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6.0 EXISTING BIOLOGICAL ENVIRONMENT

This section describes the existing biological environment, including marine fish and fish habitat, marine and migratory birds, marine mammals and sea turtles, and Special Areas. Species at Risk (SAR) and Species of Conservation Concern (SOCC) are discussed within each biological group. SAR include all species listed under Schedule 1 of the federal *Species at Risk Act* (SARA) that are endangered, threatened, or of special concern, or under the Newfoundland and Labrador *Endangered Species Act* (NL ESA) as endangered, threatened, or vulnerable. Designations listed on Schedule 1 of SARA are defined as follows:

- Extirpated: A species that no longer exists in the wild in Canada, but exists in the wild elsewhere
- Endangered: A species that is facing imminent extirpation or extinction
- Threatened: A species that is likely to become endangered if nothing is done to reverse the factors leading to its extirpation or extinction
- Special Concern: Species which may become threatened or endangered because of a combination of biological characteristics and identified threats

Under the NL ESA the categories for protection designation of indigenous species, sub-species and populations are as follows:

- Endangered: A species that is facing imminent extirpation or extinction
- Threatened: A species that is likely to become endangered if nothing is done to reverse the factors leading to its extirpation or extinction
- Vulnerable: A species that has characteristics which make it sensitive to human activities or natural events

SOCC include those species that are listed as endangered, threatened, or of special concern by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC), or under the International Union for Conservation of Nature (IUCN) Red List.

This description of the biological environment relies substantially on previous research; no field work was conducted as part of this EIS. Key information sources are discussed within each section and include but are not limited to: the Eastern Newfoundland SEA (Amec 2014), previous EA reports prepared for other exploration drilling projects in the Orphan Basin, Flemish Pass and Jeanne d’Arc Basin in the Eastern Newfoundland offshore area; surveys of seabirds at-sea in these areas by industry from 1999 to 2002 (Baillie et al 2005); surveys by industry from 2004 to 2017 (reports per individual geophysical programs); surveys by university researchers (Wiese and Montevecchi 1999; Burke et al. 2005); surveys by Bedford Institute of Oceanography and Canadian Wildlife Service (Brown 1986); surveys by Environment Canada’s Programme intégré de recherches sur les oiseaux pélagiques (PIROP) (Lock et al 1994); and surveys conducted for Environment and Climate Change Canada’s Eastern Canadian Seabirds at Sea (ECSAS) program (Fifield et al. 2009; Bolduc et al 2018).

6.1 Marine Fish and Fish Habitat

This section of the EIS describes the existing biological environment for marine fish and fish habitat in areas that have the potential to interact with routine Project activities or by accidents and malfunctions including a characterization of fish populations, plankton, marine plants (e.g., macroalgae) and benthic invertebrate communities (e.g., corals and sponges). Fish habitat is described according to the benthic and pelagic habitats likely to be present in the Project Area. Specific information on physical characteristics of fish habitat (e.g., marine geology, and geomorphology, sediment, and marine water quality) are described in Chapter 5.

The eastern Newfoundland offshore area is a highly-productive ecosystem, and many marine fish species are known to occur in Newfoundland and Labrador waters (Templeman 2010; Amec 2014). The occurrence of these species is based on their physiological and life history requirements; their presence may vary according to habitat, environmental conditions, and life history stage (Amec 2014). The marine fish species that may occur in or near the Project Area are described in the following sections.

Within the Project Area, habitats transition from Newfoundland slope to abyssal. These Newfoundland slope areas support regionally important areas of biodiversity and marine productivity and are used by fish and invertebrate species of commercial, cultural, and / or ecological value. The abundance and distribution of these fish and invertebrate species depend on their linkages with other species across fish habitats and interactions with the physical parameters of the marine environment.

6.1.1 Approach and Key Information Sources

The description of the biological environment presented for the Project is based on the results of previous research and existing scientific literature and environmental assessments; no field work was conducted as part of this EIS. The Project falls within the geographical scope of the Eastern Newfoundland SEA (Amec 2014), which provides a regional overview of the offshore marine ecosystem that includes the Grand Banks, Flemish Cap, Orphan Basin, and adjacent slope and abyssal habitats. Descriptions of species life histories and ranges can be found in the Eastern Newfoundland SEA (Amec 2014), as well as EAs for Statoil's Flemish Pass Exploration Drilling (Statoil 2017), and Chevron's North Grand Banks Regional Seismic Program (LGL Limited 2003).

A list of the key information sources used to describe marine fish and fish habitat in the Project Area and RAA is provided below:

- Eastern Newfoundland SEA (Amec 2014)
- DFO Research Vessel Trawl Surveys (DFO 2016a)
- NASA Satellite Imagery of Chlorophyll an Open access data source: http://neo.sci.gsfc.nasa.gov/view.php?datasetId=MY1DMM_CHLORA
- International Union for Conservation of Nature (IUCN)
- SARA / COSEWIC Species Status Reports
- NAFO Reviews (e.g., Wang and Greenan 2014)

6.1.2 Trophic Linkages and Community Changes

Describing fish and fish habitat in terms of trophic linkages helps to understand how projects interact with fish and fish habitat. In the marine environment, photosynthetic phytoplankton are the primary producers and the food source for primary consumers such as zooplankton, planktivorous fish and invertebrates through consumption. These organisms are consumed by larger fish, marine mammals, and birds. Detritivores consume dead flora and fauna at all stages in the cycle and provide nutrients back to the marine environment. Significant changes to the abundance of any group of organisms can result in effects to other levels of the food web. Changes in the abundance of organisms can occur over a range of time scales, from diurnal migrations within the water column to shifts in habitat characteristics or predator-prey ratios over decades.

Recent shifts in the Northwest Atlantic occurred between the mid-1980s to early 1990s, where the ecosystem structure shifted with a decrease in groundfish stocks. Several studies in the Northwest Atlantic have suggested that the increase in shrimp biomass was a consequence of lower predation attributable to the collapse of groundfish stocks such as cod (Lilly et al. 2000; Myers and Worm 2003; Frank et al. 2005), although climate fluctuations may also have been partially responsible (Rose et al. 2000). Additional prey species including pelagic fish and invertebrates such as sand lance, herring, shrimp, and snow crab were shown to increase in abundance (Koen-Alonso et al. 2010; Templeman 2010; Dawe et al. 2012; Nogueira et al. 2017). In more recent years, rising water temperatures and restrictions on harvesting are favoring the return of a groundfish-dominated system (Koen-Alonso et al. 2010; Templeman 2010; Dawe et al. 2012; Nogueira et al. 2017). The rising water temperatures in the Northwest Atlantic put the region in the top 1% globally in terms of increasing sea-surface temperatures (EPA 2016; Pershing et al. 2015). Warming sea surface temperatures in this region have been linked to a northward shift in both fish species distribution and commercial fishing industry catch (Pershing et al. 2015, Nye et al. 2009; Pinsky and Fogarty 2012).

6.1.3 Key Marine Assemblages

Fish have physiological, morphological, and life history requirements which define their preferred habitats and resulting distributions. Key physical attributes which factor into species distributions include salinity, water depth, and temperature (Gomes et al. 1992). Gomes et al. (1992) utilized a 16-year data set from the Grand Banks spring groundfish surveys to determine six broad geographic groups and subgroups. Each group was defined by a persistent and relatively homogenous fish community. The group most representative of the Project Area was defined as the Northeast Shelf Deep Sub-Group. The geographic area of this sub-group occurs along the north, eastern and southern slopes of the Grand Banks. The fish assemblage in this region includes the following species: Acadian redfish (*Sebastes fasciatus*); Atlantic cod (*Gadus morhua*); thorny skate (*Amblyraja radiata*); American plaice (*Hippoglossoides platessoides*); striped wolffish (*Anarhichas lupus*); Greenland halibut (*Reinhardtius hippoglossoides*); witch flounder (*Glyptocephalus cynoglossus*); and roughhead grenadier (*Macrourus berglax*). These species were consistently recorded in at least 13 of the 16 surveys.

Snelgrove and Haedrich (1985) have assessed the fish assemblages of the deeper waters off the continental slopes at water depths similar to that of the Project (1,000 m to 3,000 m) and determined that the deep-water fish assemblage is comprised of: blue hake (*Antimora rostrate*); roundnose grenadier (*Coryphaenoides rupestris*); carapine grenadier (*Lionurus carapinus*); smoothhead (*Alepocephalus sp.*); and Kaup's arrowtooth eel (*Synaphobranchus kaupii*).

Structure-forming benthic invertebrate species that occur in the Orphan Basin and in surrounding areas, include corals, sponges, and sea pens (Amec 2014). These coral, sponge, and sea pen communities provide nurseries, areas of refuge, and spawning and breeding grounds for a variety of species, including commercially-important species (Working Group on Ecosystem Approach Framework to Fisheries Management 2008; Baillon et al. 2012; FAO 2016). Corals known to be present within the Project Area include alcyonaceans (small and large gorgonians, soft corals), pennatulaceans (sea pens), scleractinians (stony corals), and antipatharians (black corals) (DFO 2014a, 2015, 2016a). More information on corals and sponges is provided in Section 6.1.6.

6.1.4 Plankton, Plants and Macroalgae

Plankton consists of small organisms that passively move in aquatic ecosystems, drifting in relation to currents and other oceanographic processes. Taxa in this group consist of microscopic marine plants (phytoplankton), invertebrates (zooplankton), the eggs and larvae of fish (ichthyoplankton), bacteria, fungi, and viruses (Amec 2014). Plankton are the largest group of organisms in the ocean in terms of both biomass and diversity. As a result, this group plays a foundational role in the marine environment as the base layer of most food webs. Plankton are also the mechanism by which nitrogen and carbon are absorbed into the marine environment from the atmosphere. They create a biological pump in which CO_2 is consumed in the surface waters, resulting in a reduced partial pressure and the absorption of atmospheric CO_2, which plays a key role in climate regulation. Recent studies have also shown the importance that zooplankton play in transferring organic matter from depth to the surface (benthic-pelagic coupling) (Amec 2014).

The following sections provide an overview of marine bacterial communities, phytoplankton, zooplankton, and ichthyoplankton in or near the Project Area.

6.1.4.1 Bacterial Communities / Microbes

Bacterial communities consist of prokaryotes (single-celled organisms including bacteria and archaea) which make up the smallest free-living cells in any pelagic ecosystem. Bacteria can have a variety of energy sources with some using light as their primary energy source (photoautotrophs), or auxiliary source (photoheterotrophs), with most bacteria using organic material as an energy source (heterotrophs) (DFO 2011a). Since most bacteria are secondary producers, relying on organic material for energy, their abundance can be correlated to the abundance of phytoplankton communities. Most bacteria rely on material derived from phytoplankton, including waste exuded from plankton cells, cell autolysis, viral lysis, and organic material released from grazers feeding on phytoplankton (DFO 2011a).

The highest concentration of bacteria is found in the upper surface layer of the water column where the highest abundance of phytoplankton is also found. Bacteria also exist throughout the water column, below the photic zone, relying on dissolved organic matter for energy.

Bacteria, specifically heterotrophic bacteria, are natural microbial agents which can remediate hydrocarbon contamination in the marine environment. Crude oil can be found naturally in the marine environment from natural seeps in the ocean floor (ASM 2011). Crude oil is a natural product which has been generated by organisms millions of years ago that used photosynthesis to harness the energy of the sun as their principal energy source. Certain microbes in the marine environment have evolved to use energy contained in hydrocarbons including crude oils, using enzymes to allow them to use hydrocarbons as an energy source (ASM 2011). Within the Orphan Basin, concentrations of bacteria are generally highest in water depths less than 500 m and decrease with depth. Bacterial abundance also increases in areas overlying seamounts or knolls, with bacterial concentrations on the seamount summit higher than those in surrounding waters. This suggests downwelling of bacteria normally limited to the sea surface (Greenan et al. 2010).

6.1.4.2 Phytoplankton

Phytoplankton are single-celled photosynthetic organisms that are adapted to living in the upper water column of coastal and offshore regions (Archambault et al. 2010). While marine phytoplankton comprise less than 1% of the Earth’s photosynthetic biomass, they contribute more than 45% of annual net primary production of the planet (Archambault et al. 2010). Phytoplankton are at the base of the marine food web and influence the production of all higher trophic levels in the ecosystem (Worcester and Parker 2010). Most phytoplankton species range in size from 0.2 µm to 200 µm (Archambault et al. 2010). At least 60 species of phytoplankton, 160 species of zooplankton, and 30 species of icthyoplankton may occur in the Orphan Basin based on historical studies (Movchan 1963; Buchanan and Foy 1980a, 1980b; Buchanan and Browne 1981; Tremblay and Anderson 1984, in LGL Limited 2003).

Most phytoplankton productivity occurs in the epipelagic zone (0-200 m water depth). This productivity, however, is also transferred to the benthic zone through sinking biomass and wastes (Licandro et al. 2015; Legendre and Rassoulzadegan 1995). The pattern of primary production in the North Atlantic Ocean is related to light conditions, sea surface temperatures, vertical water column stabilization, and grazing (Melle et al. 2014). There is also variation in primary production between shelf and deep basin regions (Melle et al. 2014). Phytoplankton in the Orphan Basin is likely dominated by microflagellates and diatoms, at least during the summer months (LGL Limited 2003).

There has been an observed shift in the abundance, timing, and duration of some phytoplankton species in the Northwest Atlantic. This shift included a decrease in overall abundance in the 1970s, a return to maximum levels in the 1990s, and a subsequent decline since then (Maillet et al. 2004; Head and Sameoto 2007, in Amec 2014). These changes are correlated with the North Atlantic Oscillation (Harrison et al. 2013, in Amec 2014) whereby an intensification of northwestern atmospheric flows cause increased mixing and sea ice extent and colder, fresher ocean conditions. These conditions are also correlated with an increased nutrient flux, which triggers higher primary productivity, and in turn, secondary productivity (zooplankton) (Maillet et al. 2004, in Amec 2014).

Remote sensing data suggest there is enhanced primary production at the northern edge of the northern Grand Banks, or at least a greater phytoplankton biomass than in surrounding areas (LGL Limited 2003).

Hotspots for chlorophyll *a*, a surrogate for plankton biomass, were identified north of the Grand Banks (LGL Limited 2003).

Chlorophyll irradiance in the North Atlantic was measured from NASA Satellite Imagery for all four seasons to show seasonal variation in chlorophyll *a* concentration (Figures 6.1 to 6.4). Chlorophyll *a* is a pigment used to measure photosynthetic activity (Behrenfeld and Falkowski 1997). Within the Project Area, there are relatively low chlorophyll *a* concentrations during the winter and fall (Figures 6.1 and 6.4). Data from the spring season shows the highest chlorophyll *a* concentrations in the Project Area where concentrations were 10 to 30 mg/m^3 along the Newfoundland shelf and over the Orphan Knoll. In the RAA, the concentrations of chlorophyll *a* were observed up to 90 mg/m^3 to the west of the Project Area. Chlorophyll *a* concentrations in summer tend to increase with water depth and latitude, with the highest chlorophyll *a* concentrations occurring within the Labrador Sea (Figure 6.4).

6.1.4.3 Zooplankton

Zooplankton are key elements of marine ecosystems, as they serve as the dominant conduit for the transfer of energy from phytoplankton to higher trophic levels (Archambault et al. 2010). Zooplankton are consumed by most marine species at some stage of their life cycle, from small anemones to baleen whales (Breeze et al. 2002). The distribution of zooplankton and community structure is therefore important for predicting the distribution of predator species, such as fish, seabirds, and marine mammals (Kjellerup et al. 2015).

Zooplankton can be divided into three main categories based on size:

- Microzooplankton (20-200 µm in length), includes ciliates, tintinnids, and the eggs and larvae of larger taxa
- Mesozooplankton (0.2-2.0 mm in length, includes copepods, larvaceans, pelagic molluscs, and larvae of benthic organisms
- Macrozooplankton (>2.0 mm), includes larger and gelatinous taxa such as euphausiids (krill), tunicates, and salps

The abundance of zooplankton in the Orphan Basin expected on shelf waters follows a similar pattern as phytoplankton populations, which is their primary food source. The spring phytoplankton bloom (Figure 6.2) triggers a surge in zooplankton that benefit from the abundance of their phytoplankton food source. Zooplankton peak after the spring bloom and decline later in summer. Species such as *Calanus finmarchicus* return to shelf waters each spring to reproduce and feed on phytoplankton. Once this food source is sufficiently depleted, they abandon the shelf environment and descend to deep-water overwintering sites (Head et al. 2013, in Amec 2014).

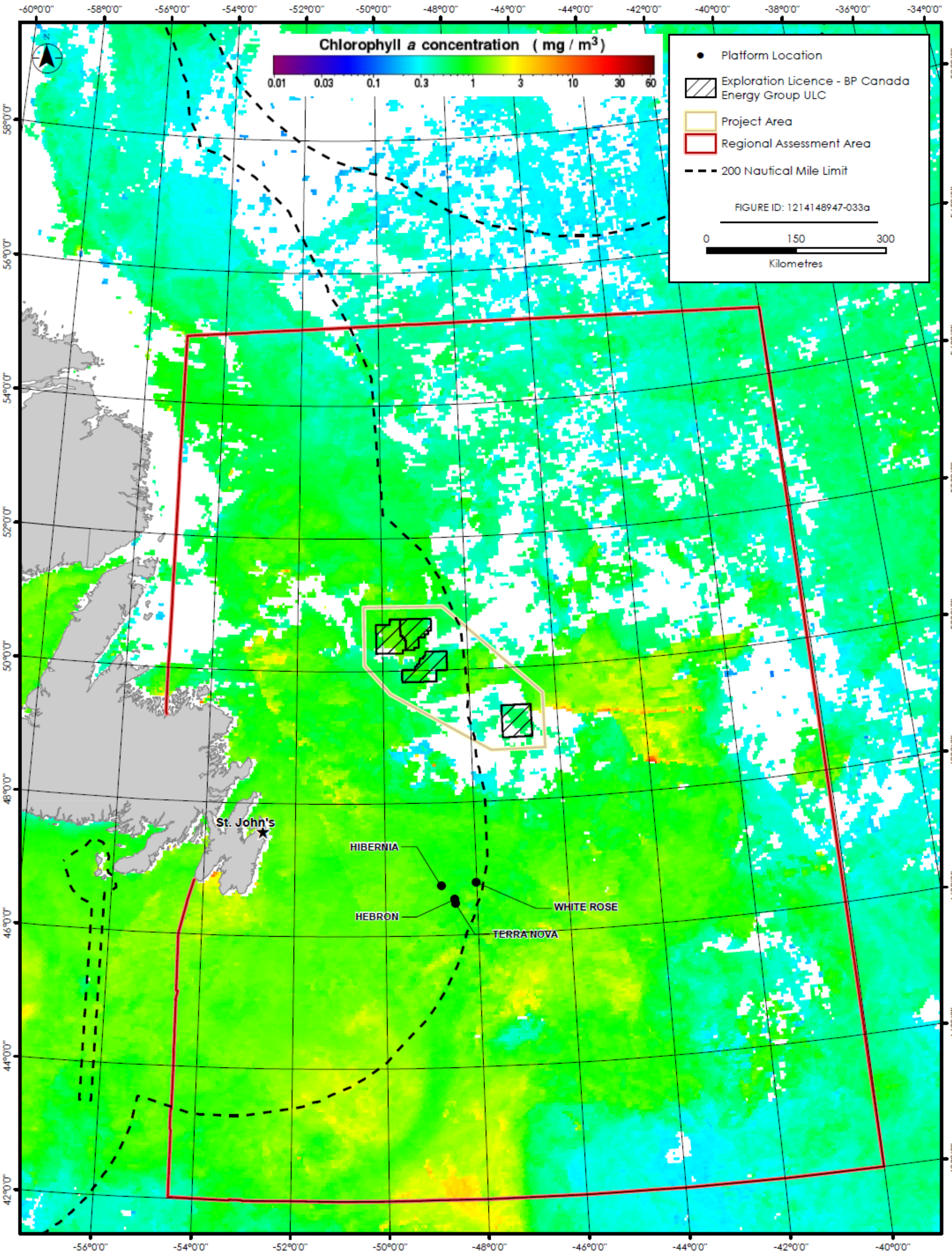


Figure 6.1 Distribution of Chlorophyll Irradiance Measured from NASA Satellite Imagery of the North Atlantic - Winter (December-February) 2017

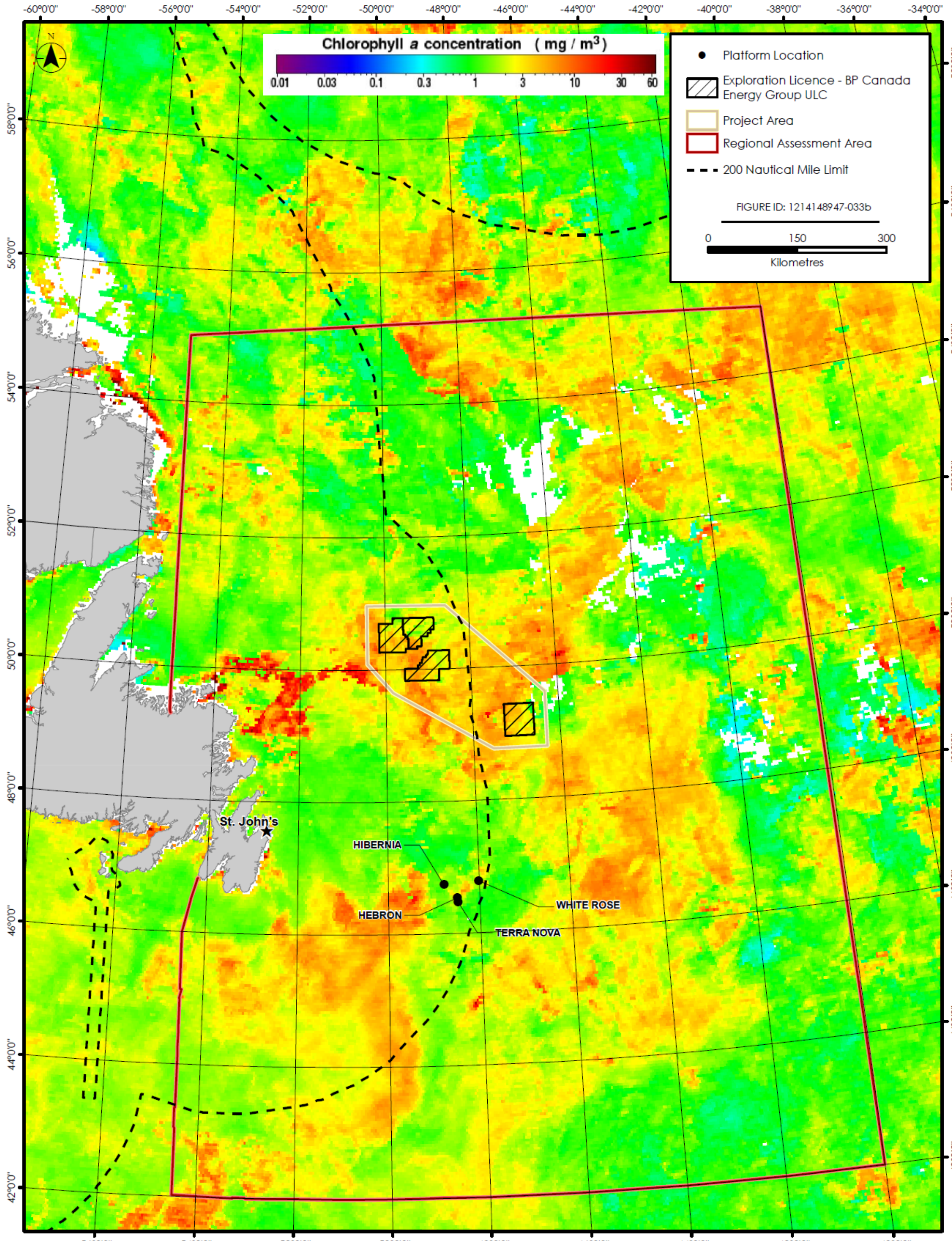


Figure 6.2 Distribution of Chlorophyll Irradiance Measured from NASA Satellite Imagery of the North Atlantic - Spring (March-May) 2017

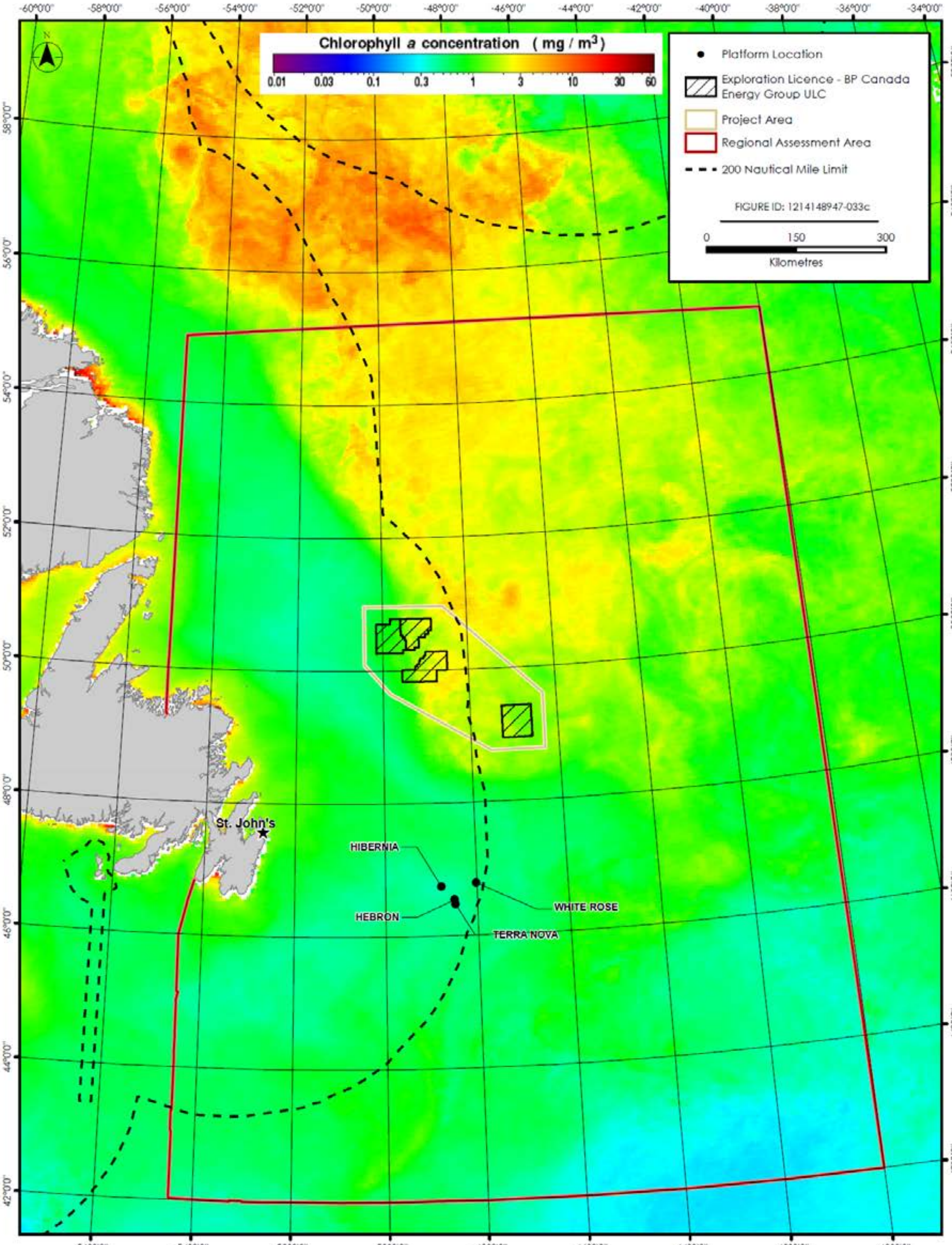


Figure 6.3 Distribution of Chlorophyll Irradiance Measured from NASA Satellite Imagery of the North Atlantic - Summer (June-August) 2017

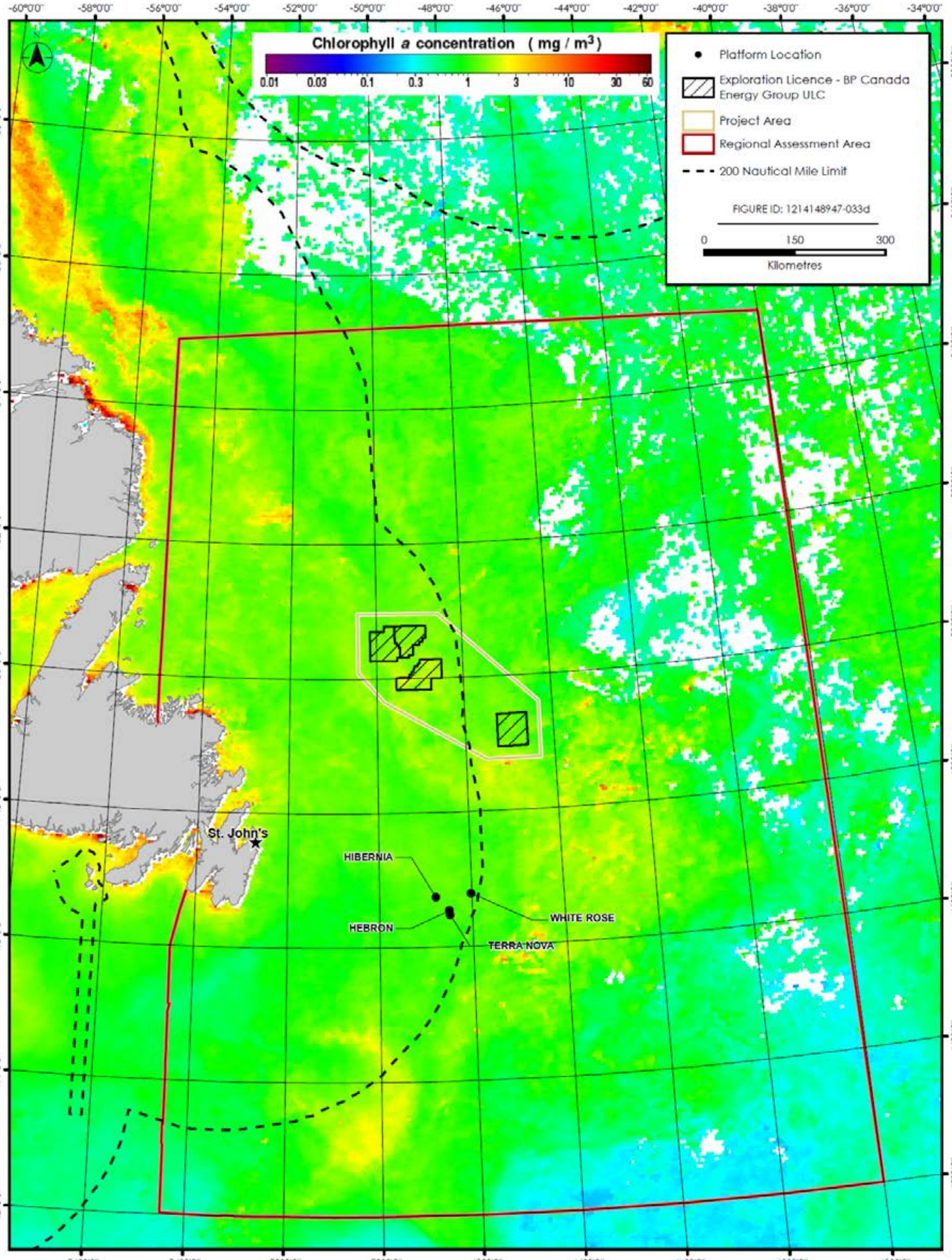


Figure 6.4 Distribution of Chlorophyll Irradiance Measured from NASA Satellite Imagery of the North Atlantic - Fall (September - November) 2017

Surveys of the Grand Banks and Newfoundland Shelf indicate a north-south gradient in total zooplankton biomass, with production declining from inshore areas to the shelf edge depending on the year (Dalley and Anderson 1998, in Amec 2014). However, taxa-specific distributions vary. The main zooplankton taxa found on the Grand Banks from a survey conducted by Dalley et al*.* (2001) include copepods, cladocerans, limacina, larvaceans and bivalve larvae; these five taxa represented approximately 98% of the zooplankton recovered, with copepods representing 87% of the total zooplankton catch. Copepods found in the vicinity of the Orphan Basin are dominated by three large species: *Calanus finmarchicus*, *Calanus glacialis* and *Calanus hyperboreus*. *C. finmarchicus* is at the northern extent of the species range and prevalent from throughout the North Atlantic to the Gulf of Maine (Wang and Greenan 2014). The other two *Calanus* species are often found in more Northern waters and associated with Arctic waters (Wang and Greenan 2014).

Zooplankton, in particular calanoid copepods, limacina, and krill, are in turn, a key food source for macroinvertebrates, fish, marine mammals and birds (Maillet 2014; Comeau et al. 2010). These taxa have the highest densities in slope waters and offshore regions (e.g., the Orphan Basin) (Maillet et al*.* 2004).

6.1.4.4 Ichthyoplankton

Ichthyoplankton include the planktonic eggs and larvae of fish and shellfish species found mainly in the upper 200 m of the water column (NOAA 2014). Ichthyoplankton are referred to as meroplankton because they are planktonic only for a portion of their life cycles (NOAA 2014).

The planktonic life stages for these species are an important period of dispersal and represent a key stage that can affect recruitment success (Cushing 1990 in Amec 2014). It has been shown that the abundances of eggs and larvae for several species, such as sardines and anchovies, are good indicators of the transient population size of the adults (NOAA 2014).

Spawning periods of many species are synchronized with plankton blooms to provide access to seasonal abundance of food supplies. Most taxa of ichthyoplankton exhibit passive movement, and their dispersal is dependent on oceanographic features such as gyres, upwelling zones (Bradbury et al. 2008, Ings et al. 2008 in Amec 2014), and thermoclines (Frank et al. 1992 in Amec 2014). The densities of ichthyoplankton on the Northeast Newfoundland Shelf and Grand Banks can vary by orders of magnitude (Dalley and Anderson 1998; Bradbury et al. 1999 in Amec 2014), and community structure can differ according to year, season, and location (Frank et al. 1992; Dalley and Anderson 1998; Bradbury et al. 2008 in Amec 2014).

Data on the areal extent of zooplankton dispersion can be inferred from the average occurrence rate during the 0-group surveys. 0-group fish are those fish that have not yet completed a year of life. Biomass of 0-group assemblages of the Northeast Newfoundland Shelf is largely dominated by capelin (73.5%), sand lance (11.3%), lanternfish (5.9%), Arctic cod (3.4%) and squid (3.1%). Squid, alligatorfish, Arctic cod and capelin were all captured in greater than 50% of pelagic trawls (Table 6.1).

Table 6.1 Relative Abundance of Dominant Fish Species Caught in the International Young Gadoid Pelagic Trawl during the Pelagic 0-group Survey (1997-1998)

Common Name	Scientific Name	Relative Abundance (%)	Average Occurrence (%)
Capelin	*Mallotus villosus*	73.5	51.1
Sand lance	*Ammodytes* spp.	11.3	36.4
Lanternfish	Myctophidae	5.9	2.5
Arctic cod	*Boreogadus saida*	3.4	56.2
Squid	Cephalopoda	3.1	67.1
Alligatorfish	Agonidae	0.9	60.3
Sculpins	Cottidae	0.8	47.9
Shannies / Blennies	Stichaeidae	0.4	12.9
Atlantic cod	*Gadus morhua*	0.2	33.5
Redfish	*Sebastes* spp.	0.2	17.7
Wolffish	*Anarhichas* spp.	0.1	28.8
Seasnail	*Liparis* sp.	0.1	15.6
American plaice	*Hippoglossoides platessoides*	0.1	10.6
Haddock	*Melanogrammus aeglefinus*	0.1	7.2
Witch flounder	*Glyptocephalus cynoglossus*	<0.1	4.9
Greenland halibut	*Reinhardtius hippoglossoides*	<0.1	4.9
Hake	*Urophycis* spp.	<0.1	3.4
Yellowtail flounder	*Limanda ferruginea*	<0.1	0.8
Source: Amec 2014 (modified from Dalley et al. 1999; Dalley and Anderson 1998)			

6.1.4.5 Marine Plants and Macroalgae

The distribution of macroalgae and marine plants is predominantly limited to areas reached by sunlight, as they are reliant on photosynthesis to produce energy; however, some types of marine algae (e.g., coralline algae) occur at greater depths (Amec 2014).

Anderson et al. (2002) surveyed approximately 2,000 km of coastal habitat between 10 and 220 m water depth to delineate marine habitats. Most marine algae was found to occur in less than 30 m water depth, and no algae were observed below 50 m. This study corroborates previous studies which determined most marine plants and macroalgae in Newfoundland rarely occur in water depths greater than 50 m (Gregory and Anderson 1997).

There is limited published information regarding macroalgae and marine plants in the Eastern Newfoundland SEA Study Area, including the Project Area, likely because this area contains oceanic habitat that is generally not conducive for the growth of seaweeds and macroalgae (Amec 2014). The entire Project Area is too deep for these species, and most areas of the Grand Banks do not contain the hard substrates required to establish holdfasts (Dayton 1985, in Amec 2014). Previous studies within the boundaries of the SEA Study Area (e.g., Houston and Haedrich 1985; Schneider 1987; Kenchington et al. 2001 in Amec 2014) did not characterize any of the habitats within their survey areas to contain macroalgae or marine plants (Amec 2014).

6.1.5 Pelagic Macroinvertebrates

Pelagic macroinvertebrates include marine invertebrates that live exclusively in the pelagic environment or swim up from the benthos to feed. There is a high proportion of small crustaceans (copepods and shrimp) that live in the pelagic environment, along with a variety of gelatinous organisms, for example, pelagic tunicates (Statoil Canada Ltd. 2017). Pelagic tunicates include salps, pyrosomes, and doliolids, and are gelatinous, free-floating, filter feeding organisms that are found as single individuals or as colonies (Statoil Canada Ltd. 2017).

The results of the 2016 DFO RV survey indicate multiple shrimp species are present within the RAA such as Northern shrimp (*Pandalus borealis*), *Acanthephyra pelagica*, Crimson pasiphaeid (*Pasiphaea tarda*), *Sergia robusta*, and *Atlantopandalus propinqvus*. Within the RAA, Northern shrimp are the most abundant with the large majority of northern shrimp surveyed concentrated along the Newfoundland Shelf to the west of the Project Area (DFO 2016a). In the deeper waters of the Project Area, deep-water shrimp species such as *A. pelagica*, and *P. Tarda* are more abundant.

Salps and doliolids provide a prey source for Atlantic bluefin tuna (Dragovich 1970; Fromentin and Powers 2005), sunfish (Potter and Howell 2011), and leatherback turtles (Eckert 2006; Dodge et al. 2011). Several species of salps occur in the North Atlantic, including *Cyclosalpa pinnata*, *Pegea bicaudate*, *P. confoederata*, *P. socia*, *Salpa cylindrica,* and *S. maxima* (Madin 1982).

Other gelatinous pelagic invertebrates present in the eastern Newfoundland offshore area include cnidarians and ctenophores (jellyfish) (Statoil Canada Ltd. 2017). Some jellyfish contain photosynthetic symbionts, called zooxanthellae, and obtain their energy through photosynthesis; however, most jellyfish are carnivorous and consume zooplankton including larval fish and invertebrates (Gibbons and Richardson 2009). Like salps and doliolids, jellyfish are consumed by Atlantic bluefin tuna (Fromentin and Powers 2005), leatherback turtles (Heaslip et al. 2012), and sunfish (Potter and Howell 2011).

6.1.6 Benthic Invertebrates and Habitat

Benthic invertebrates form an important link to higher trophic level organisms such as fish, birds, and marine mammals (LGL Limited 2003), and certain taxa (e.g., cold-water corals) provide habitat for other species of invertebrates and fishes (Buhl-Mortensen and Mortensen 2005; Buhl-Mortensen et al. 2010). Cold-water corals are structures that are used by other species for feeding, shelter, and as nursery areas (LGL Limited 2003). Cold-water corals found on the continental margins provide resting, feeding, and spawning sites for other species (Buhl-Mortensen et al. 2010; Watling et al. 2011; Baillon et al. 2011).

There are few existing studies of benthic community composition specifically for the Orphan Basin (LGL Limited 2003), and there is a considerable gap in knowledge of existing benthic communities that occur on deeper continental shelf environments and in abyssal habitats (LGL Limited 2003).

BP will conduct an imagery-based seabed survey at the proposed wellsite(s) prior to drilling to confirm the presence or absence of any aggregations of habitat-forming corals or sponges within a 500-m radius from the wellsite(s). The survey will provide baseline data for coral and sensitive benthic habitat that may be present.

Geology in the region has been investigated for the purposes of resource extraction and rarely for biological purposes. Surficial sediment in the Orphan Basin ranges from fine muds and clays to extremely coarse boulders and bedrock 0.1 to 1.1 m thick (LGL Limited 2003; Tripsanas et al. 2008). Sediment cores collected from the Basin floor resulted in surficial sediments composed of tan foram-rich mud, with rare pebbles and cobbles (Tripsanas et al. 2008). This sediment type is typical throughout the abyssal habitats of the Labrador Sea and similar characteristics are expected all over Orphan Basin (Tripsanas 2008, Campbell 2005). Within the slope habitats, the surficial sediment is coarser with upper layers of the cores consisting of sand bed tens of centimeters thick. This sand layer is interpreted as the bottom current deposit resulting from the Labrador Current (Tripsanas et al. 2008).

A study on benthic invertebrates conducted in 1977 (Carter et al. 1979) in the Project Area collected data at 59 stations along four transects that extended from the continental shelf break, at 300-350 m depth, down the slope and rise to the 3000-m isobath. Samples included collection of sediment from 43 of these 59 stations and photographs from 15 stations. These data were utilized to define four habitat areas. The shallow slope (300 m to 700 m) was characterized by polychaetes, marine bivalves (*Nuculana* sp., *Cuspidaria*., and *Dentalium* sp.), and echinoderms, specifically sand dollars, sea urchins and brittle stars. Hard substrates in this area, such as cobbles and boulders, were colonized by sponges, bryozoans, and brachiopods. The middle slope (700 m to 2,000 m) had exposed macrofauna, including sea aneomes (*Cerianthus* sp.), tubicolous polychaetes, sand dollars, sea urchins and brittle stars. The infauna of the middle slope included a marine bivalve species specifically *Nucula* sp., *Nuculana* sp., *Thyasira* sp., *Cylichna* sp., and *Dentalium* sp. The deep slope (2,000 to 2,500 m) macrofauna was sparse and included tubicolous polychaetes, brittle stars, and the mollusc genus *Nucula*. Cobbles at this depth were colonized by sponges and brachiopods. The macrofauna on the deep slope (>2,500 m) was similar to that of the lower slope with tubicolous polychaetes, brittle stars, and the mollusc *Cuspidaria* sp.

Table 6.2 lists the dominant benthic invertebrate taxa anticipated to occur within the Project Area.

Table 6.2 Dominant Invertebrate Taxa in Photographic Surveys within the Orphan Basin

Area	Common Name	Scientific Name
Shallow Slope 300-700 m	Polychaete	Polychaeta (C)
	Marine Bivalves	*Nuculana* sp., *Cuspidaria*., and *Dentalium* sp.
	Sand dollar/sea urchins	Echinoidea (C)
	Brittlestar	Ophiuroidea (C)
	Sponges	Porifera (P)
	Bryozoan	Bryozoa (P)
	Brachiopod	Brachiopoda (P)
Middle Slope 700-2,000 m	Sea anemone	*Cerianthus* sp.
	Polychaete	Polychaeta (C)
	Marine Bivalves	*Nucula* sp., *Nuculana* sp., *Thyasira* sp., *Cylichna* sp., and *Dentalium* sp
	Gastropod	Gastropoda (C)
	Brittlestar	Ophiuroidea (C).
	Tusk shell	*Dentalium* sp.
	Sand dollar/sea urchins	Echinoidea (C)
Deep Slope 2,000-2,500 m	Polychaete	Polychaeta (C)
	Marine Bivalves	*Nucula* sp
	Brittlestar	Ophiuroidea (C).
	Sponges	Porifera (P)
	Brachiopod	Brachiopoda (P)
Deep Slope >2,500	Polychaete	Polychaeta (C)
	Marine Bivalves	*Cuspidaria* sp.
	Brittlestar	Ophiuroidea (C).

Notes:
Adapted from Carter et al. 1979
Taxonomic group: Phylum (P), Class (C), Order (O)

6.1.6.1 Corals and Sponges

Cold-water corals and sponges are sessile benthic invertebrates that are an important component of benthic ecosystems by providing habitat for other species of invertebrates and fishes (Buhl-Mortensen and Mortensen 2005; Buhl-Mortensen et al. 2010). Studies which have looked at species interactions with cold-water corals and their associated fauna have shown evidence that cold-water corals are as ecologically important as shallow-water systems by providing structurally complex habitat for a variety of marine species (Krieger and Wing 2002; Roberts et al. 2009; Buhl-Mortensen et al. 2010; Watling et al. 2011). Cold-water corals found on continental margins provide resting, feeding, and spawning sites for other species (Costello et al. 2005; Buhl-Mortensen et al. 2010; Watling et al. 2011), including commercially important species (Baillon et al. 2012). Different species of cold-water corals provide habitats of varying physical size and life spans (Roberts et al. 2009). For example, gorgonians can grow close together and form dense forest-like habitats, sea pens may occur in aggregations known as sea pen meadows, and other species (e.g., scleractinian cup corals) are solitary (Colpron 2016).

There is a high abundance and diversity of structure-forming benthic invertebrate species that occur in the Orphan Basin and in surrounding areas, including corals, sponges, and sea pens (Amec 2014). Corals include alcyonaceans (small and large gorgonians, soft corals), pennatulaceans (sea pens), scleractinians (stony corals), and antipatharians (black corals). These coral, sponge, and sea pen communities provide nurseries, areas of refuge, and spawning and breeding grounds for a variety of species, including commercially-important species (Working Group on Ecosystem Approach Framework to Fisheries Management 2008; Baillon et al. 2012; FAO 2016). Sea pens and cup corals are commonly found on soft mud substrates while black corals, soft corals and sea fans are often found attached to hard substrates such as bedrock and gravel.

Knudby et al. (2013) used data obtained from DFO RV trawls, and to a lesser extent sediment box cores and underwater video, to produce distribution maps for the structure forming sponge Geodia spp., and Geodia-dominated sponge grounds in the northwest Atlantic Ocean. The study included a NL subarea which included the Project Area, in this area sponge grounds were evaluated based on a threshold of 200 kg/km of RV tow; tows with greater than 200 kg/km were classified as sponge grounds. This NL subarea model indicated sponge ground presence is predicted with high probability along the edge of the continental slope approximately 100 km north of the Project Area. There were no sponge grounds identified within the Project Area. While Geodia *spp*. may be observed within the Project Area (Figure 6.5), dense aggregations such as those found in sponge grounds are unlikely.

Within the Project Area, corals are present in northwest section of EL1145 and EL1146, on the Northeast Newfoundland Shelf and slope, but data on presence in the deeper water areas of the Project Area was unavailable based on DFO Research Vessel (RV) data (Figure 6.5). Of BP's four ELs, EL1145 appears to contain the highest diversity of corals; within the boundaries of this EL, soft corals, scleractinian stony corals, gorgonians, and sea pens have been recorded. Table 6.3 provides a summary of the known and potential occurrence of corals and sponges in the ELs that form part of this Project.

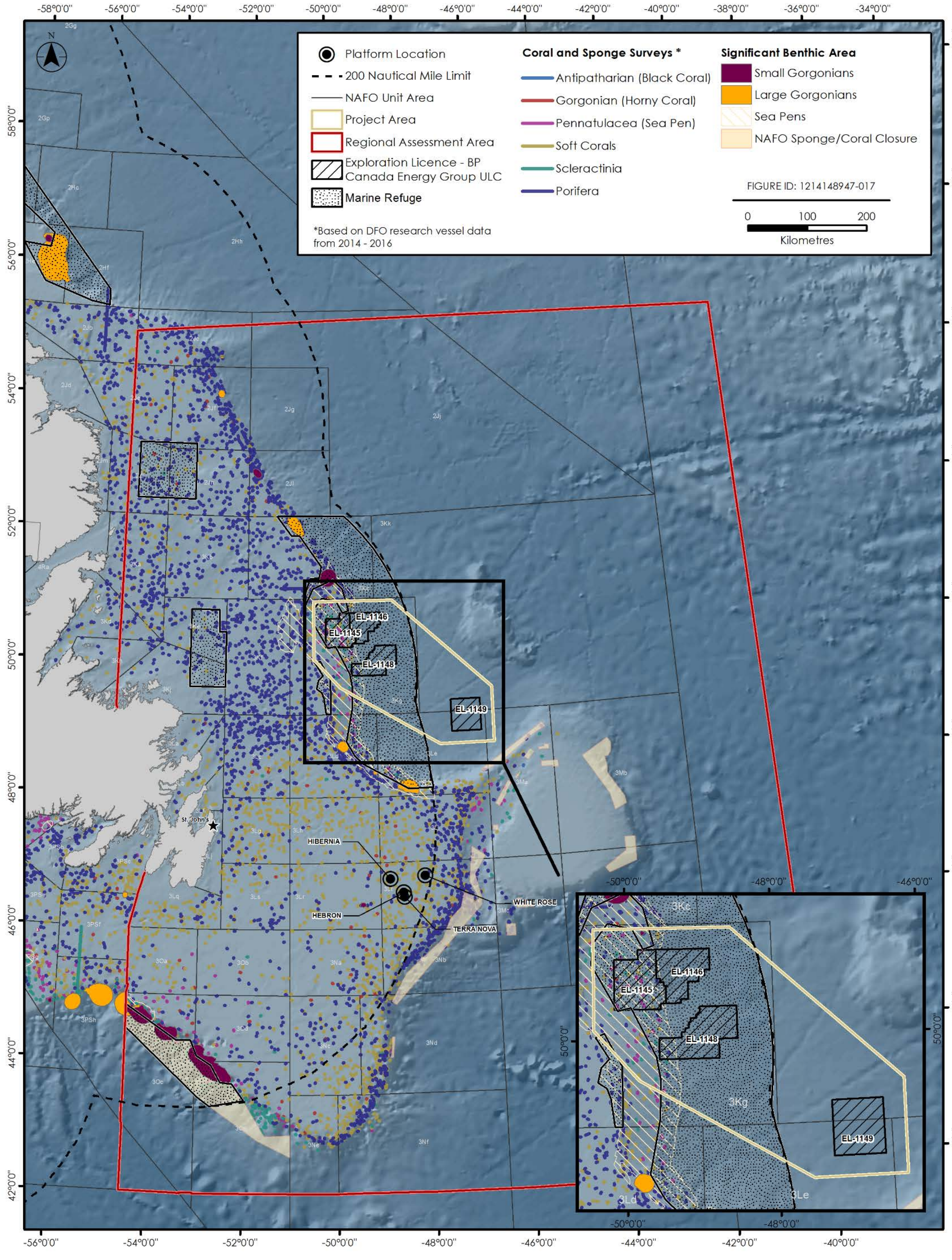


Figure 6.5 Corals and Sponges in the Project Area and Regional Assessment Area Based on DFO Research Vessel Data / Records

Table 6.3 Potential Occurrences of Corals and Sponges in the Project Area

Exploration Licence	Known Presence and Distribution Based on Existing Information	Summary of Known or Potential Presence and Distribution
EL1144/EL1145/EL1148	**Sponges** - Demosponges Geodia sp. **Corals** - soft corals Acanella arbuscular Paragorgia arborea Paramuricea spp. Capnella florida Neptheidae - sea pens Anthoptilum grandiflorum Distichoptilum gracile - stony corals Flabellum alabastrum Antipatharian spp.	• Depth and minimum bottom salinity are key predictors for Geodia sp. presence (Knudby et al. 2013). • High density aggregations of sponges are unlikely based on distribution modelling (Knudby et al. 2013). • Around EL 1144 and EL 1145 corals were concentrated on the shelf edge and slope with soft corals on the bank tops. Acanella arbuscula and soft corals were the most abundant species, along with A. grandiflorum (Wareham and Edinger 2007). • The coral species around EL1148 were dominated by C. florida, sea pens, and antipatharians (Wareham and Edinger 2007).
EL1149	**Sponges** - Demosponges *Geodia* sp. **Corals** - soft corals - sea pens - stony corals	• EL1149 is not associated with slope or shelf habitats. Data is limited based on location outside Canada's EEZ. • Information on abundance of sponges is limited due to poor sampling of deep areas; eight of the ten deepest sample locations in Knudby et al. 2013 show Geodia spp. presence (water depths of 1,827 to 2,201 m).
Data Sources: DFO RV Data (2014a, 2015, 2016a), Guijarro et al. 2016, Knudby et al. 2013, Wareham and Edinger 2007.		

Within the RAA, corals and sponges are present on the Labrador Shelf and slope, the Northeast Newfoundland Shelf and Slope, the Flemish Pass and Flemish Cap, and are widespread on slopes and submarine canyons on the eastern and southern Grand Banks. The Orphan Knoll, located approximately 100 to 150 km to the northeast of the Project Area, is a biologically rich and complex area, and corals (including stony corals) and sponges have been observed on the flanks of the knoll and surrounding seamounts using a Remotely-Operated Vehicle (ROV) (NAFO 2017).

DFO has defined a large Significant Benthic Area (SBA) for sea pens that encompasses the edge of the Northeast Newfoundland Shelf, including the far western portion of the Project Area and EL 1145, and small portions of ELs 1146 and 1148 (Figure 6.5). There are additional SBAs for small and large gorgonians surrounding the Project Area along the Northeast Newfoundland slope.

Within the RAA, there are NAFO coral and sponge closures to the southeast, south, and southwest of the Project Area, in addition to the Northeast Newfoundland Slope Closure (DFO marine refuge area protected under the *Fisheries Act*) (Figure 6.5). These closures are concentrated on the slope of the Grand Banks, the Flemish Pass and Cap, and other seamounts further offshore (Figure 6.5). Special Areas, including descriptions of NAFO sponge/coral closures, are described in Section 6.4.

6.1.7 Finfish (Demersal and Pelagic Species)

There are two regulatory regimes with authority over marine fish within the Project Area. The Government of Canada manages fish stocks within the EEZ. Within these areas, the Canadian federal *Fisheries Act* provides protection to commercial, recreational, and Aboriginal fisheries by managing the fish resources and habitats that support these activities. Outside Canada's EEZ, groundfish and benthic invertebrates are managed by the Northwest Atlantic Fisheries Organization (NAFO).

The benthic or demersal species which inhabit the continental slope and abyssal habitats in the vicinity of the Project Area are not yet well studied. These species typically have life history traits of late maturation, long life-spans, low reproductive rates, and slow growth which leave them sensitive to habitat and population disturbances (Devine et al. 2006, Baker et al. 2012). Emerging continental slope fisheries for grenadiers, Greenland halibut and redfish are resulting in additional pressures for other continental slope species found within the Project Area such as blue hake, roughhead grenadier, roundnose grenadier, skate species and synaphobranchid eels (Devine et al. 2006).

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

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

The 2016 DFO RV survey data was analyzed for the Project Area (DFO 2016a). The results of the RV survey indicate deepwater redfish, Greenland halibut, roughhead grenadier, scyphozoan (marine jellyfish), roundnose grenadier, witch flounder and northern wolffish make up 91% of the catch by weight, with redfish contributing 41% of the abundance by weight. Distribution of the six most abundant fish species in the Project Area are shown in Figures 6.6 to 6.11.

Table 6.4 Key Fish Species from the 2016-2017 Canadian RV Survey Sets Collected within the RAA and Project Area

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

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

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

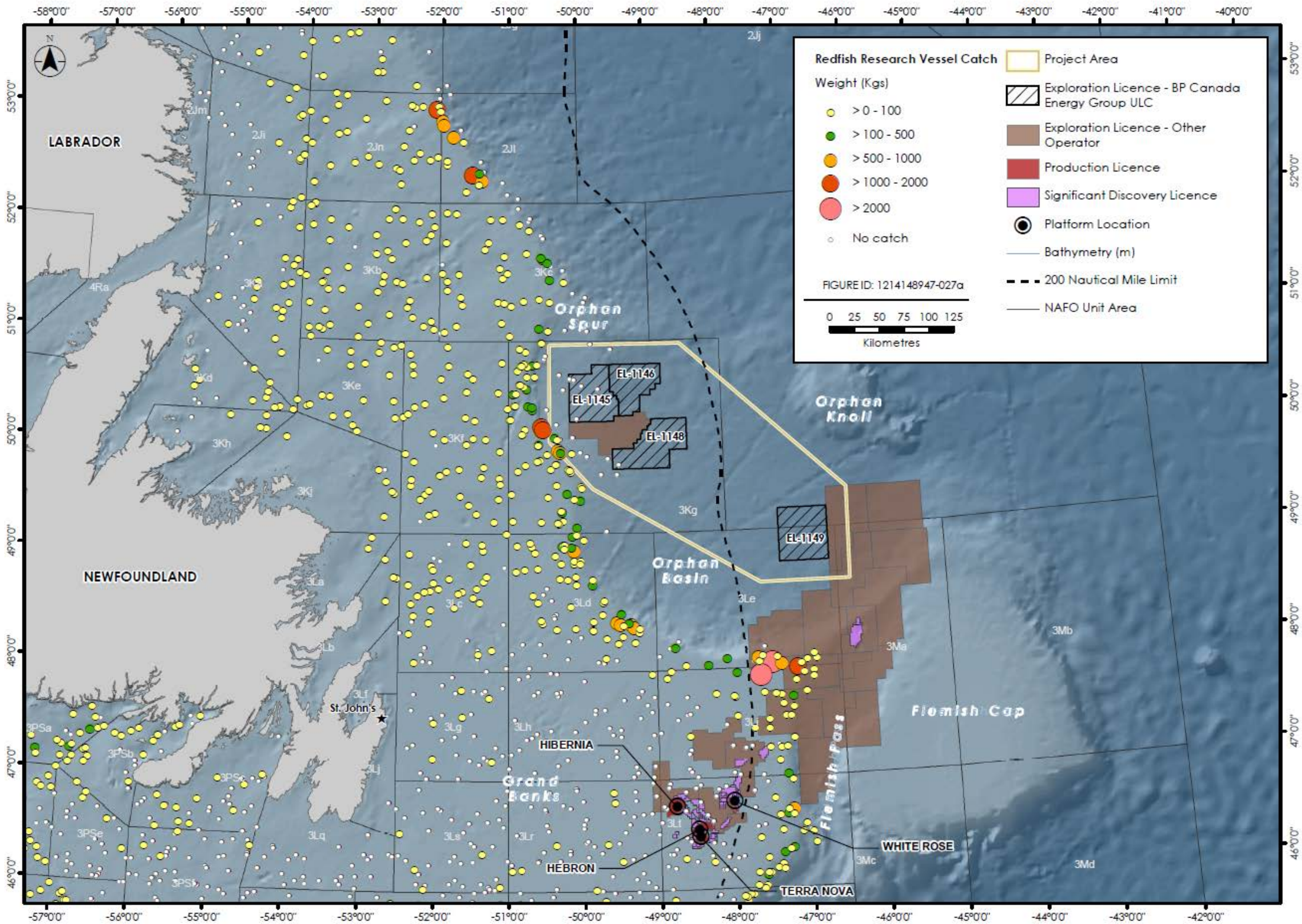


Figure 6.6 Redfish Distribution in the RAA and Project Area based on the 2015-2016 DFO RV Data

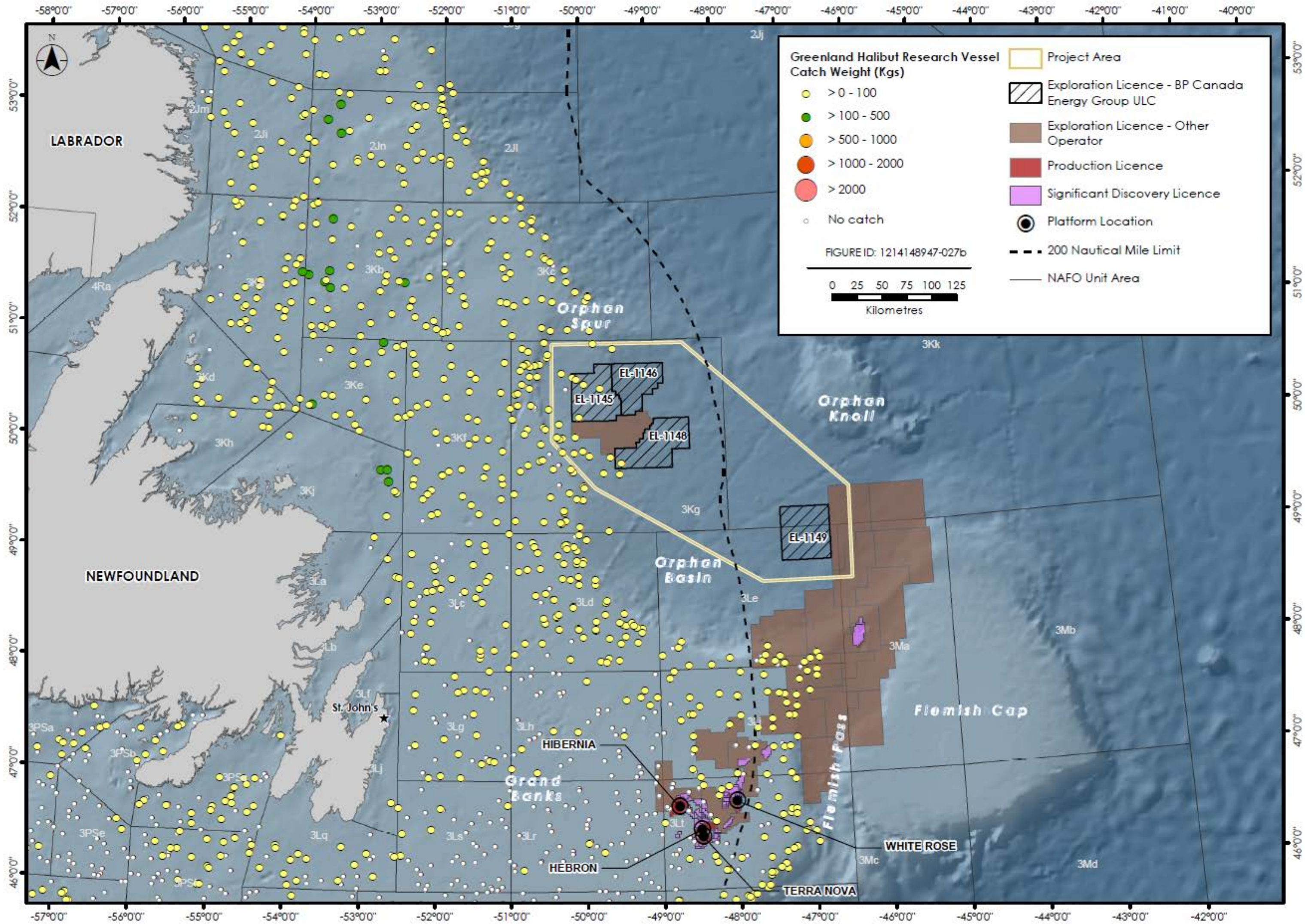


Figure 6.7 Greenland Halibut in the RAA and Project Area based on the 2015-2016 DFO RV Data

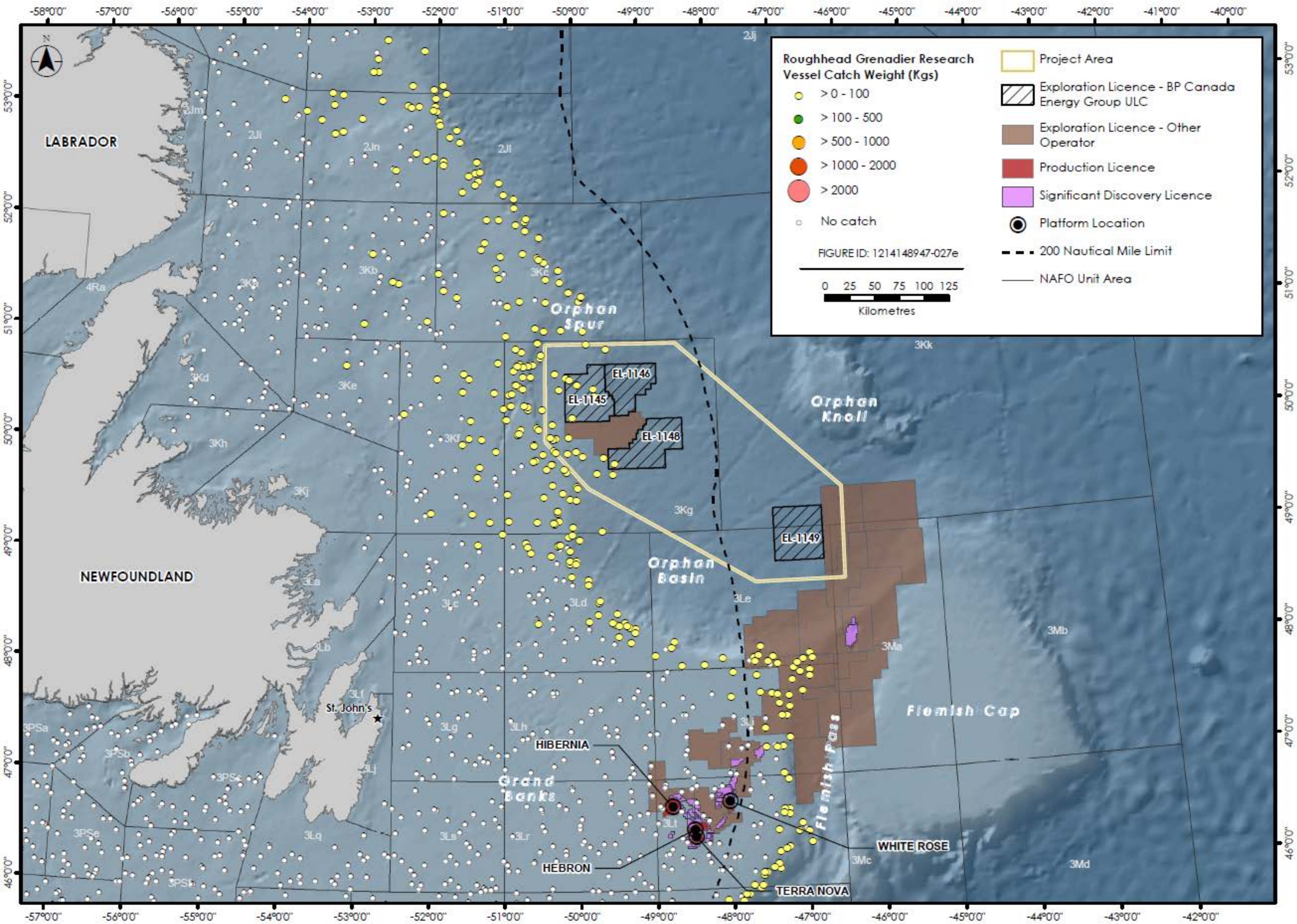


Figure 6.8 Roughhead Grenadier Distribution in the RAA and Project Area based on the 2015-2016 DFO RV Data

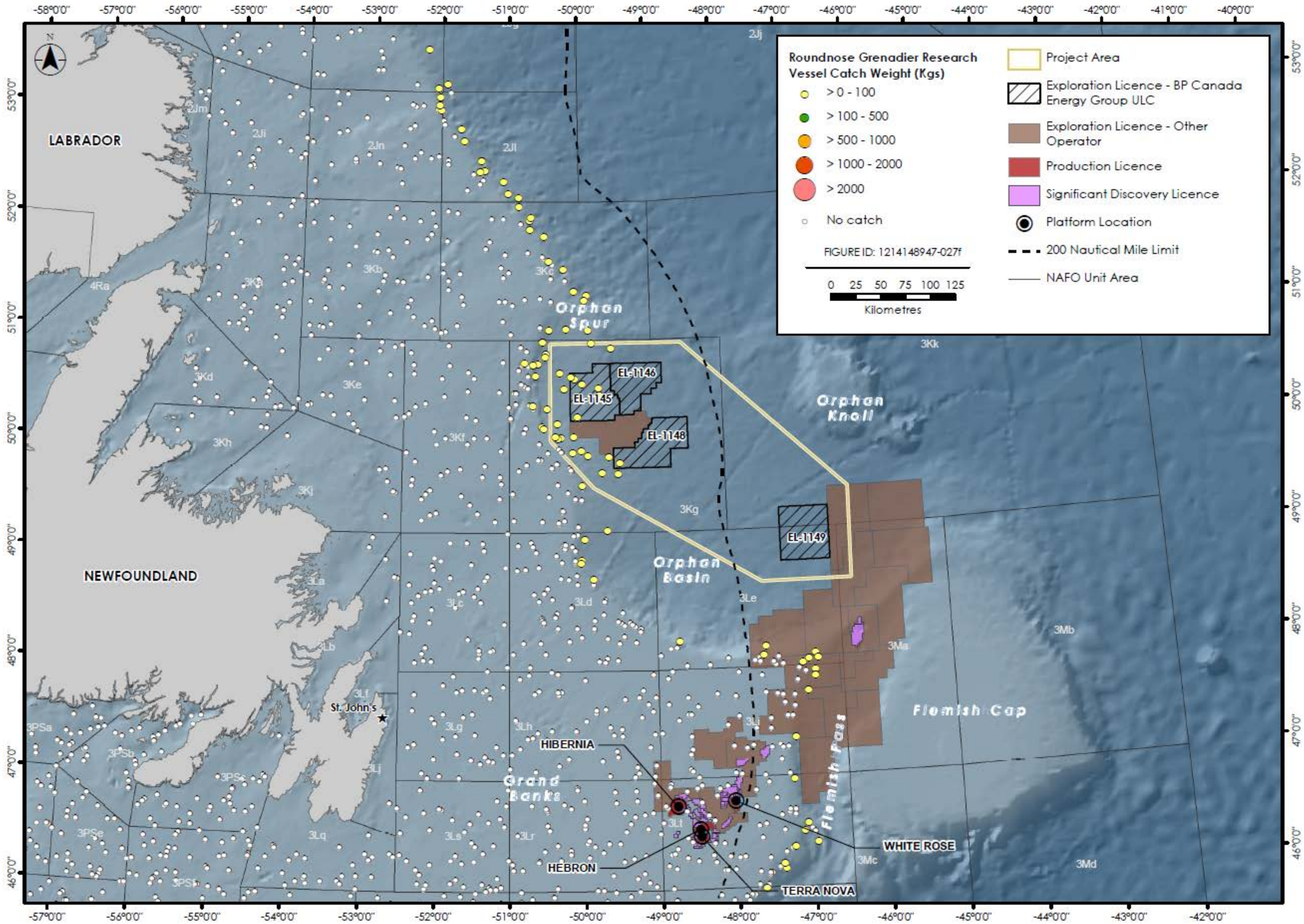


Figure 6.9 Roundnose Grenadier in the RAA and Project Area based on the 2015-2016 DFO RV Data

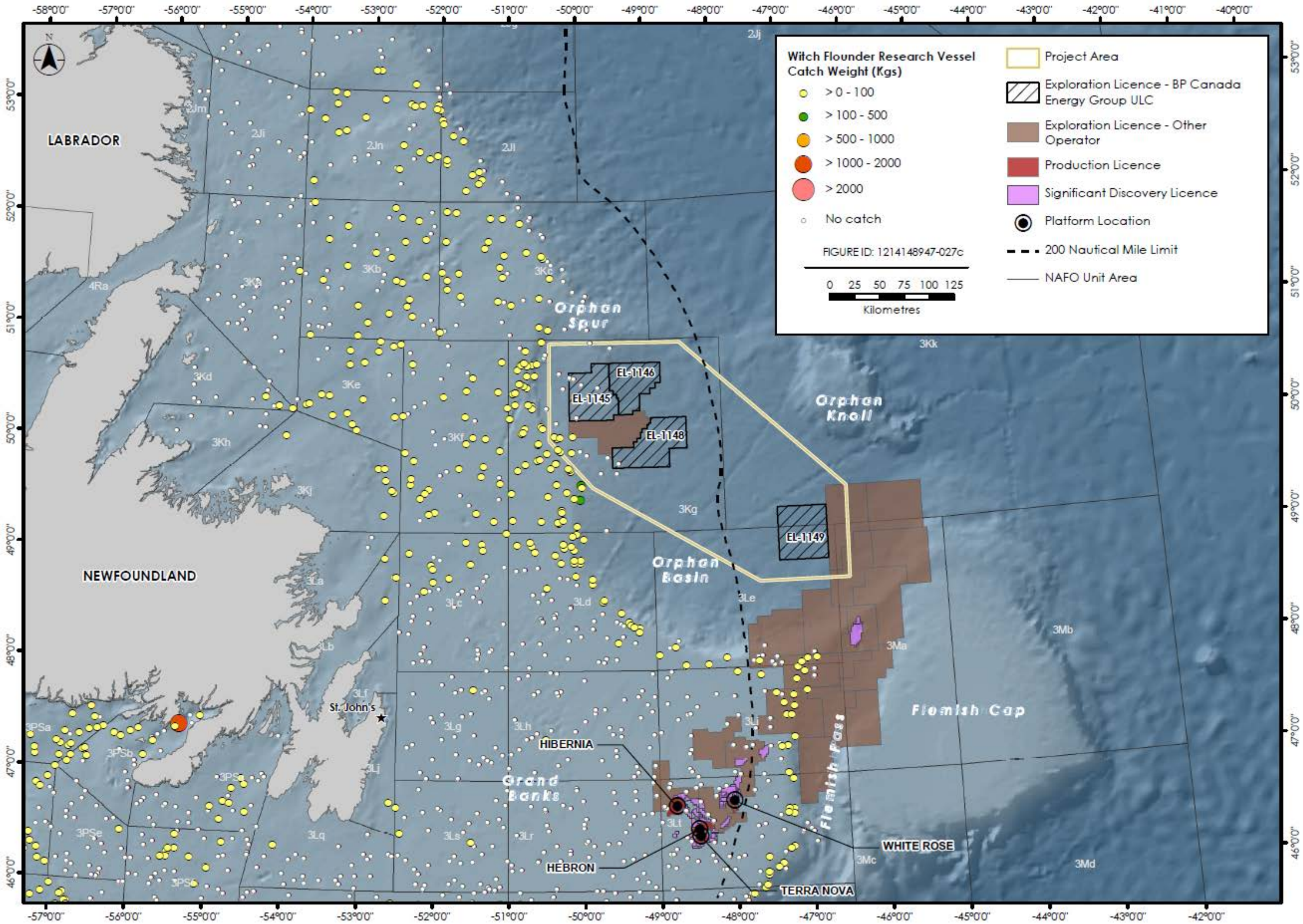


Figure 6.10 Witch Flounder in the RAA and Project Area based on the 2015-2016 DFO RV Data

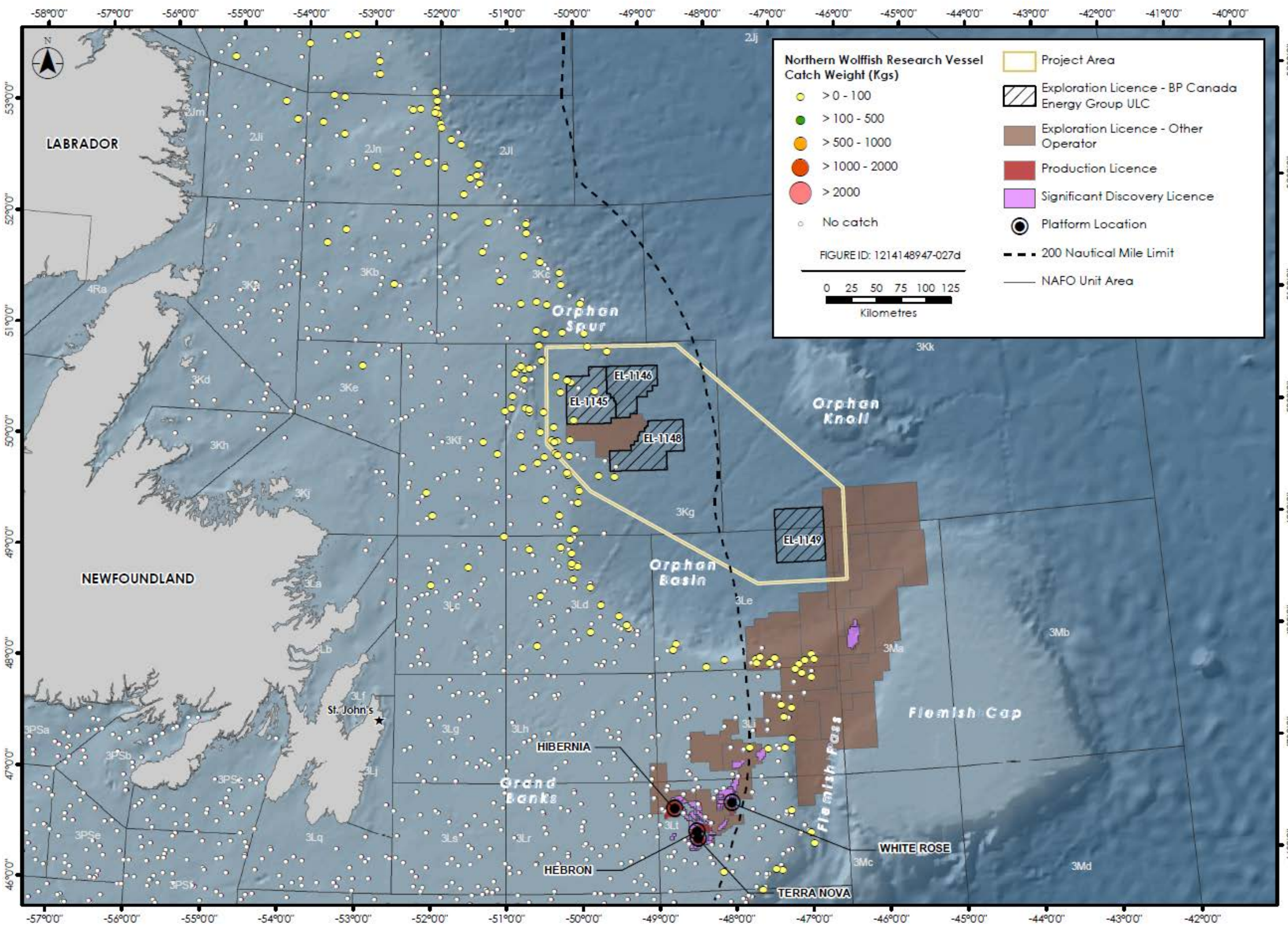


Figure 6.11 Northern Wolffish in the RAA and Project Area based on the 2015-2016 DFO RV Data

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

Table 6.5 Spawning Periods and Locations for Fish with High Potential to be Found Within the Project Area

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

Note: Shading indicates spawning periods.
Sources: [1] Vaskov 2005, [2] DFO 1993, [3] Bowering & Nedreaas, 2000, [4] Shelvelev and Kuz'michev 1990 in COSEWIC 2001; [5] COSWEIC 2008a; [6] COSEWIC 2007; [7] Bowering W.R. 1989.

6.1.8 Species at Risk

There are five fish SAR and 19 SOCC that may be present in the Project Area. Their protection and conservation status are provided in Table 6.6. SAR includes species that are listed as as endangered, threatened, or of special concern under SARA (Schedule 1) and/or as endangered, threatened, or vulnerable under the NL ESA. SARA provides federal protection to facilitate the recovery of threatened and endangered species as well as promotes the management of other species to prevent them from becoming at risk in the future.

SOCC listed in Table 6.6 include those species identified as endangered, threatened or of special concern under COSEWIC or those species identified as critically endangered, endangered, vulnerable or near threatened under the International Union for the Conservation of Nature (IUCN) Red List. These species are not formally protected by conservation bodies, including COSEWIC or IUCN. Additional general life history, diet, and distribution information on these and other species is available within the Eastern Newfoundland SEA (Amec 2014). A summary of the habitat, distribution and general life characteristics of species of conservation interest (SAR and SOCC) that may occur in the Project Area and/or RAA is provided in Table 6.7.

Table 6.6 Fish Species of Conservation Interest with Potential to Occur in the Project Area and/or in the RAA

Common Name	Scientific Name	SARA Schedule 1 Status	COSEWIC Designation	NL ESA Designation	IUCN Red List Designation	Potential for Occurrence in the Project Area*
Acadian redfish	*Sebastes fasciatus*	No Status	Threatened	Not Listed	Not Assessed	Moderate
American eel	*Anguilla rostrata*	No Status	Threatened	Vulnerable	Endangered	Migratory/ Transient
American plaice (Newfoundland and Labrador population)	*Hippoglossoides platessoides*	No Status	Threatened	Not Listed	Not Assessed	Low
Atlantic bluefin tuna	*Thunnus thynnus*	No Status	Endangered	Not Listed	Endangered	Low
Atlantic cod (Newfoundland and Labrador population)	*Gadus morhua*	No Status	Endangered	Not Listed	Vulnerable	Moderate
Atlantic halibut	*Hippoglossus hippoglossus*	Not Listed	Not at Risk	Not Listed	Endangered	Moderate
Atlantic salmon (South Newfoundland population)	*Salmo salar*	No Status	Threatened	Not Listed	Least Concern	Migratory/ Transient
Atlantic salmon (Gaspe-Southern Gulf of St. Lawrence)	*Salmo salar*	No Status	Special Concern	Not Listed	Least Concern	Low

Common Name	Scientific Name	SARA Schedule 1 Status	COSEWIC Designation	NL ESA Designation	IUCN Red List Designation	Potential for Occurrence in the Project Area*
Atlantic salmon (Outer Bay of Fundy)	*Salmo salar*	No Status	Endangered	Not Listed	Least Concern	Migratory/ Transient
Atlantic salmon (Eastern Cape Breton)	*Salmo salar*	No Status	Endangered	Not Listed	Least Concern	Migratory/ Transient
Atlantic salmon (Nova Scotia Southern Upland)	*Salmo salar*	No Status	Endangered	Not Listed	Least Concern	Migratory/ Transient
Atlantic salmon (Quebec Eastern North Shore population)	*Salmo salar*	No Status	Special Concern	Not Listed	Least Concern	Low
Atlantic salmon (Quebec Western North Shore population)	*Salmo salar*	No Status	Special Concern	Not Listed	Least Concern	Low
Atlantic salmon (Anticosti Island population)	*Salmo salar*	No Status	Endangered	Not Listed	Least Concern	Low
Atlantic wolffish	*Anarhichas lupus*	Special Concern	Special Concern	Not Listed	Not Assessed	Low
Basking shark (Atlantic population)	*Cetorhinus maximus*	No Status	Special Concern	Not Listed	Vulnerable	Moderate
Bigeye tuna	*Thunnus thynnus*	No Status	Not Listed	Not Listed	Vulnerable	Low
Blue shark (Atlantic population)	*Prionace glauce*	No Status	Not at Risk	Not Listed	Near Threatened	Low
Common lumpfish	*Cyclopterus lumpus*	No Status	Threatened	Not Listed	Not Assessed	Low
Cusk	*Brosme brosme*	No Status	Endangered	Not Listed	Not Assessed	Low
Deepwater redfish (Northern population)	*Sebastes mentella*	No Status	Threatened	Not Listed	Least Concern	High
Northern wolffish	*Anarhichas denticulatus*	Threatened	Threatened	Not Listed	Not Assessed	High

Common Name	Scientific Name	SARA Schedule 1 Status	COSEWIC Designation	NL ESA Designation	IUCN Red List Designation	Potential for Occurrence in the Project Area*
Porbeagle shark	*Lamna nasus*	No Status	Endangered	Not Listed	Vulnerable	Moderate
Roughhead grenadier	*Macrourus berglax*	No Status	Special Concern	Not Listed	Not Assessed	High
Roundnose grenadier	*Coryphaenoides rupestris*	No Status	Endangered	Not Listed	Endangered	High
Shortfin mako shark (Atlantic population)	*Isurus oxyrinchus*	No Status	Special Concern	Not Listed	Vulnerable	Low
Smooth skate (Funk Island Deep Population)	*Malacoraja senta*	No Status	Endangered	Not Listed	Endangered	Low
Spotted wolffish	*Anarhichas minor*	Threatened	Threatened	Not Listed	Not Assessed	Moderate
Thorny skate	*Amblyraja radiata*	No Status	Special Concern	Not Listed	Vulnerable	Moderate
White shark (Atlantic population)	*Carcharodon carcharias*	Endangered	Endangered	Not Listed	Vulnerable	Low
Winter skate (Eastern Scotian Shelf – Newfoundland population)	*Leucoraja oscellata*	No Status	Endangered	Not Listed	Endangered	Low

Notes: Data from the SARA Registry (http://www.sararegistry.gc.ca/sar/index/default_e.cfm) as of April 10, 2018

* This qualitative characterization is based on expert opinion, and an analysis of understood habitat preferences across life-history stages, available distribution mapping, and catch data for each species within the Project Area.

Summary information on the biology and the distribution of SAR and SOCC within the Project Area is provided in Table 6.7.

Table 6.7 Summary of the Distribution, Habitat, and Ecology of Species of Conservation Interest

Species	Distribution, Habitat, and Ecology
Acadian redfish (Atlantic Population)[1]	• Year-round residents • Primarily along continental slopes and in deep channels, from 150 to 300 m • Larvae prefer surface waters, where they feed on copepods and fish eggs • Slow growth and long lifespan; they can live up to 75 years • Ovoviviparous, females keep their fertilized eggs inside their brood chamber until the larvae have hatched • Larvae are released between the end of spring to early summer
American eel[2]	• Found on the western side of the Atlantic Ocean from the Caribbean Sea north to Greenland and Iceland • Spawns in the Sargasso Sea and eggs hatch within roughly one week • Larvae drift passively, and are widely dispersed by surface currents of the Gulf Stream • Larvae, elvers or mature adults may pass through Project Area during migrations to or from spawning areas • Culturally significant to Indigenous peoples
American plaice (Newfoundland and Labrador population)[3]	• Benthic flatfish that occurs along the continental shelves on both sides of the North Atlantic • Settled juveniles prefer depths of 100-200 m • Adults typically prefer depths of 100-300 m, but have been found as deep as 1,400 m • Spawning occurs on the Newfoundland Shelf in April or May • Commercially important
Atlantic bluefin tuna[4]	• Two discrete and evolutionarily significant populations, Gulf of Mexico (western population) and Mediterranean Sea (eastern population) • Majority of the fish found in Canadian waters are thought to be from the western population • Specific habitat requirements have not been defined for Atlantic bluefin tuna • No spawning or rearing occurs within Canadian waters • Majority of fishery captures are in Gulf of St. Lawrence and off Nova Scotia
Atlantic cod (Newfoundland and Labrador population)[6]	• Atlantic cod inhabit all waters overlying the continental shelves of the Northwest and the Northeast Atlantic Ocean • Occurs in offshore waters (typically at depths less than 500 m), can also be found throughout the coastal, inshore waters • Broadcast spawner • Known to spawn extensively throughout the inshore, nearshore, and offshore waters from April to October • Northeast Newfoundland Shelf cod migrate from offshore waters to inshore coastal waters in spring and may to spawn inshore • Eggs, and then larvae, present in the upper water column (10 to 50 m) • Mature slower in Newfoundland Shelf, eastern Labrador and Barents Sea; mature later than more southern populations • Commercial species harvested by several countries
Atlantic halibut[7]	• Eggs and larvae are pelagic, while the juveniles move to deeper waters • Distribution of pelagic Atlantic halibut larvae is mostly between 5 and 50 m • Juveniles and adults are closely associated with the seabed. Typically found at depths of 100 to 700 m, though may be present at depths up to 1,000 m • Commercially important

Species	Distribution, Habitat, and Ecology
Atlantic salmon[8]	• Atlantic salmon originally occurred in every country whose rivers flow into the North Atlantic Ocean and Baltic Sea • Canadian range is roughly one-third the area of the total global range • Life history begins in freshwater and may involve extensive migrations through freshwater and marine environments before returning to fresh water to spawn • Growth in ocean is rapid relative to that in fresh water • In spring, adult salmon are generally concentrated in abundance off the eastern slope of the Grand Bank and less abundantly in the southern Labrador Sea and over the Grand Bank • During summer to early fall, adult, non-maturing salmon are concentrated in the West Greenland area and less abundantly in the northern Labrador Sea • Culturally significant to Indigenous peoples
Atlantic wolffish[9]	• The species is widely distributed across the North Atlantic • The centre of its western Atlantic distribution is off the coast of northeast Newfoundland • Inhabits the cold (1.5 °C to 4 °C), deep (up to 900 m) waters of the continental shelf • Spawn in September, larvae are pelagic while adult Atlantic wolffish are relatively sedentary • Atlantic wolffish can conduct short (few km) seasonal migrations between offshore waters and shallow waters (<120 m deep) for spawning
Basking shark (Atlantic population)[10]	• Circumglobal, temperate, migratory pelagic species • Have been observed throughout Atlantic waters including the Gulf of St. Lawrence, Bay of Fundy, Scotian Shelf and Grand Banks, generally during the summer months. • Frequently encountered at the surface during summer months in the Project Area • May target areas of high zooplankton concentrations • Speculated individuals hibernated in deep shelf or slope waters during the winter • Annual southern migration associated with a change in seasons from late summer to winter
Bigeye tuna[11]	• Migratory, pelagic oceanic species that is found in 13 to 29 ºC water • Mostly found in depths shallower than 500 m but can dive deeper • Would occur in the Project Area generally during warm water seasons • Commercially important
Blue shark (Atlantic population) [12]	• Distributed worldwide in temperate and tropical oceans, primarily in surface waters and offshore • Range in Canada includes Gulf Stream-associated waters off Nova Scotia and Newfoundland • Found at depths from surface to at least 600 m depth • Prefers temperatures of 12-20 °C, potentially only occurs in the Project Area during summer
Common Lumpfish[23]	• Distribution ranges from southwest Greenland and Baffin Island, along the coasts of Newfoundland and Labrador, the Flemish Cap, down to the Gulf of St. Lawrence, Nova Scotia, and New Brunswick. • Occur in waters ranging from less than 20 m to over 300 m • Tolerate low salinity waters • Females lay on average approximately 100,000 eggs per spawning season • Spawning occurs in nearshore and inshore areas

Species	Distribution, Habitat, and Ecology
Cusk [13]	• Northern species found in the Subarctic and boreal shelf waters of the North Atlantic Ocean • Temperate species typically found at depths of 150 to 400 m with relatively warm water temperatures of 6 to 10 ºC, occasionally found at depths up to 1185 m. • Slow moving, sessile species that does not undergo extensive local movements, seasonal, or spawning migrations • Spawning occurs over banks during spring/summer
Deepwater redfish (Northern population) [1]	• Generally, live at depths from 350 to 500 m • Larvae prefer surface waters, where they feed on copepods and fish eggs • Slow growth and long lifespan; they can live up to 75 years • Ovoviviparous, females keep their fertilized eggs inside their brood chamber until the larvae have hatched • Larvae are released between the end of spring to early summer
Northern wolffish [14]	• The Northern wolffish inhabits boreal and subarctic waters on both sides of the North Atlantic and in the Arctic • It is most abundant on the shelf off northeastern Newfoundland and in the Labrador Sea with highest densities at temperatures between 2 and 5 °C • Found between 38-1504 m, but mainly between 500 and 1000 m • Spawns September through November • Larvae and young of the year are pelagic • Project Area overlaps with recently proposed designated critical habitat. This is further discussed in Section 6.1.10.
Porbeagle shark [15]	• Coastal and oceanic shark that lives in cold to temperate waters • Juvenilles most common and continental shelves but can occur well offshore • Most can be found at temperatures ranging from 5 ºC to 10 ºC • Mating occurs in the northwest Atlantic occurs in the Grand Banks, south of Newfoundland and at the mouth of the Gulf of St. Lawrence • Females give birth to live young outside Canadian waters • Rarely found between January and June in the RAA • Potentially only occurs in the Project Area during warm water season
Roughhead grenadier [16]	• Globally found along the continental shelf and slope in temperate to arctic waters of the North Atlantic • In Canadian waters distributed along the continental slope and deep shelf; been observed off Newfoundland and the Grand Banks • In the trawl surveys off Newfoundland, densities tend to be highest at depths of about 500 – 1500 m although they may inhabit depths between 200-2000 m • Spawning occurs in winter and early spring and may even extend over an entire year • Spawning grounds are not certain, but they are thought to lie on the southern and southeastern slopes of the Grand Bank • Eggs are reported to be pelagic
Roundnose grenadier [17]	• Globally found along the continental slope and mid-Atlantic ridge of the North Atlantic Ocean • In Canadian waters, it is most abundant in the northern part of the range (Labrador and Northeast Newfoundland shelves, Davis Strait) • Its range extends beyond the 200-mile limit • Has been reported at depths between 200 and 2600 m, most abundant at depths greater than 800-1000 m • Spawning may occur along the northern Mid-Atlantic Ridge, developing eggs and larvae are transported by currents and the young settle on the continental slopes off Baffin Island, Labrador and eastern Newfoundland

Species	Distribution, Habitat, and Ecology
Shortfin mako shark (Atlantic population)[18]	• Circumglobally distributed in temperate and tropical waters • Canadian waters represent the northern fringe of the Shortfin Mako range • Preferred water temperature is between 17-22 °C usually associated with the Gulf Stream • Appears as if females migrate to latitudes of 20-30 °N to give birth
Smooth skate[24]	• Captures in Canadian RV surveys of the Project Area were restricted to depths less than 500 m • Resident species but not numerically dominant in Canadian or NAFO waters in Project Area • Lays 40-100 large egg capsules per year • Not commercially important in the region
Spotted wolffish [19]	• Found on both sides of the North Atlantic and in the Arctic • Eggs are deposited on the bottom, the larvae are pelagic, and the juveniles and adults occupy bottom waters • Typically occupy depths between 200 and 750 m on the continental shelf or in deep trenches • Fertilization is internal and mating probably occurs in the summer • DFO recently proposed designated critical habitat for spotted wolfish, which is located within the RAA and further discussed in Section 6.1.10
Thorny skate [20]	• Globally found on both sides of the North Atlantic • Distributed continuously from Baffin Bay, Davis Strait, Labrador Shelf, Grand Banks, Gulf of St. Lawrence, Scotian Shelf and Bay of Fundy to Georges Bank, over a wide range of depths. • Inhabit a wide range of depths (primarily 18-1200 m) and typically in water temperatures of 0 to 10 °C • Spawning appears to occur in the fall and winter • egg cases are often deposit deposited on sandy or muddy flats
White shark (Atlantic population) [21]	• Circumglobally distributed in sub-polar to tropical seas of both hemispheres • Has been recorded from the Northeast Newfoundland Shelf to the Bay of Fundy • Canadian waters represent the northern fringe of the white shark's range. • Depth from just below the surface to just above the bottom, down to a depth of at least 1,200 m • Recorded in water temperatures from 5 to 27 °C, preferred temperature's above 11 °C • Possible white shark pupping areas in the Atlantic Ocean include the Mid-Atlantic Bight
Winter skate (Eastern Scotian Shelf – Newfoundland population) [22]	• Globally restricted to the northwest Atlantic • Found from southern Newfoundland to the Canada/US border • >90% of individuals are caught in less than 150 m of water, may occur as deep as 400 m • Found over sandy or gravelly bottoms • Eggs deposited throughout the year in its southern range, eggs deposited in late summer to fall off Newfoundland
[1] COSEWIC 2010c; [2]COSEWIC 2012a; [3]COSEWIC 2009a; [4]Lam et al. 2014; [5] COSEWIC 2010b; [6]COSEWIC 2010b; [7] COSEWIC. 2011a. [8] COSEWIC 2010a. [9] COSEWIC 2012b. [10] COSEWIC 2009b. [11] Collette et al. 2011. [12] COSEWIC 2016. [13] COSEWIC 2012c. [14] COSEWIC 2012d. [15] COSEWIC 2014. [16] COSEWIC 2007. [17] COSEWIC 2008a. [18] COSEWIC 2017. [19] COSEWIC 2012e. [20] COSEWIC 2012f. [21] COSEWIC 2006b [22] COSEWIC 2015. [23]Simpson et al.2016. [24]Statoil 2017	

6.1.9 Species of Indigenous Significance

Within the waters offshore Newfoundland and Labrador, including waters within the Project Area and the RAA, commercial fishing activity for several different species occurs, including species that Indigenous groups may hold commercial communal licenses to harvest. Species harvested for commercial communal purposes within the RAA include capelin, groundfish, herring, mackerel, seal, shrimp, snow crab, tuna, and whelk. Commercial communal fishing activity and licenses for Indigenous groups is described in Section 7.4. Species harvested by Indigenous groups for food, social, and ceremonial (FSC) purposes include, but not limited to, gaspereau, trout, Atlantic salmon, bass, mackerel, eel, shad, groundfish (e.g., flounder, halibut, pollock), Arctic char, smelt, blue shark, herring, mussel, clams, periwinkle, soft-shell clams, squid, tomcod, quahaug, razor clams, lobster, crab and scallops. Many FSC species are harvested in the inshore and/or freshwater systems. However, some species are anadromous and can potentially migrate through the RAA and/or Project Area. Two migratory fish species in particular have been highlighted during Indigenous engagement as being of concern due to potential interaction with Project activities: American eel and Atlantic salmon. The American eel has been identified as key to Aboriginal rights-based, Treaty rights-based, and commercial fisheries, particularly to the Mi'kmaq peoples (Denny and Kavanagh 2018). Atlantic salmon have traditionally been a staple food for Indigenous peoples, although today, due to a lack of abundance and concern for local populations, it is often reserved for special occasions (Denny and Fanning 2016). These species, including their potential for occurrence in the RAA, are described below. Further discussion on these species, with more focus on significance to FSC fisheries can be found in Section 7.4.7.

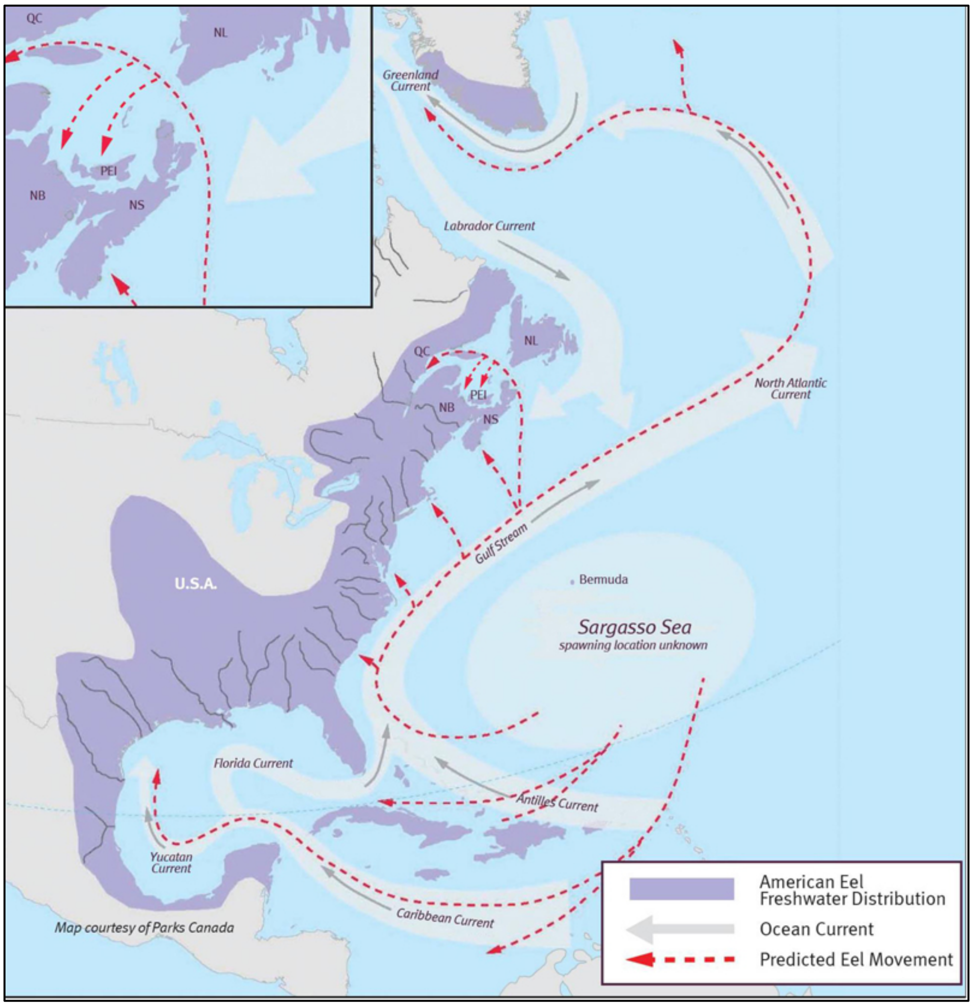
American Eel

The American eel (*Anguilla rostrate*) is a catadromous fish (i.e., migrating down rivers to the sea to spawn) that lives primarily within freshwater and estuarine environments and has a broad distribution throughout the northwest Atlantic Ocean, stretching from Venezuela to Greenland and Iceland (COSEWIC 2012a). The Canadian portion of this distribution includes coastlines, freshwater habitats, estuaries, and coastal marine waters connected to Canada, up to the mid-Labrador coast.

American eels are considered a single breeding population, and all eels will travel to the Sargasso Sea, just north of Bermuda, to breed (Wildlife Division 2010; DFO 2016b). Therefore, there is no geographic heterogeneity for eels in different areas. Once eggs have hatched, the larvae (known as leptocephali) are transported northward along the currents of the Gulf Stream, toward the coastal waters of eastern North America. As larvae become larger and develop, becoming known as glass eels, they begin to make their way to coastal waters and the shore. The glass eels continue to grow and turn into elvers, which begin to move into estuarine and freshwater habitats (Wildlife Division 2010). These upriver migrations typically occur between April and August. The final stage is when elvers become pigmented and turn into yellow eels. This stage can last over 30 years for eels in some environments and is the stage when sexual differentiation occurs. Yellow eels change once more into silver eels upon preparation for migration back to the Sargasso Sea to breed (Wildlife Division 2010). Fully mature eels are presumed to die after spawning. Spawning migrations for adult American eels in Canada occur during the fall, and eels typically follow the continental shelf before travelling across open ocean to the Sargasso Sea (COSEWIC 2012a;

Béguer-Pon et al. 2015). Once the eggs hatch, the Gulf Stream will carry larvae up towards the northeast coast. Figure 6.12 outlines general migration patterns of the American eel.

The most recent DFO research vessel surveys for 2016 / 2017 found that American eel occurs within the Project Area between March and November, but the potential for occurrence within the Project Area was considered low (see Section 6.1.7). There is little information available on specific migration patterns of American eel, and if American eel were to occur within the Project Area, it is likely that they would be transported by currents on their way either to Greenland, Iceland, or to Newfoundland and Labrador.



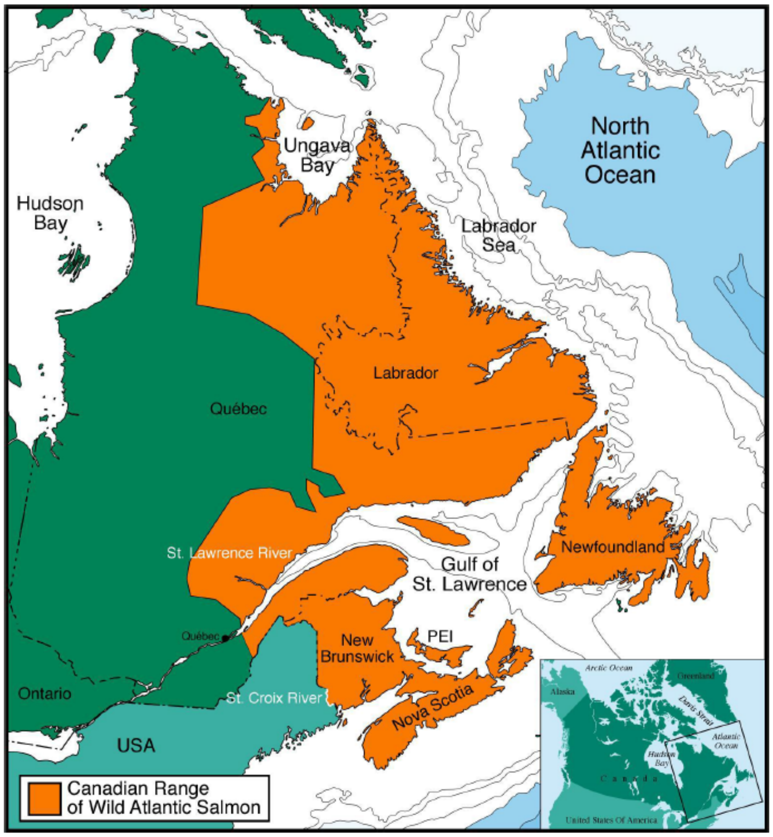
Source: DFO 2016b

Figure 6.12 Predicted Migration Pattern for American Eel

The American eel is assessed as Threatened in Canada (COSEWIC) and Endangered Globally (IUCN) (Table 6.6). Mi'kmaq eel fishers have observed declines in traditional fishing areas as having to fish longer to get the same amounts to feed their families and provide for cultural events (Denny et al. 2012 and Wagner et al. 2004, in Denny and Kavanagh 2018).

Atlantic Salmon

North American Atlantic salmon (*Salmo salar*) breed and spend the early part of their life cycle in freshwater systems throughout Atlantic Canada, eastern Québec, and the northeastern seaboard of the United States (Figure 6.13). The genetic structure and life history traits of Atlantic salmon tend to vary among river populations. This variation among salmon rivers tends to increase with geographic distance. As a result, DFO manages groups of salmon rivers as metapopulations, called Designatable Units (DUs), based on geography and unique genetic and life history traits (COSEWIC 2010a).



Source: DFO 2017b

Figure 6.13 Inland Range of Atlantic Salmon in Canada

DFO manages Atlantic salmon populations under 16 DUs (Table 6.8 and Figure 6.13). Among these DUs, COSEWIC has identified five as Endangered (Outer Bay of Fundy, Inner Bay of Fundy, Southern Uplands, Eastern Cape Breton, and Anticosti Island metapopulations; Table 6.8). All of these Atlantic salmon populations, except the Inner Bay of Fundy population, have the potential to occur in the Project Area, although most likely as a transient presence during migration. The Lake Ontario metapopulation is considered Extinct.

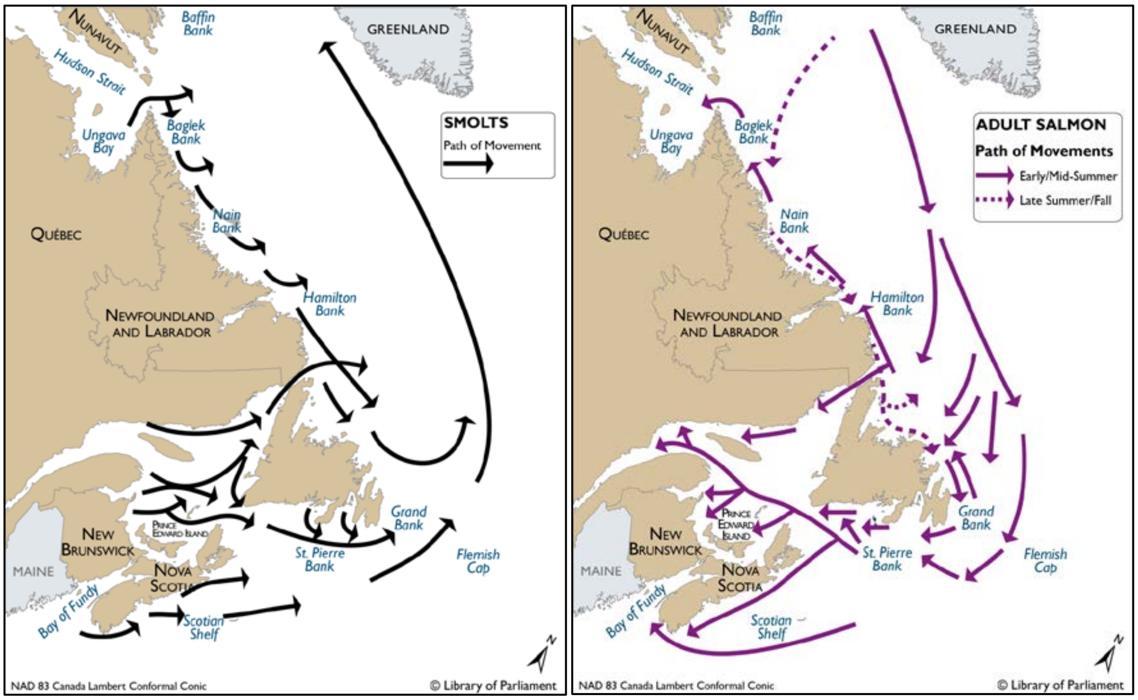
Table 6.8 Federal Conservation Status of Canada's Atlantic Salmon Designatable Units

Metapopulation No. (Designatable Unit)	Metapopulation Name (Designatable Unit)	Range	COSEWIC Status	SARA Status
1	Nunavik	Quebec, Newfoundland and Labrador, Atlantic Ocean	Data Deficient	No Status
2	Labrador	Quebec, Newfoundland and Labrador, Atlantic Ocean	Not at Risk	No Status
3	Northeast Newfoundland	Newfoundland and Labrador, Atlantic Ocean	Not at Risk	No Status
4	South Newfoundland	Newfoundland and Labrador, Atlantic Ocean	Threatened	No Status
6	Northwest Newfoundland	Newfoundland and Labrador, Atlantic Ocean	Not at Risk	No Status
7	Quebec Eastern North Shore	Quebec, Atlantic Ocean	Special Concern	No Status
8	Quebec Western North Shore	Quebec, Atlantic Ocean	Special Concern	No Status
9	Anticosti Island	Quebec, Atlantic Ocean	Endangered	No Status
10	Inner St. Lawrence	Quebec, Atlantic Ocean	Special Concern	No Status
11	Lake Ontario	Ontario, Atlantic Ocean	Extinct	No Status
12	Gaspé-Southern St. Lawrence	Quebec, New Brunswick, Prince Edward Island, Nova Scotia, Atlantic Ocean	Special Concern	No Status
13	Eastern Cape Breton	Nova Scotia, Atlantic Ocean	Endangered	No Status
14	Southern Uplands	Nova Scotia, Atlantic Ocean	Endangered	No Status
15	Inner Bay of Fundy	New Brunswick, Nova Scotia, Atlantic Ocean	Endangered	Schedule 1; Endangered
16	Outer Bay of Fundy	New Brunswick, Nova Scotia, Atlantic Ocean	Endangered	No Status

Source: DFO 2017b

The Inner Bay of Fundy metapopulation is the only Atlantic salmon DU with legal protection as a listed species (Endangered) on Schedule 1 of SARA. Consultation documents were distributed for inclusion of the Outer Bay of Fundy (DFO 2014b), Southern Uplands (DFO 2013a), Anticosti Island (DFO 2012a) and Eastern Cape Breton (DFO 2014c) DUs in Schedule 1 of SARA. DFO is in the process of developing SARA listing recommendations to include Outer Bay of Fundy, Southern Uplands, and Eastern Cape Breton DUs (DFO 2016c).

Anadromous phenotypes of Atlantic salmon leave their natal rivers of Atlantic Canada and eastern Quebec in the spring and migrate to summer/fall feeding areas in the Labrador Sea gyre, the western coast of Greenland, and the eastern Grand Banks via the Strait of Belle Isle and waters off the eastern Newfoundland Coast (Figure 6.14) (Reddin 2006). Migration routes are generally thought to follow the dominant surface water currents. Overwintering distribution is not well-defined but is generally believed to encompass an area from the southern Labrador Sea, to the eastern edge of the Scotian shelf (COSEWIC 2010a). Available literature suggests that the Labrador Sea is the primary overwintering area (Reddin 2006; DFO 2013b).



Source: The Standing Committee on Fisheries and Oceans 2017

Figure 6.14 General Ocean Distribution and Migratory Patterns of Canadian Atlantic Salmon

Migration back to freshwater, in the summer and fall, generally follows ocean currents back toward coastal environments and onward to natal rivers. The distribution and migration patterns of Atlantic salmon are influenced by the age structure of the population. Salmon of various ages may be found during the ocean life cycle, and those ages influence migratory patterns so that at any given time, there are individuals in a population inhabiting ocean environments (COSEWIC 2010a). Post-smolts (salmon that have not yet spent a winter at sea) exit rivers in May / June to feed in the summer/fall and overwinter. Following their first winter, those salmon are termed one sea-winter (1SW) salmon. One sea-winter salmon may migrate back to their natal rivers to spawn the following summer or they may migrate to ocean foraging grounds and overwinter for another season. Those that remain are known as two sea-winter (2SW) salmon and these individuals return to spawn the following summer. Fish that are successful at spawning typically overwinter in freshwater and return to the ocean the following spring. Thus, at any given time there are multiple age classes of salmon expected to be using ocean environments.

The marine distribution and habitat requirements of salmon at sea have generally been inferred from commercial catch data, research vessel surveys, and telemetry studies (Reddin 2006; COSEWIC 2010a; Lacroix 2013). During spring, summer, and fall migration and foraging activities, salmon spend most of the time in the warmer surface waters, although they have been shown to enter deeper waters as well. Salmon are opportunistic foragers that will consume a variety of prey species. It is thought that abundances of energy-rich small fish species, such as capelin (*Mallotus villosus*) and sand lance (*Ammodytes dubius*), are important components of the diet. The physiological temperature range of Atlantic salmon is quite broad (approximately 0°C to 20°C); however, the catch data suggest individuals are more common in waters ranging from 4°C to 12°C. It is likely that these temperature-related observations are the result of biological rhythms associated with prey life cycle and abundance trends. Little is known regarding the overwintering habitats of Atlantic salmon. Due to metabolic constraints, it is likely that winter is a period of reduced foraging activity where individuals are inhabiting deeper, warmer waters.

While there is a general understanding of the spatial and temporal distribution of salmon at sea, the resolution of this information is low (Reddin and Frieland 1993; Reddin 2006; COSEWIC 2010a). This is further complicated by evidence of climate-induced salmon prey population changes that may be actively changing salmon distribution patterns within the North Atlantic Ocean over time (Mills et al. 2013; Renkawitz et al. 2015; Caesar et al. 2018). Although it is an active area of current research, the potential variation in ocean distribution within and among salmon DUs is not well described. It is generally thought that the open-ocean distribution of many DUs overlap (Reddin 2006). While salmon populations all seem to migrate north to feeding areas, the relative incidence of individual salmon from more southerly populations is expected to decrease with increasing longitude (Reddin 2006; COSEWIC 2010a). Most individuals from a population are expected to migrate to the feeding grounds by the most direct, or energy efficient, path. Therefore, for example, DUs from the Bay of Fundy and the eastern coast of Nova Scotia are expected to have little presence in the Gulf of St. Lawrence (Bradbury et al. 2016a) and be more concentrated in the eastern Grand Banks and Labrador Sea in the spring (Reddin 2006).

Research vessel surveys have caught salmon within the Project Area in the spring (Reddin and Frieland 1993; Reddin 2006). There is no specific information for the Project Area with respect to salmon abundance or the relative DU composition of individuals that may inhabit the area. Likewise, there is no information with regards to salmon overwintering in relation to the Project Area.

Ocean distribution and migration information for all Atlantic salmon DUs are provided below. The information available for specific DUs is limited. Where data do exist, it is based on tagging studies of salmon from a limited sample of river systems (Hedger et al. 2009; Jacobs 2011; Lefévre et al. 2012; Lacroix 2013; Strøm et al. 2017) or it is inferred from the genetic composition of commercial fisheries catch data (Bradbury et al. 2015; Bradbury et al. 2016a, Bradbury et al. 2016b). The general information provided below is inferred from the general understanding of salmon distribution when DU-specific information is not available. This information is subject to change as future studies are completed.

Labrador, Nunavik DUs

The Labrador DU includes 91 known salmon rivers extending from the northern tip of Labrador southward to the Napitipi River, Quebec. The Nunavik DU includes five known salmon rivers extending from the tip of Labrador westward into Ungava Bay, Quebec – the northwestern extent of the species' current range (COSEWIC 2010a). There have been no Atlantic salmon commercial fishery activities since 2000. Indigenous peoples continue to fish in several salmon rivers for FSC purposes. Catch and release and limited retention recreational fishing is still authorized on some rivers under restrictive conservation management restrictions.

Limited work has been conducted on the ocean distribution of salmon from the Labrador and Nunavik DUs. A high proportion of salmon from these DUs are identified in the Labrador subsistence and west Greenland fisheries (Bradbury et al. 2015; Bradbury et al. 2016b) suggesting salmon from these DUs likely feed in the Labrador Sea gyre and the western coast of Greenland, moving into the southern Labrador Sea to overwinter. Migration routes back to these DUs are thought to be like the routes out to sea. Therefore, it is not expected that many individuals of this metapopulation would be in the immediate Project Area.

Northeast Newfoundland, Northwest Newfoundland

The Northeast Newfoundland DU includes 127 known salmon rivers extending from the tip of the Northern Peninsula eastward to Cape Race on the Island of Newfoundland. The Northwest Newfoundland DU includes 34 known salmon rivers extending just north of the Bay of Islands to the tip of the Northern Peninsula (COSEWIC 2010a). There have been no Atlantic salmon commercial fishery activities since 2000. Indigenous peoples continue to fish in several salmon rivers for FSC purposes. Catch and release and limited retention recreational fishing is still authorized on some rivers under restrictive conservation management restrictions.

Limited work has been conducted on the ocean distribution of salmon from the Northeast and Northwest Newfoundland DUs. The low proportion of salmon from these DUs identified in the Labrador subsistence and west Greenland fisheries (Bradbury et al. 2015; Bradbury et al. 2016b) suggests most do not migrate to these more northwesterly feeding grounds. Therefore, salmon from these DUs may be more prevalent in Labrador Sea and eastern Grand Banks feeding areas during the summer/fall feeding season (Reddin and Frieland 1993). Migration routes back to these DUs are thought to be like the routes out to sea. Available information does not allow the resolution to determine if salmon from these DUs would be commonly found in the Project Area. It is expected that large numbers of salmon would only occur if high concentrations of prey items circulated through the Project Area during the spring/summer feeding season. However, given the large expanse of known salmon feeding grounds, it is not expected that many individuals would be in the immediate Project Area at any given time.

South Newfoundland, Southwest Newfoundland DUs

The South Newfoundland DU includes 104 known salmon rivers extending from the southeast tip of the Avalon Peninsula westward to the south coast of Cape Ray on the Island of Newfoundland. The Southwest Newfoundland DU includes 40 known salmon rivers extending from Cape Ray northward along Newfoundland's west coast just beyond the Bay of Islands (COSEWIC 2010a). There have been no

Atlantic salmon commercial fishery activities since 2000. Indigenous peoples continue to fish in several salmon rivers for FSC purposes. Catch and release and limited retention recreational fishing is still authorized on some rivers under restrictive conservation management restrictions.

Limited work has been conducted on the ocean distribution of salmon from the South and Southwest Newfoundland DUs. Based on their geographies, most salmon from the Southwest Newfoundland DU likely migrate directly through the Cabot Strait toward the eastern Grand Banks and Labrador Sea (Bradbury et al. 2016a). However, migration eastward around the Avalon Peninsula on the Island of Newfoundland is expected among many Southern Newfoundland populations (Bradbury et al. 2016a). The low proportion of salmon from these DUs identified in the Labrador subsistence and west Greenland fisheries (Bradbury et al. 2015; Bradbury et al. 2016b) suggests most do not migrate to these more northerly feeding grounds. Therefore, salmon from these DUs may be more prevalent in Labrador Sea and eastern Grand Banks feeding areas during the summer/fall feeding season (Reddin and Frieland 1993). Migration routes back to these DUs are thought to be similar to the routes out to sea. Available information does not allow the resolution to determine if salmon from these DUs would be commonly found in the Project Area. It is expected that large numbers of salmon would only occur if high concentrations of prey items circulated through the Project Area during the spring/summer feeding season. However, given the large expanse of known salmon feeding grounds, it is not expected that many individuals would be in the immediate Project Area at any given time.

Inner St. Lawrence, Quebec Western North Shore, Quebec Eastern North Shore, Anticosti Island, Gaspe-Southern Gulf of St. Lawrence DUs

The Inner St. Lawrence DU consists of nine known salmon rivers located along the northern and southern banks of the St. Lawrence River between the communities of Grondines and Tadoussac, Quebec. The Quebec Western North Shore DU consists of 25 known salmon rivers located approximately from the community of Tadoussac to Natashquan. The Quebec Eastern North Shore DU consists of 20 known salmon rivers located approximately from the community of Natashquan to rivers just east of Pakuashipi. Members of the Anticosti Island metapopulation originate from the 25 known salmon rivers on Anticosti Island (DFO 2017b). The Gaspe-Southern Gulf of St. Lawrence DU includes 78 known salmon rivers extending from the western Gaspe to the northern tip of Cape Breton, including Prince Edward Island (COSEWIC 2010a; DFO 2011b; DFO 2013b). There have been no Atlantic salmon commercial fishery activities since 2000. Indigenous peoples continue to fish in several salmon rivers for FSC purposes. Catch and release recreational fishing is still authorized on some rivers under restrictive conservation management restrictions.

Some research has been conducted on the ocean distribution of salmon populations originating from Québec's north shore and the Gaspé Peninsula. It is likely that most salmon from these DUs migrate toward the Labrador Sea by the most efficient geographical means. Thus, salmon populations from the more western rivers in these DUs are expected to access the Labrador Sea through the Strait of Belle Isle (Hedger et al. 2009; Jacobs et al. 2011; Lefévre et al. 2012; Strøm et al. 2017). However, the more eastern salmon populations, largely those in the southwestern Gulf of St. Lawrence, may be more apt to move eastward around the Avalon Peninsula on the Island of Newfoundland (Bradbury et al. 2016a). Salmon from these DUs likely feed in the Labrador Sea gyre and the western coast of Greenland, moving into the southern Labrador Sea to overwinter. Migration routes back to theses DUs are thought to be like the routes out to sea. All age groups of salmon at sea are represented in the Labrador Sea, where they also probably spend the winter. It is not expected that many individuals of this metapopulation would be in the immediate Project Area.

Outer Bay of Fundy, Southern Uplands and Eastern Cape Breton DUs

Outer Bay of Fundy metapopulation breeds in rivers along the New Brunswick shores of the Bay of Fundy, from the U.S. border to the Saint John River (DFO 2011c), with 17 rivers identified as containing (or historically containing) Atlantic salmon (Gibson et al. 2016). There have been no recreational fisheries or food, social, and ceremonial allocations in this Salmon Fishing Area since 1998. All rivers remained closed to salmon fishing in 2015 (DFO 2016c).

The Southern Uplands metapopulation breeds in rivers from northeastern mainland Nova Scotia, along the Atlantic coast and into the Bay of Fundy as far as Cape Split (DFO 2011d, 2011e), with 72 rivers identified as containing (or historically containing) Atlantic salmon (Gibson and Bowlby 2013). All rivers within SFA 20 and 21 have been closed to recreational fishing and FSC allocations since 2010 (DFO 2016c).

The Eastern Cape Breton metapopulation breeds in rivers on Cape Breton Island that drain into the Bras d'Or Lakes and Atlantic Ocean (DFO 2011e), with 46 rivers identified as containing (or historically containing) Atlantic salmon (DFO 2014b). Except for Middle River, Baddeck River, and North River, all rivers in this DU were closed to salmon fishing in 2015. In 2015, FSC allocations were available from these three rivers; however, no FSC harvests were recorded from these three rivers in 2015 (DFO 2016c).

Limited work has been conducted on the ocean distribution of salmon from the Outer Bay of Fundy, Southern Uplands, and Eastern Cape Breton DUs. The interpretation presented below for all three DUs is largely based on Lacroix (2013), who worked on salmon from a single tributary of the Saint John River system (n=15; Hammond River; Outer Bay of Fundy DU).

Based on their geographies, most salmon from these three DUs likely migrate directly across the Cabot Strait toward the eastern Grand Banks and Labrador Sea (Bradbury et al. 2016a; Lacroix 2013). The low proportion of salmon from these DUs identified in the Labrador subsistence and west Greenland fisheries (Bradbury et al. 2015; Bradbury et al. 2016b) suggests most do not migrate to these more northerly feeding grounds. Therefore, salmon from these DUs may be more prevalent in Labrador Sea and eastern Grand Banks feeding areas during the summer/fall feeding season (Reddin and Frieland 1993; Lacroix 2013). Recent work with salmon from the outer Bay of Fundy DU have also suggested that the Project Area may serve as a summer marine feeding area (Samways et al. unpublished data). Specifically, this study linked the stable carbon ($\delta 13C$) isotope signature of salmon caught between 1982 and 2011 with broad areas of the Northwest Atlantic Ocean, including the Project Area (Samways et al. unpublished data). Migration routes back to these DUs are thought to be similar to the routes out to sea. Available information does not allow the resolution to determine if salmon from these DUs would be commonly found in the Project Area. It is expected that large numbers of salmon would only occur if high concentrations of prey items circulated through the Project Area during the spring/summer feeding season. However, given the large expanse of known salmon feeding grounds, it is not expected that many individuals would be in the immediate Project Area.

Inner Bay of Fundy Salmon DU

As the only Atlantic salmon DU afforded legal protection under SARA, the spatial and temporal distribution of Inner Bay of Fundy salmon are relatively well understood. Existing data suggest that the distribution of Inner Bay of Fundy salmon at sea is unique relative to other DUs. Studies tracking the movement of post-smolts, salmon that have not yet spent a full winter at sea, suggest that most of the population stays within the Northern Gulf of Maine in their first summer (Marshall 2014). It is unclear where the minority of post-smolts that do leave the northern Gulf of Maine go, and their overwintering distribution is not known. However, Inner Bay of Fundy kelts (salmon that have returned to the ocean following spawning) seem to follow migratory patterns similar to that of post-smolts. Kelt overwintering data suggest that the majority remain in the northern Gulf of Maine through the colder winter months, with some venturing into the warmer Scotian Shelf waters (Lacroix 2013). The existing information suggests that Inner Bay of Fundy salmon are not known to inhabit North Atlantic Ocean waters near the Orphan Basin or the Grand Banks. Thus, with respect to the Project Area, the presence of Inner Bay of Fundy salmon is not expected at any life history stage or season.

6.1.10 Summary of Key Areas and Temporal Periods

In the vicinity of the Project, temporal periods of significance are often synchronized across several species in the spring/early summer period. Plankton blooms along the Newfoundland slope triggers blooms of primary productivity. These increases in primary productivity increase zooplankton growth and other secondary productivity. The resulting spike in available prey attracts migratory pelagic species from more southerly environments (sharks, tuna, swordfish) and provides optimal conditions for spawning and subsequent larval survival during the spring bloom and warm summer months. This is reflected in the spawning times listed in Table 6.5.

A summary of the 2004-2013 Canadian RV surveys indicate the slope area along the northeast edge of the Grand Banks has the highest abundance, richness, and biomass of finfish relative to the shelf and other slope areas surveyed in the vicinity of the Project (Statoil 2017). The greatest fish densities occurred at the interface of the northeast slope of the Grand Banks and the northern section of the Grand Banks. This area supports habitat diversity, strong nutrient content, seawater mixing and typically strong primary production (Amec 2014). This area includes the Northeast Shelf and Slope a designated Environmentally and Biologically Significant Area (EBSA) and the Bonavista Cod Box both of which are discussed in Section 6.4.1. The Northern Grand Banks encompasses an area designated as proposed critical habitat for both northern and spotted wolffish. The proposed northern wolffish critical habitat overlaps the Project Area along a portion of the Northeast Newfoundland Slope. The critical habitat was delineated using the Area of Occurrence approach based on the number of wolffish present at sea bottom temperature and depth.

Cold-water corals and sponges are sessile benthic invertebrates that have been shown to play an important role in abyssal ecosystems by providing habitat for other species of invertebrates and fishes. Cold-water corals found on continental margins provide resting, feeding, and spawning sites for other species including commercially important species. There is a high abundance and diversity of structure-forming benthic invertebrate species that occur in the Orphan Basin and in surrounding areas along the Northeast Newfoundland Slope including the Orphan Spur, a designated EBSA. Within the Project Area, corals and sponges were identified in the northwest section of EL 1145 and EL 1146, where the Project intersects with the Northeast Newfoundland Slope Closure, a marine refuge area closed to bottom-contact fishing to protect corals and sponges (refer to Section 6.4.1).

Deep slope habitats, such as those located within the Project Area, are likely to have less temporal variability. This is attributed to primary productivity blooms being restricted to upper water layers and water temperatures are cold and more stable, thus limiting seasonal intrusions by temperate migratory species.

At greater depths, species and habitats are poorly understood but are considered fragile because the species that occupy these areas have life history traits that limit their resilience to perturbations. Investigations on abyssal fish assemblages determined the most diverse assemblages at depths greater than 1500 m occurred around microhabitats, comprised of rock outcroppings, corals, and boulder fields. Each of these microhabitats produced distinct assemblages (Beazley et al 2013; Baker et al. 2012).

6.2 Marine and Migratory Birds

The eastern Newfoundland offshore area is rich in seabirds year-round. The southward flowing Labrador Current interacts with the continental shelf edge, causing mixing in the water column and creating a productive environment for the growth of plankton, which is the base of a rich oceanic environment. Similarly, productive conditions for the growth of plankton are generated in the Orphan Basin through a mixing of currents and upwellings. The highly productive Grand Banks and adjacent waters are known to support large numbers of seabirds in all seasons (Lock et al. 1994; Fifield et al. 2009).

6.2.1 Approach and Key Information Sources

Surveys of seabirds at-sea in the Project Area and surrounding areas (Regional Assessment Area (RAA) have been conducted by the Canadian Wildlife Service (CWS) and through oil industry related seabird monitoring. Prior to 2000, seabird surveys were sparse on the Orphan Basin, northern Grand Banks and Flemish Cap. Original baseline information was collected by CWS through PIROP (Programme intégré de recherches sur les oiseaux pélagiques). These data were published for 1969-1983 (Brown 1986) and 1984-1992 (Lock et al. 1994). Since the late 1990s additional seabird observations have been collected on the northeast Grand Banks by the offshore oil and gas industry from drill platforms and supply vessels (Baillie et al. 2005; Burke et al. 2005). CWS, with funding from Environmental Studies Research Funds (ESRF), resumed surveys of seabirds at-sea with a program called Eastern Canadian Seabirds at Sea (ECSAS) to improve knowledge of the abundance and distribution of seabirds at-sea in areas of oil industry activity in eastern Canada (Fifield et al. 2009). This program introduced distance sampling techniques into data collection to improve the accuracy of density estimates of less detectable seabird species. Survey data from both the PIROP and ECSAS programs were obtained from CWS to illustrate relative abundance of 11 species groups in the RAA and Project Area. ECSAS density maps newly published at the on-line “Atlas of Seabirds at Sea in Eastern Canada” were consulted for the most recent densities of marine bird species in the Project Area (Bolduc et al. 2018) (Figure 6.15). In this Atlas, the year is divided into three seasons: April to July (spring migration and breeding), August to November (fall migration), and December to March (winter).

To fulfill marine bird monitoring required by the C-NLOPB, seabird surveys were also conducted from vessels conducting geophysical surveys within the RAA from 2004 to 2016 (Moulton et al. 2005; Abgrall et al. 2008; Jones et al. 2012; Mactavish et al. 2012; Jones and Lang 2013; Holst and Mactavish 2014; Lang 2016). Although the earlier seabird monitoring surveys were not conducted using distance sampling, they are cited to fill in gaps in ECSAS coverage. However, the density estimates from these surveys should be regarded as underestimates in comparison with ECSAS data. The distribution of seabirds at-sea is dependent on a variety of factors and is therefore patchy and ephemeral. Potential bias also originates from the necessity to conduct surveys from vessels of opportunity rather than randomly. As noted in the recent EIS of Statoil's proposed exploration drilling program in the Flemish Pass, these factors require that the resulting data be viewed as representing large scale distribution and abundance rather than small scale. However, these data provide a representative picture of avifauna in the Project Area and RAA (Statoil Canada Ltd. 2017).

CWS periodically censuses the seabird nesting colonies around Newfoundland and Labrador. These data were obtained from CWS (unpublished data) current to 2017. Data for areas identified under the Important Bird Areas in Canada program (IBA), many of which are major nesting colonies, were also consulted. Summaries of data collected under the Atlantic Canada Shorebird Survey (ACSS) program in the Statoil drilling EIS were also consulted (Statoil Canada Ltd. 2017).

6.2.2 Seabirds

The RAA includes continental shelf, slope, and deep-water habitats, as well as cold Labrador Current and warm Gulf Stream waters, all of which influence the distribution and abundance of marine birds. Marine birds are not distributed evenly over the ocean but tend to be concentrated over anomalies such as shelf edges and areas where currents mix. Mixing in the water column at these edges provide nutrients for phytoplankton creating the basis of a productive marine food web. The food resources of the Grand Banks and adjacent oceanographic features support large numbers and diversity of marine birds in every season (Brown 1986; Lock et al. 1994). Several million seabirds nest along the coasts of the eastern and northeastern Newfoundland, and forage on the Grand Banks and adjacent areas during and following the nesting season. In addition to local breeding birds, there are many non-breeding seabirds on the RAA during the summer months. Most of the world's population of great shearwater and large numbers of sooty shearwater are thought to migrate to Newfoundland waters to moult and feed during summer months after completion of nesting in the Southern Hemisphere. During the winter months, seabirds from the Arctic and subarctic of eastern Canada, and from Greenland, gather in the RAA. All species of seabirds require more than a single year to become sexually mature. Many of those non-breeding, sub-adult seabirds, especially northern fulmar and black-legged kittiwake, are present In the RAA year-round.

6.2.2.1 Phalaropes

Red and red-necked phalaropes occur in the pelagic waters of the RAA as migrants in passage between nesting grounds on the Arctic tundra and pelagic wintering areas in the tropics and sub-tropics. Red-necked phalarope is designated a Species of Special Concern (see Section 6.2.4). At sea, both species feed at the surface on zooplankton and are thought to forage primarily at ocean fronts bordered by upwelling (Rubega et al. 2000; Tracy et al. 2002).

Phalaropes migrate in small flocks in low densities, and are often seen in flight, so they have not been recorded in Orphan Basin during surveys of seabirds at-sea in a sample sufficient to calculate densities (e.g., Moulton et al. 2006; Bolduc et al. 2018; Figure 6.15). However, they have been recorded off-transect in small numbers from mid-May to early June and during August and September in the Project Area (e.g., Moulton et al. 2006).

6.2.2.2 Gulls and Terns

Gull species are a major component of the avifauna off eastern Newfoundland. Black-legged kittiwake, and herring, great black-backed, ring-billed, and black-headed gulls nest and, with the exception of ring-billed gull, winter in the RAA. More than two-thirds of the breeding gull population of Atlantic Canada nest around insular Newfoundland (Cotter et al. 2012). Almost half of this number is comprised of kittiwakes. The breeding gull population declined with the closure of the groundfish fishery and the closure of municipal sanitary landfills, but appears to be recovering (Cotter et al. 2012). Sabine's and lesser black-backed gull migrate through the RAA, whereas ivory and Ross's gulls and black-legged kittiwake winter in the RAA. Glaucous, Iceland and lesser black-backed gulls also winter in the RAA. Laughing gull is a vagrant in the RAA, occurring less than annually in the RAA (Moulton et al. 2006; Mactavish et al. 2016). Gulls feed primarily by picking food from the surface or plunge-diving from a short height.

Black-legged Kittiwake

Black-legged kittiwake, a mid-sized gull, is present in the RAA throughout the year. Thousands nest in colonies in eastern Newfoundland (Table 6.9). During the nesting period, from April to August, this species is restricted to inshore waters, with the exception of small numbers of immature, non-breeding birds (Lock et al. 1994). This is reflected in seabird surveys of the Project Area (Holst and Mactavish 2014; Bolduc et al. 2018). Many kittiwake nesting colonies are undergoing unexplained declines in the number of breeding individuals (Frederiksen et al. 2012). Post-breeding kittiwakes begin to arrive in the Project Area by August in densities ranging from 0 to 14.7 birds/km² (Figure 6.16) (Holst and Mactavish 2014; Bolduc et al. 2018). From December through March, densities range from >0 to 35.2 birds/km² (Bolduc et al. 2018). The placement of geolocators on breeding individuals at nesting colonies reveals that the RAA is part of the most important area used by post-breeding kittiwakes in the Atlantic. An estimated 80% of the 4.5 million adult kittiwakes in the Atlantic winter from the shelf edges off Newfoundland and offshore areas extending to the Mid-Atlantic Ridge and the Labrador Sea (Frederiksen et al. 2012). These birds include those from all of the nesting colonies in Europe except those in the Barents Sea. This species is designated Vulnerable on IUCN's Red List of globally threatened species (BirdLife International 2018).

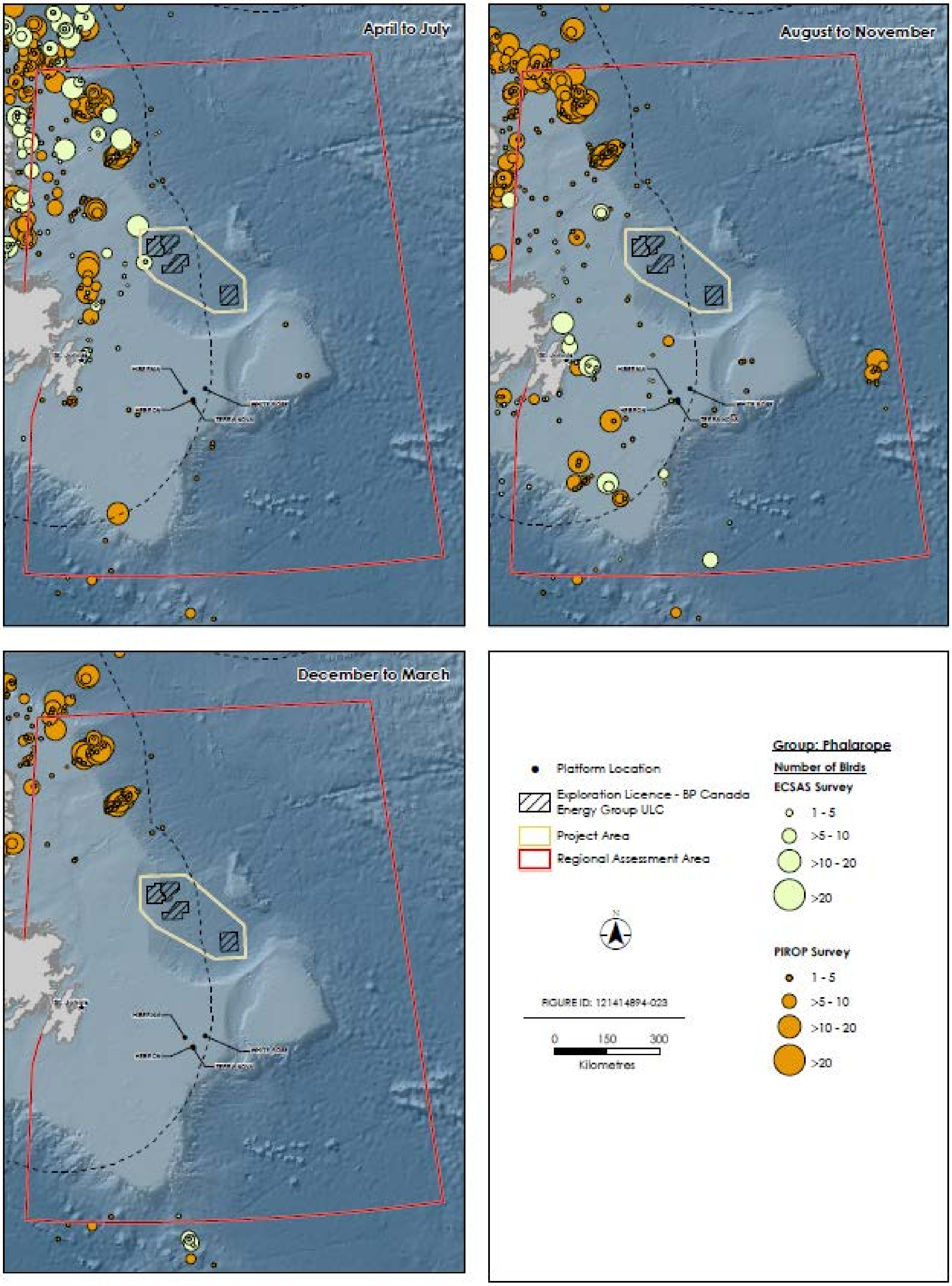


Figure 6.15 Seasonal Distribution of ECSAS and PIROP Phalarope Observations in the Waters Off Eastern Newfoundland (2001 – 2016)

Table 6.9 Numbers of Pairs of Marine Birds Nesting at Major Colonies in the RAA

Species	Wadham Islands	Funk Island	Cape Freels / Cabot Island	Bonavista Peninsula	Baccalieu Island	Witless Bay Islands	Mistaken Point	Cape St. Mary's
Black-legged Kittiwake	-	118[a]	Present[a] (80 individuals)	Present[a] (1,000 individuals)	5,096[a]	13,852[a]	4,170[f]	10,000[b]
Herring Gull	-	150[a]	Present[a] (993 individuals)	Present[a] (993 individuals)	46[a]	2,328[a] (135 individuals)	12[f]	39[f]
Great Black-backed Gull	-	100[a]	Present[a] (165 individuals)	Present[a] (1000 individuals)	2[a]	98[a] (15 individuals)	1[f]	Present
Ring-billed Gull	-	-	Present[a] (700 individuals)	-	-	-	-	
Arctic and Common Terns	Present[c] (22 individuals)	-	1,420[a] (1,080 individuals)	Present[a] (17 individuals)	-	-	-	
Common Murre	-	472,259[d]	9,897[a]	-	1,440[a]	261,793[a] (1,037 individuals)	Present[f] (152 individuals)	
Thick-billed Murre	-	250[a]	-	-	73[a]	1[a] (242 individuals)	-	
Razorbill	273[e]	198[b]	4[a]	-	406[a]	371[a] (202 individuals)	72[f]	
Black Guillemot	50[g]	1[b]	-	25[a]	113[a]	2[a] (17 individuals)	Present[b] (17 individuals)	
Atlantic Puffin	6,190[e]	2,000[g]	755[a]	4,870	75,000[f]	304,042[a]	79[f]	
Northern Fulmar	-	40[a]	-	-	13[a]	63[a]	-	9[a]
Leach's Storm-Petrel	200[g]	-	8,200[a]	60[a]	1,977,692[a]	313,902[a]	-	-
Northern Gannet	-	10,198[a]	-	-	3,241[a]	-	-	13,515[a]
Great and Double-crested Cormorants			60[a] (210 individuals)	Present[a] (152 individuals)				
Total (pairs only)	6,713+	485,275+	20,336+	4,955+	2,062,973+	896,452+	4,255+	23,563+

Source: [a] CWS 2017 (unpublished data), [b] Cairns et. al (1989), [c] Thomas et al. (2014), [d] Wilhelm et al. (2015), [e] Robertson and Elliot (2002), [f] Parks and Natural Areas (unpublished data); [g] Montevecchi (unpublished data); [h] Stenhouse and Montevecchi (1999).

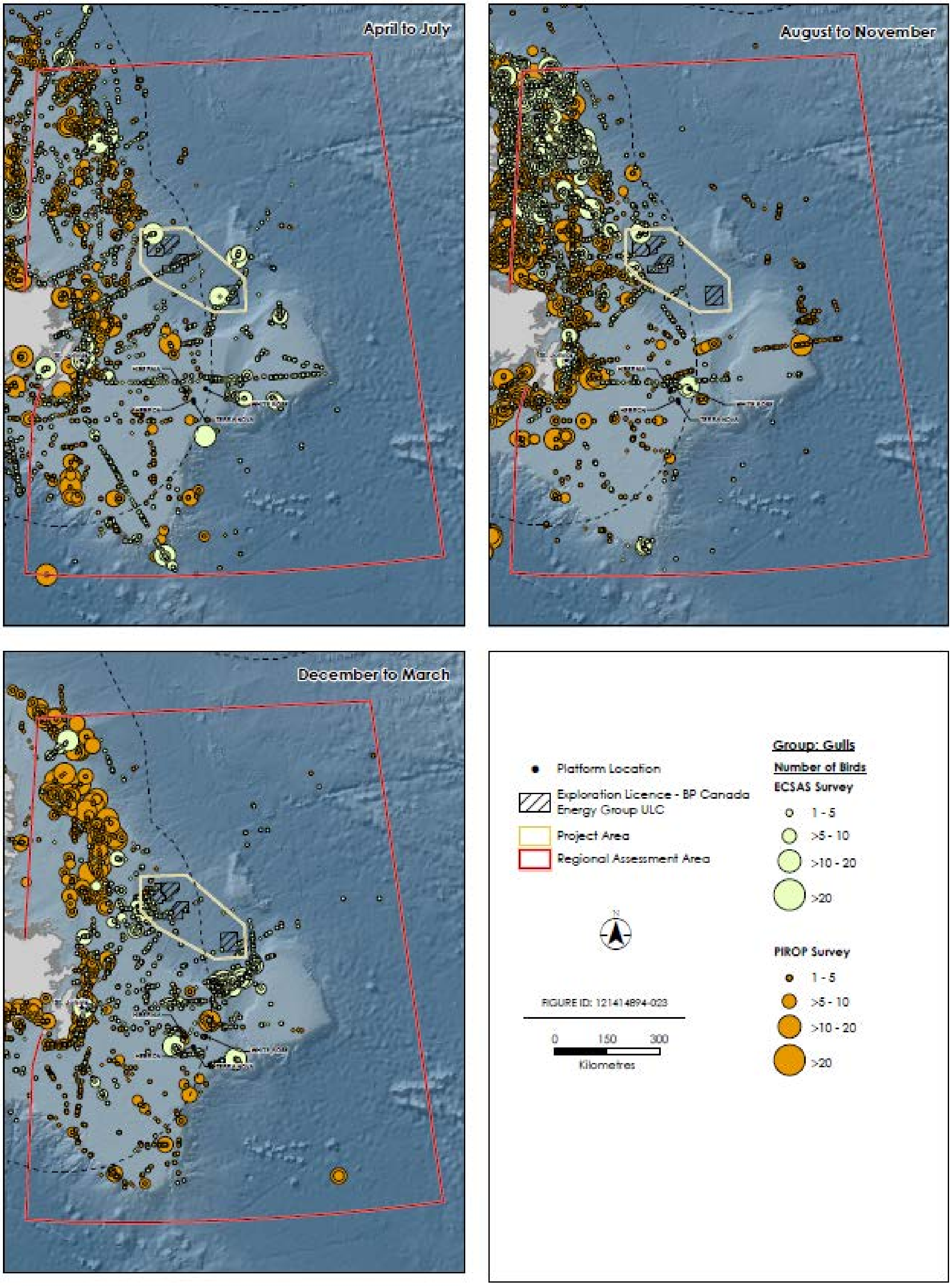


Figure 6.16 Seasonal Distribution of ECSAS and PIROP Gull Observations in the Waters Off Eastern Newfoundland (2001 – 2016)

Ivory Gull

Ivory gull is designated Endangered under both the NL ESA and SARA (see Section 6.2.4). This species is strongly associated with pack ice outside of the breeding season and occurs annually on the Northeast Newfoundland Shelf when the pack ice reaches that area in late winter and early spring (Gilg et al. 2010; Spencer et al. 2016). As a result, this species is occasionally seen on the coast of the Northern Peninsula (Stenhouse 2004; NLDEC 2016).

Small Gulls

Some Sabine's gulls nesting in the Canadian Arctic depart their colonies and migrate through the Labrador Sea well offshore (Davis et al. 2016). This species has been recorded in small numbers from seismic vessels in Orphan Basin and adjacent areas in all months from late May to late September (Moulton et al. 2005, 2006; Abgrall et al. 2008; Mactavish et al. 2012, Jones and Lang 2013; Holst and Mactavish 2014).

Ross's gulls nesting in the Canadian Arctic winter from the Labrador Sea to Orphan Basin (Maftei et al. 2015). Ross's gull is designated Threatened by COSEWIC and is listed on SARA Schedule 1 as Threatened (see Section 6.2.4).

Black-headed gull nests in small numbers in the RAA at Ladle Cove and outside the RAA at other scattered locations along the Newfoundland coastline (Cotter et al. 2012; B. Mactavish, 2018, pers. comm.). It also winters along the same coastlines (B. Mactavish, 2018, pers. comm.). It is occasionally seen in Orphan Basin (Hauser et al. 2010).

Large Gulls

Herring and great black-backed gull pairs nest alone or in small colonies whereas ring-billed gulls nest in fewer, larger colonies all along the coast (Statoil Canada Ltd. 2017). The numbers of nesting pairs at major nesting colonies in eastern Newfoundland are presented in Table 6.9. Densities of herring gulls in Orphan Basin range from > 0 to 2.6 birds/km² during April to July, from 0 to 16.6 birds/km² during August to November, and from 0 to 7.6 birds/km² during December to March (Bolduc et al. 2018). Most great black-backed gulls move at least 50 km offshore following nesting (Good 1998). Some of these individuals gather in large flocks at offshore Newfoundland production and drilling platforms (Baillie et al. 2005; Burke et al. 2012). There they forage at night for prey attracted to the surface by light from electrical lighting and flares on the platforms (Burke et al. 2005; Montevecchi 2006). This is reflected in densities of great black-backed gull in Orphan Basin, which range from 0 to 1.7 birds/km² during April to July, from 0 to 7.3 birds/km² in August to November, and 0 to 9.8 birds/km² during December to March (Bolduc et al. 2018). Ring-billed gull was not recorded on-transect in ECSAS surveys in Orphan Basin but have been sighted during geophysical surveys (Moulton et al. 2006; Abgrall et al. 2008).

Iceland gulls winter in large numbers scattered along the coastline in the RAA, along with smaller numbers of glaucous gull, as well as offshore. Iceland gull densities in Orphan Basin during April to July range from 0 to 2.2 birds/km², from 0 to 5.9 birds/km² during August to November, and from 0 to 3.9 birds/km² during December to March (Bolduc et al. 2018). Glaucous gull densities in Orphan Basin range from 0 to 3.9 birds/km² during April to August, 0 to 12.4 birds/km² during August to November, and

0 to 3.3 birds/km² during December to March (Bolduc et al. 2018). Small but growing numbers of lesser black-backed gulls from recently established colonies in southwest Greenland are also present in both coastal and offshore areas during migration and winter (Moulton et al. 2006; Abgrall et al. 2008; Hauser et al. 2010; Jones et al. 2012; Mactavish et al. 2012; Jones and Lang 2013; Holst and Mactavish 2014) (B. Mactavish, 2018, pers. comm.). Densities of lesser black-backed gulls in Orphan Basin range from 0 to 0.6 birds/km² (Bolduc et al. 2018).

Terns

Terns are present in Newfoundland waters from late May to early September. Common and Arctic terns nest in several colonies of various sizes in eastern Newfoundland (Statoil Canada Ltd. 2017). Caspian tern formerly nested in the RAA on the Wadham Islands (CWS, unpublished data). Outside of the nesting season Arctic tern is highly pelagic (Hatch 2002). In the offshore portion of the RAA Arctic tern is a fairly common spring and fall migrant, although it is seen primarily in small flocks or individually and probably migrates across a broad corridor (Moulton et al. 2006; Hauser et al. 2010; Mactavish et al. 2012; Holst and Mactavish 2014). Common and Caspian terns are rarely seen offshore but have been photographed in Orphan Basin (Jones et al. 2012; Mactavish et al. 2012; Jones and Lang 2013). ECSAS surveys did not record terns on transect in Orphan Basin in a sufficient sample to calculate densities (Figure 6.17). These species of terns feed primarily by plunge-diving (Cuthbert and Wires 1999; Hatch 2002; Nisbet 2002).

6.2.2.3 Skuas and Jaegers

Two species of skua and three species of jaeger occur regularly in the RAA. Pomarine, parasitic, and long-tailed jaegers are highly pelagic outside of the nesting season and migrate through the RAA between Arctic nesting grounds and tropical wintering areas. Great skua nests in northern Europe and Iceland. South polar skuas travel from nesting areas in the South Atlantic to spend the boreal summer in the offshore waters of the Northwest Atlantic. The skuas and jaegers occur in Orphan Basin in densities that are often too low to be recorded on-transect during seabird surveys during the May to October period (Figure 6.18) but have been recorded off-transect and between surveys (Moulton et al. 2006; Hauser et al. 2010; Jones and Lang 2013; Holst and Mactavish 2014). During winter, great skua is present because a large percentage of those nesting in Iceland migrate to the offshore waters of eastern Canada (Magnusdottir et al. 2012). During the pelagic part of their annual cycle, skuas and jaegers obtain a large part of their diet through kleptoparasitism (piracy on other seabirds) (Wiley and Lee 1998, 1999, and 2000).

ECSAS surveys recorded great skua densities in Orphan Basin ranging from 0 to 0.1 birds/km² during April to July, 0 to 1.2 birds/km² during August to November, and 0 to 0.5 birds/km² during December to March (Bolduc et al. 2018). ECSAS surveys did not record south polar skua in Orphan Basin (Bolduc et al. 2018). However, this species was recorded from seismic survey vessels in densities ranging from 0.02 birds/km² during late August to 0.3 birds/km² during mid-August (Moulton et al. 2006; Jones et al. 2012; Jones and Lang 2013; Holst and Mactavish 2014).

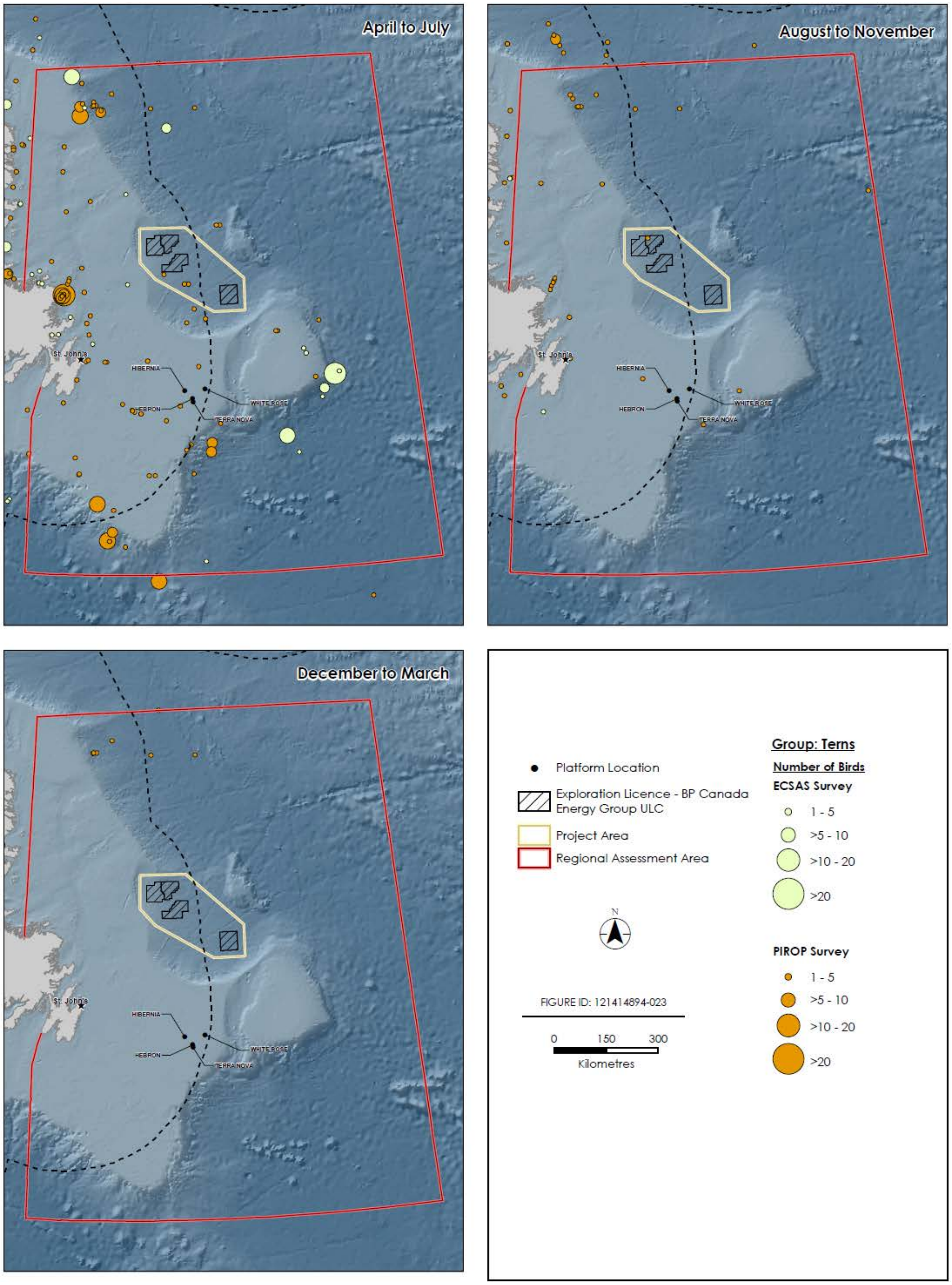


Figure 6.17 Seasonal Distribution of ECSAS and PIROP Tern Observations in the Waters Off Eastern Newfoundland (2001 – 2016)

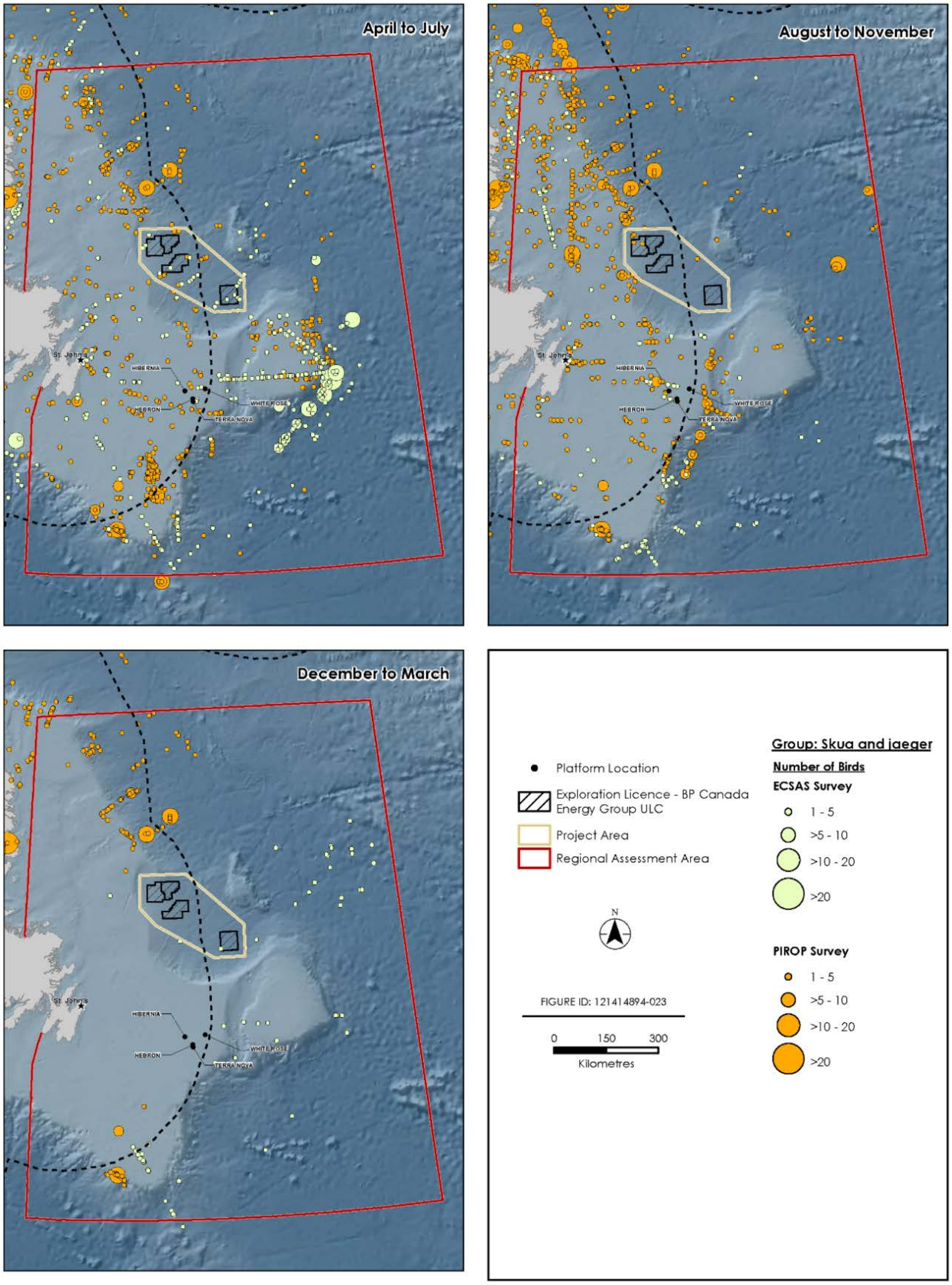


Figure 6.18 Seasonal Distribution of ECSAS and PIROP Skua and Jaeger Observations in the Waters Off Eastern Newfoundland (2001 – 2016)

Pomarine jaeger is found in densities of up to 0.6 birds/km² during April to July but was not recorded by ECSAS surveys at other times of the year (Bolduc et al. 2018). This species was recorded from seismic vessels in densities of up to 0.2 birds/km² during early August (Moulton et al. 2006; Jones and Lang 2013; Holst and Mactavish 2014). Parasitic jaeger densities in Orphan Basin range from 0 to 0.18 birds/km² during April to July but were not recorded by ECSAS surveys during other seasons (Bolduc et al. 2018). This species was recorded from seismic vessels in densities of up to 0.04 birds/km² during September (Moulton et al. 2006; Jones et al. 2012; Jones and Lang 2013). Long-tailed jaeger densities in Orphan Basin range from 0 to 0.6 birds/km² during April to July, and 0 to 0.7 birds/km² during August to November (Bolduc et al. 2018).

6.2.2.4 Auks, Murres, Puffins, and Guillemots

The members of the Alcidae native to the RAA consist of: dovekie, common murre, thick-billed murre, razorbill, Atlantic puffin, and black guillemot. Dovekie nests in the Arctic, common murre nests in the RAA, while the other species nest in both the Arctic and the RAA. They arrive at nesting colonies in the RAA in May to early June, and usually abandon them by late August (Statoil Canada Ltd. 2017). They forage primarily in coastal waters during this period. The numbers of pairs of alcids nesting at major colonies in eastern Newfoundland are provided in Table 6.9).

Alcids capture prey by pursuit diving, feeding on small fish (e.g., capelin and sand lance) and invertebrates. Dovekies primarily eat copepods, predominantly *Calanus* species (Fort et al. 2012), whereas the other alcids primarily consume fish. During pursuit diving alcids use their wings for propulsion, so those wings are short to maximize efficiency underwater. This makes their wings relatively inefficient for aerial flight. As a result, alcids spend a larger proportion of their time on the sea surface compared with more aerial seabirds and are therefore more vulnerable to oil pollution (Weise and Ryan 2003; Wilhelm et al. 2007; Fifield et al. 2009). They are especially vulnerable during the late summer moulting period, when they are left flightless for several weeks (Gaston and Hipfner 2000; Ainley et al. 2002; Lavers et al. 2009; Montevecchi and Stenhouse 2002).

In winter, alcids concentrate over relatively small, productive areas such as around the shelf slope of the Grand Banks (Figures 6.19 and 6.20) (Gaston et al. 2011; Hedd et al. 2011; Montevecchi et al. 2012b). The core winter distribution of the 30 million dovekies nesting in both west and east Greenland colonies lies off eastern Newfoundland, including Orphan Basin (Fort et al. 2013). The core wintering area for Common Murres breeding at nesting colonies in North America is offshore Newfoundland, based on data logged by geolocators (McFarlane Tranquilla et al. 2015). A portion of the wintering area of the thick-billed murres nesting in North American colonies also occurs within the RAA, although the core wintering range is the Labrador Sea. The RAA is part of one most important wintering areas for thick-billed murres nesting at colonies in the North Atlantic (Frederiksen et al. 2016). These birds nest primarily at colonies on Baffin Bay and Hudson Bay, with a smaller proportion from Spitsbergen. Females nesting on Baffin Bay migrate rapidly to the Newfoundland-Labrador Shelf. Males move more gradually, beginning in mid-September. Atlantic puffins are not seen offshore in large numbers, so the core winter distribution is not known (Fifield et al. 2009). Atlantic puffin is designated Vulnerable by IUCN (BirdLife International 2018). Razorbill winters primarily in the Bay of Fundy (Huettman et al. 2005), whereas black guillemot is rarely seen away from coastal waters at any time of the year (Butler and Buckley 2002).

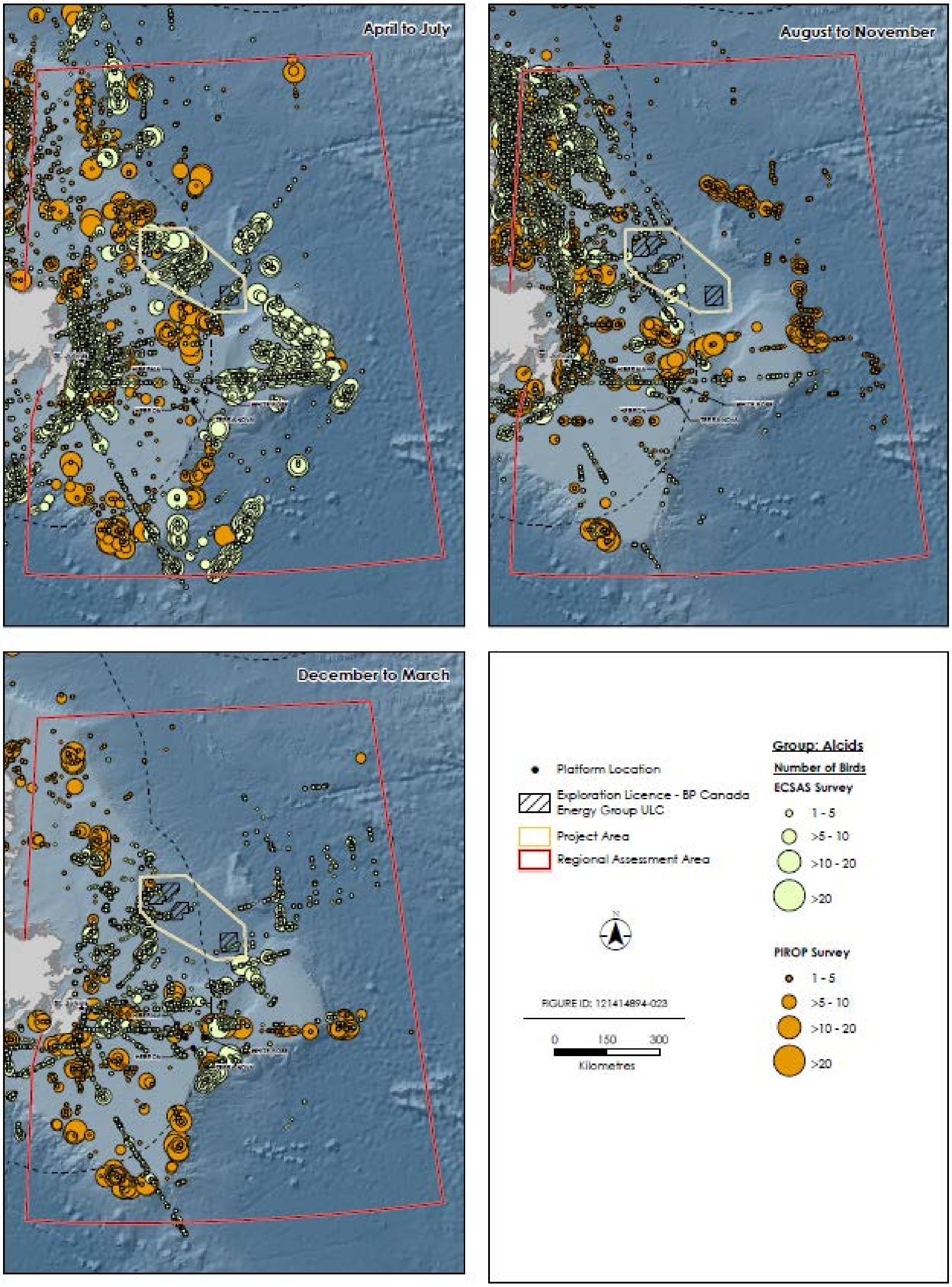


Figure 6.19 Seasonal Distribution of ECSAS and PIROP Dovekie, Razorbill, and Black Guillemot Observations in the Waters Off Eastern Newfoundland (2001 – 2016)

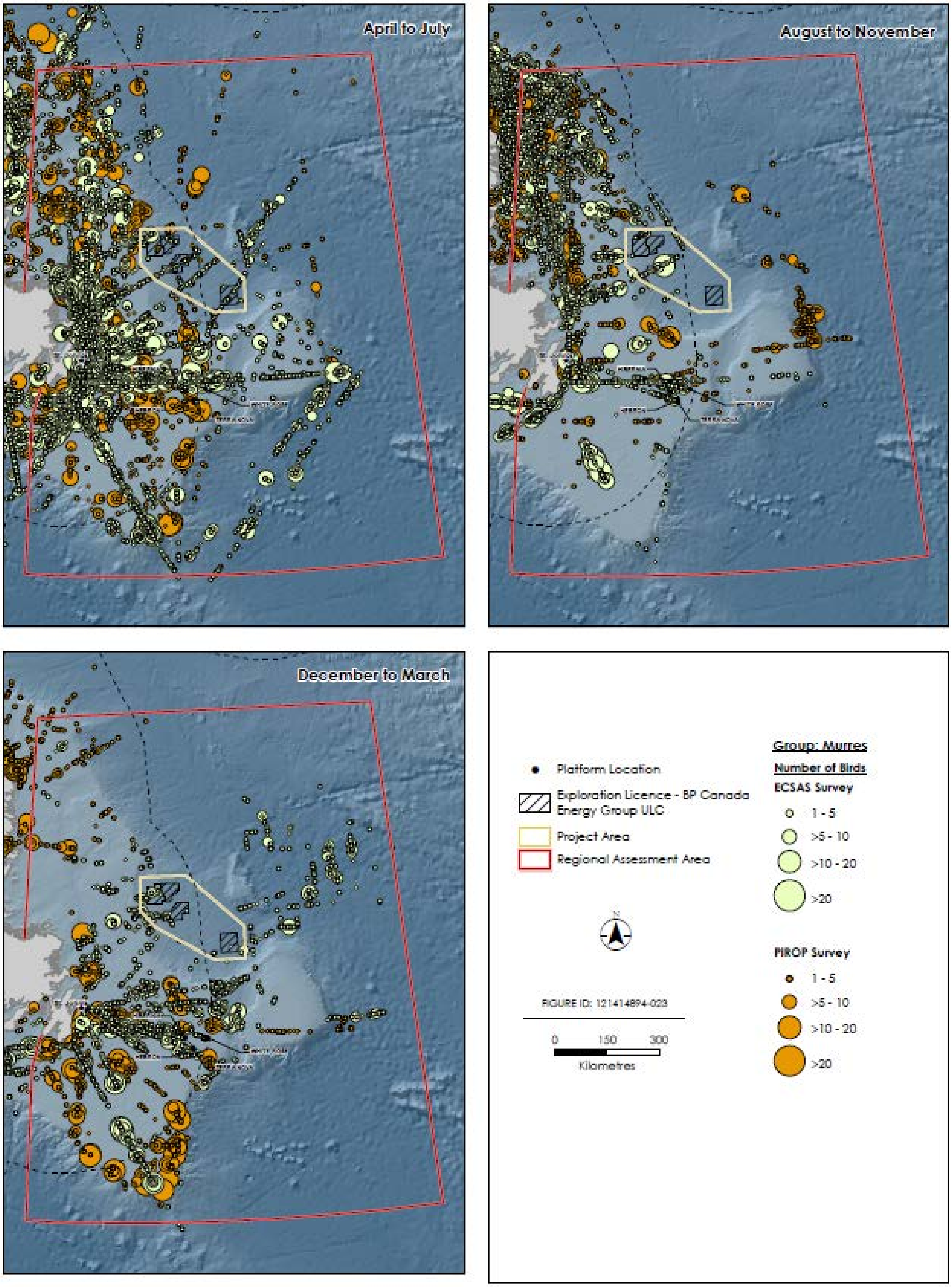


Figure 6.20 Seasonal Distribution of ECSAS and PIROP Murre Observations in the Waters Off Eastern Newfoundland (2001 – 2016)

Dovekies densities in Orphan Basin range from 0 to 99.3 birds/km² during April to July (Bolduc et al. 2018). However, they are scarce by June, presumably having migrated north to nesting colonies (Moulton et al. 2006). During August to November, densities range from 0 to 28.2 birds/km² (Bolduc et al. 2018). However, there are very few dovekies in Orphan Basin during this period until migrants arrive in October (Holst and Mactavish 2014). During December to March, densities range from >0 to 18.6 birds/km² (Bolduc et al. 2018). Common murre densities range from 0 to 3.5 birds/km² during April to July, 0 to 1.1 birds/km² during August to November, and 0 to 0.6 birds/km² during December to March (Bolduc et al. 2018). Thick-billed murre densities in Orphan Basin range from 0 to 7.7 birds/km² during April to July (Bolduc et al. 2018), although most have migrated north by June (Holst and Mactavish 2014). During August to November, thick-billed murre densities range from 0 to 34.0 birds/km² (Bolduc et al. 2018). However, few are present until migrants arrive in October (Holst and Mactavish 2014). During December to March, thick-billed murre densities in Orphan Basin range from >0 to 7.6 birds/km² (Bolduc et al. 2018). Razorbill densities in Orphan Basin range from 0 to 0.3 birds/km² during April to July, 0 birds/km² during August to November, and 0 birds/km² during December to March (Bolduc et al. 2018). Black guillemots have not been recorded in Orphan Basin during ECSAS surveys in a sufficient sample for the calculation of densities (Bolduc et al. 2018). Atlantic puffin densities in Orphan Basin range from 0 to 1.6 birds/km² during April to July, 0 to 0.3 birds/km² during August to November, and 0 to 1.1 birds/km² during December to March (Bolduc et al. 2018).

6.2.2.5 Fulmarine Petrels, Shearwaters, and Gadfly Petrels

A total of five species of the fulmarine petrels and shearwaters group are regularly found in the RAA. Northern fulmar and Manx shearwater nest along the Newfoundland coast and fulmars winter in the RAA. Non-breeding great, sooty, and Cory’s shearwaters summer in the RAA. These species are dynamic soarers and spend most of their time on the wing near the sea surface during migration and breeding. However, tracking of sooty shearwaters shows that they spend most of their time on the water during their residence in the Northwest Atlantic, making them more vulnerable to oil pollution at this time of the year (Hedd et al. 2012). Northern fulmars usually forage on the surface, whereas shearwaters forage by pursuit plunging to capture fish, squid, and offal (Statoil Canada Ltd. 2017).

Northern fulmars nest in small numbers in Newfoundland (Table 6.9). However, larger numbers are present offshore in the RAA during summer due to the presence of moulting, sub-adult non-breeders from European colonies (Huettmann and Diamond 2000). During winter, large numbers from nesting colonies in the Canadian Arctic, Greenland, and Europe winter in the Northwest Atlantic from the Labrador Sea to New England (Huettmann and Diamond 2000; Mallory et al. 2008). Northern fulmars are found in Orphan Basin in densities ranging from < 6.6 to 111.5 birds/km² during April to July (Bolduc et al. 2018). However, many of these birds have departed by June for northern nesting colonies (Moulton et al. 2006; Holst and Mactavish 2014). During August to November, densities range from <14.2 to 212.7 birds/km² (Bolduc et al. 2018). However, many of these birds do not arrive until September or October (Moulton et al. 2006; Holst and Mactavish 2014). During December to March, densities in Orphan Basin range from 0 to 50.0 birds/km² (Bolduc et al. 2018). The distribution of ECSAS and PIROP counts of fulmars and shearwaters is illustrated in Figure 6.21.

Great and sooty shearwaters migrate from nesting colonies in the South Atlantic to spend the austral winter in the Northwest Atlantic (Lock et al. 1994) and, in the case of great shearwaters, to undergo its wing moult (Huettmann and Diamond 2000). For great shearwater, these birds comprise most of the world's population of this species (Brown 1986). Most of these sooty shearwaters moult in the deep, warm waters west of the Mid-Atlantic Ridge from April to early June before moving into the cooler waters of the Grand Banks for the northern summer (Hedd et al. 2012). Great and sooty shearwaters are the primary consumers of fish on the Grand Banks at this time of year (Hedd et al. 2012). Great shearwater densities in Orphan Basin range from 0 to 38.3 birds/km² during April to July, 0 to 33.6 birds/km² during August to November, and 0 birds/km² during December to March (Bolduc et al. 2018). However, the majority are present from June to early September (Abgrall et al. 2008; Holst and Mactavish 2014). Sooty shearwater densities in Orphan Basin range from 0 to 1.6 birds/km² during April to July, and 0 to 3.3 birds/km² during August to November (Bolduc et al. 2018), although like great shearwaters, most are gone by October. Counts of shearwaters and fulmars are illustrated in Figure 6.21.

The only confirmed North American nesting colony of Manx shearwater lies off the Burin Peninsula. It nests in small numbers at Middle Lawn Island but has been recorded in larger numbers prospecting for nest sites on other nearby islands (Roul 2010). Manx shearwater forages near the breeding colony during the nesting period (Onley and Scofield 2007). Densities of non-breeders in Orphan Basin range from 0 to 1.4 birds/km² during April to July, and 0 birds/km² during August to November (Bolduc et al. 2018). However, this species is seen in August in Orphan Basin in small numbers (Jones et al. 2012; Jones and Lang 2013).

Non-breeding Cory's shearwaters from nesting colonies on Berlengas, Madeira, Desertas, Salvages, Azores, and Canary Islands (Onley and Scofield 2007) spend the summer off Eastern Canada (Brown 1986). They are found in small numbers in Gulf Stream waters from the edge of the Scotian Shelf to edge of the southern Grand Banks (Brown 1986) and east of the Grand Banks (Bolduc et al. 2018). This species has not been recorded on-transect during ECSAS surveys in Orphan Basin (Bolduc et al. 2018).

Three species of gadfly petrel identified as globally Threatened on the IUCN Red List of Threatened Species occur in the RAA during fall and winter. Bermuda petrel is designated Endangered by IUCN (BirdLife International 2018). Data loggers placed on individuals of this species have shown presence on the Grand Banks and to the south and east within the RAA (Madeiros et al. 2014). Zino's petrel and Desertas (Bugio) petrel have been tracked in the RAA in the warm waters off the continental shelf (Ramirez et al. 2013; Ramos et al. 2016). Zino's petrel is also designated Endangered by IUCN (BirdLife International 2018). Desertas petrel is designated Vulnerable by IUCN (BirdLife International 2018).

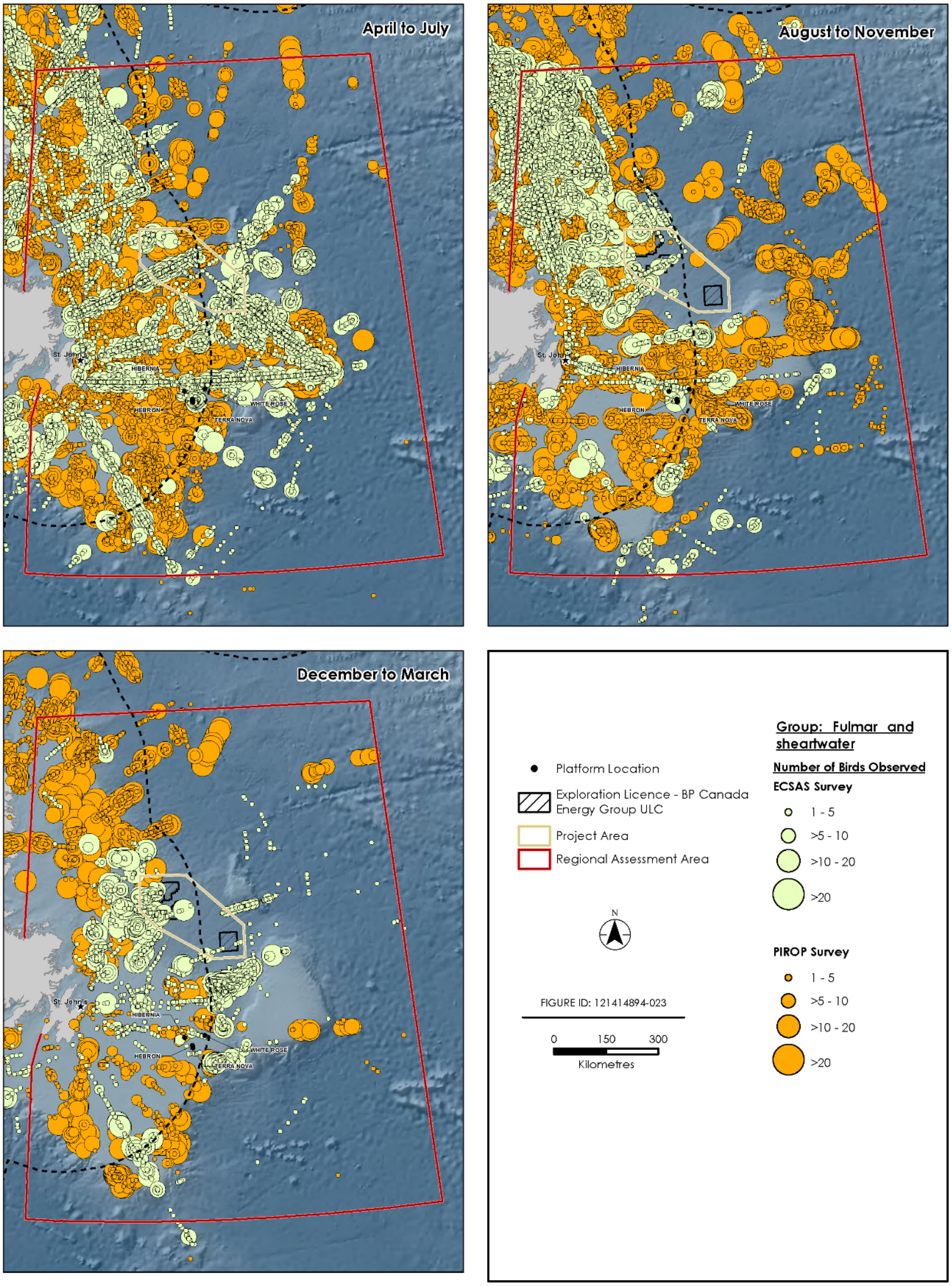


Figure 6.21 Seasonal Distribution of ECSAS and PIROP Fulmar and Shearwater Observations in the Waters Off Eastern Newfoundland (2001 – 2016)

6.2.2.6 Storm-Petrels

Leach's and Wilson's storm-petrels are the two members of this group that are found regularly in the RAA Figure 6.22). In the Atlantic Ocean, Leach's storm-petrels nest in Newfoundland, Nova Scotia, and Norway, whereas Wilson's storm-petrels nest in sub-Antarctic and Antarctic regions and winters in the Northern Hemisphere up to 77°N in the North Atlantic (Onley and Scofield 2007). Leach's storm-petrels feed by picking food items from the surface. During the nesting season this species commutes from the nesting colony across the continental shelf to forage in deep water off the shelf (Pollet et al. 2014) for lower mesopelagic (> 400 m deep) crustaceans and small fish that undergo diel vertical migration to the surface at night (Steele and Montevecchi 1994). Wilson's storm-petrel's diet while in the Northern Hemisphere is poorly known but likely includes crustaceans, small fish, molluscs, other invertebrates, and fish oil, which it picks from the surface (Brooke 2004).

Leach's storm-petrel is the most abundant nesting seabird in Newfoundland (Table 6.9). More than two million pairs of Leach's storm-petrel nested on the Avalon Peninsula in the recent past. Accumulating evidence suggests the population of Newfoundland Leach's Storm-Petrels is experiencing a significant decline. Preliminary results from a 2013 survey of nesting Leach's Storm-Petrel on Baccalieu Island, the largest breeding colony of Leach's storm-petrels in the world, give an estimate of just under 2 million pairs, a decline of 40% from the previous survey in 1984 (CWS unpublished data). The results of surveys of nesting Leach's storm-petrels on Gull Island in the Witless Bay Ecological Reserve indicated a decline from 352,000 breeding pairs in 2001 to 180,000 pairs in 2012, a decrease of 51% (CWS unpublished data). A 2015 population estimate update for Green Island, Fortune Bay (next to St. Pierre et Miquelon) was 48,000 pairs (CWS unpublished data), down from a previous estimate of 103,833 pairs (Russell 2008). The cause of the Leach's storm-petrel population decline has not yet been determined. This species is designated Vulnerable by IUCN (BirdLife International 2018). Leach's storm-petrel densities in Orphan Basin are higher than the inner Grand Banks, ranging from <1.7 to 25.9 birds/km² during April to July, 0 to 23.2 birds/km² during August to November, and 0 birds/km² during December to March (Bolduc et al. 2018).

Wilson's storm-petrel densities in Orphan Basin range from 0 to 9.1 birds/km² during April to July, and 0 birds/km² during August to November (Bolduc et al. 2018). However, it is found in Orphan Basin in small numbers during summer (Moulton et al. 2006; Mactavish et al. 2012; Holst and Mactavish 2014).

Band-rumped storm-petrel nests on archipelagos in the East Atlantic. From May to August it ranges west to Gulf Stream waters as far north as the RAA (Howell 2012; BirdLife International 2018).

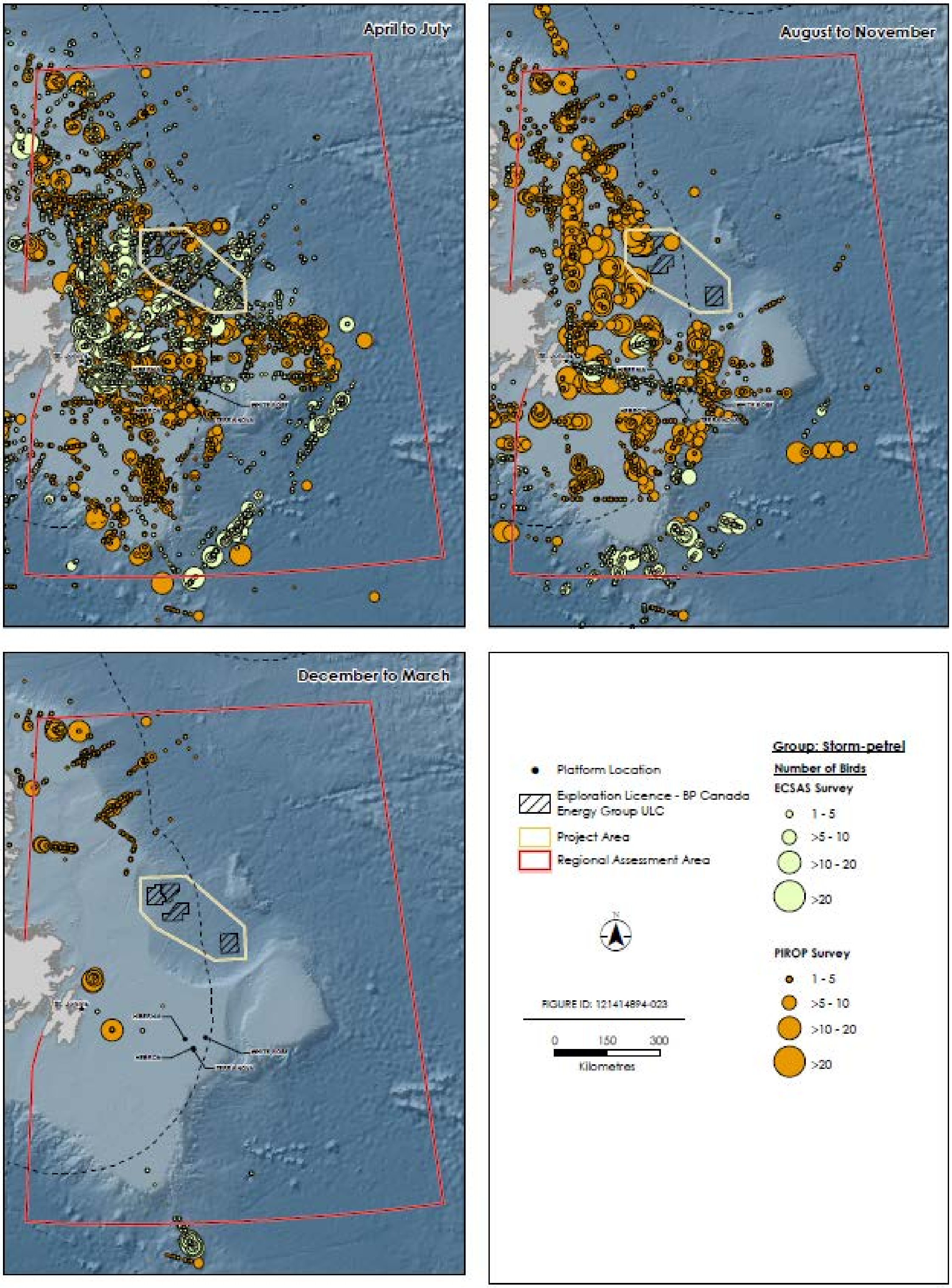


Figure 6.22 Seasonal Distribution of ECSAS and PIROP Storm-Petrel Observations in the Waters Off Eastern Newfoundland (2001 – 2016)

6.2.2.7 Northern Gannet

Northern gannet is a pelagic species but spends most of its time in continental shelf waters (Garthe et al. 2007a; Fifield et al. 2014). It nests in large, dense colonies in Newfoundland, including the RAA (Table 6.9). Adults arrive at the colony in mid-March, followed a few weeks later by subadults (Statoil Canada Ltd. 2007). Juveniles migrate southward in September; adults and older immature birds may travel north from the colonies to feed along the Labrador Coast before southward migration (Statoil Canada Ltd. 2007). Gannets feed by plunge diving from a height of 10-40 m above the surface, descending to depths of 15 m. They may travel over 200 km from breeding colony to forage (Garthe et al. 2007b), and flocks of up to a thousand gannets may congregate over shoals of fish (herring, mackerel and capelin), and invertebrates such as squid (Mowbray 2002). Most individuals winter along the Atlantic coast of the U.S. and Gulf of Mexico (Fifield et al. 2014).

Gannets are most likely to be present in the RAA from March to November (Mowbray 2002; Montevecchi et al. 2012a). However, only small numbers venture off the continental shelf to the Project Area. Both of these trends are reflected in ECSAS and PIROP data (Figure 6.23) as well as in the geophysical monitoring data (Moulton et al. 2006, Abgrall et al. 2008, Holst and Mactavish 2014). Gannet densities in Orphan Basin range from 0 to 0.4 birds/km² during April to July, 0 birds/km² during August to November, and 0 birds/km² during December to March (Bolduc et al. 2018).

6.2.2.8 Cormorants

Both great and double-crested cormorants nest in coastal Newfoundland (Table 6.9). The two species are often found in mixed colonies (Hatch et al. 2000). Cormorants are coastal in distribution throughout the year (Hatch et al. 2000; Dorr et al. 2014). Cormorants arrive at the breeding colony as early as late February (Hatch et al. 2000; Dorr et al. 2014). Most double-crested cormorants leave Newfoundland colonies and migrate southward between late August and mid-October (Hatch et al. 2000; Dorr et al. 2014). Small numbers remain in coastal Newfoundland in winter (Mactavish et al. 2016). Great cormorant is a year-round resident, but some individuals migrate south (Hatch et al. 2000; Dorr et al. 2014).

Few ECSAS surveys recorded cormorants off eastern Newfoundland (Figure 6-50 in Statoil Canada Ltd. 2017). Most were close to shore and all were in the winter months. One survey recorded cormorants in Orphan Basin (Statoil Canada Ltd. 2017).

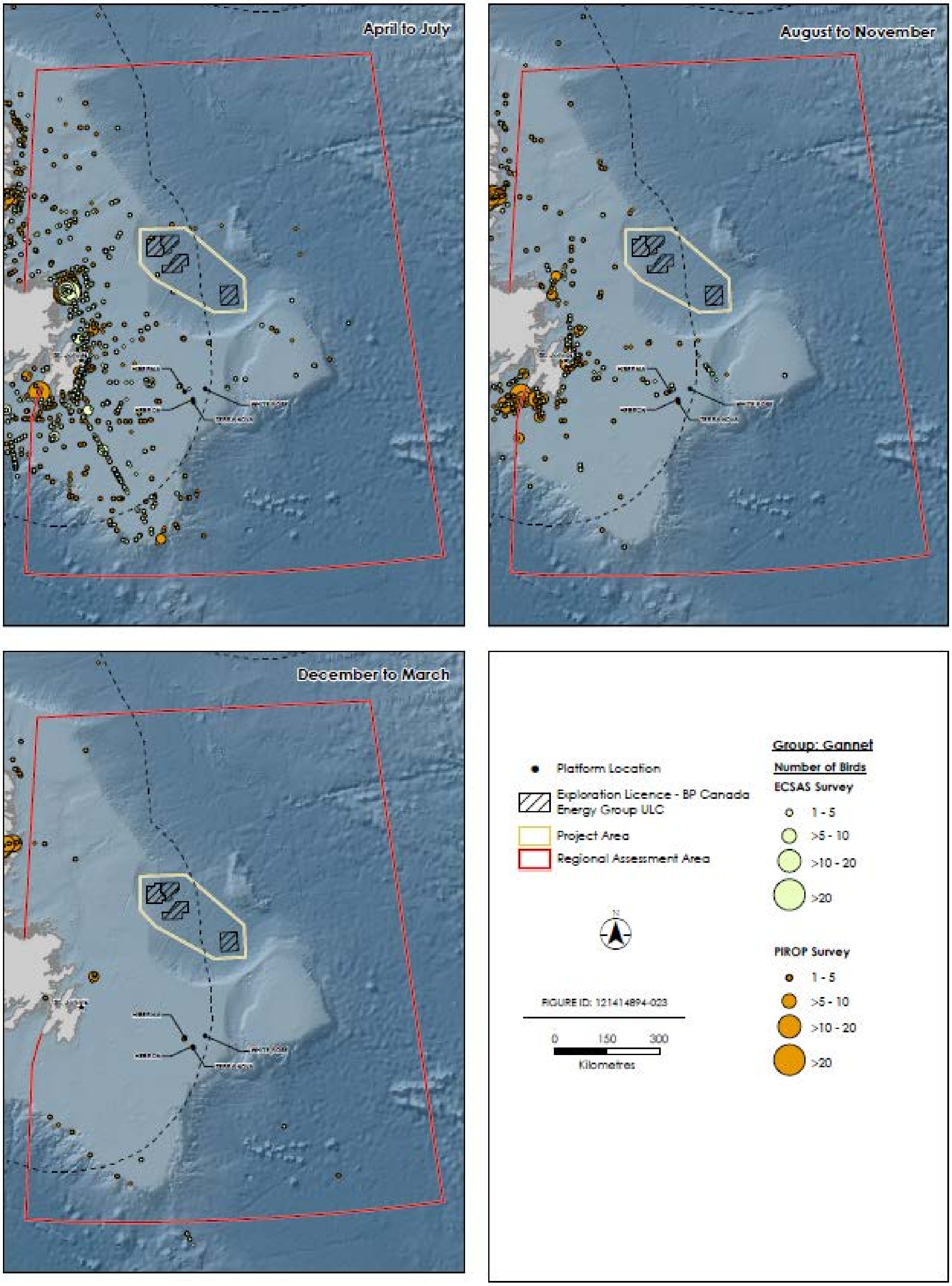


Figure 6.23 Seasonal Distribution of ECSAS and PIROP Northern Gannet Observations in the Waters Off Eastern Newfoundland (2001 – 2016)

6.2.3 Other Marine-associated Avifauna

Waterfowl nest in coastal Newfoundland in relatively small numbers but winter in coastal waters in large numbers (Lock et al. 1994). However, they occur away from the coast generally only as vagrants in small numbers. Some species of loons and grebes also winter in coastal Newfoundland waters. Some species of Arctic-nesting shorebirds (plovers and sandpipers) undertake trans-oceanic flights during fall migration from eastern North America to South America (Williams and Williams 1978; Richardson 1979), so some passage offshore through the RAA may be expected.

6.2.3.1 Waterfowl, Loons, and Grebes

Waterfowl, loons, and grebes are relatively vulnerable to oil pollution because, like alcids, they spend a great deal of time feeding or resting on or under the surface of the water. They rarely occur outside of coastal waters. A total of 32 species have occurred in Newfoundland (Statoil Canada Ltd. 2017), but only 24 species regularly occur in the marine waters of the RAA (Table 6.10). Two of these are species of conservation concern (harlequin duck and Barrow’s goldeneye (Section 6.2.4).

Table 6.10 Waterfowl, Loons, and Grebes Likely to Occur in the Marine Waters of the RAA

Group	Species
Geese	Canada goose
Dabbling ducks	Eurasian wigeon
	American wigeon
	American black duck
	Mallard
	Northern pintail
	Green-winged teal
Diving ducks	Tufted duck
	Greater scaup
Sea ducks	King eider
	Common eider
	Harlequin duck*
	Surf scoter
	White-winged scoter
	Black scoter
	Long-tailed duck
	Barrow’s goldeneye*
	Common goldeneye
Mergansers	Red-breasted merganser
	Common merganser
Loons	Red-throated loon
	Common loon
Grebes	Pied-billed grebe
	Red-necked grebe

* Species with conservation designation (see Section 6.24)

Eiders, scoters, and long-tailed ducks winter along the coast in large flocks (Lock et al. 1994). The largest numbers concentrate between the Cape Freels coastline and nearby Wadham Islands, and at Grates Point, Cape St. Francis, Witless Bay, Mistaken Point, Cape St. Mary's, and Placentia Bay (Bird Studies Canada 2016). Long-tailed duck is designated Vulnerable by IUCN (BirdLife International 2018). Concentrations along eastern Newfoundland increase in late winter as the winter sea ice forces those flocks along the north coast of the island to move southeastward. The most abundant species is common eider. The largest concentration of the eastern population of harlequin duck wintering in Canada is found at Cape St. Mary's (Bird Studies Canada 2015). Barrow's goldeneye has wintered in small numbers at Port Blandford, Newman Sound in Terra Nova National Park, Traytown Bay, St. Mary's Bay, and Spaniard's Bay (Schmelzer 2006, in Statoil Canada Ltd.).

ECSAS and PIROP surveys both recorded waterfowl in coastal areas (Figure 6.24). However, only PIROP surveys recorded waterfowl in the Project Area (August to November) (Figure 6.24; Bolduc et al. 2018). Individual ducks have been sighted occasionally from seismic survey vessels well offshore during migration (Abgrall et al. 2008; Jones and Lang 2013; Holst and Mactavish 2014). During ECSAS surveys, the most commonly observed species of waterfowl, loons, or grebes, in declining order of abundance, were common eider, long-tailed duck, loons (common and red-throated), scoters (all three species), and a handful of other duck species (Statoil Canada Ltd. 2017).

6.2.3.2 Shorebirds

A total of 26 species of plovers and sandpipers occur on and around insular Newfoundland as breeders, migrants in passage, or winter residents (Mactavish et al. 2016). The most likely species to occur in the RAA are listed in Table 6.11. Eight of these species nest in Newfoundland. Most species nest near freshwater bodies, but piping plover, spotted sandpiper, and willet nest along marine coastlines. Piping plover is designated Endangered by COSEWIC and under the provincial ESA and Schedule 1 of SARA (Section 6.2.4). However, piping plover and willet nest only at sites in southwestern and western Newfoundland, including Stephenville Crossing, Cheeseman Provincial Park and Burgeo, well outside the RAA (Statoil Canada Ltd. 2017). Several species use coastlines in the RAA during fall migration. ACSS data show migration stopovers in the RAA at Witless Bay, Renews, Long Beach, St. Shotts, Spaniard's Bay, and Bellevue Beach, Cape Freels, and Cape Bonavista (Environment Canada 2009; Bird Studies Canada 2016). Purple sandpipers winter (November to April) along rocky shorelines, offshore rocks, and islands along southern and eastern Newfoundland, including at Cape Spear, Witless Bay, Ferryland, Cape St. Francis, and Mistaken Point in the RAA (Environment Canada 2009; Bird Studies Canada 2016). A small number of ruddy turnstones have overwintered at Mistaken Point, the northernmost site in this species' usual wintering range (Bird Studies Canada 2015).

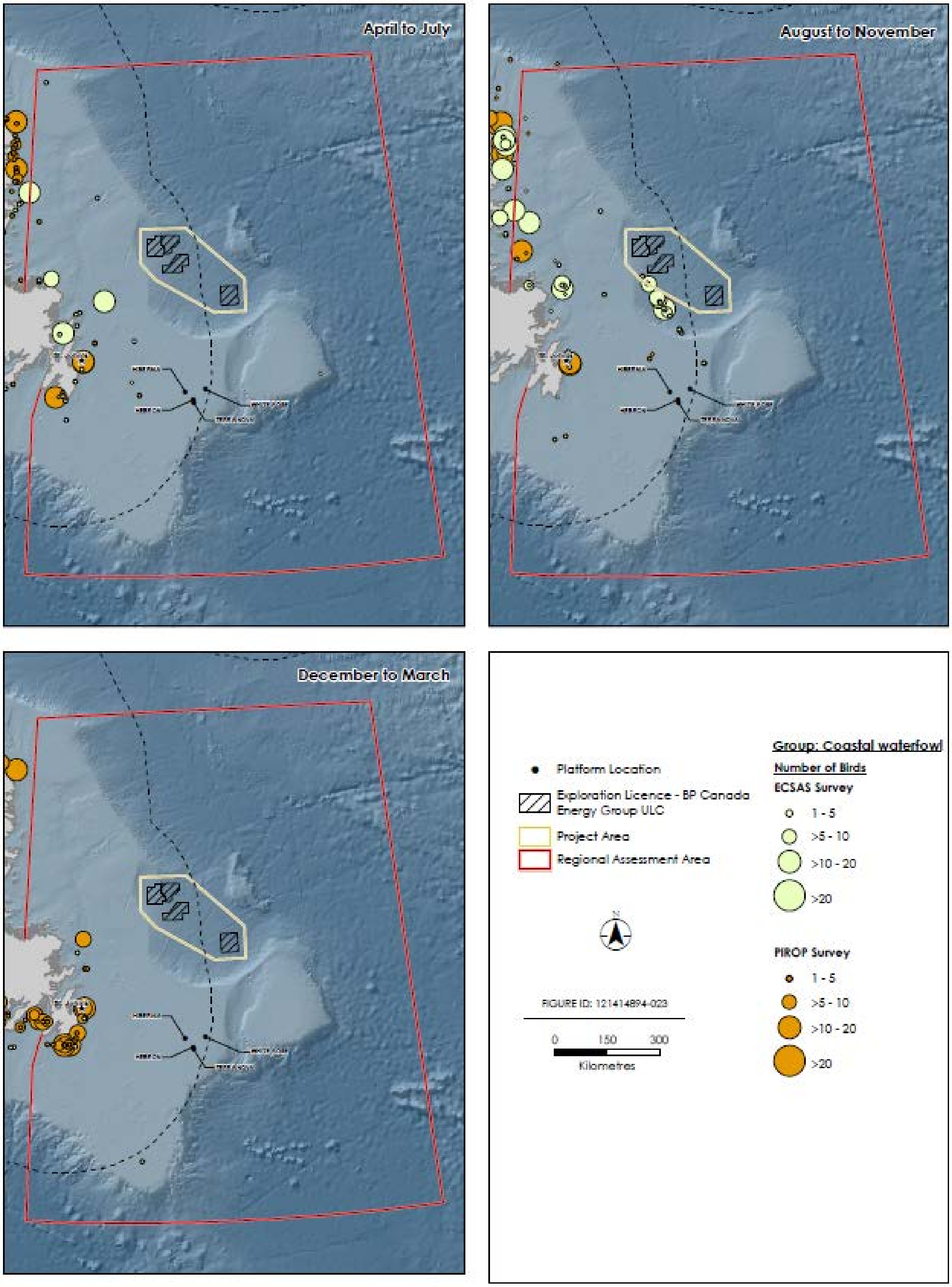


Figure 6.24 Seasonal Distribution of ECSAS and PIROP Coastal Waterfowl Observations in the Waters Off Eastern Newfoundland (2001 – 2016)

Table 6.11 Shorebird Species Likely to Occur Over the Marine Waters of the RAA

Group	Species
Plovers	Black-bellied plover
	American golden-plover
	Semipalmated plover
	Piping plover, *melodus* ssp.*
Sandpipers	Whimbrel
	Hudsonian godwit
	Ruddy turnstone
	Red knot, *rufa* ssp.*
	Sanderling
	Dunlin
	Purple sandpiper
	Least sandpiper
	White-rumped sandpiper
	Buff-breasted sandpiper
	Pectoral sandpiper
	Semipalmated sandpiper
	Wilson's snipe
	Lesser yellowlegs
	Greater yellowlegs
* Species of conservation concern (see Section 6.24)	

During fall migration, shorebird species such as American golden-plover, whimbrel, semipalmated sandpiper, white-rumped sandpiper, and red knot depart from staging sites in Atlantic Canada southward over the Atlantic Ocean to South America (Morrison 1984; Harrington et al. 1991; Baker et al. 2013). At least seven species of shorebirds, including red knot and buff-breasted sandpiper, have been sighted in small numbers from seismic survey and offshore supply vessels in Orphan Basin and adjacent areas (Moulton et al. 2005; Abgrall et al. 2008; Hauser et al. 2010; Jones and Lang 2013; Holst and Mactavish 2014; Mactavish and Lang 2015). However, much of this trans-oceanic migration appears to pass to the west of the Project Area (Baker et al. 2013; Lamarre et al. 2017) and at relatively high altitudes (Burger et al. 2011). Consequently, only small numbers may be expected at sea level in the Project Area during fall migration (primarily July to October).

6.2.3.3 Landbirds

Landbirds such as raptors and songbirds associated with coastal habitats may be encountered in coastal areas of the RAA (Statoil Canada Ltd. 2017). Landbird species that breed in Newfoundland, Labrador, Nunavut, and Greenland and migrate over marine waters are also sometimes blown off course and seek refuge on vessels in the RAA; several species have been recorded on offshore platforms and vessels

(Thomas et al. 2014; Mactavish and Lang 2015; Statoil 2015a, 2015b, unpublished migratory bird salvage reports provided by Statoil). Nocturnally migrating species may be attracted to artificial lighting on vessels, especially when fog or rain sets in after the night's nocturnal migration has begun (Gauthreaux and Belser 2006). These species are most often seen during fall migration (July to November).

6.2.4 Species at Risk

A total of nine species designated at risk provincially or federally, or of conservation concern as assessed by COSEWIC have the potential to occur in the RAA or the Project Area (Table 6.12). These species consist of two coastal waterfowl species, three shorebird species, one phalarope species, two gull species, and one raptor species. Other shorebird and landbird species at risk in Newfoundland are not likely to occur in the RAA or Project Area.

Table 6.12 Marine and Migratory Bird Species of Conservation Interest Likely to Occur in the RAA

Species	NL ESA Status	Federal Status	
		SARA Listing	COSEWIC Assessment
Harlequin duck (eastern pop.)	Vulnerable	Special Concern (Schedule 1)	Special Concern
Barrow's goldeneye (eastern pop.)	Vulnerable	Special Concern (Schedule 1)	Special Concern
Piping plover (*melodus* ssp.)	Endangered	Endangered (Schedule 1)	Endangered
Red knot (*rufa* ssp.)	Endangered	Endangered (Schedule 1)	Endangered
Buff-breasted sandpiper	None	Special Concern (Schedule 1)	Special Concern
Red-necked phalarope	None	None	Special Concern
Ivory gull	Endangered	Endangered (Schedule 1)	Endangered
Ross's gull	None	Threatened (Schedule 1)	Threatened
Peregrine falcon anatum/tundrius	Vulnerable	Special Concern (Schedule 1)	Special Concern

Harlequin duck is found in the RAA after the completion of its breeding inland. At this time, it moves to marine waters along rocky coastlines, subtidal ledges, and exposed headlands to moult and winter (NLDEC 2016). About 200 individuals winter around insular Newfoundland. A large proportion of these birds winter at Cape St. Mary's. Some non-breeding individuals may be found year-round, making this location one of the few known moulting sites in the province (Bird Studies Canada 2016; NLDEC 2016). Small numbers are sporadically reported in winter from other locations on the Avalon Peninsula and the south coast of Newfoundland (B. Mactavish, 2018, pers. comm.). This species is likely to occur in the Project Area only rarely as a vagrant during migration. A harlequin duck was seen in Orphan Basin from a seismic survey vessel on 29 September 2016 (Lang 2016).

Barrow's goldeneye moults and winters in small numbers in coastal Eastern Canada, often with common goldeneye (Schmelzer 2006). Small numbers have been occasionally reported wintering in the RAA along the north coast of insular Newfoundland and St. Mary's Bay (Schmelzer 2006). The eastern population of this species is vulnerable to oil pollution because some wintering concentrations are in important shipping corridors (Schmelzer 2006).

Piping Plover is found in Newfoundland during the breeding season on sandy beaches primarily along the coasts of southwestern and western portions of the island (NLDEC 2016; Bird Studies Canada 2016). However, in 2013, breeding was reported at Deadman's Bay near the Cape Freels Coastline IBA in northeastern Newfoundland Bird (Studies Canada 2016). Breeding at that location has not been reported since 2013, nor has this species been recorded by the ACSS in the RAA. This species is not likely to migrate through the RAA or to be affected by typical Project activities, although accidental spills near breeding habitat could potentially be harmful (Amirault-Langlais et al. 2007; Statoil Canada Ltd. 2017).

The *rufa* subspecies of red knot occurs in Newfoundland during fall migration (1 August to 30 October) on open sandy inlets, coastal mudflats, sand flats, salt marshes, sandy estuaries and areas with rotting kelp deposits (Garland and Thomas 2009; NLDEC 2016). Although most of the migration takes place to the west of the RAA, sightings have been reported around almost the entire coast of Newfoundland, with most on the west coast (Baker et al. 2013). ACSS data indicate that this species is a regular or occasional migrant during fall migration at Bellevue Beach, Cape Freels, and the Codroy Valley Estuary, and is a rare visitor at a number of other survey sites (Environment Canada 2009). Red knot has been sighted at-sea in the RAA (Jones and Lang 2013).

Buff-breasted sandpiper was designated a species of Special Concern under SARA and added to Schedule 1 in 2017. This species nests in the central and western Arctic of North America. Most of the migration passes through the Great Plains, but small numbers pass through eastern Canada during fall migration (McCarty et al. 2017). It occurs in Newfoundland during fall migration and is considered to be very uncommon in the province (likely to be found annually in appropriate season / habitat) (Mactavish et al. 2003). This species is occasionally observed at St. Shott's Sod Farm near the southern shore of the Avalon Peninsula and at Cape Bonavista and is reported as a rare visitor at a number of other survey sites (ACSS data; Environment Canada 2009). It is occasionally seen in Orphan Basin in fall migration (Abgrall et al. 2008; Jones and Lang 2013).

Red-necked phalarope is designated a species of Special Concern by COSEWIC due to a large decrease in the numbers staging during fall migration in the Bay of Fundy. It is a surface feeder, often congregating in areas such as upwellings which are associated with higher prey densities (Statoil Canada Ltd. 2017). Red-necked phalarope is difficult to distinguish from red phalarope at-sea. However, the former is seen in small numbers in the RAA. It is reported as a rare visitor at Cape Spear and Bonavista / Cape Bonavista Atlantic Canada Shorebird Survey sites (Environment Canada 2009). A male tagged with a geolocator at its nest site in Scotland migrated in fall through the RAA on its way to its wintering area and back again in the following spring (Smith et al. 2014). This raises the possibility that the RAA may lie along the regular migration route of some nesting populations of red-necked phalarope.

Ivory gulls nesting in the Canadian Arctic and Greenland and fitted with satellite transmitters wintered from Baffin Bay to the Northeast Newfoundland Shelf (Gilg et al. 2010; Spencer et al. 2016). Individuals from those two nesting populations comprise most of the world's population, so this wintering area has global importance for this species. Ivory gulls were recorded twice during bird surveys at the Bay de

Verde Wellsite in the winter of 2014-2015 (Statoil 2015a). Ivory gull can be expected to occur in small numbers in the portion of the RAA north of 50°N during periods when sea ice is present (i.e., late winter and early spring). It probably occurs irregularly south of 50°N among the ice pack during heavier ice years.

Ross's gulls nesting in the Canadian Arctic that have been tagged with geolocators and satellite transmitters have been tracked to a wintering area that reaches from the Labrador Sea to Orphan Basin (Maftei et al. 2015). As a result, this species may be expected to be present in very small numbers in the RAA and the Project Area during winter.

Peregrine falcons migrate along the coast of Newfoundland during the fall, including the Bonavista and Avalon peninsulas, preying on concentrations of migrating shorebirds (White et al. 2002). During migration, this species is seen regularly in small numbers well offshore on vessels and oil drilling and production facilities (Moulton et al. 2006; Lang et al. 2008; Mactavish and Lang 2015). This species is a strong flyer, crossing large bodies of water during migration. However, it may be attracted to vessels and platforms for the opportunity to rest or to prey on landbirds that are often seeking refuge on those vessels and platforms during migration.

6.2.5 Summary of Key Areas and Times

The marine waters off eastern Newfoundland are important to many marine-associated and migratory bird species at various times of the year (Table 6.13). During summer, seabirds in the RAA are largely concentrated in the coastal areas (Fifield et al. 2009) at nesting colonies in globally important numbers of Atlantic puffin, common murre, Leach's storm-petrel, and northern gannet, in continentally important numbers of black-legged kittiwake, and in smaller numbers of other species. Most of these birds forage close to their colonies on pelagic fish that have migrated to the shallow waters to spawn. The exception is Leach's storm-petrel, which traverses the continental shelf to forage for its nestlings in deep waters off the shelf such as Orphan Basin, which is the nearest deep-water area to the largest nesting colony in the world of this species at Baccalieu Island. Summer concentrations of non-breeding, sub-adult northern fulmars are also found in deep waters off the shelf. During summer, the Grand Banks also host species that migrate from nesting areas in the South Atlantic, including globally important numbers of great shearwater, large numbers of sooty shearwater, and smaller numbers of Wilson's storm-petrel, and south polar skua.

Table 6.13 Summary of Seasonal Presence of Marine-associated Birds in the Project Area

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

	Presence and Relative Abundance											
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.

Following the breeding season, the species that were abundant in coastal areas of the RAA largely move south and are replaced by continentally important numbers of wintering common eider, nationally important numbers of harlequin duck (Special Concern, SARA Schedule 1), large numbers of other species of sea duck, and large numbers of Iceland gulls. Other Arctic nesting species arrive to winter along the continental shelf break and adjacent areas. These include globally important numbers of black-legged kittiwake, dovekie, and thick-billed murre, and large numbers of northern fulmar. Great black-backed gulls also move offshore. Newfoundland waters are also an important wintering area for the great skua population nesting in Iceland. In the northwest quarter of the RAA, the Northeast Newfoundland Shelf is part of a globally important wintering area for ivory gull (Endangered, SARA Schedule 1). The ECSAS program has identified ‘hotspots’ in the offshore areas of the RAA where these species concentrate in winter and in fall migration: Orphan Basin and Sackville Spur, Flemish Cap and Pass, the northeast section of the Grand Banks, the northeast Newfoundland Shelf, and the Labrador Shelf / Labrador Sea (Fifield et al. 2009).

Several coastal areas have been designated as an IBA because of seabirds that concentrate to nest, stage, or winter. The program was initiated and is coordinated by BirdLife International and is administered in Canada by the Canadian Nature Federation and Bird Studies Canada. The program uses internationally standardized criteria to identify sites of national and international importance. These criteria consist of one or more of the presence of species at risk, species with restricted range, habitats holding representative species assemblages, or a congregation of a significant proportion of a species’ population during one or more seasons. There are 21 IBA sites in eastern Newfoundland and 10 of these include marine waters of the RAA (Figure 6.25). These are summarized in Table 6.14. Some of these IBAs are also designated federal Migratory Bird Sanctuaries (MBS) or provincial Seabird Ecological Reserves (Table 6.14). Seabird Ecological Reserves are protected from industrial development and other activities that can cause disturbance to breeding seabirds pursuant to the *Seabird Ecological Reserve Regulations, 2015*.

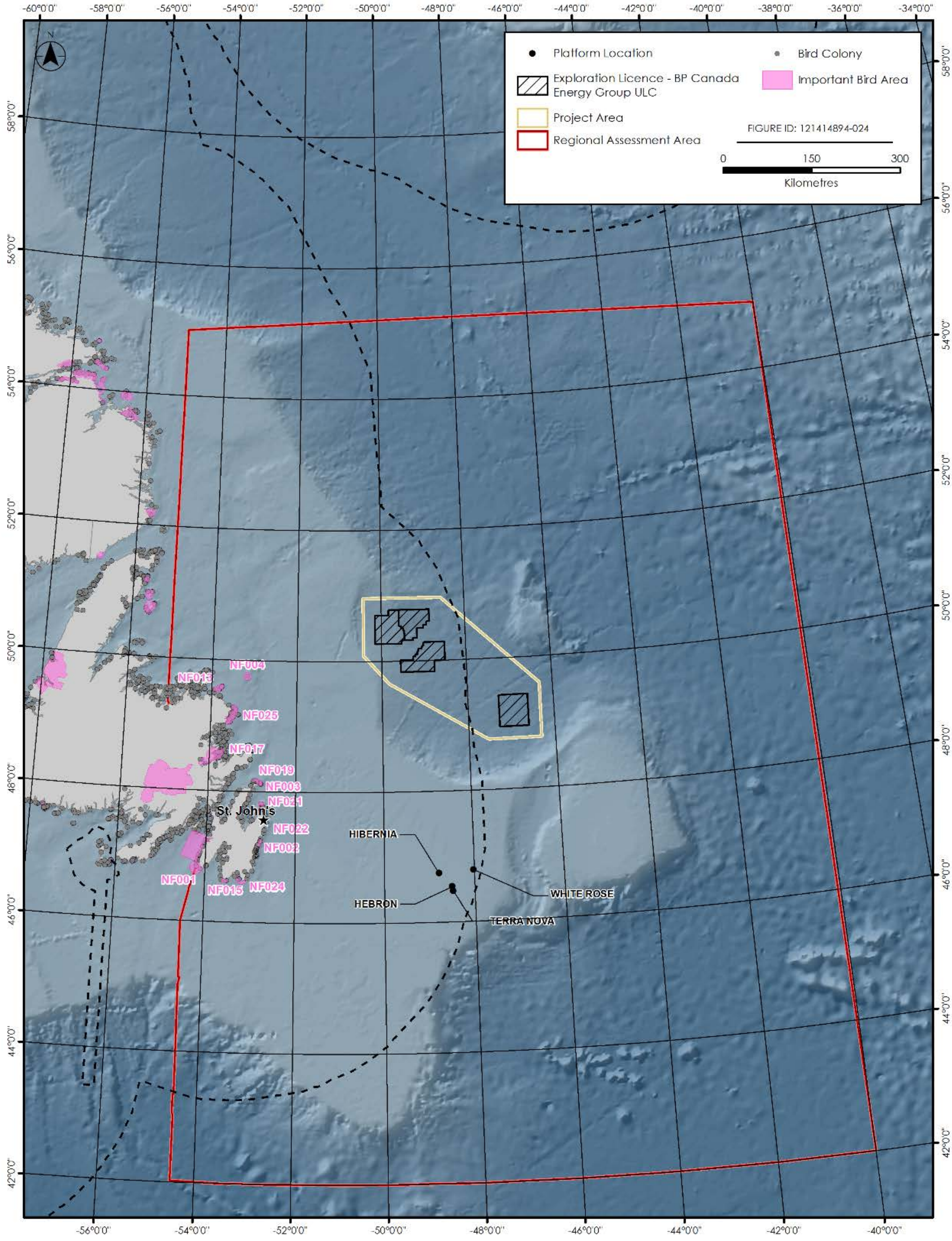


Figure 6.25 Important Bird Areas and Marine Bird Nesting Colony Locations

Table 6.14 Important Bird Areas on Marine Waters of Eastern Newfoundland

IBA Name	Importance to Marine and Migratory Birds
Funk Island (NF004)	Nesting[G] common murre, nesting[G] northern gannet; provincially protected SAR[E]; overlaps Fogo Shelf EBSA[E]
Wadham Islands and adjacent Marine Area (NF013)	Wintering[C] common eider; nesting[C] Atlantic puffin, nesting Leach's storm-petrel and razorbill; overlaps Fogo Shelf EBSA
Cape Freels Coastline and Cabot Island (NF025)	Wintering[C] common eider; nesting[C] black-headed gull; nesting common murre, razorbill, Atlantic puffin, and common / Arctic tern; overlaps Fogo Shelf EBSA
Terra Nova National Park (NF017)	Wintering[C] black-headed gull; wintering[C] dovekie; shorebirds, gulls and waterfowl on tidal flats at Big Brook and Newman Sound; large nos. nesting common / Arctic terns; federal MBS
Grates Point (NF019)	Wintering[C] common eiders; wintering black-legged kittiwake, thick-billed murre, dovekie; summer use Atlantic puffin, northern Gannet
Baccalieu Island (NF003)	Nesting[G] Leach's storm-petrel and Atlantic puffin; nesting[C] black-legged kittiwake, large nos. nesting northern gannet; other nesting species; SER
Cape St. Francis (NF021)	Fall migration[C] dovekie; fall migration[C] Manx shearwater; large nos. wintering common eider; wintering purple sandpiper
Witless Bay Islands (NF002)	Nesting[G] Atlantic puffin, common murre, razorbill, and Leach's storm-petrel; nesting[C] black-legged kittiwake and herring gull; staging waterfowl; SER; overlaps Eastern Avalon Coast EBSA
Mistaken Point (NF024)	Wintering common eider; wintering[C] purple sandpiper; nesting black-legged kittiwake, common murre and razorbill; spring[C], summer and fall Manx shearwater; Provincial Ecological Reserve and UNESCO World Heritage Site (fossil deposits)
Cape Pine and St. Shotts Barren (NF015)	Nesting razorbill; large nos. fall staging American golden-plover and whimbrel; overlaps Placentia Bay EBSA
Cape St. Mary's (NF001)	Nesting[G] northern gannet; nesting[C] black-legged kittiwake, wintering[N] and moulting harlequin duck[S]; nesting common and thick-billed murre, razorbill, black guillemot, herring and great black-backed gull, great and double-crested cormorant, wintering waterfowl; overlaps Placentia Bay EBSA

[C] Continentally Significant concentration of birds (IBA criteria), [E] Ecologically or Biologically Significant Area, [G] Globally Significant concentration, [N] Nationally Significant concentration, [P] Provincial Seabird Ecological Reserve (SER), [S] Species of Conservation Concern

Locations illustrated in Figure 6.2.5

As discussed above, other breeding sites for colonially nesting species are important sites and habitat for marine birds. The locations are discussed in Section 6.4.1.4.

Ecologically or Biological Significant Areas (EBSA) have also been identified in the RAA (Table 6.15). The criteria for selection and ranking of EBSAs included importance to seabird biodiversity, density, reproduction, and survival.

Table 6.15 Ecologically and Biologically Significant Areas of Importance to Marine Birds*

EBSA	Importance to Marine Birds
Southwest Shelf Edge and Slope	Highest density of pelagic marine birds foraging within the Placentia Bay / Grand Banks Large Ocean Management Area
Placentia Bay Extension	Important foraging area for many breeding marine bird species from spring to fall. Includes IBAs: Cape Pine and St. Shotts Barren, Cape St. Mary's.
Eastern Avalon Coast	Important foraging area for many breeding marine bird species from spring to fall. Includes IBA: Witless Bay Islands.
Southeast Shoal and Tail of the Bank	Important seasonal foraging area for marine birds
Virgin Rocks	High aggregations of capelin and other spawning groundfish such as Atlantic cod, American plaice, and yellowtail flounder. Seabird feeding area.
Northeast Shelf and Slope	Seabird concentrations year-round.
Fogo Shelf	Funk Island, the largest common murre colony in the western North Atlantic and the only northern gannet breeding colony in the Newfoundland and Labrador Shelves Bioregion. Other bird species aggregations also, due to abundance of beach and sub-tidal capelin spawning areas. Includes IBAs: Cape Freels Coastline and Cabot Island, Wadham Islands and adjacent Marine Area, Funk Island.
Notre Dame Channel	Frequented by several species of seabirds.
Grey Islands	Important for waterfowl and seabirds in coastal areas and on the shelf. Common eider and harlequin duck occur in high concentrations. Important breeding colonies for great black-backed gulls, herring gulls, and terns. High diversity of seabird species that aggregate along the inner shelf area. Includes IBAs outside of the Regional Assessment Area: Fischot Islands, Northern Groais Island, Bell Island South Coast.
Labrador Marginal Trough	High densities of shrimp, snow crab, Greenland halibut, American plaice, witch flounder, and capelin. Potential corridor for several fish and mammal species. Part of the highest probability of use for harp seal whelping and feeding. Aggregations of plankton piscivores, and small and medium benthivores. Aggregations of cetaceans in summer and fall. Important for seabirds including murres, black-backed kittiwake, great black-backed gull, herring gull, northern fulmar, Atlantic puffin, skuas, jaegers, sooty shearwater, and the SARA-listed ivory gull.
* From Templeman (2007), DFO (2012b, 2016h), Wells (2017), and environmental monitoring reports (seabirds and marine mammals) of geophysical surveys (various years)	

More information on special areas of importance to Marine Birds (e.g., Migratory Bird Sanctuaries, EBSAs) is included in Section 6.4.1.4.

6.3 Marine Mammals and Sea Turtles

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

6.3.1 Approach and Key Information Sources

Descriptions of marine mammals and sea turtles in the eastern Newfoundland offshore area have been recently presented in the Eastern Newfoundland SEA (Section 4.2.3 of Amec 2014) and project-specific seismic and exploration drilling EAs off Newfoundland's east coast (Section 4.5 of LGL 2015, 2016; and Section 6.3 of Statoil 2017 and ExxonMobil 2017). An overview of marine mammals and sea turtles that occur in or near the Project Area, based primarily on the above cited documents, is provided below. New information not included in the SEA and project-specific EAs is also summarized. DFO research and scientific documents and COSEWIC species assessment and status reports also served as primary sources of information on the occurrence, distribution, and abundance of marine mammals and sea turtles in the Project Area.

A large database of cetacean and sea turtle sightings in Newfoundland and Labrador waters has been compiled from various sources by DFO in St. John's (J. Lawson, DFO Research Scientist, pers. comm., January 2017), and has been made available for the purposes of describing species sightings within the Project Area. These data have been opportunistically gathered and provide no information on survey effort. Therefore, while these data can be used to indicate what species occur in the Project Area and when they occur, they cannot be used to reliably predict species abundance, distribution, or fine-scale habitat use in the area (see Section 6.3.2). Details on the caveats that should be considered when using data from the DFO sightings database were described in Section 4.5.1.1 of LGL (2015).

6.3.2 Overview of Species Occurrence

Information on the occurrence, habitat, and conservation status for each of the marine mammal species that could occur within or near the Project Area and RAA is presented in Table 6.16. Cetacean sightings in the Project Area and RAA within the temporal scope of the Project (year-round) compiled from the DFO sightings database (1947–2015) are summarized in Table 6.17. Sightings include baleen whales (mysticetes), large toothed whales, dolphins, and porpoises.

Table 6.16 Marine Mammals with Reasonable Likelihood of Occurrence in the Regional Assessment Area and Project Area

Species	RAA and Project Area		Habitat	SARA Status[a]	COSEWIC Status[b]
	Occurrence	Season			
Baleen Whales (Mysticetes)					
North Atlantic Right Whale	Rare	Summer	Coastal, shelf & pelagic	Schedule 1: Endangered	Endangered
Humpback Whale	Common	Year-round, but mostly May-Sept	Coastal & banks	Schedule 3: Special Concern	Not at Risk
Minke Whale	Common	Year-round, but mostly May-Oct	Coastal, shelf, & banks	No Status	Not at Risk
Sei Whale	Uncommon	May–Nov	Pelagic	No Status	Data Deficient
Fin Whale	Common	Year-round, but mostly summer	Shelf breaks, banks & pelagic	Schedule 1: Special Concern	Special Concern

Species	RAA and Project Area		Habitat	SARA Status[a]	COSEWIC Status[b]
	Occurrence	Season			
Blue Whale	Uncommon	Year-round	Coastal & pelagic	Schedule 1: Endangered	Endangered
Toothed Whales (Odontocetes)					
Sperm Whale	Common	Year-round, but mostly summer	Slope, canyons & pelagic	No Status	Not at Risk; Mid-priority Candidate
Northern Bottlenose Whale	Uncommon	Year-round	Slope, canyons & pelagic	Schedule 1: Endangered [c] / No Status [d]	Endangered [c] / Special Concern [d]
Sowerby's Beaked Whale	Rare	Year-round	Slope, canyons & pelagic	Schedule 1: Special Concern	Special Concern
Striped Dolphin	Rare	Summer	Shelf & pelagic	No Status	Not at Risk
Atlantic Spotted Dolphin	Rare	Summer	Shelf, slope & pelagic	No Status	Not at Risk
Short-beaked Common Dolphin	Common	Summer	Shelf & pelagic	No Status	Not at Risk
White-beaked Dolphin	Common	Year-round, but mostly June-Sept	Shelf & pelagic	No Status	Not at Risk
Atlantic White-sided Dolphin	Common	Year-round, but mostly summer-fall	Coastal & shelf	No Status	Not at Risk
Common Bottlenose Dolphin	Rare	Summer	Coastal & pelagic	No Status	Not at Risk
Risso's Dolphin	Rare	Year-round	Continental slope	No Status	Not at Risk
Killer Whale	Uncommon	Year-round	Coastal & pelagic	No Status	Special Concern
Long-finned Pilot Whale	Common	Year-round, but mostly spring-fall	Shelf break, pelagic & slope	No Status	Not at Risk
Harbour Porpoise	Uncommon	Year-round, but mostly spring-fall	Coastal, shelf & pelagic	Schedule 2: Threatened	Special Concern
True Seals (Phocids)					
Harp Seal	Common	Year-round, but mostly winter-spring	Pack ice & pelagic	No Status	Not Considered; Low-priority Candidate
Hooded Seal	Common	Year-round, but mostly winter-spring	Pack ice & pelagic	No Status	Not at Risk; Mid-priority Candidate
Grey Seal	Uncommon	Year-round, but mostly summer	Coastal & shelf	No Status	Not at Risk
Ringed Seal	Uncommon	Winter-spring	Landfast ice with snow cover	No Status	Not at Risk; High-priority Candidate
Bearded Seal	Uncommon	Year-round	Coastal, shallow & ice edge	No Status	Data Deficient; Mid-priority Candidate

[a] Species designation under the *Species at Risk Act* (SARA website; Government of Canada 2018).
[b] Species designation by COSEWIC (Committee on the Status of Endangered Wildlife in Canada; COSEWIC website 2018).
[c] Scotian Shelf population.
[d] Davis Strait-Baffin Bay-Labrador Sea population.

Table 6.17 Cetacean and Sea Turtle Sightings in the Regional Assessment Area and Project Area (compiled from the DFO sightings database, 1947–2015)

Species	Regional Assessment Area			Project Area		
	Number Sightings	Number Individuals.	Months Sighted	Number Sightings	Number Individuals	Months Sighted
Mysticetes (Baleen)						
North Atlantic Right Whale	4	6	Jun, Aug, Sep	0	0	–
Bowhead Whale	1	1	May	0	0	–
Humpback Whale	4349	17478	Jan-Dec	78	145	May-Sep, Nov
Blue Whale	41	61	Mar-Oct	0	0	–
Fin Whale	3812	5594	Feb-Dec	48	81	May-Oct
Sei Whale	205	349	Feb, May-Dec	12	21	Jun-Sep
Fin / Sei Whale	43	73	Apr-Oct, Dec	16	23	Jun-Sep
Minke Whale	1708	4012	Jan, Mar-Dec	34	35	Jun-Sep
Unidentified Baleen Whale	291	379	May-Dec	37	48	Jun-Sep
Odontocetes						
Sperm Whale	332	829	Jan-Dec	28	64	Jun-Sep
Northern Bottlenose Whale	116	352	Mar-Dec	18	58	May-Sep
Sowerby's Beaked Whale	1	4	Sep	1	4	Sep
Cuvier's Beaked Whale	1	1	Jul	0	0	–
Beluga	8	8	May-Jul	1	1	Jul
Narwhal	5	5	Jun-Jul	0	0	–
White-beaked Dolphin	310	2641	Jan-Mar, May-Nov	3	16	Jul
Atl. White-sided Dolphin	447	7377	Jan-Dec	24	569	Jun-Oct
Bottlenose Dolphin	13	33	Apr-Jun, Aug-Oct	0	0	–
Common Dolphin	295	3806	Jan, Mar, Apr, Jun-Dec	3	42	Jul
Striped Dolphin	6	295	Aug-Sep	3	259	Aug-Sep
Atl. Spotted Dolphin	2	13	Jul	0	0	–
Risso's Dolphin	6	12	Sep, Nov	0	0	–
False Killer Whale	1	2	Jun	0	0	–
Killer Whale	341	2043	Jan, Mar-Dec	1	5	Oct
Long-finned Pilot Whale	888	18614	Jan-Dec	119	1758	Feb, May-Oct
Harbour Porpoise	351	1439	Feb-Dec	19	53	Jun-Aug, Oct

Species	Regional Assessment Area			Project Area		
	Number Sightings	Number Individuals.	Months Sighted	Number Sightings	Number Individuals	Months Sighted
Unidentified Dolphin	842	13652	Jan-Dec	69	1077	Jun-Sep
Unidentified *Stenella*	2	2	Jun, Oct	1	1	Oct
Unidentified Beaked Whale	2	2	Jun, Sep	0	0	–
Unidentified Toothed Whale	16	43	Jun-Sep	4	20	Jul-Sep
Others						
Unidentified Cetacean	12	22	May-Oct	0	0	–
Unidentified Whale	665	1751	Jan-Dec	28	36	Jun-Oct
Unidentified Large Whale	604	2905	Jan-Dec	19	27	May, Jul-Sep
Unidentified Medium Whale	35	108	Jun-Oct, Dec	0	0	–
Unidentified Small Whale	30	225	May-Nov	0	0	–
Sea Turtles						
Leatherback Sea Turtle	129	194	Mar, May-Oct, Dec	0	0	–
Loggerhead Sea Turtle	2	4	May, Jul	0	0	–
Green Sea Turtle	2	2	Jul	0	0	–
Unidentified Sea Turtle	12	14	Jan-Mar, Aug-Oct	0	0	–
Note: See Section 6.3.1 for description of DFO sightings database and associated caveats						

6.3.3 Mysticetes (Baleen Whales)

Six species of baleen whales are known to occur in the Project Area, three of which occur commonly (Table 6.16). Given that the Atlantic population of blue whale and the North Atlantic right whale each have endangered status under Schedule 1 of SARA, they are described in Section 6.3.7, Species at Risk. Although some individual baleen whales may be present in offshore waters of Newfoundland and Labrador year-round, most baleen whale species presumably migrate to lower latitudes during the winter months (Amec 2014).

6.3.3.1 Humpback Whale

The humpback whale is listed as *special concern* under SARA (Schedule 3; Government of Canada 2018) and is considered not at risk by COSEWIC (COSEWIC 2003a). Lawson and Gosselin (2009) provided an abundance estimate of 1,427 humpback whales (95 percent CI: 952-2,140) for Newfoundland based on aerial surveys conducted off the southern and eastern coast; when corrected for perception and availability biases, abundance was estimated at 3,712 whales (Lawson and Gosselin

2011). Humpbacks are the most commonly recorded mysticete in the Project Area in the DFO sightings database (78 sightings; 145 individuals). While humpback sightings occur year-round, they are predominant during June–September (Table 6.17; Figure 27). Modeling by Mannocci et al. (2017) for the summer months showed the highest densities in the northeastern portion of the Project Area. Humpback whales are expected to be common throughout the Project Area.

6.3.3.2 Minke Whale

Minke whales have no status under SARA (Government of Canada 2018) and are considered not at risk in Atlantic Canada by COSEWIC (COSEWIC 2018). The current best abundance estimate for the Canadian East Coast stock is 2,591 (Hayes et al. 2017). Although the previously reported abundance estimate was much greater for this stock, that estimate was based on the 2007 Trans North Atlantic Sightings Survey (TNASS), which is now considered too old to be reliable (Hayes et al. 2017). Nonetheless, the 2007 TNASS resulted in an abundance of 1,315 (95 percent CI: 855-2,046) individuals within Newfoundland and Labrador waters (Lawson and Gosselin 2009). Lawson and Gosselin (2011) provided a corrected abundance estimate of 4,691 for Newfoundland and Labrador. The minke whale is the third most commonly recorded mysticete in the Project Area in the DFO sightings database (34 sightings; 35 individuals), with sightings recorded during June-September (see Table 6.17; Figure 6.27). Modeling by Mannocci et al. (2017) showed consistent year-round densities estimates throughout the Project Area. Minke whales are considered common throughout the Project Area.

6.3.3.3 Sei Whale

In the Canadian Atlantic, the sei whale has no status under SARA (Government of Canada 2018) and is considered *data deficient* by COSEWIC (COSEWIC 2003b). Two stocks of sei whales are currently considered to occur in eastern Canada, on the Scotian Shelf and in the Labrador Sea, although there is limited evidence supporting the definition of the Labrador Sea stock (COSEWIC 2003b). The best estimate of abundance for the Nova Scotia stock of sei whales is 357 (CV = 0.52; Hayes et al. 2017).

Based on the DFO sightings database, there have been at least 12 sightings (21 individuals) of sei whales in the Project Area; sightings occurred during June–September (see Table 6.17; Figure 6.27). Habitat-density modeling for the summer by Mannocci et al. (2017) showed consistent densities estimates throughout the Project Area. Sei whales are considered uncommon in the Project Area.

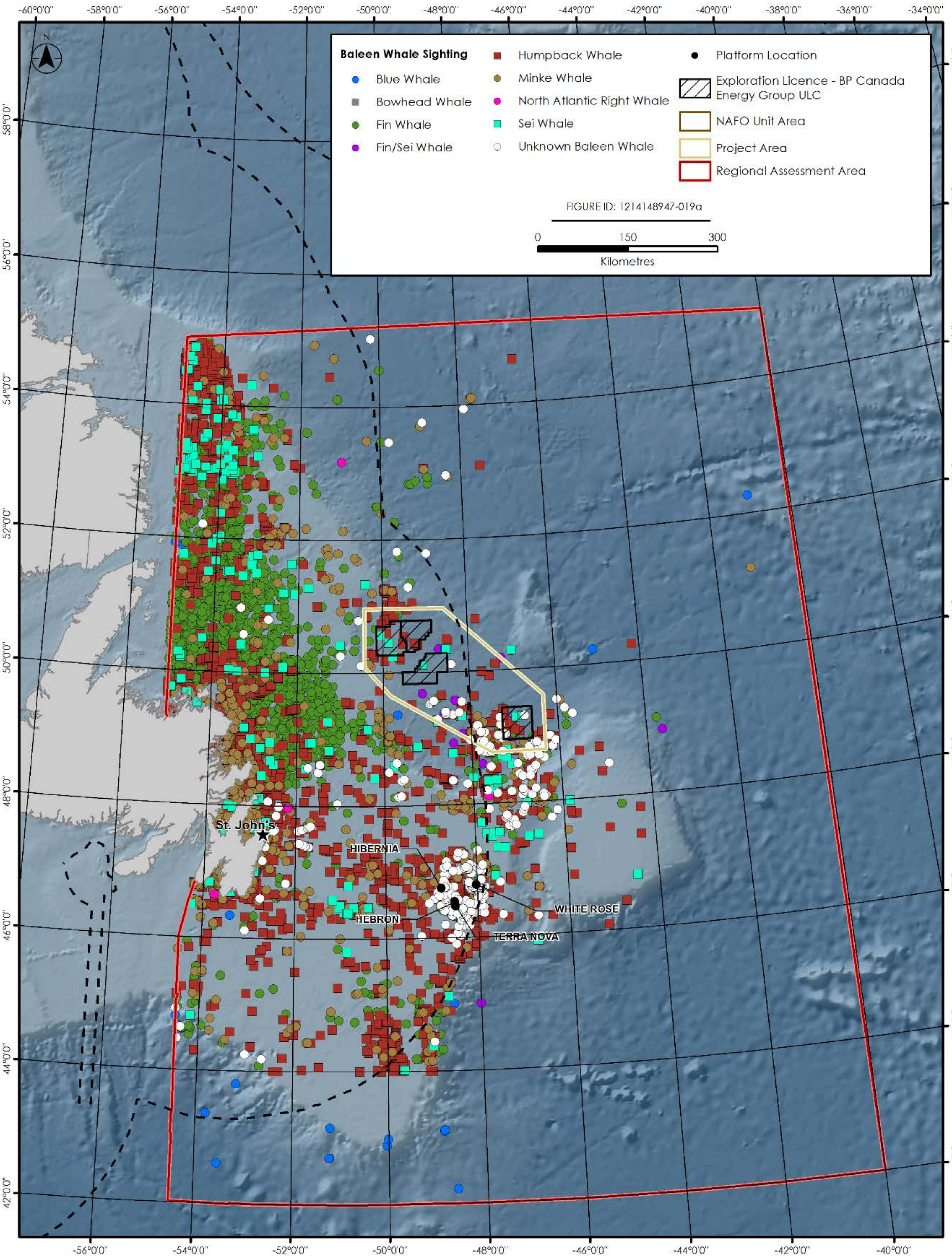


Figure 6.26 Baleen Whale Sightings in the Project Area and Regional Assessment Area (compiled from the DFO sightings database, 1947-2015)

6.3.4 Odontocetes (Toothed Whales)

Thirteen species of toothed whales are likely to occur in the Project Area (Table 6.17), ranging from the largest, the sperm whale, to one of the smallest, the harbour porpoise. Several of these species only occur in the Project Area seasonally; but in general, there is little information about the distribution and abundance of these species. There are two genetically distinct populations of northern bottlenose whales in Canada (Dalebout et al. 2006). The Scotian Shelf population of northern bottlenose whale has endangered status under Schedule 1 of SARA, and its profile is included in Section 6.3.6, Species at Risk. The Davis Strait-Baffin Bay-Labrador Sea population of northern bottlenose whales could also occur in the Project Area.

6.3.4.1 Sperm Whale

Sperm whales have no status under SARA (Government of Canada 2018) and are designated not at risk but considered a *mid-priority candidate* species by COSEWIC (COSEWIC 2018). There is currently no reliable estimate of sperm whale abundance in the entire western North Atlantic; the best recent abundance estimate, based on aerial and shipboard surveys and uncorrected for dive-time, of 2,288 (CV = 0.28) is likely an underestimate (Hayes et al. 2017). Sperm whales were observed in small numbers (11 sightings of 11 individuals) in the waters off Eastern and Southern Newfoundland during aerial surveys conducted in the summer of 2007 (Lawson and Gosselin 2009).

There are 28 sightings (64 individuals) of sperm whales in the Project Area in the DFO sightings database. Sightings were recorded year-round in the RAA, but mainly in June and July in the Project Area (Table 6.17; Figure 6.27). Mannocci et al. (2017) presented modeled year-round densities of sperm whales, with higher densities occurring in the eastern portion of the Project Area. Sperm whales are expected to be common in the deep waters of the Project Area.

6.3.4.2 Northern Bottlenose Whale

The Davis Strait-Baffin Bay-Labrador Sea population of northern bottlenose whale has no status under SARA (Government of Canada 2018) and special concern status under COSEWIC (COSEWIC 2011b); there is no reliable population estimate. Northern bottlenose whales are expected to regularly occur in the Project Area but in low numbers (Table 6.16). Additional details on the Scotian Shelf population of northern bottlenose whale are provided in Section 6.3.7.

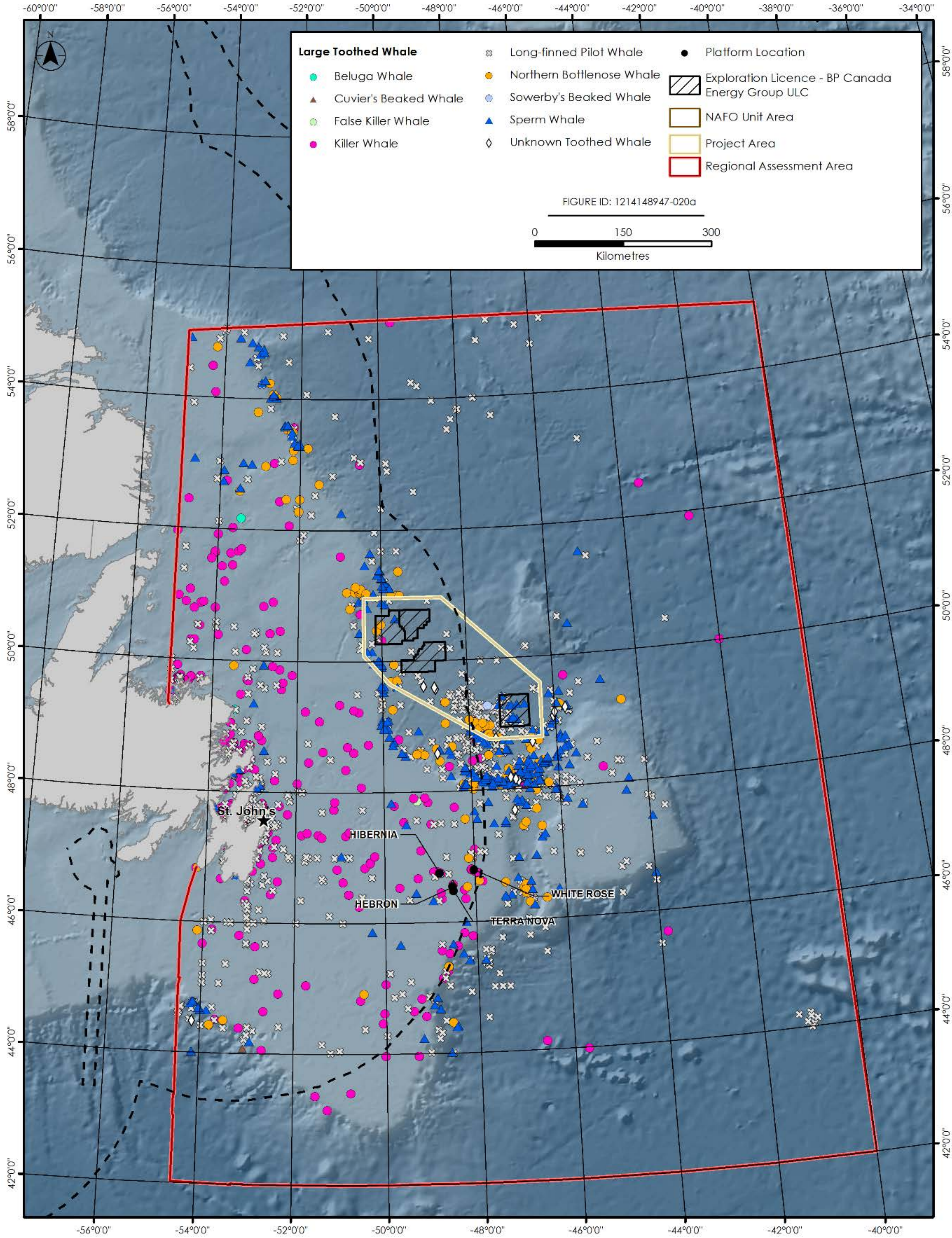


Figure 6.27 Toothed Whale Sightings in the Project Area and Regional Assessment Area (compiled from the DFO sightings database, 1947-2015)

6.3.4.3 Striped Dolphin

There are an estimated 46,882 striped dolphins (CV = 0.33) from central Virginia to the lower Bay of Fundy (Hayes et al. 2017), and no abundance estimate for Canadian waters. Based on the DFO sightings database, there are three sightings (259 individuals) of striped dolphins in the Project Area. All sightings occurred in August and September (Table 6.17; Figure 6.28). Year-round habitat-density modeling by Mannocci et al. (2017) showed consistent densities estimates throughout the Project Area. Striped dolphins are considered rare in the Project Area.

6.3.4.4 Atlantic Spotted Dolphin

There are an estimated 26,798 Atlantic spotted dolphins (CV = 0.66) from central Virginia to the lower Bay of Fundy (Hayes et al. 2017), and no abundance estimate for Canadian waters. Based on the DFO sightings database, there were no sightings of Atlantic spotted dolphins made in the Project Area. Mannocci et al. (2017) estimated low densities year-round throughout the Project Area. Atlantic spotted dolphins are considered rare in the Project Area.

6.3.4.5 Short-beaked Common Dolphin

Currently, the best abundance estimate for the Western North Atlantic stock of short-beaked common dolphin is 70,184 individuals (CV=0.28), which was derived from the TNASS surveys that occurred from July to August 2007 (Hayes et al. 2017). The abundance estimate for the Newfoundland area based on the 2007 TNASS suggests a population of 576 individuals (95 percent CI: 314-1,056) (Lawson and Gosselin 2009). Based on the DFO sightings database, there are three sightings (42 individuals) of short-beaked common dolphins in the Project Area (Table 6.17; Figure 6.28). All sightings occurred during July. Mannocci et al. (2017) presented consistent year-round densities of short-beaked common dolphins throughout the Project Area. The short-beaked common dolphin is considered common in the Project Area.

6.3.4.6 White-beaked Dolphin

Lawson and Gosselin (2009) provided an abundance estimate of 1,842 white-beaked dolphins (95 percent CI: 1,188-2,854) for Newfoundland, based on aerial surveys conducted off the southern and eastern coasts; when corrected for perception and availability biases, abundance was estimated at 15,625 dolphins (Lawson and Gosselin 2011). Based on the DFO sightings database, there are three sightings (16 individuals) of white-beaked dolphins in the Project Area. All sightings occurred during July (Table 6.17; Figure 6.28). The white-beaked dolphin is considered common in the RAA.

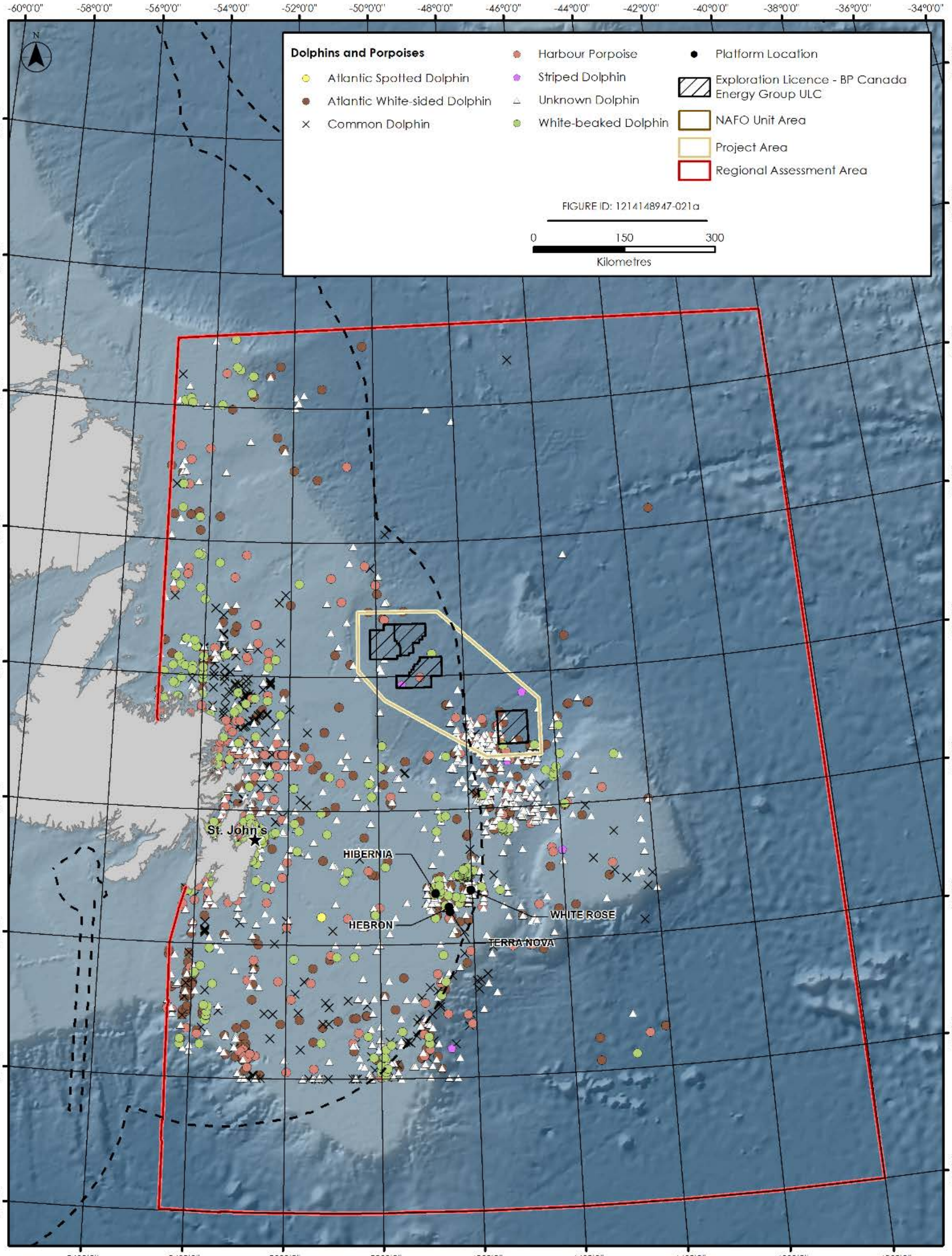


Figure 6.28 Dolphin and Porpoise Sightings in the Project Area and Regional Assessment Area (compiled from the DFO sightings database, 1947-2015)

6.3.4.7 Atlantic White-sided Dolphin

Based on the distribution of sightings, strandings, and incidental takes, Palka et al. (1997) suggested the existence of three stock units in the Northwest Atlantic: Gulf of Maine, Gulf of St. Lawrence, and Labrador Sea. To date, the best available abundance estimate for the Northwest Atlantic is 48,819 (CV=0.61), derived from surveys completed in 2011 (Hayes et al. 2017). Lawson and Gosselin (2009) estimated a total of 1,507 Atlantic white-sided dolphins (95 percent CI: 968-2,347) in the waters off Newfoundland. Lawson and Gosselin (2011) provided a corrected abundance estimate of 3,384. Based on the DFO sightings database, there are 24 sightings (569 individuals) of white-sided dolphins in the Project Area. Sightings occurred primarily during July-September (Table 6.17; Figure 6.28). Mannocci et al. (2017) predicted consistent year-round densities of Atlantic white-sided dolphins throughout the Project Area. The Atlantic white-sided dolphin is considered common in the Project Area.

6.3.4.8 Common Bottlenose Dolphin

Two morphologically and genetically distinct stocks of common bottlenose dolphins occur in the Northwest Atlantic, referred to as the coastal and offshore forms (Hoelzel et al. 1998). The best available abundance estimate, based on surveys conducted in 2011, for the offshore stock of the species in the Northwest Atlantic is 77,532 individuals (CV=0.40) (Hayes et al. 2017). Based on the DFO sightings database, there were no sightings of bottlenose dolphins made in the Project Area. (Table 6.17; Figure 6.28). Mannocci et al. (2017) estimated consistently year-round low densities throughout the Project Area. The common bottlenose dolphin is considered rare in the Project Area.

6.3.4.9 Risso's Dolphin

Risso's dolphin can be found globally in tropical and temperate waters and occurs in the Northwest Atlantic from Florida to eastern Newfoundland (Hayes et al. 2017). Currently, the best abundance estimate for Risso's dolphin is 18,250 individuals (CV=0.46), based on surveys conducted in 2011 (Hayes et al. 2017). Based on the DFO sightings database, there were no sightings of Risso's dolphins made in the Project Area. (Table 6.17; Figure 6.28). Mannocci et al. (2017) predicted consistent year-round densities of Risso's dolphins throughout the Project Area. However, the Risso's dolphin is considered rare in the Project Area.

6.3.4.10 Killer Whale

The Northwest Atlantic / Eastern Arctic killer whale population has no status under SARA (Government of Canada 2018) and is considered special concern by COSEWIC (COSEWIC 2008b). The size of the Northwestern Atlantic/Eastern Arctic population is not known. Based on the DFO sightings database, there is a single sighting of five killer whales in the Project Area (Table 6.17; Figure 6.28). This sighting was recorded in October 1994. Killer whales are considered uncommon in the Project Area.

6.3.4.11 Long-finned Pilot Whale

The long-finned pilot whale is widespread in the North Atlantic and considered an abundant year-round resident of Newfoundland and Labrador (Nelson and Lien 1996). To date, the best available abundance estimate for the western North Atlantic is 5,636 (CV=0.63), derived from surveys completed in 2011 (Hayes et al. 2017). This 2011 survey covered waters from central Virginia to the lower Bay of Fundy. A total of 65 long-finned pilot whales were observed during the 2007 TNASS off Newfoundland and an estimate of 6,134 individuals was calculated for the entire survey area (95 percent CI: 2,774-10,573) (Lawson and Gosselin 2009). Long-finned pilot whales are the most commonly recorded odontocete (119 sightings and 1,758 individuals) in the in the DFO sightings database study area (Table 6.17; Figure 6.28); sightings have been reported year-round but predominantly from June-August. Mannocci et al. (2017) modeled year-round densities of pilot whales showing high densities throughout the Project Area. Long-finned pilot whales are considered common in the Project Area.

6.3.4.12 Harbour Porpoise

In the Northwest Atlantic, harbour porpoises are considered threatened (Schedule 2) by SARA (Government of Canada 2018) and of special concern by COSEWIC (COSEWIC 2006d). There are at least three populations recognized in the Northwest Atlantic: eastern Newfoundland and Labrador, the Gulf of St. Lawrence, and the Gulf of Maine / Bay of Fundy (Palka et al. 1996). There are an estimated 79,883 harbour porpoise (CV = 0.32) in the Gulf of Maine / Bay of Fundy stock (Hayes et al. 2017). Lawson and Gosselin (2009) provided an abundance estimate of 1,195 harbour porpoises (95 percent CI: 639-2,235) for Newfoundland, based on aerial surveys conducted off the southern and eastern coasts; when corrected for perception and availability biases, abundance was estimated to be 3,326 porpoises (Lawson and Gosselin 2011). Based on the DFO sightings database, there are 19 sightings (53 individuals) of harbour porpoises in the Project Area. Most sightings occurred from June-August (Table 6.17; Figure 6.29). Harbour porpoises are generally considered uncommon in the Project Area, although Mannocci et al. (2017) reported relatively high densities in and near Project Area.

6.3.5 Phocids (Seals)

Five seal species occur in the Project Area (Table 6.16). None of these species are listed under SARA (Government of Canada 2018); however, four are considered candidate species by COSEWIC (COSEWIC 2018). The ringed seal is considered a *high-priority candidate* species. The hooded and bearded seals are considered *mid-priority candidate* species, and the harp seal is considered a *low-priority* candidate species (COSEWIC 2018). As discussed in Section 7.4.7, harp, grey, hooded, and ringed seals are harvested by Indigenous groups in Newfoundland and Labrador. Sealing generally occurs between late March and mid-May, however can vary by species, and considers environmental and biological conditions (DFO 2011f).

Harp and hooded seals are expected to be common in the Project Area. The Northwest Atlantic harp seal population appears to have levelled off since 2008 at approximately 7.4 million (95 percent CI: 6,475,800-8,273,600; Hammill et al. 2015). Declines in sea ice associated with climate change may cause harp seals to use whelping areas farther to the north (Stenson and Hammill 2014). Hooded seals are also likely to be common in the Project Area. During spring and late-fall / winter, hooded seals outfitted with satellite relay data loggers showed movements throughout the Project Area during 2004-2008 (Andersen et al. 2012, 2013, 2014). Andersen et al. (2012) suggested that hooded seals prefer areas with topographic and oceanographic conditions off the coast of Newfoundland that produce good feeding conditions. During autumn / winter, males showed greater search effort in areas with complex seabed relief, including areas in the Flemish Cap; whereas females spent more effort along the Labrador Shelf. Juveniles occurred off the east coast of Newfoundland between the Grand Banks and the Flemish Cap during spring.

Given their preference for nearshore areas, grey seals are likely to be uncommon in the Project Area. The 2014 grey seal population was estimated at 505,000 individuals (Hammill et al. 2014). The distributional ranges of ringed and bearded seals extend to Labrador and northern Newfoundland. These species are expected to be uncommon in the Project Area.

6.3.6 Sea Turtles

While four species of sea turtles have been reported in Newfoundland waters, only three have a reasonable likelihood of occurring in or near the Project Area; the presence of Kemp's ridley sea turtle within the Project Area would be extremely rare. Information on the occurrence, habitat, and conservation status for the leatherback, loggerhead, and green sea turtles in the Project Area is presented in Table 6.18. Figure 6.29 shows locations of sea turtle sightings in the Project Area, based on the DFO sightings database.

Table 6.18 Sea Turtles with Reasonable Likelihood of Occurrence in the Project Area

Species	Project Area		Habitat	SARA Status[a]	COSEWIC Status[b]
	Occurrence	Season			
Leatherback Sea Turtle	Rare	April to December	Shelf & pelagic	Schedule 1: Endangered	Endangered
Loggerhead Sea Turtle	Rare	Summer and fall	Pelagic	Schedule 1: Endangered	Endangered
Green Sea Turtle	Rare	Summer	Pelagic	No Status	Not considered; Low-priority candidate

[a] Species designation under the *Species at Risk Act* (SARA website; Government of Canada 2018)
[b] Species designation by COSEWIC (Committee on the Status of Endangered Wildlife in Canada; COSEWIC website 2018)

The leatherback and loggerhead sea turtles have an endangered status under Schedule 1 of SARA and are included in Section 6.3.6, Species at Risk. Green sea turtles are expected to be very rare in the Project Area. There are two records of green turtles to the south of the Project Area, within the RAA, in the DFO sightings database. Both sightings were near the Flemish Cap, in water depth >4,000 m and occurred in July (Figure 6.29).

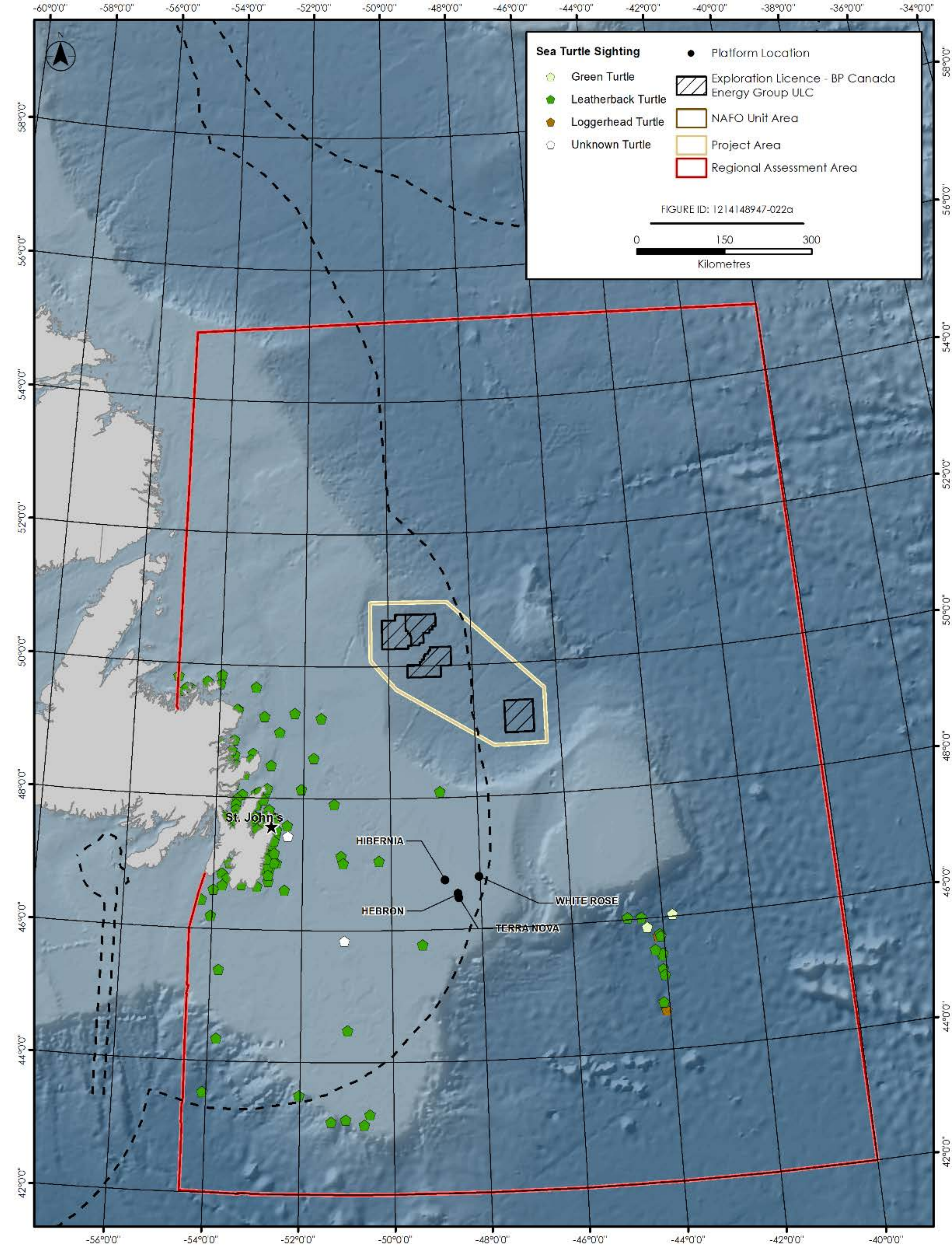


Figure 6.29 Sea Turtle Sightings in the Project Area and Regional Assessment Area (compiled from the DFO sightings database, 1947-2015)

6.3.7 Species at Risk

Five marine mammal and two sea turtle species / populations that may occur in the Project Area are currently listed under Schedule 1 of SARA: (1) blue whale (Atlantic population); (2) fin whale; (3) North Atlantic right whale; (4) northern bottlenose whale (Scotian Shelf population); (5) Sowerby's beaked whale; (6) leatherback sea turtle; and (7) loggerhead sea turtle. Profiles of these species are provided in this section.

6.3.7.1 Blue Whale

The Atlantic population of blue whales is listed as endangered on Schedule 1 of SARA (Government of Canada 2018) and by COSEWIC (COSEWIC 2002a, 2012g). The lastest proposed Action Plan for the Northwest Atlantic population of the blue whale (DFO 2018) recommends recovery objectives intended to increase knowledge of the population, its habitat and threats, and implement measures to mitigate threats (e.g., underwater sound, vessel collisions, spills). No critical habitat has yet been defined for the Northwest Atlantic blue whale.

Blue whales became severely depleted during industrial whaling and still occur at relatively low densities in the North Atlantic. It has been estimated that 400-600 whales may be found in the western North Atlantic (Waring et al. 2011). There are no sightings of blue whales in the Project Area in the DFO sightings database. Blue whales were recorded during spring, summer and fall within the RAA in the DFO sightings database, with peak numbers in July and August (Table 6.17 in Section 6.3.1.1). Results from tagging studies in the Gulf of St. Lawrence (2013) and St. Lawrence Estuary (2014) suggest that underwater seamounts and the deep ocean structures along the shelf edge may be important habitat for blue whales (Lesage et al. 2016). Blue whales are considered uncommon in the Project Area (Table 6.16).

6.3.7.2 Fin Whale

The Atlantic population of fin whale currently has a special concern status under Schedule 1 of SARA (Government of Canada 2018) and COSEWIC (COSEWIC 2005), and a management plan was released in 2017 (DFO 2017c). Delarue et al. (2014) suggested that there are four distinct stocks in the Northwest Atlantic based on geographic differences in fin whale calls. The current best abundance estimate for the Western North Atlantic stock is 1,618 (CV=0.33), using surveys conducted in 2011 (Hayes et al. 2017). An abundance estimate of 1,352 individuals (95 percent CI: 821-2,226) for the Canadian TNASS survey area was calculated in 2007 (Lawson and Gosselin 2009). Lawson and Gosselin (2011) provided a corrected abundance estimate of 1,555.

Fin whales are the second most commonly recorded mysticete in the Project Area in the DFO sightings database (81 individuals), with most sightings occurring during June–August (Table 6.17; Figure 6.27). Similarly, according to Edwards et al. (2015), highest densities of fin whales occur in offshore waters off Newfoundland during June-August. Modeling by Mannocci et al. (2017) showed the highest year-round densities in the northeastern and southeastern borders of the Project Area. Fin whales are expected to be common throughout the Project Area.

6.3.7.3 North Atlantic Right Whale

The North Atlantic right whale is listed as endangered on Schedule 1 of SARA (Government of Canada 2018) and by COSEWIC (COSEWIC 2003c, 2013). An action plan was recently proposed for the North Atlantic right whale, detailing necessary tasks required to achieve the population and distribution objectives identified in the recovery strategy for this species (DFO 2016d).

In spite of being the first whale to receive total international protection from hunting in 1937, the population size of North Atlantic right whales remains low. The current best estimate is 451 animals and this number has been declining since 2010 (Pace et al. 2017; Pettis et al. 2017). It is likely that only ~100 reproductive females remain in the population (Baumgartner et al. 2017; Pennisi 2017). Decreasing calving rates (down 40% since 2010) and increasing rates of human-caused mortality are of great concern (Kraus et al. 2016). In 2017, only five calves were reportedly born and there were three times as many mortalities (Pettis et al. 2017). From 6 June to 15 September 2017, 12 dead North Atlantic right whales were reported in the Gulf of St. Lawrence. Nine were observed floating in the southern Gulf of St. Lawrence and four came ashore in western Newfoundland (Daoust et al. 2017). One of the whales that came ashore in western Newfoundland had previously been observed floating in the Gulf of St. Lawrence. Eight of the twelve dead animals were males and four were females. The whales ranged from 2 to 37 years old. Necropsies were performed on seven of the whales and it was determined that the cause of death was blunt trauma in four instances and drowning as a result of entanglement in two instances. The cause of death could not be determined in the case of one whale for which post-mortem decomposition was very advanced (Daoust et al. 2017). An additional five entanglements were reported between 5 July and 28 August 2017. Of these entanglements, two were disentangled, one shed the gear on its own and the remaining two entangled whales could not be disentangled; their fate remains unknown (Daoust et al. 2017).

The North Atlantic right whale is considered rare in the RAA (Table 6.16 in Section 6.3.1). There is one recorded sighting of two individual right whales south of the Project Area in the DFO sightings database, in June near the Flemish Cap (Figure 6.27 in Section 6.3.2).

6.3.7.4 Northern Bottlenose Whale

The Scotian Shelf population has endangered status under Schedule 1 of SARA (Government of Canada 2018) and COSEWIC (COSEWIC 2002b, 2011c) and is estimated to comprise 143 individuals (O'Brien and Whitehead 2013). 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 2016e, 2017d). There are 18 sightings (58 individuals) of northern bottlenose whales in the Project Area in the DFO sightings database. These sightings occurred during May-September (Table 6.17; Figure 6.27). Northern bottlenose whales from the Scotian Shelf population are expected to be uncommon in the Project Area (Table 6.16).

Preliminary photo-identification work has found that at least 78 different animals (i.e., not recorded during previous photo-identification studies) occurred in the Grand Banks, Flemish Pass, and Flemish Cap area during 2016–2017 (L.J. Feyrer, Ph.D. Candidate, Dalhousie University, pers. comm., 5 February 2018).

Although genetic and other tissue analyses are underway at Dalhousie University based on samples collected from those individuals, results are not yet available to elucidate whether animals in that area were from the Scotian Shelf or Davis Strait–Baffin Bay-Labrador Sea populations (L.J. Feyrer, Ph.D. Candidate, Dalhousie University, pers. comm., 2018).

6.3.7.5 Sowerby's Beaked Whale

Sowerby's beaked whale has a special concern status under Schedule 1 of SARA (Government of Canada 2018) and COSEWIC (COSEWIC 2006c), and a management plan was released in 2017 (DFO 2017e). There is one sighting of four Sowerby's beaked whales in the Project Area in the DFO sightings database (Table 6.17; Figure 6.27). The sighting of four individuals was made during a seismic survey in Orphan Basin in September 2005 (Moulton et al. 2006). There are also several stranding records for Newfoundland and Labrador (DFO 2017e). It is considered rare in the Project Area.

To date, there is little information known on Sowerby's beaked whale in the waters of offshore Newfoundland and Labrador. The majority of information that has been gathered is based on strandings records (Lien and Barry 1990, in Husky 2012). Sowerby's beaked whales are also relatively difficult to detect at sea due to their short surface durations, apparent offshore distribution, and barely detectable blows (Hooker and Baird 1999a, in Husky 2012). They have most often been observed in deep waters and continental shelf edges or slopes (Kenney and Winn 1987, in Husky 2012; COSEWIC 2006e) and presumably make deep dives to forage on medium to large-bodied squid (COSEWIC 2006e).

6.3.7.6 Leatherback Sea Turtle

The leatherback sea turtle is designated as endangered under SARA (Schedule 1; Government of Canada 2018) and by COSEWIC (COSEWIC 2012h). Recent studies in Atlantic Canadian waters have yielded insight into the foraging and movements of leatherback sea turtles using both satellite telemetry and camera tags, providing footage of leatherbacks searching for, capturing, and handling their prey. This footage revealed that this species finds its prey by entirely visual means and feeds only during daylight hours, predominantly within the top 30 m of the water column (DFO 2016f).

Leatherback turtles outfitted with satellite telemetry tags and vessel-based sightings have been reported in the offshore waters off Nova Scotia and Newfoundland (Stewart et al. 2013; Dodge et al. 2014; Archibald and James 2016; Chambault et al. 2017). As of 2006, there were an estimated 34,000-94,000 adult leatherback sea turtles throughout the North Atlantic (TEWG 2007). While the size of the seasonal foraging population in Atlantic Canada is not known, sightings data suggest that the population in Canadian Atlantic waters numbers in the thousands (COSEWIC 2012h). Archibald and James (2016) suggested that Canadian waters may have the highest density of foraging leatherbacks anywhere 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 2016g). Three proposed critical habitat areas have been identified: (1) the Southwestern Scotian Slope Area, the Gulf of St. Lawrence-Laurentian Channel Area, and the Placentia Bay Area (DFO 2016g). The main threat facing leatherback sea turtles in Canadian waters is bycatch in fisheries, although globally, the species is threatened by ship strikes, marine debris, and oil and gas exploration (COSEWIC 2012h). 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 in the DFO sightings database (Figure 6.29 in Section 6.3.6). However, some leatherback sea turtles have been observed to the south and west of the Project Area, within the RAA. Leatherback sea turtles are considered rare in the Project Area (Table 6.18).

6.3.7.7 Loggerhead Sea Turtle

The loggerhead sea turtle is designated as endangered under SARA (Schedule 1; Government of Canada 2018) and by COSEWIC (COSEWIC 2010d). There are no current population estimates for loggerhead turtles in Atlantic Canada (DFO 2010). Neonate loggerheads from Florida beaches equipped with satellite tags travelled through the southeastern waters of Newfoundland after release (Mansfield et al. 2014). A juvenile loggerhead equipped with a satellite tag in the Canary Islands was also tracked to the southeastern waters of Newfoundland (Vero-Cruz et al. 2016).

There are no sightings of loggerhead turtles within the Project Area in the DFO sightings database (Figure 6.29). Two sightings were made to the south of the Project Area, near the Flemish Cap, in water depth >4,000 m during May and July. Loggerhead sea turtles are considered rare in the Project Area (Table 6.18).

6.3.8 Summary of Key Areas and Times

A summary of important areas and times for marine mammals and sea turtles was provided in the Eastern Newfoundland SEA (Section 4.2.3.6 of Amec 2014). Based on the DFO sightings database, the southern portion of the Project Area appears to host a more concentrated proportion of the marine mammals recorded within the Project Area (Figures 6.27 to 6.29). While marine mammal sightings appear to occur year-round in the RAA, they are more common during the months of June-September within the Project Area. However, the appearance of concentrations in certain areas and during certain times may be an artifact of the survey effort in these areas. Conversely, low sighting numbers in other areas and during other times may, at least in part, be attributable to a lack or absence of survey effort.

Several EBSAs in the RAA provide important ecological functions for marine mammals and sea turtles. Table 4.102 in the Eastern Newfoundland SEA (Amec 2014) highlights EBSA relevance to marine mammals and sea turtles. In particular, EBSAs which are known to provide important habitat (e.g., overwintering, refuge, feeding) for marine mammals or sea turtles include the Northeast Shelf and Slope, Notre Dame Channel, Fogo Shelf, Labrador Marginal Trough, Eastern Avalon, Placentia Bay Extension, Lilly Canyon-Carson Canyon, Southeast Shoal and Tail of the Banks, Southwest Shelf Edge and Slope (Table 6.15).

Overall, the summer is an important period for cetaceans and sea turtles in waters offshore Newfoundland, where many migratory species come to feed before returning to more southern latitudes for the winter. Pinnipeds may be more common during winter and spring.

6.4 Special Areas

Newfoundland and Labrador has several areas that are protected under federal, provincial, international, and/or other legislation or programs because they are considered to be important for ecological, historical, or socio-economic reasons. The proximity of special areas within the Project Area and RAA are evaluated, providing a contextual setting for the interaction of the Project with the surrounding marine and coastal environment. Special areas described below can be identified on Figure 6.30.

6.4.1 Federal Designations and Their Management

Federally designated special areas include protected areas designated under federal legislation (refer to Table 6.19) and other special or sensitive areas which are designated federally, but not protected by legislation, such as Ecological and Biologically Significant Areas (EBSAs) and Significant Benthic Areas (SBAs) (Section 6.4.1.5).

Table 6.19 Federal Legislation Under Which Protected Areas are Established

Legislation / Regulation	Type of Area	Department / Agency	Purpose	Area Present Within RAA
Oceans Act, 1996, c.31	*Oceans Act* Marine Protected Area, Marine Refuges	DFO	To conserve and protect fish, marine mammals, and their habitats; unique areas; areas of high productivity or biological diversity	Yes
Fisheries Act, 1985, c.43	Fisheries Closure Areas, Marine Refuges	DFO	To conserve and protect fish and fish habitat; to manage inland fisheries (among other purposes)	Yes
Canada Wildlife Act, R.S., 1985, c. W-9	Migratory Bird Sanctuary	ECCC	To conserve and protect habitat for migratory bird species	Yes
Canada National Marine Conservation Areas Act, 2002, c. 18	National Marine Conservation Area	Parks Canada Agency (PCA)	To conserve and protect representative examples of Canada's natural and cultural marine heritage and provide opportunities for public education and enjoyment	No
Canada National Parks Act, 2000, c.32	National Park	PCA	To protect representative examples of Canada's natural heritage for the benefit, education and enjoyment of Canadians	No
Canada Wildlife Act, R.S., 1985, c. W-9	National Wildlife Area	ECCC	To conserve and protect habitat for a variety of wildlife, including migratory birds and species at risk	No
SARA	Protected critical habitat	DFO, PCA, and ECCC	To protect and recover wildlife species at risk in Canada	No
Source: Government of Canada 2011				

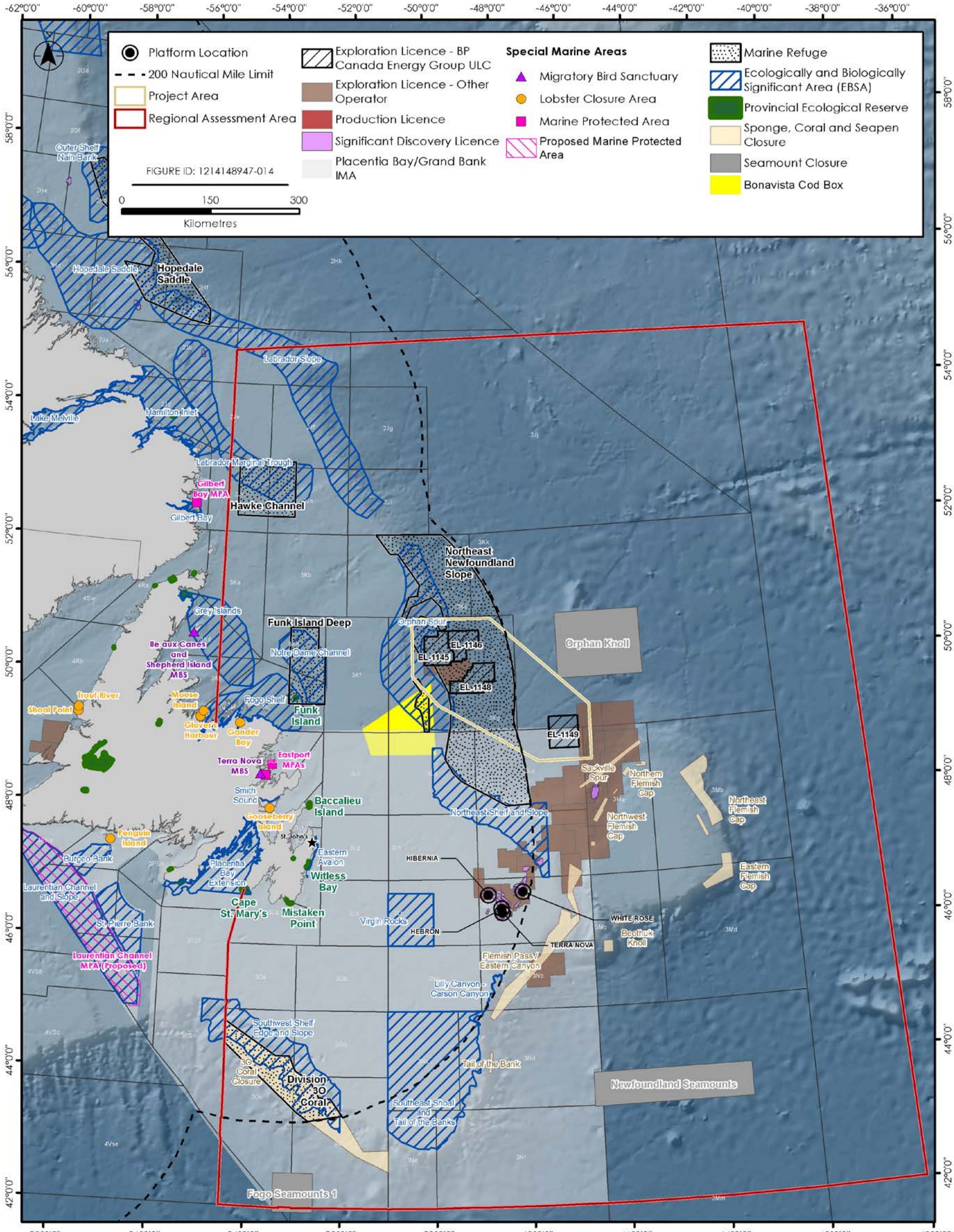


Figure 6.30 Special Marine Areas with the Project Area and RAA

6.4.1.1 Introduction to the Federal Bioregional Network

There are 13 bioregions identified in Canadian waters by the Fisheries and Oceans Canada (DFO 2002; Government of Canada 2011). These areas are designated based on oceanographic and bathymetric properties and are identified by DFO to define ecological uses for marine habitat and facilitate better ocean management decisions (DFO 2005). The Project Area and RAA are within the Newfoundland and Labrador Shelves Bioregion.

There are also five Integrated Management Areas (IMAs) throughout Canada: three are on the Atlantic Coast; one in the Arctic; and one on the Pacific Coast (DFO 2018). The three on the Atlantic coast are: Placentia Bay / Grand Banks (PB / GB) IMA; Gulf of St. Lawrence IMA; and the Scotian Shelf, Atlantic Coast and the Bay of Fundy IMA. Each IMA is governed by representatives from federal government departments and agencies, Indigenous groups and stakeholders such as coastal communities, which have regulatory or economic interests within the area, known as a Secretariat. The PB / GB IMA Secretariat has prepared an integrated management plan that addresses ecological, social, cultural, and economic considerations regarding resource use within the area (Placentia Bay Grand Banks-Large Ocean Management Area Secretariat 2012).

The Project Area is contained in the PB / GB IMA, while the RAA lies almost entirely within the PB / GB IMA, but has a small area within the Scotian Shelf, Atlantic Coast, and the Bay of Fundy IMA along the southwest corner (Figure 6.30).

6.4.1.2 *Ocean's Act* Marine Protected Areas and Areas of Interest

Part of DFO's mandate under the *Oceans Act* is the establishment of a national network of Marine Protected Areas (MPAs). MPAs are created with long-term conservation in mind and identify areas of high biodiversity, important habitats for marine species, and unique bathymetric features such as underwater canyons and hydrothermal vents (DFO 2002). MPAs can also protect areas with spiritual or cultural importance, including archaeological sites, shipwrecks, and areas traditionally used by Indigenous and non-Indigenous communities. The bioregions, as mentioned in Section 6.4.1.1, act as a spatial planning framework for Canada's national network of MPAs.

There are two MPAs in the Newfoundland and Labrador Shelves Bioregion: Eastport, and Gilbert Bay; Laurentian Channel is an Area of Interest or candidate MPA (Figure 6.30). The Eastport MPAs are also designated as the Eastport Peninsula Lobster Management Area and protected under the jurisdiction of the *Fisheries Act*. Lobster fishing within the area it is limited. Table 6.20 lists the reason for protection of each of the MPAs/candidate MPA and their proximity to the Project Area.

Table 6.20 *Oceans Act* MPAs and their Proximity to the Project Area

Marine Protected Area/Area of Interest	Reason for Designation	Area (km²)	Nearest Distance to Project Area (km)	Within RAA
Eastport MPAs	Established in 2005 to limit fishing with an aim to provide a viable American lobster population and to protect other threatened or endangered species.	2.1	280	Yes
Gilbert Bay	Established in 2005 to conserve one of the few coastal concentrations of northern cod in the Newfoundland region and to indirectly protect other species and habitats.	60	397	No
Laurentian Channel (AOI for consideration as an MPA)	Designated as an Area of Interest in 2010. Highest concentration of black dogfish and only pupping area in Canadian waters. Important spawning, nursing and feeding area for variety of species including porbeagle shark and smooth skate. Critical migration route for marine mammals moving in and out of Gulf of St. Lawrence. Two SARA-listed species (northern wolffish and leatherback sea turtle) found in area. One of the highest concentrations of sea pens (soft feather-shaped corals) in the Newfoundland and Labrador Shelves Bioregion.	11,619	653	No
Source: DFO 2013c; Statoil 2017				

6.4.1.3 Preliminary Representative Marine Areas

Under the *Canada National Marine Conservation Areas Act, 2002*, Parks Canada establishes National Marine Conservation Areas (NCMAs) to protect and conserve representative marine ecosystems and key features. NCMAs are protected from activities such as ocean dumping, undersea mining, and oil and gas exploration and development. Traditional fishing activities are permitted but managed with the conservation of the ecosystem as the main goal (Parks Canada 2017). There are currently two operating sites within the NMCA program, and two additional sites that are in the planning stages for operations. There are no NMCAs in the RAA.

NCMAs are established in a manner set out in the National Marine Conservation Areas Policy and guided by the national system plan, Sea to Sea to Sea. Parks Canada's goal is to represent each of the 29 marine regions in the country. The first key step in establishing a new NCMA is to identify Representative Marine Areas (RMAs) as candidate sites within a marine region. In many cases, these RMAs overlap with EBSAs (refer to Section 6.4.1.5.1).

The Grand Banks in the Atlantic Ocean is identified as a marine region requiring representation in the NCMA system (Parks Canada 2017). Within the Grand Banks marine region, four preliminary RMAs have been identified. Northwestern Conception Bay, Virgin Rocks and South Grand Bank Area RMAs occur in the RAA but are located outside the Project Area or LAA; the Southern Coast of Burin Peninsular and

Southwestern Placentia Bay RMA is outside the RAA. Within a marine region, one RMA would be selected as a preferred candidate for the establishment of a NMCA would be subject to additional study and consultation prior to establishment as a NMCA (Amec 2014).

6.4.1.4 Marine Refuges and Lobster Area Closures

Fisheries closure areas are identified under the *Fisheries Act* to conserve and protect fish and fish habitat and to manage inland fisheries. Fisheries management measures in Canadian waters provide marine refuge to fish and marine mammals and their habitat and qualify as other effective area-based conservation measures. These areas are also protected areas under the *Oceans Act* and, in combination with *Oceans Act* MPAs, contribute to Canada's national and international conservation targets (Government of Canada 2017). As of December 21, 2017, marine refuges have been identified throughout Canadian waters. There are four marine refuges that are fully within the Newfoundland and Labrador Shelves bioregion, including: Hopedale Saddle; Hawke Channel; Northeast Newfoundland Slope; Funk Island Deep; and Division 3O Coral (Figure 6.30). These areas are protected as a means of long term conservation of biodiversity (DFO 2016h). Table 6.21 lists the marine refuges, their reason for protection, and proximity to the Project Area. The Northeast Newfoundland Slope marine refuge is the only one that occurs within the Project Area (24,460 km² of co-occurrence, or 44% of the total area of the marine refuge). Hawke's Channel and Funk Island Deep and Division 3O coral marine refuges are located within the RAA. Hopedale Saddle is not within the RAA and is located 606 km from the Project Area.

Table 6.21 *Fisheries Act* Marine Refuges and their Proximity to the Project Area

Marine Refuge Name	Main Reasons for Protection	Closed to	EBSA Co-occurrence	Area (km²)	Nearest Distance to Project Area (km)	Co-occurrence with Project Area (km², %)
Division 3O Coral	Presence of large and small gorgonian corals and sea pens. Visited by leatherback sea turtles, redfish, and Atlantic cod.	all bottom fishing activities	Southwest Shelf Edge and Slope	10,336	640	N/A
Northeast Newfoundland Slope	High density of corals and sponges. High biodiversity.	bottom contact fishing activities	Orphan Spur	55,251	0	24,460; 44%
Funk Island Deep	Benthic habitat important to Atlantic cod and smooth skate Funk Island Deep population (assessed as Endangered by COSEWIC). Substantial concentrations of groundfish and other fish species. Important feeding area for marine mammals.	bottom trawl, gillnet, and longline fishing activities	Notre Dame Channel Fogo Shelf	7,272	147	N/A

Marine Refuge Name	Main Reasons for Protection	Closed to	EBSA Co-occurrence	Area (km^2)	Nearest Distance to Project Area (km)	Co-occurrence with Project Area (km^2, %)
Hawke's Channel	Benthic habitat important to Atlantic cod and Atlantic wolffish. Supports a high diversity of groundfish populations such as Greenland halibut.	bottom trawl, gillnet, and longline fishing activities	Labrador Margin Trough	8,839	263	N/A
Hopedale Saddle	High density of corals and sponges. High biodiversity. Supports an important overwintering area for the Eastern Hudson Bay Beluga.	bottom contact fishing activities	Outer Shelf Nain Bank Labrador Slope, and Hopedale Saddle	15,450	606	N/A

There are seven Lobster Closure Areas along the coast of the island of Newfoundland that are also designated as marine refuges. They protect approximately 94 km^2 of important lobster spawning habitat in rocky coastal areas. Lobster fishing is prohibited in these area, along with other activities that are unsuited for conservation of the habitat (DFO 2017f). Table 6.22 lists the Lobster Closure Areas and their proximity to the Project. The Gander Bay and Gooseberry Island Lobster Closure Areas are within the RAA.

Table 6.22 Lobster Closure Area and Proximity to the Project Area

Lobster Closure Area	Nearest Distance to Project Area (km)	Within RAA
Gander Bay	302	Yes
Gooseberry Island	328	Yes
Glover's Harbour	358	No
Mouse Island	358	No
Penguin Island	560	No
Trout River	567	No
Shoal Point	568	No

6.4.1.5 Migratory Bird Sanctuaries

Under the *Migratory Birds Convention Act (1994)*, the Canadian Wildlife Service (CWS) manages migratory bird sanctuaries, which are established for the protection and conservation of migratory birds. The sanctuaries protect habitat that is optimal for breeding, nesting, or hunting. Any activities that could harm migratory birds, their nest, or egg is prohibited (Government of Canada 2010). The *Migratory Bird Sanctuary Regulations* and *Migratory Bird Regulations* also apply to migratory bird sanctuaries.

There are three migratory bird sanctuaries in Newfoundland and Labrador: Shepherd Island; Île aux Canes; and Terra Nova. Shepherd Island and Île aux Canes are located off the coast of Newfoundland's Northern Peninsula and outside the RAA. The Terra Nova sanctuary is in the estuarian waters of Terra Nova National Park in Bonavista Bay and is within the RAA (Figure 6.30). Table 6.23 lists the migratory bird sanctuaries and their proximity to the Project Area.

Table 6.23 Migratory Bird Sanctuaries and their Proximity to the Project Area

Migratory Bird Sanctuary Name	Rational for Protection	Area (km^2)	Distance to Project Area (km)	Within RAA
Terra Nova	Designated in 1967 to protect an area adjacent to Terra Nova National Park used by approximately 30 shorebird, waterfowl, and seabird species. It is an important sanctuary during fall migration. Shorebirds frequent the tidal flats during summer and early fall. Newman Sound is an important area for waterfowl species year-round.	12	298	Yes
Shepherd Island	Designated in 1991 to protect one of the largest breeding sites (together with Île aux Canes) for common eider in insular Newfoundland.	0.18	369	No
Île aux Canes	Designated in 1991 to protect nesting colonies of common eider. Together with Shepherd Island, it is one of the largest breeding sites for the common eider in insular Newfoundland.	1.62	365	No

6.4.1.6 Other Federal Designated Special Areas that are Defined, but Not Protected

Ecologically and Biologically Significant Areas

EBSAs are identified by DFO to emphasize marine areas with high ecological or biological activity relative to their surrounding environment (DFO 2005). In total, there are 25 EBSAs within Newfoundland and Labrador Shelves Bioregion, and 11 that are inside the PB / GB IMA. The Project Area overlaps with only one EBSA: the Orphan Spur EBSA (4,688 km^2 co-occurrence, or 22% of the total area of the Orphan Spur EBSA). The RAA contains portions of 14 EBSAs, six of which are completely contained within the boundary of the RAA (Figure 6.30). A list of EBSAs in the NL Shelves Bioregion and their proximity to the Project Area are provided in Table 6.24. Further information on the reasons for designation of each EBSA that is within the RAA can be found in Table 6.25. The EBSAs are ordered in the table based on proximity to the Project Area (from closest to furthest).

Table 6.24 EBSAs and their Proximity to the Project Area

EBSA Name	Total Area (km²)	Nearest Distance to Project Area (km)	Within RAA
Orphan Spur	21,569	Within	Yes
Northeast Shelf and Slope	13,885	60	Yes
Notre Dame Channel	6,222	145	Yes
Labrador Slope	29,746	188	Yes
Fogo Shelf	9,403	191	Yes
Grey Islands	11,301	268	Yes
Labrador Marginal Trough	16,952	271	Yes
Virgin Rocks	6,843	282	Yes
Eastern Avalon	36	303	Yes
Smith Sound	7	303	Yes
Placentia Bay Extension	7,693	360	Yes
Lilly Canyon - Carson Canyon	120	367	Yes
Gilbert Bay	359	395	No
Southeast Shoal and Tail of the Banks	30,935	434	Yes
Hamilton Inlet	11,038	439	No
Burgeo Bank	1,952	584	No
Southwest Shelf Edge and Slope	16,644	602	Yes
St. Pierre Bank	5,482	606	No
Lake Melville	3,071	616	No
Laurentian Channel and Slope	17,140	651	No
Hopedale Saddle	27,418	698	No
Outer Shelf Nain Bank	7,477	842	No
Nain Area	6,055	890	No
Outer Shelf Saglek Bank	24,729	1,089	No
Northern Labrador	20,002	1,127	No

Table 6.25 EBSAs Within the RAA

EBSA Name	Rationale for Designation
Orphan Spur	High concentrations of corals. Densities of sharks and species of conservation concern (e.g., northern, spotted, and striped wolffish, skates, roundnose grenadier, American plaice, redfish).
Northeast Shelf and Slope	High aggregations of Greenland halibut and spotted wolffish, which congregate in spring. Concentrations of cetaceans, pinnipeds, and corals.
Notre Dame Channel	Recognized for cetacean feeding and migration. Frequented by several species of seabirds. Harp seals feed in the area during winter.
Labrador Slope	High diversity of corals, sponges, rare or endangered species. Rare or endangered species: Atlantic, spotted, and northern wolffish. Significant concentrations of roundnose grenadier, skates, northern shrimp, Greenland halibut, redfish, Atlantic cod, and American plaice.
Fogo Shelf	Funk Island, the largest common murre colony in the western North Atlantic and the only northern gannet breeding colony in the Newfoundland and Labrador Shelves Bioregion. Other bird species aggregations. Abundance of beach and sub-tidal capelin spawning areas. Important cetacean feeding areas. Several areas of marine mammals' presence.
Grey Islands	Important for waterfowl and seabirds in coastal areas and on the shelf. Common eider and harlequin duck occur in high concentrations. Important breeding colonies for great black-backed gulls, herring gulls, and terns. High diversity of seabird species that aggregate along the inner shelf area.
Labrador Marginal Trough	High densities of shrimp, snow crab, Greenland halibut, American plaice, witch flounder, and capelin. Potential corridor for several fish and mammal species. Part of the highest probability of use for harp seal whelping and feeding. Aggregations of plankton piscivores, and small and medium benthivores. Aggregations of cetaceans in summer and fall. Important for seabirds including murres, black-backed kittiwake, great black-backed gull, herring gull, northern fulmar, Atlantic puffin, skuas, jaegers, sooty shearwater, and the SARA-listed Ivory Gull.
Virgin Rocks	High aggregations of capelin and other spawning groundfish such as Atlantic cod, American plaice, and yellowtail flounder. Seabird feeding areas. Unique geological features and habitat.
Eastern Avalon	Seabird feeding areas. Cetaceans, leatherback turtles, and seals feed in the area from spring to fall.
Smith Sound	Atlantic cod use the area for spawning and nursery grounds and as an overwintering refuge.
Placentia Bay Extension	High level of biodiversity. Supports important seabird breeding areas and a high biomass of birds and mammals. High aggregation of cetaceans and leatherback sea turtles in the spring and summer. Otters and harbour seals use area year-round. Important feeding area from spring to fall for many seabird species and cetaceans (especially humpbacks and porpoises). Important for reproduction of many seabird species, harbour seals and otters. Possible migratory path for leatherback turtles.
Lilly Canyon - Carson Canyon	Concentration, reproduction and feeding area for Iceland scallop. Aggregation and refuge / overwintering for cetaceans and pinnipeds.
Southeast Shoal and Tail of the Banks	Highest benthic biomass in the Grand Banks; aggregation, feeding, breeding, and/or nursery habitats for capelin, yellowtail, American plaice and Atlantic cod and cetaceans and seabirds, Area of reproduction of striped wolffish. Unique populations of species. Unique sandy habitat with important glacial history.

EBSA Name	Rationale for Designation
Southwest Shelf Edge and Slope	Critical to a wide variety of seabirds, providing the highest density of pelagic seabird feeding within the PB / GB IMA. Many marine mammals and leatherback sea turtles aggregate in summer.
DFO (2013c, 2016b); Amec (2014)	

Significant Benthic Areas (SBAs)

Significant Benthic Areas (SBAs) are defined in DFO's Ecological Risk Assessment Framework (ERAF) as "significant areas of cold-water corals and sponge dominated communities" (DFO 2013c). The SBAs were determined using a kernel density estimation, a quantitative analyses technique applied to research vessel data to identify sponge, coral, and sea pen catches (Kenchington et. al. 2016). The taxa used in the analyses are those identified by NAFO as indicator species for Vulnerable Marine Ecosystems (VMEs) (see Section 6.4.3.2 for further information on NAFO VMEs). These areas are not protected; however, they identify key marine species distribution and may indicate areas of future restoration activities. The SBAs for the Newfoundland Shelves Bioregion are presented in Figure 6.5 (Section 6.1.6). As noted in Section 6.1.6, there is a designated SBA for sea pens that encompasses the edge of the Northeast Newfoundland Shelf, including the far western portion of the Project Area and EL 1145, and small portions of ELs 1146 and 1148 (Figure 6.5). There are additional SBAs for small and large gorgonians surrounding the Project Area along the Northeast Newfoundland Slope.

6.4.2 Provincial Designations and Their Management

There are seven types of protected areas that are managed by the Government of Newfoundland and Labrador; all are managed under the Newfoundland and Labrador Department of Municipal Affairs and Environment by the Parks and Natural Areas Division or the Wildlife Division. Table 6.26 lists the seven types of protected areas in Newfoundland and Labrador.

Table 6.26 Parks and Natural Areas

Type	Division	Legislation	Count in NL
Public Reserve	Parks and Natural Areas Division	*Lands Act (1991)*	1
Provincial Park	Parks and Natural Areas Division	*Provincial Parks Act (1970)*	31
Ecological Reserve	Parks and Natural Areas Division	*Wilderness and Ecological Reserves Act (1980)*	20
Wilderness Reserve	Parks and Natural Areas Division	*Wilderness and Ecological Reserves Act (1980)*	2
Special Management Area	Parks and Natural Areas Division	*Lands Act (1991)*	1
Wildlife Reserve	Wildlife Division	*Wild Life Act (1970)*	3
Wildlife Park	Wildlife Division	*Wild Life Act (1970)*	1

In total, there are 59 provincial parks and protected areas. Ecological reserves are the only provincial special area type where portions of the marine environment are also included as part of the boundary and are therefore also protected under the Newfoundland and Labrador *Wilderness and Ecological Reserves Act (1980)*. These ecological reserves are protected to conserve important seabird species and their habitat (Table 6.27). The closest ecological reserve to the Project is Funk Island Ecological Reserve (199 km from Project Area). Four of the seven ecological reserves are within the RAA, including Funk Island, Baccalieu Island, Witless Bay, and Cape St. Mary's Ecological Reserves. The proximity of each ecological reserve to the Project Area is also presented in Table 6.27.

Table 6.27 Provincial Ecological Reserves and Proximity to the Project Area

Name	Area (km²)	Date Gazetted	Justification for Protection	Nearest Distance to Project Area (km)	Within RAA
Funk Island Ecological Reserve	5	8/18/1964	Funk Island Ecological Reserve is home to more than 1,000,000 common murres, making it the largest colony of common murre in the western North Atlantic.	199	Yes
Baccalieu Island Ecological Reserve	17	2/1/1991	Baccalieu Island Ecological Reserve contains the largest Leach's storm-petrel colony in the world and is the largest protected seabird island in the Province.	271	Yes
Witless Bay Ecological Reserve	29	8/18/1964	Witless Bay Ecological Reserve hosts North America's largest Atlantic puffin colony and the second largest Leach's storm-petrel colony in the world.	342	Yes
Hare Bay Islands Ecological Reserve	26	8/18/1964	Hare Bay Islands Ecological Reserve was created to protect breeding habitat of the common eider.	378	No
Cape St. Mary's Ecological Reserve	54	8/18/1964	Cape St. Mary's Ecological Reserve is one of the best and most accessible places in the world to see nesting seabirds.	449	Yes
Lawn Bay Ecological Reserve	4	7/17/2009	Lawn Bay Ecological Reserve is the only known location in North America where manx shearwaters (*Puffinus puffinus*) are known to breed. The reserve includes Middle Lawn Island, Colombier Island, and Swale Island.	519	No
Gannet Islands Ecological Reserve	22	8/18/1964	Gannet Islands Ecological Reserve protects the largest razorbill colony in North America. The reserve contains the largest and most diverse seabird breeding colony in Labrador.	528	No
Department of Fisheries and Land Resources, Government of Newfoundland and Labrador, 2018					

6.4.3 International Designations and Their Management

6.4.3.1 Vulnerable Marine Ecosystems

Vulnerable Marine Ecosystems (VMEs) are the generalized areas outside of the Canadian EEZ that describe benthic environments that are sensitive to bottom fishing (FAO 2016). The sensitivity of the environment is due to the presence of species (e.g., corals, sponges, and sea pens) or features that are unique and important for biodiversity (i.e., canyons and seamounts). VMEs are illustrated on Figure 6.30 as the region surrounding the colloquially-named bathymetric features (e.g., Knoll, Cap) or by the closure areas with the same name (Section 6.4.3.2). A description of each VME and the rationale for designation can be found in Table 6.28.

Table 6.28 VMEs in and around the Project Area

VME	Rationale for Designation as VME
Division 3O Coral Closure	Coral concentrations, high density of sea pens, and solitary stony corals. Vulnerable fish species include white hake, redfish, black dogfish, smooth skate, and deep-sea cat shark.
South East Shoal and Adjacent Shelf Edge / Canyons	Unique spawning grounds on South East Shoal, marine mammal feeding grounds, long-lived and relict bivalve populations in sandy shoal habitat. Vulnerable fish species include spawning capelin, northern wolffish, redfish, striped and spotted wolffish, roundnose grenadier, black dogfish.
Beothuk Knoll	Abundant gorgonian corals and high density of sponges. Vulnerable fish species include northern wolffish, spiny tailed skate, roundnose grenadier, deep-sea cat shark, black dogfish.
Southern Flemish Pass to Eastern Canyons	Large gorgonians and high density of sponges. Vulnerable fish species include striped wolffish, redfish, spiny tailed skate, northern wolffish, some black dogfish, deep-sea cat shark.
Flemish Cap East	Large gorgonians and high density of sponges. Vulnerable fish species include black dogfish and smooth skate.
Northern Flemish Cap	High density of sea pens, soft corals, and black corals and, to a lesser extent, solitary stony corals and small gorgonians. Vulnerable fish species include northern wolffish and spiny dogfish.
Sackville Spur	High density of sponges.
Northeast Shelf and Slope (within Canadian EEZ)	Abundance of gorgonian and black corals.
Deep Water Coral Area	An area where deep-water coral VMEs are considered likely.
WG-EAFM (2016); Statoil (2017)	

6.4.3.2 Vulnerable Marine Ecosystem Closure Areas

NAFO has identified defined areas within the general VME region that are closed to bottom fishing. VME closure areas are split into two groups: coral, sponge, and sea pen closures (n=15); and seamount closures (n=5). The nearest distance of the VMEs to the Project Area, along with other information, is provided in Table 6.29. The Orphan Knoll Seamount closure is the only one that overlaps with the Project Area (1.7 km², or <0.5% of the entire area of the Orphan Knoll closure). The New England Seamounts closure is the farthest away from the Project Area (1,435 km) and is located outside of the figure extent in the shelf area.

Table 6.29 NAFO VMEs and their Proximity to the Project Area

Name	Group	Total Area (km²)	Nearest distance to Project Area (km)	Intersects with RAA
Tail of the Bank	Coral, Sponge, and Sea Pen Closure	144	499	Yes
Flemish Pass / Eastern Canyon		5,418	175	Yes
Beothuk Knoll		309	309	Yes
Eastern Flemish Cap		1,368	272	Yes
Northeast Flemish Cap		2,898	150	Yes
Sackville Spur		992	24	Yes
Northern Flemish Cap		259	86	Yes
Northern Flemish Cap		98	75	Yes
Northern Flemish Cap		128	57	Yes
Northwest Flemish Cap		317	71	Yes
Northwest Flemish Cap		61	141	Yes
Northwest Flemish Cap		35	67	Yes
Beothuk Knoll		340	269	Yes
Eastern Flemish Cap		241	272	Yes
3O Coral Closure		14,057	640	Yes
Corner Seamounts	Seamount Closure	40,251	1,420	Yes
Fogo Seamounts 1		4,522	796	Yes
Fogo Seamounts 2		4,616	908	Yes
Newfoundland Seamounts		15,491	530	Yes
Orphan Knoll		15,817	0	Yes
New England Seamounts		178,306	1,435	No

6.4.4 Other Identified Marine Special Areas

There are several worldwide programs to which existing protected areas can be nominated or designated in order to heighten their presence as a protected area. Two of these programs include United Nations Educational, Scientific and Cultural Organization (UNESCO) world heritage sites program and BirdLife International's Important Bird Area (IBA) Program.

6.4.4.1 UNESCO Word Heritage Sites

In 1992, UNESCO adopted the Convention Concerning the Protection of the World Cultural and Natural Heritage, which recognizes outstanding cultural and natural heritage sites that hold value to humankind. There are four UNESCO World Heritage sites in Newfoundland and Labrador, including Red Bay Basque Whaling Station, L'Anse aux Meadows, Grose Morne National Park, and Mistaken Point Provincial Ecological Reserve. Mistaken Point Provincial Ecological Reserve is the only one within the RAA. The Mistaken Point Ecological Reserve is designated because of its seaside cliffs contain 580-560 million-year-old fossils. The fossils are believed to one of the largest collections, which represent the presence of complex organisms on Earth (UNESCO 2017). The provincial ecological reserve does not have any protected marine ecosystem components.

6.4.4.2 Important Bird Areas (IBAs)

In Canada, there are 597 IBAs identified as having worldwide, continental, or national significance. IBAs are discrete sites that support specific groups of birds: threatened birds; large groups of birds; and birds restricted by range or by habitat (IBA Canada 2018). Some of them are portions of Migratory Bird Sanctuaries or Provincial Ecological Reserves. In Newfoundland and Labrador, here are 41 IBAs. There are 12 IBAs that occur within the RAA. The 12 IBAs and their proximity to the Project Area are listed in Table 6.30. For more detailed information on the IBAs, please refer to Figure 6.25 (Section 6.2.5).

Table 6.30 Important Bird Areas in the RAA and their Proximity to the Project Area

IBA ID	Name	Total Area (km^2)	Nearest Distance to Project Area (km)
NF001	Cape St. Mary's	34	442
NF002	Witless Bay Islands	6	341
NF003	Baccalieu Island	5	270
NF004	Funk Island	14	194
NF013	Wadham Islands and adjacent Marine Area	16	242
NF015	The Cape Pine and St. Shotts Barren	6	433
NF017	Terra Nova National Park	66	284
NF019	Grates Point	7	273
NF021	Cape St. Francis	7	294
NF022	Quidi Vidi Lake	1	311
NF024	Mistaken Point	11	413
NF025	Cape Freels Coastline and Cabot Island	34	232

6.4.4.3 Other Protected Marine Areas (General)

As defined by the International Union for Conservation of Nature (IUCN), a marine protected area is “a clearly defined geographical space, recognized, dedicated, and managed, through legal or other effective means, to achieve the long-term conservation of nature with associated ecosystem services and cultural values” (IUCN 2017). These areas are protected marine areas, but they are not designated as *Oceans Act* MPAs. These areas include the marine ecosystem portion of the Migratory Bird Sanctuaries (Section 6.4.1.4) and the marine ecosystem portion of the provincial Ecological Reserves (Section 6.4.2).

6.4.4.4 Bonavista Cod Box

The Bonavista Cod Box (Figure 6.30) is an experimental closure area designated by the Fisheries Resource Conservation Council (FRCC). It is an important spawning and migration area for Atlantic cod, American plaice, and redfish (Amec 2014). It is closed to all fishing activity (excluding snow crab trapping), and seismic exploration. Although the FRCC was disbanded in 2011, the area defined as the restriction surrounding the Bonavista Cod Box are still adhered to by local fishery groups and other organizations.

6.4.5 Other Programs

There are other programs to which Canada is a participating member or signatory that designate special or sensitive marine areas. The programs and their objectives are listed in Table 6.31. There are no special areas with these designations within the RAA; however, the number of special areas with these designations continue to grow across Eastern Canada.

Table 6.31 Other Programs and their Objectives

Program Name	Objective
Convention on Wetlands of International Importance (Ramsar Convention)	Sustaining important wetland habitats throughout this network, including 169 countries.
Western Hemisphere Shorebird Reserve Network	Scientific network in North and South America to protect key habitats to sustain healthy populations of shorebirds
UNESCO World Biosphere Reserve Program	Provides international recognition to special places nominated by their national governments, for applying interdisciplinary approaches to managing interactions between social and ecological systems

6.5 References

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