Table of Contents

4	Biolo	ogical and Socioeconomic Environment	
4	.1	Plankton	4-2
4	.2	Benthos	4-3
4	.3	Deep-water Corals and Sponges	4-4
4	.4	Fish	4-4
	4.4.1	1 Fish Migration	4-24
	4.4.2	2 Species at Risk	4-24
4	.5	Seabirds and Migratory Birds	4-26
	4.5.1	1 Seabird Distribution and Abundance	4-26
	4.5.2	2 Important Bird Areas and Seabird Colony Sites	4-38
4	.6	Marine Mammals and Sea Turtles	4-40
	4.6.1	1 Marine Mammals	4-40
	4.6.2	2 Sea Turtles	4-40
	4.6.3	3 Species at Risk	4-40
4	.7	Sensitive and Protected Areas	4-44
	4.7.1	Ecologically and Biologically Significant Areas (EBSAs)	4-44
	4.7.1	1.1 EBSAs within the Study Area	4-45
	4.7.2	2 Other Protected Areas	4-47
4	.8	Fisheries and other Ocean Users	4-47
	4.8.1	1 Commercial Fisheries	4-47
	4.8.1	1.1 Commercial Fishing Locations and Effort	4-47
	4.8.1	1.2 Commercial Fish Species	4-56
	4.8.1	1.3 Commercial Fishing Gear	4-64
	4.8.1	1.4 Sealing	4-64
	4.8.2	2 Aquaculture	4-68
	4.8.3	3 Shipping	4-68
	4.8.4	4 Unexploded Ordnance	4-68
4	.9	Summary of Sensitivities	4-70

List of Figures

Figure 4.1. High Density Area and Protection Zones for Corals Seamounts and Sponges	4-5
Figure 4.2. Canadian RV American Plaice Number per Tow (Canadian RV Surveys, 2010-2014)	4-9
Figure 4.3. Canadian RV Atlantic Cod Number per Tow (Canadian RV Surveys, 2010-2014)	4-10
Figure 4.4. Canadian RV Broadhead Wolffish Number per Tow (Canadian RV Surveys, 2010-2014)	4-11
Figure 4.5. Canadian RV Capelin Number per Tow (Canadian RV Surveys, 2010-2014)	4-12
Figure 4.6. Canadian RV Greenland Halibut Number per Tow (Canadian RV Surveys, 2010-2014)	4-13





Figure 4.36. Commercial Fishing Locations for all Species 2010-2014 (August) (DFO Catch L	andings 2010 to 2014).4-52.
Figure 4.37. Commercial Fishing Locations for all Species 2010-2014 (September) (DFO Ca	atch Landings 2010 to 2014) 4-53
Figure 4.38. Commercial Fishing Locations for all Species 2010-2014 (October) (DFO Catch 54	Landings 2010 to 2014)4-
Figure 4.39. Commercial Fishing Locations for all Species 2010-2014 (November) (DFO Ca	tch Landings, 2010 to 2014) 4-55
Figure 4.40. Most Landed Species by Percentage of Weight (kg) across NAFO Divisions 3 2010 to 2014)	KLMN (DFO Catch Landings, 4-56
Figure 4.41. Most Landed Species by Percentage of Value (CAD \$) across NAFO Divisions 3 2010 to 2014)	KLMN (DFO Catch Landings, 4-57
Figure 4.42. Key Fisheries (American Plaice) 2010-2014 May to November (DFO Catch Land	dings 2010 to 2014)4-58
Figure 4.43. Key Fisheries (Crab Queen-Snow) 2010-2014 May to November (DFO Catch La	andings 2010 to 2014)4-59
Figure 4.44. Key Fisheries (Northern Shrimp) 2010-2014 May to November (DFO Catch Lar	ndings 2010 to 2014)4-60
Figure 4.45. Key Fisheries (Redfish) 2010-2014 May to November (DFO Catch Landings 201	10 to 2014)4-61
Figure 4.46. Key Fisheries (Turbot - Greenland Halibut) 2010-2014 May to November (D 2014)	PFO Catch Landings 2010 to
Figure 4.47. Key Fisheries (Yellowtail Flounder) 2010-2014 May to November (DFO Catch I	andings 2010 to 2014) 4-63
Figure 4.48. Fish Harvests using Fixed Gear Types 2010-2014 (May to November)	4-65
Figure 4.49. Fish Harvests using Mobile Gear Types 2010-2014 (May to November)	4-66
Figure 4.50. Department of Fisheries and Oceans Sealing Areas	4-67
Figure 4.51. Unexploded Ordinance, Shipwrecks, and Disposal Sites (DND, 2016)	4-69

List of Tables

Table 4.1. Baseline Data Updated Since the Eastern Newfoundland SEA (August, 2014).	4-1
Table 4.2. Coral Occurrence within the Eastern Newfoundland Offshore Area (Murillo et al., 2012)	4-6
Table 4.3. Species Selection Rationale (Canadian RV Surveys, 2010-2014)	4-7
Table 4.4. Marine Fish Species at Risk within the Eastern Newfoundland Offshore Area (C-NLOPB, 2014)	.4-25
Table 4.5. Bird Species at Risk within the Eastern Newfoundland Offshore Area (C-NLOPB, 2014)	.4-37
Table 4.6. Marine Mammal and Turtle Species at Risk that are Known to or May Occur within the Study Area NLOPB, 2014)	э (С- .4-44
Table 4.7. Landings Data for the NAFO Divisions 3KLMN ((DFO Catch Landings, 2010 to 2014)	.4-56
Table 4.8. Summary of Sensitivities in the Eastern Newfoundland Offshore Area	.4-70



4 Biological and Socioeconomic Environment

The biological and socioeconomic environment within the vicinity of the proposed survey is described in the Eastern Newfoundland Offshore Area SEA (*AMEC*, 2014). In order to provide context for the survey and the information to inform the environmental impact assessment (Section 5), this chapter provides a summary of the biological and socioeconomic characteristics described within the Eastern Newfoundland Offshore Area SEA, and incorporates new information from recent studies within the region. Table 4.1 below demonstrates where updated baseline data has been included in this report.

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

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



Data	Section	Eastern Newfoundland SEA (August, 2014)	Polarcus Project- Based EIA	Data Source
Ecologically and biologically sensitive areas (EBSAs) (Section 4.7.1)	4.7.1	DFO (2007 – 2013)	DFO (2007, 2013); CBD (2016)	Fisheries and Oceans Canada; Convention on Biological Diversity
Distribution of other species of commercial importance (DFO Research Vessel (RV) Fisheries Surveys) (Section 4.8.1)	4.8.1.1	2005-2009	2010-2014	Fisheries and Oceans Canada Research Vessel (RV) Fisheries surveys conducted spring and fall, offshore Newfoundland by the Fisheries and Oceans Canada.
DFO Fisheries catch data by weight and value (Section 4.8.1)	4.8.1.2	2008-2012	2010-2014	Fisheries landings (catch) data analysed by Fisheries and Oceans Canada Ottawa
DFO Commercial fishing locations (Section 4.8.1.1)	4.8.1.2	2008-2012	2010-2014	Fisheries landings (catch) data analysed by Fisheries and Oceans Canada Ottawa
DFO Key fisheries landed by species (Section 4.8.1.2)	4.8.1.2	2008-2012	2010-2014	Fisheries landings (catch) data analysed by Fisheries and Oceans Canada Ottawa
DFO Fish harvests by gear types (Section 4.8.1.3)	4.8.1.3	2008-2012	2010-2014	Fisheries landings (catch) data analysed by Fisheries and Oceans Canada Ottawa
Sealing (Section 4.8.1.4)	4.8.1.4	2011-2013	2015	Fisheries and Oceans Canada
Shipwrecks, UXO (Section 4.8.4)	4.8.4	2013	2016	The Department of National Defence

4.1 Plankton

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

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

Generally, the waters of the Northwest Atlantic experience a spring and autumn bloom in plankton. Previous research indicates that the dominant phytoplankton bloom occurs in the Northwest Atlantic



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

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

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

4.2 Benthos

Benthic fauna forms an important part of the marine ecosystem, providing a food source for other invertebrates and fish as well as cycling nutrients and materials between the water column and underlying sediments. The benthos is made up of diverse species which are relatively long-lived and sedentary, and which exhibit different tolerances to stress, making them useful indicators of environmental conditions. The benthic invertebrate communities of Eastern Newfoundland are described in the Eastern Newfoundland Offshore Area SEA. The SEA found that benthic communities in the Study Area are quite diverse compared to higher trophic levels, depending on species and habitat type, and these communities can be expected to vary over time and with changing environmental conditions (*LGL 2012& 2013; Kenchington et al., 2001*).

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



An overview of the ecology and distribution of key invertebrate species within the Study Area is presented in Table A.1 of Appendix A.

4.3 Deep-water Corals and Sponges

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

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

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

4.4 Fish

This section gives an overview of key marine fish species occurring within the Study Area. A large number (approximately 188) and variety of marine fish species are known to occur in Newfoundland and Labrador waters (*Templeman, 2010*). Faunal assemblages offshore Newfoundland are influenced by temperature and depth, but they can change across relatively short distances because of the varying prominence of cold (Labrador Current) and warm currents (Gulf Stream) as well as depth and habitat complexity (*Houston and Haedrich, 1984; Schneider et al., 1987; Baker et al., 2012*).

Within the Study Area, the southwest edge of the Grand Banks has many species that are found near the northern extent of their range (e.g. white hake, argentine, silver hake, Atlantic halibut, longfin hake, butterfish, billfish). In contrast, the northern portion of the Grand Banks away from the shelf edge is perpetually cold at the seabed, and is inhabited by species typically found further north (e.g. Arctic sculpin, Arctic cod, northern shrimp and snow crab). Yellowtail flounder, sea ravens and longhorn sculpin, are associated with the shallows of the region (40 to 100 metres) *(Gomes et al., 1992; Baker et al., 2012)*.

An overview of the key groundfish and pelagic species found within the Study Area are presented in Tables A.2 and A.3 respectively in Appendix A. The number of species recorded per tow with data from the DFO research vessel surveys of NAFO Divisions 2J3KLNOPs, during spring and fall 2010 to 2014, is presented in Figures 4.2 to 4.16. The data is standardized to tows of 15 minute duration.





Figure 4.1. High Density Area and Protection Zones for Corals Seamounts and Sponges



Table 1 2	Coral Occurrence within	n the Factorn New	ufoundland Offsh	oro Aroa I	(Murillo et al 201	2)
TUDIC 4.2.	corur occurrence within	I THE LUSTERN WE	vjounulullu Ojjsin	ore Areu j	Wiulino et ul., 201	<u> </u>

		Order / Species																																				
		Alcyonacea															Pennatulacea									Ant	ipath	aria	Sclera- ctinia		Total Species							
Area	Alcyonacea indet.	Clavulariidae indet.	Telestula septentrionalis	Anthomastus spp.	Anthomastus sp.	Duva florida	Gersemia rubiformis	Nephtheidae indet.	Anthothela grandiflora	Paragorgia arborea	Paragorgia johnsoni	Acanthogorgia armata	Paramuricea sp.	Paramuricea spp.	Placogorgia sp.	Swiftia sp.	Radicipes gracilis	Acanella arbuscula	Keratoisis sp.	Parastenella atlantica	Primnoa resedaeformis	Kophobelemnon stelliferum	Funiculina quadrangularis	Distichoptilum gracile	Protoptilum sp.	Umbellula lindahli	Anthoptilum grandiflorum	Halipteris finmarchica	Halipteris cf. christii	Virgularia sp.	Pennatula aculeata	Pennatula grandis	Stichopathes sp.	Leiopathes sp.	Stauropathes arctica	Desmophylllum dianthus	Flabellum alabastrum	
Flemish Cap	x	x	x	x	x	x		x	x		x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	х	x	x		x	х	x	34
Flemish Pass				x	x	x	x	x		x		x		x			x	x	x				x	x		x	x	x			x	x		x	x	x	x	22
Grand Banks		x		x	x	x	x	x									x	x	x				x	x		x	x	x			x	x		x	x	x	x	17
North-eastern Slope						x		x		x				x				x			x						x				x	x			x		x	11



The species mapped in this section were determined by aggregating the results across all surveys from the entire survey period (2010 to 2014) and then ranking the species based on abundance, and weight (Table 4.3). Species at risk were also considered.

Top 10 Species by Abundance	Top 10 Species by Biomass	Species at Risk / Species Concern
Redfish	Redfish	Broadhead Wolffish
Capelin	Yellowtail flounder	Striped Wolffish
Sandlance	Atlantic cod	Spotted Wolffish
American plaice	American Plaice	
Yellowtail flounder	Thorny Skate	
Greenland halibut	Greenland Halibut	
Silver hake	Capelin	
Atlantic cod	Sandlance	
Lantern fish	Silver hake	
Moustache sculpin	Roughhead Grenadier	

 Table 4.3. Species Selection Rationale (Canadian RV Surveys, 2010-2014)

The maps give a characterization of species abundance and distribution within the Study Area, however, there are coverage gaps in some surveys due to lost time as a result of weather and/or vessel delays. The fall 2014 survey extended into early January 2015 as a result of weather and vessel delays (B. Healey, pers. comm. 2016). In addition, the survey extent does not cover the full Study Area, particularly deep water, and a limited number of taxa have been represented. Further, due to the mobile nature of the species surveyed, the lack of a record during surveying may not necessarily indicate absence within a given region of the Study Area.

American plaice have a preference for temperatures from just below 0 to 1.5 degrees Celsius and for depths between 90 to 250 metres (*Scott and Scott, 1988*). The species is widely distributed on the Newfoundland shelf, and has been recorded across the southwest and northwest edges of the Study Area (Figure 4.2). American plaice is a commercially significant species within the region (refer to Section 4.8.1). The Newfoundland and Labrador population of American Plaice has COSEWIC status (refer to Section 4.4.2).

Atlantic cod are generally found in waters from inshore regions to the edge of the continental shelf. The species occurs throughout the Canadian Atlantic Area, and has been recorded within the Flemish Pass and across the southwest and northwest edges of the Study Area (Figure 4.3). The Newfoundland and Labrador population of Atlantic cod has COSEWIC status (refer to Section 4.4.2), and is a commercially significant species within the region (refer to Section 4.8.1).

Broadhead wolffish are not common with the Study Area. During the Canadian RV Surveys, broadhead wolfish were only recorded in low number (0 to 2 fish per tow) across the southwest and northwest of the Study Area, with a few smaller, more concentrated species recordings (2 to 50 fish per tow) recorded in the south and west of the Study Area (Figure 4.4).

The largest concentrations of capelin in Canadian waters are found off Newfoundland and the Labrador Coast (*Scott and Scott, 1988*), with high concentrations recorded within the southwest of the Study Area (Figure 4.5). Over 200 capelin per tow were recorded during Canadian RV Surveys between 2010 and 2014. Capelin are a commercially significant species (refer to Section 4.8.1).



Greenland halibut occupy an extensive depth range from approximately 200 metres to 2,200 metres, and are distributed across areas of the Grand Banks and Flemish Pass (*Morgan et al., 2013*). Greenland halibut are a commercially significant species (refer to Section 4.8.1), and have been recorded within the south west and northwest edges of the Study Area (Figure 4.6).

Lantern fish are a deep pelagic fish, generally occurring at depths of 300 to 1,200 metres during the day and migrating to surface waters at night. The species has been recorded in low numbers in the west of the Study Area, with higher concentrations within the Flemish Pass (Figure 4.7).

Moustache sculpin occur from shallow to deep water, and are an important forage fish species in the region. Moustache sculpin have been recorded in low numbers in the south west of the Study Area (Figure 4.8).

Redfish are both a bottom-dwelling and semi-pelagic species and are of commercial significance offshore Newfoundland (refer to Section 4.8.1). Redfish have been recorded in high numbers (0 to >2,000 fish per tow) in the south and west of the Study Area, particularly through the Flemish pass (Figure 4.9).

Roughhead grenadier mainly inhabit deep water between 600 and over 1,000 metres (*Edinger et al., 2007*). The species are often associated with large gorgonian and antipatharian corals and soft corals (*Edinger et al., 2007*). The Atlantic population of roughhead grenadier has COSEWIC status (refer to Section 4.4.2), and is a commercially significant species (refer to Section 4.8.1). Within the Study Area, roughhead grenadier have been recorded in low numbers (2 to 50 fish per tow) in the northwest and southwest, particularly through the Flemish Pass (Figure 4.10).

Sand lance occur on sandy or fine gravel bottoms at offshore depths less than 91 metres (*Scott and Scott, 1988*). The species has been recorded across the south west region of the Study Area in numbers over 2000 fish per tow (Figure 4.11).

Silver hake are not common in the Study Area. During the Canadian RV tows, only zero to two silver hake were recorded per tow in the south and west of the Study Area, with slightly higher numbers (2 to 50) recorded within a small area of the Flemish Pass (Figure 4.12).

Spotted wolffish usually occur at temperatures of one to six degrees Celsius (*Simpson et al., 2012*). Spotted wolfish have been recorded in low numbers (0 to 2 fish per tow) within the south west of the Study Area. Localized patches of higher numbers (2 to 50 fish per tow) have also been recorded in this region (Figure 4.13). The species is not commercially significant, and mandatory live-release is required when captured as bycatch. The Atlantic population of spotted wolffish has SARA and COSEWIC status (refer to Section 4.4.2).

Striped wolfish have been recorded in the southwest of the Study Area, with numbers ranging from 0 to 50 fish per tow. The higher concentrations have been recorded through the Flemish Pass (Figure 4.14).

Thorny skate live offshore on hard and soft bottoms at depths of approximately 18 to 966 metres and at temperatures of -1.4 to 14 degrees Celsius (*Scott and Scott, 1988*). The Atlantic population of thorny skate has COSEWIC status (refer to Section 4.4.2). The commercially significant species (refer to Section 4.8.1), has been recorded in low to medium numbers (0 to 250 fish per tow) within the southwest region of the Study Area (Figure 4.15).

Yellowtail flounder inhabit mud or mud-sand bottoms, particularly across the Grand Banks region (*Scott and Scott, 1988*). Yellowtail flounder are a commercially significant species (refer to Section 4.8.1). Yellow flounder have been recorded in varying numbers (0 to >2000 fish per tow) within the extreme southwest of the Study Area (Figure 4.16).





Figure 4.2. Canadian RV American Plaice Number per Tow (Canadian RV Surveys, 2010-2014)





Figure 4.3. Canadian RV Atlantic Cod Number per Tow (Canadian RV Surveys, 2010-2014)





Figure 4.4. Canadian RV Broadhead Wolffish Number per Tow (Canadian RV Surveys, 2010-2014)





Figure 4.5. Canadian RV Capelin Number per Tow (Canadian RV Surveys, 2010-2014)





Figure 4.6. Canadian RV Greenland Halibut Number per Tow (Canadian RV Surveys, 2010-2014)





Figure 4.7. Canadian RV Lantern Fish Number per Tow (Canadian RV Surveys, 2010-2014)





Figure 4.8. Canadian RV Moustache Sculpin Number per Tow (Canadian RV Surveys, 2010-2014)





Figure 4.9. Canadian RV Redfish Number per Tow (Canadian RV Surveys, 2010-2014)





Figure 4.10. Canadian RV Roughhead Grenadier Number per Tow (Canadian RV Surveys, 2010-2014)





Figure 4.11. Canadian RV Sand Lance Number per Tow (Canadian RV Surveys, 2010-2014)





Figure 4.12. Canadian RV Silver Hake Number per Tow (Canadian RV Surveys, 2010-2014)





Figure 4.13. Canadian RV Spotted Wolffish Number per Tow (Canadian RV Surveys, 2010-2014)





Figure 4.14. Canadian RV Striped Wolffish Number per Tow (Canadian RV Surveys, 2010-2014)





Figure 4.15. Canadian RV Thorny Skate Number per Tow (Canadian RV Surveys, 2010-2014)





Figure 4.16. Canadian RV Yellowtail Flounder Number per Tow (Canadian RV Surveys, 2010-2014)



4.4.1 Fish Migration

Fish migration on the Newfoundland Shelf and within the Study Area is discussed within the Eastern Newfoundland SEA. One general migration pattern, exhibited by fish species such as capelin and Atlantic cod, entails a migration to shallow coastal areas in summer from offshore wintering habitats in deep warm water along the continental shelf edge (*Shackell et al., 1994; Carscadden et al., 1997*). Atlantic cod, a key predator of capelin, follow their prey to coastal areas in spring and summer and return to warm deep waters along the continental shelf in the fall where they eventually spawn during winter and spring (*Lear and Green, 1984; Hutchings et al., 1993; Rose et al., 2013*).

Highly migratory pelagic species such as tunas, swordfish migrate northward to feed in productive northern waters of the Study Area during the summer. The Southern Grand Banks area is likely to experience more use by migrating pelagics such as tuna, which are less likely to occur in more northerly areas of the Study Area (*Rose et al., 2013*).

Anadromous species such as Atlantic salmon migrate from oceanic feeding grounds in the northwest Atlantic to freshwater habitats to spawn. Migration pathways are region-specific but Atlantic salmon from Newfoundland pass through the Study Area between January and to April on their journey to and from spawning grounds (*Lear, 1976; Reddin, 1985*). Redfish, witch flounder, wolffish and Greenland halibut have also known to undertake coastal migrations in the region of the Study Area (*Templeman, 2007; Bowering and Chumakov, 1989*).

4.4.2 Species at Risk

The Newfoundland and Labrador Endangered Species Act (NL ESA) provides protection for indigenous species, sub-species and populations considered to be; Endangered (facing imminent extirpation or extinction), Threatened (likely to become endangered if nothing is done to reverse the factors leading to its extirpation or extinction), or Vulnerable (has characteristics which make it particularly sensitive to human activities or natural events).

The Canadian Species at Risk Act (SARA) provides protection to species at the national level via four designations under Schedule 1; Extirpated (no longer exists in the wild in Canada, but exists in the wild elsewhere), Endangered (facing imminent extirpation or extinction), Threatened (likely to become endangered if nothing is done to reverse the factors leading to its extirpation or extinction), and Special Concern (may become threatened or endangered because of a combination of biological characteristics and identified threats). The SARA aims to prevent extinction and extirpation, facilitate the recovery of endangered and threatened species, and to promote the management of other species to prevent them from becoming at risk in the future. Section 79 of SARA is concerned with the adverse effects of a project on listed wildlife species. Further, Section 36(3) of the Fisheries Act is concerned with the pollution of water frequented by fish.

Species in the Study Area which have been identified as a conservation concern under NL ESA or SARA and/or regionally rare by conservation bodies such as COSEWIC (Committee on the Status of Endangered Wildlife in Canada) or the IUCN (International Union for the Conservation of Nature) are identified in Table 4.4.



														Specie	es												
Designatio	n	American Eel Anguilla rostrata (AP)	White Shark Carcharodon carcharias (AP)	Northern Wolffish Anarhichas denticulatus (AP)	Spotted Wolffish Anarhichas minor (AP)	Atlantic Wolffish Anarhichas lupus (AP)	Bluefin Tuna <i>Thunnus thynnus</i> (AP)	Atlantic Cod Gadus morhua (NL)	Cusk Brosme brosme (AP)	Roundnose Grenadier Coryphaenoides rupestris (AP)	Porbeagle Lamna nasus (AP)	Smooth Skate Malacoraja senta (FL)	Spiny Dogfish Squalus acanthias (AP)	Shortfin Mako Isurus oxyrinchus (AP)	American Plaice Hippoglossoides platessoides (NL)	Acadian Redfish Sebastes fasciatus (AP)	Deepwater Redfish Sebastes mentella (NP)	Atlantic Salmon Salmo salar ((NW, SN, SW)	Roughhead Grenadier <i>Macrourus berglax</i> (AP)	Basking Shark <i>Cetorhinus maximus</i> (AP)	Blue Shark <i>Prionace glauca</i> (AP)	Thorny Skate Amblyraja radiata (AP)	Winter Skate Leucoraja ocellata (GB)	Barndoor Skate Dipturus laevis (AP)	Albacore Tuna Thunnus alalunga (AP)	Bigeye Tuna <i>Thunnus obesu</i> s (AP)	Total Species
	EN																										0
NL ESA	тн																										0
	VU	x																									1
	EN		x																								1
SARA Status	н			x	x	~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~																					2
	SC ENI		v			X	v	v	v	v	v	v															1 7
COSEWIC	ТН	x	^	x	x		^	^	^	^	^	^		x	x	x	x	x									, 8
	SC					x							x						x	x	x	x	x				7
	EN						x					x				x							x	x			5
	VU		x					х			x		x	x						x		x				x	8
IUCN	NT																				x				x		2
	LC																x	x									2

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

Classification: EN = Endangered TH = Threatened VU = Vulnerable SC = Special Concern NT = Near Threatened LC = Least Concern

Population: AP = Atlantic Population NL= Newfoundland and Labrador Population FI= Funk Island Population GB= Georges Bank-Western Scotian Shelf-Bay of Fundy Population NP= Northern Population NW= Northwestern Newfoundland Population SN= Southern Newfoundland Population SW= Southwestern Newfoundland Population SW= Southwestern Newfoundland Population



4.5 Seabirds and Migratory Birds

Seabirds occurring in the marine waters off Eastern Newfoundland include alcids, cormorants, fulmars, shearwaters, gannets, gulls, jaegers and skuas, phalaropes, storm-petrels, terns, loons, and grebes.

Data provided by Environment Canada (*ECSAS, 2015*) for the years 2006 to 2015 is presented below to provide updated information on seasonal and spatial trends in abundance for seabird groups commonly observed in the SEA Study Area. These are only sightings, and sighting efforts, that were observed while the ship was moving, within transect, and not following the ship. Although these data cannot be used to calculate densities (*Fifield et al., 2009*) they do provide updated representations of seasonal and spatial trends in abundance (C. Gjerdrum, pers. comm. 2015).

An overview of key bird species and their distribution within the Study Area is given in Figures 4.17 to 4.27. A summary of the ecology and habitat of key bird species within the Study Area is provided in Table A.4 of Appendix A.

A number of marine bird species recorded within the Study Area are recognized as being at risk Table 4.5). Several species are protected under SARA and/or the Newfoundland and Labrador Endangered Species Act. Further, migratory birds, their eggs, and young are protected in Newfoundland under the Migratory Birds Convention Act (MBCA). Under the Migratory Birds Regulations (MBR) it is forbidden to disturb or harm a migratory bird or its nest.

4.5.1 Seabird Distribution and Abundance

The nutrient-rich Grand Banks provide an extremely important feeding area for seabirds, and tens of millions of these birds, representing numerous species, nest off Eastern Newfoundland (*Russell and Fifield, 2001a,b; Fifield et al., 2009*). Most seabird nesting in the area takes place on islands off the coast, inaccessible mainland cliffs, or on sandy beaches and peninsulas, and therefore takes place outside of the Study Area itself, however, seabirds will travel offshore to feed. Some species arrive at the colonies as early as February (Black-legged Kittiwakes) and March (Northern Gannet), and egg-laying commences in mid to late May and into June. The young of most species depart the colony by July to August, and as late as November for Northern Gannets.

Alcid seabirds are present within the Study Area throughout the year, with most sightings recorded during the summer and winter (Figure 4.17). Conversely, cormorant species are recorded only during the summer months within the Study Area, with only a few uncharacteristic sightings during the winter months (Figure 4.18).

Fulmar, shearwaters, and gulls have been sighted in all seasons across the Study Area (Figure 4.19 and Figure 4.20 respectively). Gannets, jaegers, and skuas have also been recorded throughout the year across the Study Area, albeit much less frequently (Figure 4.21 and Figure 4.22 respectively).

Phalarope seabirds have only been recorded, very infrequently, in the Study Area during the fall (Figure 4.23), while terns have not been recorded within the Study Area during any month (Figure 4.24).

Storm Petrels have been most commonly sighted in the Study Area during summer; however have been recorded in lower frequencies all year round (Figure 4.25). Waterfowl loon and grebe seabirds have only been recorded during the fall and winter within the Study Area (Figure 4.26).





Figure 4.17. Alcid Seasonal Distribution (Environment Canada, 2006-2015)





Figure 4.18. Cormorant Seasonal Distribution (Environment Canada, 2006-2015)





Figure 4.19. Fulmar and Shearwater Seasonal Distribution (Environment Canada, 2006-2015)





Figure 4.20. Gull Seasonal Distribution (Environment Canada, 2006-2015)





Figure 4.21. Gannet Seasonal Distribution (Environment Canada, 2006-2015)





Figure 4.22. Jaeger and Skua Seasonal Distribution (Environment Canada, 2006-2015)





Figure 4.23. Phalarope Seasonal Distribution (Environment Canada, 2006-2015)




Figure 4.24. Tern Seasonal Distribution (Environment Canada, 2006-2015)





Figure 4.25. Storm-petrel Seasonal Distribution (Environment Canada, 2006-2015)





Figure 4.26. Waterfowl Loon and Grebe Seasonal Distribution (Environment Canada, 2006-2015)



	Species													
Designation		Barrow's Goldeneye Bucephala islandica (QB, NB, PEI, NS, NL)	Harlequin Duck Histrionicus histrionicus QB, NB, NS, NL)	Ivory Gull Pagophila eburnean (NL)	Piping Plover (Melodus subspecies) Charadrius melodus (QB, NB, PEI, NS, NL)	Red Knot (Rufa subspecies) Calidris canutus rufa (QB, NB, PEI, NS, NL)	Buff-breasted Sandpiper <i>Tryngites subruficollis</i> (YK, NWT, NV, BC, T, SK, MB, OO, QB, NS, NL)	Peregrine Falcon Falco peregrinus anatum and tundrius (YK, NWT, NV, BC, AT, SK, MB, OO, QB, NB, NS, NL)	Bank Swallow <i>Riparia riparia</i> (YK, NWT, BC, AT, SK, MB, OO, QB, NB, PEI, NS, NL)	Gray-cheeked Thrush Catharus minimus (N)	Olive-sided Flycatcher <i>Contopus cooperi</i> (YK, NWT, BC, AT, SK, MB, OO, QB, NB, PEI, NS, NL)	Bobolink Dolichonyx oryzivorus (BC, AT, SK, MB, OO, QB, NB, PEI, NS, NL)	Short-eared Owl Asio flammeus (YK, NWT, NV, BC, AT, SK, MB, OO, QB, NB, PEI, NS, NL)	Total Species
	EN			х	х	х								3
NL ESA	тн										x			1
	VU	x	x					x		x			x	5
	EN			x	x	x								3
SARA Status	тн										x			1
	SC	x	x					x					x	4
COSEWIC	EN			x	x	x								3
	тн								x		x	x		3
	SC	х	x				x	x					x	5

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

Classification: EN = Endangered TH = Threatened VU = Vulnerable SC = Special Concern

Population: NL= Newfoundland and Labrador Population N= Newfoundland QB= Quebec Population NB= New Brunswick Population PEI= Prince Edward Island Population NS= Nova Scotia Population YK= Yukon Population NWT= Northwest Territories Population NV= Nunavut Population BC= British Colombia Population AT= Alberta Population SK= Saskatchewan Population MB= Manitoba Population OO= Ontario Population



4.5.2 Important Bird Areas and Seabird Colony Sites

The Important Bird Area (IBA) program is coordinated by BirdLife International, and administered in Canada by the Canadian Nature Federation and Bird Studies Canada (*IBA, 2016*). The criteria used to identify important habitats are internationally standardized, and are based on 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 season (*IBA, 2016*; *EC-CWS, 2016*). These criteria are used to identify sites of national and international importance, which are discussed in the Eastern Newfoundland Offshore Area SEA (*AMEC, 2014*). In proximity to the Study Area, there are 17 designated IBAs.

Figure 4.27 shows the locations of major seabird colonies (Atlantic Canada Colonial Waterbird database, EC-CWS, 2016) portraying breeding sites for colonial species and rare species nesting sites on the coast and islands of Eastern Newfoundland adjacent to the SEA Study Area (*AMEC 2014*). Breeding sites for colonial species and species at risk represent important areas and habitats for marine birds.

A table of estimated number of breeding pairs of seabirds at marine colonies in Eastern Newfoundland was presented in the Eastern Newfoundland Offshore Area SEA (Table 4.83 in AMEC, 2014).

The table below provides updated information on the estimated number of breeding pairs (*EC-CWS*, 2014, 2015), highlighted in yellow, compared to the information (*EC-CWS*, 2013) published in the Eastern Newfoundland Offshore Area SEA (*AMEC*, 2014).

Nesting Areas and Important Bird Areas ¹	Colony # (refer to Figure) ²	Fulmars	Storm- Petrels	Gulls			Alcids (Auks)			
		Northern Fulmar	Leach's Storm- petrel	Herring Gull	Great Black- backed Gull	Black- legged Kittiwake	Common Murre	Razorbill	Black Guillemot	Atlantic Puffin
Gull Island, Witless Bay	25	0	170,000	1,881	33	<mark>6,454</mark>	<mark>14,364</mark>	<mark>250</mark>	2	140,429
		<mark>(EC-CWS,</mark> 2014)				<mark>(EC-CWS,</mark> 2015)	<mark>(EC-CWS,</mark> 2014)	<mark>(EC-CWS,</mark> 2014)		
		7				4,530	3,496	294		
		(EC-CWS, 2013)				(EC-CWS, 2013)	(EC-CWS, 2013)	(EC-CWS, 2013)		
Great	28	<mark>5</mark>	134,000	1,640	28	<mark>6,547</mark>	4,656	117	3	174,500
Island, Witless Bay		<mark>(EC-CWS,</mark> 2015)				<mark>(EC-CWS,</mark> 2015)				
		10				6,710				
		(EC-CWS, 2013)				(EC-CWS, 2013)				

² Colony # corresponds to the numbered seabird colonies in Figure 4.28



¹ Bird colonies in **bold italics** are IBAs.

Environmental Assessment Polarcus Eastern Newfoundland



Figure 4.27. IBAs and Seabird Colony Sites in Eastern Newfoundland



4.6 Marine Mammals and Sea Turtles

Over 20 marine mammal and sea turtle species are known to occur in the waters off Eastern Newfoundland, many of which are considered to be at risk or of special conservation concern.

4.6.1 Marine Mammals

Several species of marine mammals may be present in the proposed Study Area. These are summarized in Figure 4.28 to Figure 4.30 below. Marine mammals are present throughout the year within Study Area, with peak abundance during the summer and autumn months *(Fisheries and Oceans Canada Marine Mammals Sightings Database, 2015)*. A summary of the ecology and habitat of marine mammal species within the Study Area is provided in Table A.5 of Appendix A.

4.6.2 Sea Turtles

Three species of sea turtles are or may be found in the waters of the Study Area; leatherback turtle, Loggerhead turtle and Kemp's ridley turtle. A summary of the ecology and habitat of turtle species within the Study Area is provided in Table A.6 of Appendix A.

In Atlantic Canadian waters, leatherback turtles are present from April to December and most numerous from July to September. They are predominantly pelagic, typically inhabiting coastal shelf waters to a depth of less than 200 metres. Population estimates for leatherbacks in the North Atlantic range from 34,000 to 94,000 individuals, and they are thought to be a regular (albeit uncommon) part of the Newfoundland marine fauna in the summer and fall (*COSEWIC, 2012b; Goff and Lien, 1988*). The south coast of Newfoundland, in particular the Placentia Bay area, is a relatively high-use habitat for this species (*Templeman, 2007; COSEWIC, 2012b*).

Loggerhead turtles are the most abundant sea turtle in North American waters. Their range varies from coastal areas to more than 200 kilometres offshore, and therefore they may be present within the Study Area. Loggerheads are less common than leatherbacks in Eastern Canadian waters (*Breeze et al., 2002*)

Adult Kemp's ridley turtles rarely range beyond the Gulf of Mexico, but juveniles can be found as far north as Newfoundland (*COSEWIC, 2012b*). The number of Kemp's ridley turtles that visit the Eastern Newfoundland Offshore Area is unknown, but this species is likely to be extremely rare in the Study Area.

4.6.3 Species at Risk

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

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





Figure 4.28. Baleen Whale Sightings off Eastern Newfoundland (Fisheries and Oceans Canada Marine Mammals Sightings Database, 2015)





Figure 4.29. Large Toothed Whale Sightings off Eastern Newfoundland (Fisheries and Oceans Canada Marine Mammals Sightings Database, 2015)





Figure 4.30. Dolphin and Porpoise Sightings off Eastern Newfoundland (Fisheries and Oceans Canada Marine Mammals Sightings Database, 2015)



Designation		Species											
		Blue whale Balaenoptera musculus (AP)	North Atlantic right whale Eubalaena glacialis	Northern bottlenose whale Hyperoodon ampullatus (SS, DS)	Fin whale Balaenoptera physalus (AP)	Sowerby's beaked whale Mesoplodon bidens (AO)	Killer whale <i>Orcinus orca</i> (NWA, EA)	Harbour porpoise Phocoena phocoena (NWA)	Leatherback turtle Dermochelys coriacea (AP)	Loggerhead turtle <i>Caretta caretta</i> (AO)	Total Species		
SARA Status	EN	х	х	x (SS)					х		4		
	тн							х			1		
	SC				x	x					2		
COSEWIC	EN	x	x	x (SS)					x	x	5		
	тн										0		
	SC			x (DS)	x	x	x	x			4		
IUCN	EN										0		
	VU										0		
	NT										0		
	LC										0		

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

Classification: EN = Endangered TH = Threatened VU = Vulnerable SC = Special Concern NT = Near Threatened LC = Least Concern

Population: AP= Atlantic Population SS= Scotian Shelf Population DS= Davis Strait Population AO= Atlantic Ocean Population NWA= Northwest Atlantic Population EA= Eastern Arctic Population

4.7 Sensitive and Protected Areas

Sensitive and protected areas within the offshore Newfoundland region are detailed within the Offshore Newfoundland Area SEA (*AMEC, 2014*). Sites within the Study Area have been identified and summarized in the sections below and in Figure 4.31.

4.7.1 Ecologically and Biologically Significant Areas (EBSAs)

A number of EBSAs have been identified by DFO within the Placentia Bay Grand Banks Large Ocean Management Area (*Templeman, 2007*) and in the Newfoundland and Labrador Shelves Bioregion (*DFO, 2013b*). These EBSAs are identified as important areas for marine mammals and turtle species. Among the criteria for the identification, evaluation and selection of these important areas was their importance to marine mammals and seabirds in terms of biodiversity, density and importance for reproduction and survival.



4.7.1.1 EBSAs within the Study Area

Northeast Shelf and Slope

This site covers the north-eastern Grand Bank, starting at the nose of the Bank, from 48° West to 50° West, and from the edge of the shelf to the 1,000 metres isobath. A recent study of the movements of hooded seals indicates a significant feeding area is present along the shelf edge to the east of this EBSA (*Andersen et al., 2012*). This EBSA has moderate fitness consequences as a potentially important marine mammal feeding area; harp seals, hooded seals and pilot whales in particular aggregate in this area (*DFO, 2013c*).

Virgin Rocks

This area includes high aggregations of capelin, as well as being a point of aggregation for several other spawning groundfish species such as Atlantic cod, American plaice and yellowtail, flounder. The Virgin Rocks also are an area of relatively high macroalgae / seaweed abundance and diversity (*DFO*, 2013c).

Orphan Spur

This site covers the large area extending along the Labrador Slope and Outer Shelf in NAFO Division 3K, including the Orphan Spur and part of the Trinity Trough Mouth Fan. The northern portion extends from 400 metres to 2,000 metres depth; south of the Orphan Spur, the maximum depth is approximately 1,000 metres. Several marine mammal and seabird species frequent this area, including the Thick-billed Murre, Black-legged Kittiwake, Northern Fulmar, Greater Shearwater, Dovekie, Storm-petrels, Skuas and Jaegers (*DFO, 2013c*).

Orphan Knoll (Convention on Biological Diversity)

The Orphan Knoll (specifically Tobin's Point) is a high density area for black corals (*Wareham and Edinger, 2007*). Along with the Flemish Pass, the Orphan Knoll area contains the highest densities of black corals in the Study Area (*DFO, 2013c*).

Slopes of the Flemish Cap and Grand Bank (Convention on Biological Diversity)

The slopes of the Flemish Cap and Grand Bank are particularly important for benthic fauna. Collectively, sea pens, soft corals, stony corals, and sponges are represented across the shelf, slopes and banks of the Study Area but are found at their highest densities along the slopes (*Wareham and Edinger, 2007; Gilkinson and Edinger, 2009; DFO, 2010; Murillo et al., 2011*). The slopes of the Flemish Cap are dominated by axinellid and polymastid sponges (*Beazley et al., 2013*).





Figure 4.31. Ecologically and Biologically Significant Areas (DFO, 2007, DFO, 2013c, Convention on Biological Diversity - CHM, 2015)



4.7.2 Other Protected Areas

The Newfoundland and Labrador Department of Environment and Conservation establishes and manages six types of provincial protected areas, each of which is designed to fulfil various conservation, recreation and / or cultural goals. Nine Provincial Parks exists along the coast of Eastern Newfoundland. Ecological Reserves are created to protect and conserve ecosystems or ecoregions and/or to protect rare, unique or endangered species of plants, animals and other identifiable components of natural heritage. Seven existing Ecological Reserves are found in marine and coastal areas of Eastern Newfoundland (*NLDEC, 2013*).

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

To date, Canada has designated 37 Ramsar sites of which 17 are also National Wildlife Areas or Migratory Bird Sanctuaries (*Environment Canada, 2012*). The only Ramsar site in Newfoundland (Grand Codroy Estuary) is located on the west coast of the Island (*Ramsar, 2016*).

Offshore Protected Areas in the vicinity of the Study Area include the Placentia Bay / Grand Banks Large Ocean Management Area (LOMA), which covers NAFO areas 3LNOPsPn, and therefore the Grand Banks, Flemish Cap, and Orphan Knoll. This area was identified because it possesses important living and non-living marine resources, areas of high biological diversity and productivity and increasing development pressures and competition for ocean space and resources. In addition, Representative Marine Areas (RMAs) are identified by Parks Canada for each of their 29 marine regions. Four preliminary RMAs exist within the Grand Banks marine region, of which two are offshore and within the Study Area (Figure 4.31). Hydrocarbon exploration and exploitation are prohibited within National Marine Conservation Areas (*Parks Canada, 2008*).

Of the three national parks and 45 national historic sites designated in Newfoundland and Labrador under the National Parks Act, only five are located in Eastern Newfoundland (Terra Nova National Park, and Ryan Premises, Signal Hill, Cape Spear Lighthouse, and Castel Hill National Historic Sites), none of which are located within or close to the Study Area.

Within the Orphan Basin area, the "Bonavista Cod Box", is an important spawning and migration area for Atlantic cod, American plaice, and redfish. The area has a particularly high marine fish abundance, biomass and species richness (*LGL Limited, 2003*).

4.8 Fisheries and other Ocean Users

This section provides a description of the fisheries within the Eastern Newfoundland Offshore Area, covering recreational fisheries, traditional fisheries, and aquaculture activity in the Study Area. The biological characteristics and status of the principal fisheries species are described in the Section 4.4 above.

4.8.1 Commercial Fisheries

4.8.1.1 Commercial Fishing Locations and Effort

The Government of Canada has jurisdiction over fish stocks and fishing activities within a 200 nautical mile limit and for sedentary species across the entire continental shelf. Beyond that 200 mile limit, the North Atlantic Fisheries Organization (NAFO) manages groundfish activities and other resources. The Northwest Atlantic is divided into a series of NAFO Divisions, Subdivisions and Unit



Areas which are generally used to regulate and describe fishing activity throughout Eastern Canada (Figure 4.32).

Fishing activity is generally located in the southwest of the Study Area, and is most widespread from May to July (DFO Catch Landing 2010 to 2014) (Figures 4.33 to 4.39).







Figure 4.32. NAFO Subdivisions

Figure 4.33. Commercial Fishing Locations for all Species 2010-2014 (May) (DFO Catch Landings 2010 to 2014)





Figure 4.34. Commercial Fishing Locations for all Species 2010-2014 (June) (DFO Catch Landings 2010 to 2014)





Figure 4.35. Commercial Fishing Locations for all Species 2010-2014 (July) (DFO Catch Landings 2010 to 2014)





Figure 4.36. Commercial Fishing Locations for all Species 2010-2014 (August) (DFO Catch Landings 2010 to 2014)





Figure 4.37. Commercial Fishing Locations for all Species 2010-2014 (September) (DFO Catch Landings 2010 to 2014)





Figure 4.38. Commercial Fishing Locations for all Species 2010-2014 (October) (DFO Catch Landings 2010 to 2014)





Figure 4.39. Commercial Fishing Locations for all Species 2010-2014 (November) (DFO Catch Landings, 2010 to 2014)



4.8.1.2 Commercial Fish Species

Within NAFO Divisions 3KLMN, the most landed commercial species between 2010 and 2014 was the queen/snow crab, representing 52.3 percent of the total weight (Table 4.7, Figure 4.40. Most Landed Species by Percentage of Weight (kg) across NAFO Divisions 3KLMN (DFO Catch Landings, 2010 to 2014)). The queen/snow crab also represented 62.2 percent of the total value of landings (Table 4.7, Figure 4.41).

Species	% of Weight (kg)	% of Value (CAD \$)			
Queen / Snow Crab	52.3	62.2			
Turbot / Greenland Halibut	18.6	21.2			
Shrimp	14.3	11.4			
Redfish	6.4	2.4			
Yellowtail Flounder	5.4	1.6			
American Plaice	1.1	0.4			
Other	1.9	0.8			

Table 4.7. Landings Data for the NAFO Divisions 3KLMN ((DFO Catch Landings, 2010 to 2014)



% of Weight (kg)

Figure 4.40. Most Landed Species by Percentage of Weight (kg) across NAFO Divisions 3KLMN (DFO Catch Landings, 2010 to 2014)





% of Value (CAD \$)

Figure 4.41. Most Landed Species by Percentage of Value (CAD \$) across NAFO Divisions 3KLMN (DFO Catch Landings, 2010 to 2014)

The timing of fishing activity within the Study Area varies by location and species, and is often dictated by weather and ice conditions. The distribution and seasonality of key commercial species is shown in Figures 4.42 to 4.47 (DFO Catch Landings for the period 2010 to 2014).

Historically, Atlantic cod landings have been carefully managed offshore Newfoundland by the DFO. The Newfoundland and Labrador Atlantic cod population is protected under the Fisheries Act. Following stock decline, the 2J3KL cod fishery closed in 1992 with only inshore fishery allowed from 1998. This subsequently closed in 2003. In addition, cod fishery within NAFO divisions 3NO closed in 1994 due to extremely low stock levels. Cod by-catch with other target species including yellowtail flounder has been considered to be a major contributor to impeded stock recovery (*Healey et al., 2003*). Currently, there are suspensions in place for commercial cod fisheries within the Study Area, right across NAFO divisions 2GHJ and 3KLNO. There are also management measures in place for stewardship and recreational fisheries such as gear restrictions, seasons, and quotas/bag limits. By-catch limits have also been set for Atlantic cod in all fisheries targeting other species (*DFO, 2015*).



Environmental Assessment Polarcus Eastern Newfoundland



Figure 4.42. Key Fisheries (American Plaice) 2010-2014 May to November (DFO Catch Landings 2010 to 2014)





Figure 4.43. Key Fisheries (Crab Queen-Snow) 2010-2014 May to November (DFO Catch Landings 2010 to 2014)





Figure 4.44. Key Fisheries (Northern Shrimp) 2010-2014 May to November (DFO Catch Landings 2010 to 2014)





Figure 4.45. Key Fisheries (Redfish) 2010-2014 May to November (DFO Catch Landings 2010 to 2014)





Figure 4.46. Key Fisheries (Turbot - Greenland Halibut) 2010-2014 May to November (DFO Catch Landings 2010 to 2014)





Figure 4.47. Key Fisheries (Yellowtail Flounder) 2010-2014 May to November (DFO Catch Landings 2010 to 2014)



4.8.1.3 Commercial Fishing Gear

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

Fixed gear types are most commonly used during the spring and summer months, and are concentrated within the southwest and northwest edge of the Study Area (Figure 4.48). Conversely, mobile gear types are used all year round offshore Newfoundland and within the southwest and northwest edge of the Study Area, with a peak utilization during the summer months (Figure 4.49).

4.8.1.4 Sealing

The Canadian seal harvest is managed by DFO, under Canada's Marine Mammal Regulations. Due primarily to weak markets and poor ice conditions, the value and effort of seal landings in Canada has shown a decreasing trend in recent years. The Integrated Fisheries Management Plan (IFMP) for Atlantic seals has been implemented in Newfoundland to promote stakeholders input into management decisions, and the sustainable management of the resource (*DFO*, 2015).

In Atlantic Canada, harp seals are concentrated primarily off Southern Labrador, grey seals are found mostly off Northern Labrador and in the Gulf of St. Lawrence, Scotian Shelf and Bay of Fundy. Hooded seals are located off the coast of Northeast Newfoundland, in the Gulf of St. Lawrence and in the Davis Strait area (*C-NLOPB, 2014*).. The sealing areas in the Eastern Newfoundland Offshore area are shown in Figure 4.50. Sealing Areas 5, 6, 7, and 8 fall partially within the Study Area. The season for commercial sealing runs every year from the 15th November to the 15th May in Newfoundland, although most sealing occurs during the second week of April (*DFO, 2015*).





Figure 4.48. Fish Harvests using Fixed Gear Types 2010-2014 (May to November)





Figure 4.49. Fish Harvests using Mobile Gear Types 2010-2014 (May to November)





Figure 4.50. Department of Fisheries and Oceans Sealing Areas



4.8.2 Aquaculture

Blue mussels, Atlantic salmon and steelhead trout are the main fish species farmed in the offshore Newfoundland area (*NLDFA, 2013*). Aquaculture sites are located primarily around Bay D'Espoir, the Connaigre Peninsula and Notre Dame Bay on the Newfoundland coast, outside of the Study Area (*NLDFA 2013*).

4.8.3 Shipping

The Eastern Newfoundland region has 17 shipping ports, of which St. John's has the most diverse shipping activity and industrial infrastructure. The ports cover domestic Shipping (Arnold's Cove, Carmanville, Catalina, Clarenville), international shipping (Fortune, Harbour Grace, Long Harbour and Bay Bulls) or both (Argentia, Bay Roberts, Come By Chance, Holyrood, Lewisporte, Long Pond, Marystown, St. John's and Newfoundland Offshore). Come By Chance and Fortune are also key international shipping ports in Newfoundland and Labrador. Navy vessels also sometimes provide support to DFO in conducting fishery patrols in Atlantic Canada, including the coastal waters of Newfoundland (*C-NLOPB, 2014*). Marine Communications and Traffic Service (MCTS) centres are located in Placentia, Port aux Basques, and Goose Bay (*Canadian Coast Guard, 2016*).

Each year from May to October, Newfoundland and Labrador ports are visited by large cruise ships on trans-Atlantic routes or small ships that tour the Province, the Maritimes and/or Quebec. Ferry services and small craft harbours exist along the coastal areas of Newfoundland, outside of the Study Area.

4.8.4 Unexploded Ordnance

There are various locations in the Eastern Newfoundland Offshore Area which are known to contain unexploded ordnance from military operations, training, weapons testing, and wartime action. Two legacy sites of known shipwrecks (U-520 and U-658) also exist within the Study Area (*DND, 2016*) (Figure 4.51).





Figure 4.51. Unexploded Ordinance, Shipwrecks, and Disposal Sites (DND, 2016)


4.9 Summary of Sensitivities

A summary of the seasonal sensitivities and known sensitive locations for valued environmental components (VOCs) within the Study Area is provided in Table 4.8. The anticipated survey period is highlighted in red. Seismic operations may potentially occur between May and November in any given year, with the typical duration of a seismic survey being between 90 and 120 days.

Species	J	F	м	Α	м	J	J	Α	s	ο	N	D	Sensitive Locations
Fish and Fish Habitat													
Plankton													Present within Study Area
Кеу		Blo	om										
Invertebrates													
Deep sea Corals													Present within Study Area
Iceland Scallop Chlamys islandica													NAFO areas 3L and 3P. Not Present within Study Area
Northern Shrimp Pandalus borealis													Present within Study Area
Pink Shrimp Pandalus montagui													Present within Study Area
Sea Scallop Placopecten magellanicus													NAFO areas 3P. Not Present within Study Area
Snow Crab Chionoecetes opilio													Present within Study Area
Sponges Geodia sp.													Present within Study Area
Surf Clam Spisula solidissima													NAFO areas 3N. Present within Study Area
Кеу		Spa	Spawning Period										
Fish													
American Plaice Hippoglossoides platessoides													Grand Bank. Present within Study Area
Atlantic Cod Gadus morhua													Southeast shoal of Grand Bank and Virgin Rocks. Present within Study Area

Table 4.8. Summary of Sensitivities in the Eastern Newfoundland Offshore Area



Species	ſ	F	м	А	м	ſ	ſ	А	s	ο	N	D	Sensitive Locations
Capelin Mallotus villosus													Southeast shoal of Grand Bank Coastal waters . Present within Study Area
Deepwater Redfish Sebastes mentella													Southwest Shelf Edge and Slope of Grand Bank. Present within Study Area
Greenland Halibut Reinhardtius hippoglossoides													Davis Strait. Present within Study Area
Lanternfish Myctophidae													Present within Study Area
Roughhead Grenadier Macrourus berglax													Grand Bank. Present within Study Area
Sand Lance Ammodytes dubius													Grand Bank. Present within Study Area
Moustache Sculpin Triglops sp.													Present within Study Area
Yellowtail Flounder Limanda ferruginea													Grand Bank. Moustache Sculpin
Кеу		Spa	wnin	g Per	iod				l		l		
Seabirds													
Great and Double- crested Cormorants Phalacrocorax carbo Phalacrocorax auritus													Present within Study Area
Northern Gannet Morus bassanus													Present within Study Area
Red and Red-necked Phalarope Phalaropus fulicarius Phalaropus lobatus													Present within Study Area
Large Gulls													Present within Study Area
Ivory Gulls Pagophila eburnea													Present within Study Area
Sabine's Gull Xema sabini													Present within Study Area



Species	J	F	м	Α	м	J	J	А	s	ο	N	D	Sensitive Locations
Black-legged Kittiwake Rissa tridactyla													Present within Study Area
Terns													Present within Study Area
Dovekie Alle alle													Present within Study Area
Atlantic Puffin Fratercula arctica													Present within Study Area
Black Guillemot Cepphus grylle													Present within Study Area
Common Murre Uria aalge													Present within Study Area
Thick-billed Murre Uria lomvia													Present within Study Area
Razorbill Alca torda													Present within Study Area
Jaegers and Skuas													Present within Study Area
Fulmars and Shearwaters													Present within Study Area
Waterfowl													Present within Study Area
Shorebirds													Present within Study Area
Кеу		Pre in S A	esent Study rea		Pre Co	sent at lony		Ch rea pe	nick Iring riod		Fligh birc s	ntless ds at ea	
Marine Mammals and Sea	Turt	les											
North Atlantic Right Whale Eubalaena alacialis													Present within Study Area
Humpback Whale Megaptera novaeangliae													Present within Study Area
Blue Whale Balaenoptera musculus													Not Recorded within Study Area (Figure 4.29)
Fin Whale Balaenoptera physalus													Present within Study Area
Sei Whale Balaenoptera borealis													Present within Study Area
Minke Whale Balaenoptera acutorostrata													Present within Study Area



Environmental Assessment Polarcus Eastern Newfoundland

Species	J	F	м	А	м	J	J	Α	s	ο	N	D	Sensitive Locations
Sperm Whale Physeter macrocephalus													Present within Study Area
Northern Bottlenose Whale													Present within Study Area
Killer Whale Orcinus orca													Present within Study Area
Long-finned Pilot Whale Globicephala melas													Present within Study Area
Sowerby's Beaked Whale Mesoplodon bidens													Not Recorded within Study Area (Figure 4.29)
Small Dolphin Species													Present within Study Area
Harbour Porpoise Phocoena phocoena													Present within Study Area
Harp Seal Pagophilus groenlandicus													Present within Study Area
Hooded Seal Cystophora cristata													Present within Study Area
Grey Seal Halichoerus grypus													Present within Study Area
Turtles (Leatherback, loggerhead, Kemp's ridley)													Present within Study Area
Кеу		Oc	curre	ence		Peak Occurrence				Ν	lo da	ta	
Sealing													
Sealing Season													Present within West of Study Area
Кеу		Oc	curre	ence		Pe	eak C	Occur	rence	2			

