking and weather forecasting services. Reduced visibility, high wind and wave conditions, and other severe and/or extreme weather conditions may delay survey activities and increase the potential for vessel collisions and in extreme cases, cause injury or fatality.

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

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 negligible given the short time frame of the Project, reversibility of effects, limited geographic scope, the non-intrusive nature of Project activities, and implementation of mitigation described above.

Operation of the survey vessel and the ROV / AUV survey 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 other 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, as relevant.

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. Mitigation measures in advance of the ROV / AUV survey, as outlined in Section 5.4, will also help to reduce potential conflicts.

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, special 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

BHP has a clear goal to facilitate sustainable development and is committed to reducing environmental effects. BHP will implement and adhere to relevant environmental mitigation requirements outlined in applicable legislation and regulations to reduce environmental effects associated with the Project. These mitigations are outlined in Section 5.4. Environmental mitigation and compliance requirements will be implemented and adhered to by Project contractors and subcontractors (i.e., survey vessel operator) as it applies to their specific work scopes. This will be enforced through relevant commercial and contractual arrangements with these providers or goods and services to the Project.

BHP's highest priority is the safety of those affected by its operations, including BHP employees, contractors, and the communities in which it operates. BHP achieves nothing if it does not do it safely. Recognizing that BHP's operations can affect the health of its people, BHP sets clear requirements to manage and protect the health and wellbeing of its workforce, now and into the future. BHP looks to create a culture of care and trusted relationships with its people through strong leadership and open communication.

BHP aims to reduce the environmental effects from its activities and work in partnership with others to support environmental resilience. BHP seeks to build good relationships with its stakeholders based on mutual respect, open and ongoing communications, and transparency over its activities. BHP supports the development of diversified and resilient local economies that contribute to improved quality of life beyond the life of BHP's operations.



BHP

8.0 SUMMARY AND CONCLUSIONS

BHP is proposing to conduct an exploration drilling program on ELs 1157 and 1158, located in the Orphan Basin, with an initial well planned as early as 2021. BHP is planning a visual survey of the seabed using an ROV and/or AUV at potential drilling locations within ELs 1157 and 1158 to characterize seabed features (the "Project") including:

- Identification and location of sensitive environmental features / habitats such as aggregations of habitat-forming corals or sponges
- Evaluation of benthic species diversity and abundance at each location
- Identification of geologic features such as boulders or hardgrounds
- Identification and location of anthropogenic features such as unexploded ordinances, wrecks, cables, and debris

The initial seabed survey is planned to be conducted within ELs 1157 and/or 1158 between May and October 2020, pending authorization from the C-NLOPB; however, seabed surveys could be conducted between 2020 and 2025 at any time throughout the year. Anticipated survey duration will be approximately 7 to 10 days. However, the surveys could be as long as 30 days depending on factors such as scope and weather conditions. In accordance with the Accords Act, the Project requires authorization from the C-NLOPB.

Adverse environmental effects or cumulative environmental effects from planned Project activities or accidental events are predicted to be not significant for all six of the assessed VCs (i.e., marine fish and fish habitat, marine and/or migratory birds, marine mammals and sea turtles, species at risk, special areas, and fisheries and other users).

Project activities are not expected to contravene prohibitions of SARA. Throughout the duration of the seabed survey, a marine mammal and seabird observer will be onboard. Given the short duration of the Project and the unobtrusive nature of the ROV / AUV survey, there is no requirement for follow-up monitoring.

BHP is committed to build upon Indigenous and stakeholder engagement efforts associated with their proposed exploration drilling program. BHP 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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