Environmental Assessment Update (2017) of the MKI Labrador Sea Seismic Program, 2014–2018

Prepared by

LGL LIMITED
environmental research associates

Prepared for

for

Multi Klient Invest AS

&

TGS-NOPEC Geophysical Company ASA

May 2017
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1.0 Introduction

This document is an Update of the Environmental Assessment (EA; LGL 2014a) of Multi Klient Invest AS (MKI) and TGS-NOPEC Geophysical Company ASA (TGS)'s 2014–2018 2-Dimensional (2D) and/or 3-Dimensional (3D) marine seismic program in the Labrador Sea area, Newfoundland and Labrador and its associated Addendum (LGL 2014b). In 2017, MKI is proposing to conduct a 2D seismic survey in the Labrador Sea Project Area (see Figure 1.1 below). This EA Update document addresses the validity of the EA (Table 1.1) as it pertains to MKI's proposed seismic survey activities in 2017. The EA Update is intended to assist the Canada-Newfoundland and Labrador Offshore Petroleum Board (C-NLOPB) in its regulatory review process by demonstrating that both the scope of the assessment and the mitigation measures to which MKI previously committed and implemented remain technically valid for proposed seismic survey operations in 2017. Previous Updates associated with this program were prepared in 2015 (LGL 2015a) and 2016 (LGL 2016).

TABLE 1.1. Environmental Assessment documents for the MKI Labrador Sea seismic program, 2014–2018.

Screening Determination Reference	Temporal Scope	EA Document Title
C-NLOPB File No. 45006-020-003	May 1 to November 30, 2014–2018	Environmental Assessment MKI Labrador Sea Seismic Program, 2014–2018 (LGL 2014a,b)[a] and EA Addendum
	May 1 to November 30, 2015	Environmental Assessment Update of the MKI Labrador Sea Seismic Program, 2014–2018 (LGL 2015a)[b]
	May 1 to November 30, 2016	Environmental Assessment Update of the MKI Labrador Sea Seismic Program, 2014–2018 (LGL 2016)[c]

[a] On 18 August 2014 the C-NLOPB made a positive determination on the EA and EA Addendum.
[b] Originally submitted to the C-NLOPB in May 2015.
[c] Originally submitted to the C-NLOPB in March 2016.

The following sections provide the information necessary to confirm the validity of the EA and its associated Addendum (see Table 1.1), including assessment of the potential effects of 2D, 3D and 4D seismic survey activities within the defined Project Area (Figure 1.1) on the following Valued Environmental Components (VECs): Fish and Fish Habitat; Fisheries; Seabirds; Marine Mammals and Sea Turtles; Species at Risk; and Sensitive Areas. This Update also includes new relevant information not included in the EA and its associated documents.

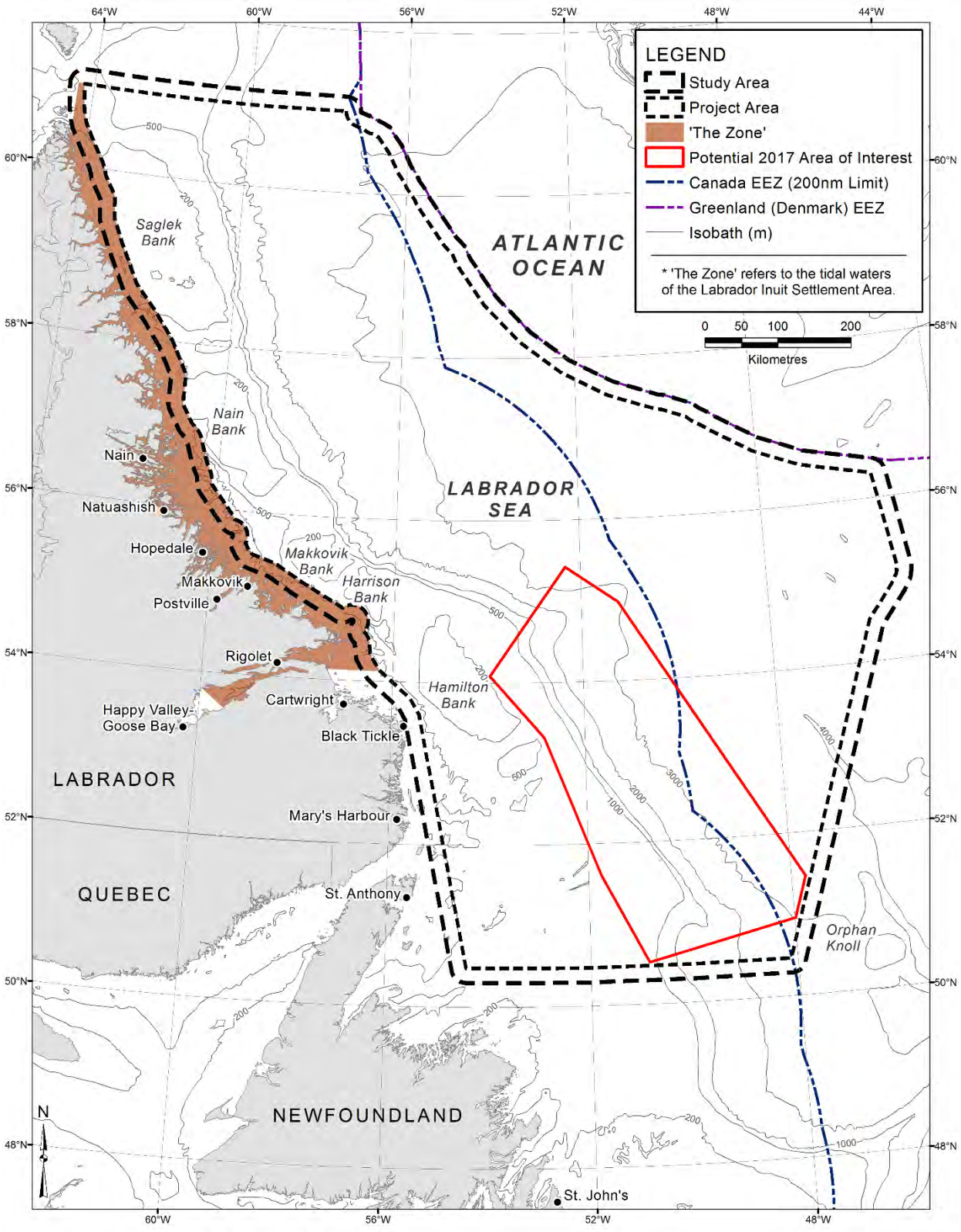

FIGURE 1.1. Locations of the Project Area, Study Area and Potential 2017 Area of Interest for MKI's Labrador Sea seismic program.

2.0 Project Description

2.1 Vessels and Equipment

In addition to the seismic vessel, 2D (and/or 3D) seismic surveys generally use one or more support vessels depending on the type of operation: (1) an escort vessel which, among other tasks as required, communicates with other vessels (primarily fishing vessels) that may be operating in the area, and scouts ahead for any other hazards such as floating debris; and (2) if necessary, a supply vessel tasked with resupply, refuelling and personnel transfer.

The seismic survey sound sources will consist of one or more airgun arrays with a total discharge volume of 3000–6000 in^3, operating at a tow depth of 6–15 m. The airgun arrays are comprised of individual airguns ranging in size from 22–250 in^3 each. The airguns will be operated with compressed air at pressures of 2000–2500 psi and produce approximate peak-to-peak pressures of 100–200 bar-m. A typical airgun array used by MKI for 2D surveys consists of four sub-arrays with a total volume of 4808 in^3, operated at a pressure of 2000 psi. This array is generally towed at a depth of 9 m and produces a peak-to-peak pressure of 179 bar-m. The airguns in the array are strategically arranged to direct most of the energy vertically downward rather than sideways. The shotpoint interval will be one array pulse every 19–25 s, and the survey speed will be around 4.5 knots (8.3 km/h).

For 2D surveys, the seismic ship will also tow a single seismic hydrophone cable (streamer) up to 10 km long, deployed near the ocean surface, at a depth of ~15–25 m. This is a passive listening device, which will receive the sound waves reflected from structures underneath the ocean floor and transfer the data to an on-board recording and processing system. The cable is a solid streamer, PGS GeoStreamer®. For 3D seismic surveys, the seismic ship will tow multiple streamers. Streamers will be solid with an expected length of 8,000–10,000 m, depending on survey design, and deployed at depths ranging from ~15–25 m. As many as 16 streamers may be towed during a 3D seismic survey. In 2017, MKI does not anticipate conducting 3D seismic surveys in the Labrador Sea Project Area.

The seismic vessel is also equipped with a Furuno FE-700 echosounder. The downward-facing echosounder operates at a frequency of 50 kHz or 200 kHz and will be used to collect water depth information. For this Project, sound velocity profiles will also be acquired in the water column at various locations in the survey area. This is a routine practice during seismic programs. Sound velocity profiles allow for more accurate interpretation of the acoustic data (i.e., seismic pulses) recorded by the seismic streamer. These data are acquired with a small, passive device that will be deployed by the support vessel. The device measures pressure, temperature, and salinity, from which the speed of sound can be calculated.

2.2 Spatial Scope

The Project and Study areas defined in the EA remain unchanged and are presented in Figure 1.1. The Project Area, in which all survey activities will occur, is encompassed by the Study Area. The boundary of the Study Area is 25 km outside of that for the Project Area.

2.3 Temporal Scope

The temporal scope defined in the EA (LGL 2014a), 1 May–30 November period, during 2014–2018 remains unchanged.

2.4 Seismic Survey Activities Planned for 2017

In 2017, MKI plans to conduct about 10,000 km of 2D seismic surveying in the Project Area, specifically off southeastern Labrador in the AOI (see Figure 1.1). Seismic lines are oriented NE-SW and NW-SE. As was the case in 2014–2016, the MV *Atlantic Explorer* (Figure 2.1) will likely be the seismic vessel conducting the 2D seismic surveying in 2017. The *Atlantic Explorer* is 91.3 m in length, 17.4 m wide, and has a draft of 8.4 m. Its maximum cruising speed is 14 knots and seismic survey speed is ~4.5 knots. All other project details presented in § 2.0 of the EA apply to MKI's seismic survey activities in 2017.

FIGURE 2.1. MV *Atlantic Explorer.*

2.5 Mitigation Measures

Mitigation measures implemented during seismic surveys carried out under this Project will follow those described in prior documents (LGL 2014a,b, 2015a, 2016) and defined in Appendix 2 of *Geophysical, Geological, Environmental and Geotechnical Program Guidelines* (C-NLOPB 2017). These include ramp-up (i.e., soft start) of the airgun arrays, the use of qualified and experienced, dedicated Marine Mammal Observer(s) (MMOs) to monitor marine mammals and sea turtles and implement shut downs/ramp-up delays of the airgun array when appropriate, and the use of a Fisheries Liaison Officer (FLO) and communication procedures to avoid conflicts with fisheries. Seabird observations and monitoring/mitigation for stranded birds will also be carried out by qualified experienced personnel according to established Canadian Wildlife Service (CWS) protocols.

3.0 Physical Environment

An overview of the physical environment in the Study Area was provided in § 3.0 of the original EA (LGL 2014a) and was based primarily on information provided in the Labrador Shelf Strategic Environmental Assessment (SEA) (C-NLOPB 2008). There have not been any notable changes in the various aspects of the physical environment of the Study Area described in the EA.

4.0 Biological Environment

Background biological environment information not previously included in documents associated with this Project (see Table 1.1) is included in this section.

4.1 Fish and Fish Habitat

New information is included for key points concerning the relationship between planktonic communities, oceanic conditions, and benthos of the Labrador Sea area, as well as for snow crab (*Chionoecetes opilio*), northern shrimp (*Pandalus borealis*), striped shrimp (*Pandalus montagui*), and Atlantic cod (*Gadus morhua*).

4.1.1 Plankton

The Atlantic Zone Monitoring Program (AZMP) was implemented by the Department of Fisheries and Oceans (DFO) in 1998 in an attempt to better understand, describe and forecast the state of the marine ecosystem. A critical element of the AZMP is an observation program designed to assess the variability in nutrients, phytoplankton and zooplankton (DFO 2016a). The AZMP findings in relation to oceanographic conditions in the Study Area for 2015 are summarized below.

- Copepod abundances throughout much of the Atlantic zone have undergone modest increases from 2014–2015 with above average concentrations of copepods present throughout much of the zone;
- The annual-mean transport index for the Labrador Current was near normal over the Labrador and northeastern Newfoundland Slope;
- Sea ice volumes on the Newfoundland and Labrador Shelf were above normal during March and April 2015 off eastern Newfoundland, and persisted up to five weeks later than normal, thereby affecting the opening dates of the snow crab and lobster fisheries;
- Chlorophyll levels have been below normal on the Newfoundland and Labrador Shelf since 2011 and the start of spring phytoplankton bloom was later than normal across much of the zone in 2015; and
- High abundances of non-copepod phytoplankton were observed in the eastern portion of the Labrador Sea in 2015.

4.1.2 Benthos

Kenchington et al. (2016) updated distribution maps that identify areas of significant concentrations of corals and sponges on the east coast of Canada, including the Newfoundland and Labrador Shelves. Using new research vessel catch data and species distribution modelling, they updated the distributions of sponges (Porifera), large and small gorgonian corals (Alcyonacea), and sea pens (Pennatulacea). Sponge areas along the Labrador Slope were expanded from previous assessments (see Figure 4.1). Several new areas containing large gorgonian corals were also identified in Saglek Bank (northernmost part of the Study Area) and the Labrador Slope (see Figure 4.2). Likewise, new small gorgonian coral areas were identified on the Labrador Slope (see Figure 4.3). No further update of sea pen distribution within the Study Area was included in Kenchington et al (2016).

4.1.3 Snow Crab

Offshore landings of snow crab in Northwest Atlantic Fisheries Organization (NAFO) Division 2HJ have been low since 2011, with less than 2,000 t being landed since that time. Consequently, fishing effort has also been substantially reduced. Division 3K landings declined by 52% between 2008 and 2015, and are currently at their lowest levels in two decades (7,200 t) (DFO 2016b). A recent stock assessment for snow crab in Newfoundland and Labrador waters claims that the overall exploitable biomass has declined by 80% since 2013, with a large overall decline of 40% occurring between 2015 and 2016. A warming oceanic climate is believed to be the biggest factor potentially affecting snow crab recruitment and the future of this species' fishery (CBC website 2017a).

4.1.4 Northern Shrimp

In recent years the northern shrimp fishable biomass index has declined significantly in Shrimp Fishing Areas (SFAs) 4, 5, and 6 (NAFO Div. 2GHJ3K). In SFA 4, fishable biomass that ranged from 76,600 t to 164,000 t between 2005 and 2012 decreased to 95,300 t in 2016. In SFA5, fishable biomass decreased by 27% (149,000 t to 110,000 t) from 2015 to 2016. Similarly in SFA 6, fishable biomass has decreased from 785,000 t in 2006 to 104,000 t in 2016, the lowest in the time series (DFO 2017a). A recent assessment completed by DFO in early February 2017 has determined that shrimp from SFA 6 are at their lowest levels since DFO began conducting research vessel (RV) multi-species surveys. The SFA 6 stock is expected to receive a "critical" designation in a report to be released in the near future (CBC website 2017b). A warming oceanic climate is not expected to be favorable to the recruitment of northern shrimp for the foreseeable future.

4.1.5 Striped Shrimp

Commercial catches of striped shrimp in SFA 4 (NAFO Div. 2G), taken as by-catch in the northern shrimp fishery, increased from 280 t in 2008 to 4,700 t in 2012, and then decreased to 1,092 t in 2016. From 2015 to 2016, the fishable biomass index for striped shrimp decreased by nearly 50% (DFO 2017b).

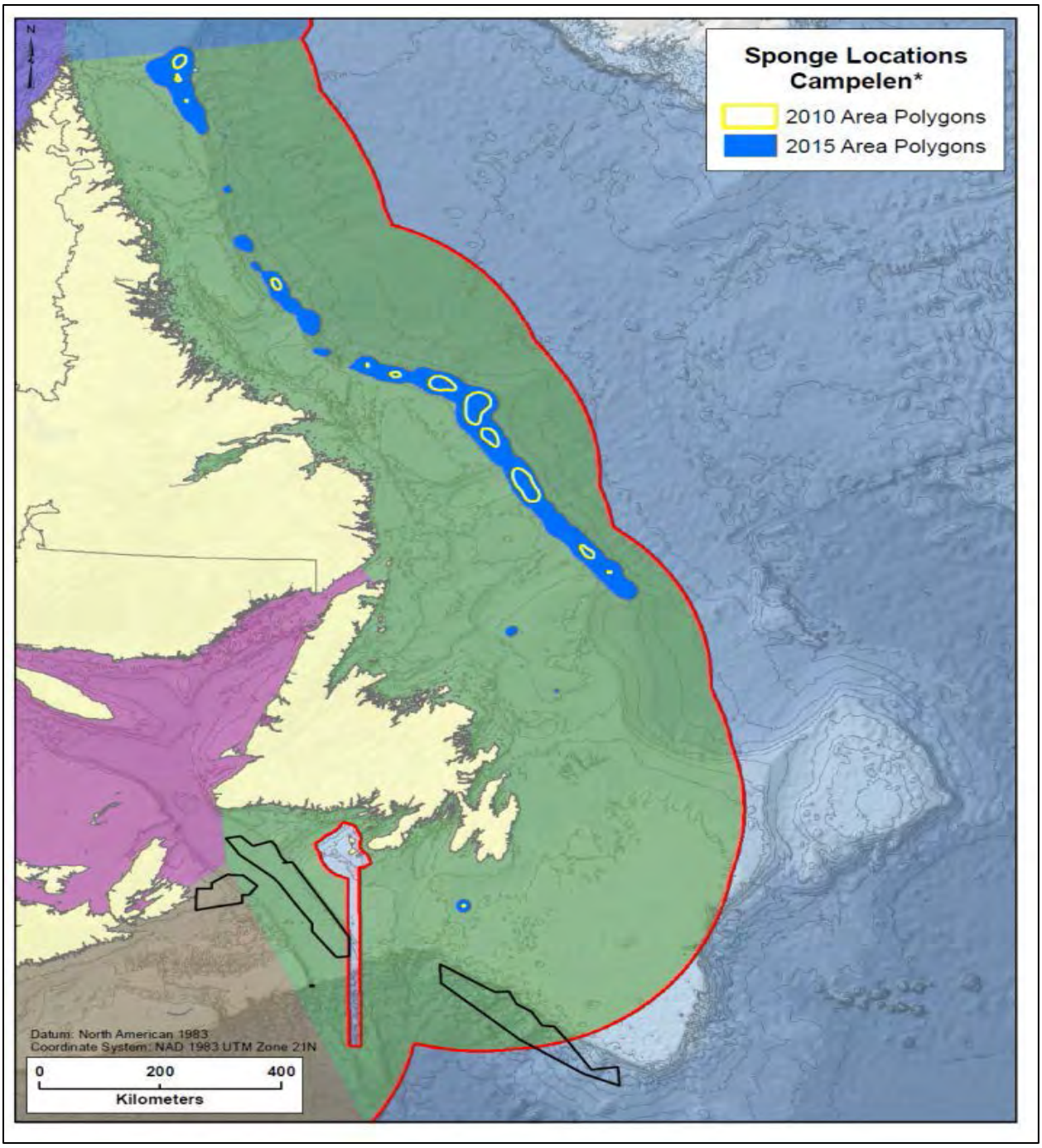

FIGURE 4.1. A comparison of the locations of significant concentrations of sponge areas as identified in 2010 (yellow outline) and 2015 (blue polygons; from Kenchington et al. [2016]). Areas closed to protect benthic habitat are indicated in black outline. Red lines indicate the EEZs of Canada and France (St. Pierre and Miquelon).

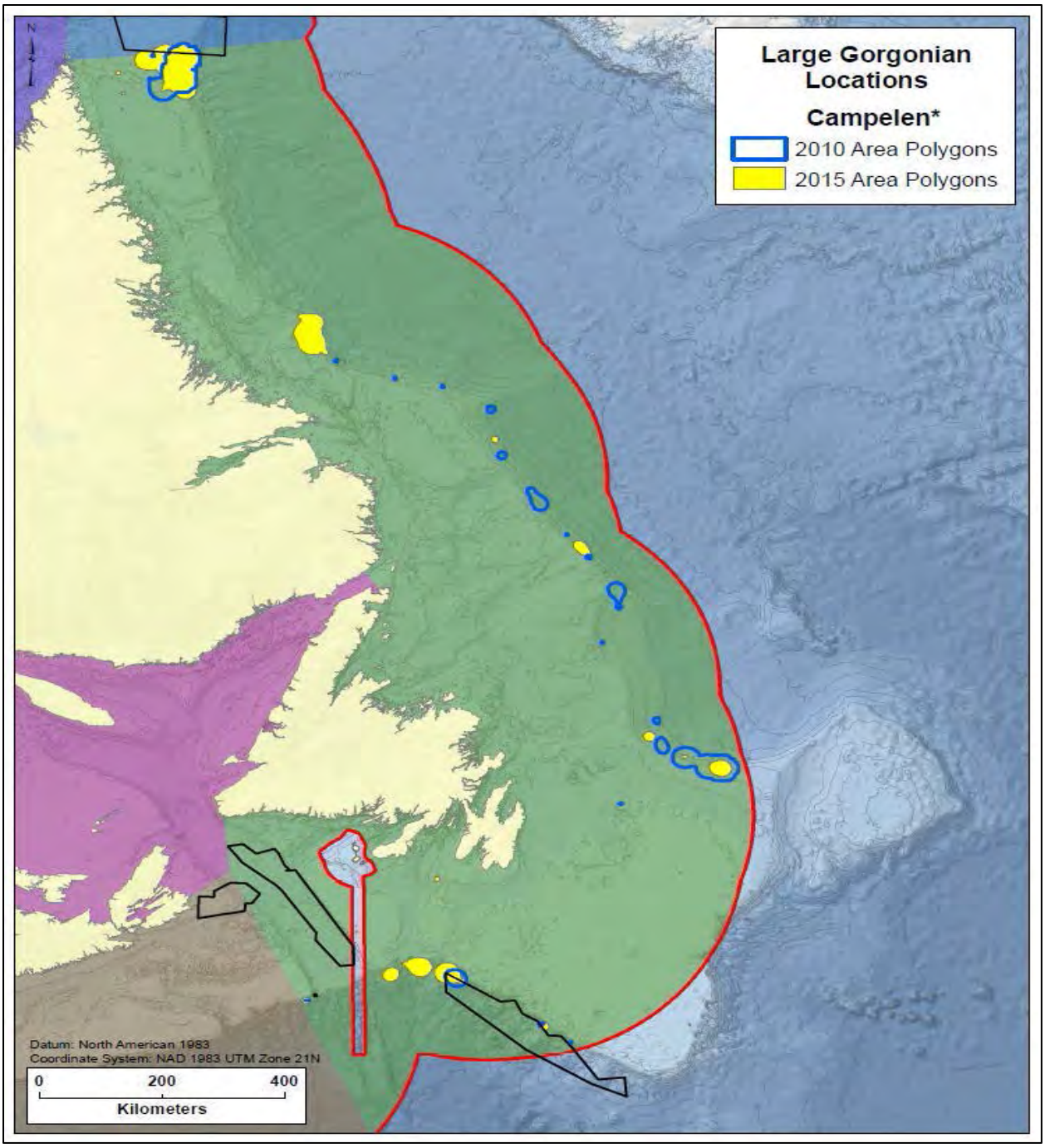

FIGURE 4.2. A comparison of the locations of significant concentrations of large gorgonian coral areas as identified in 2010 (blue outline) and 2015 (yellow polygons; from Kenchington et al. [2016]). Areas closed to protect benthic habitat are indicated in black outline. Red lines indicate the EEZs of Canada and France (St. Pierre and Miquelon).

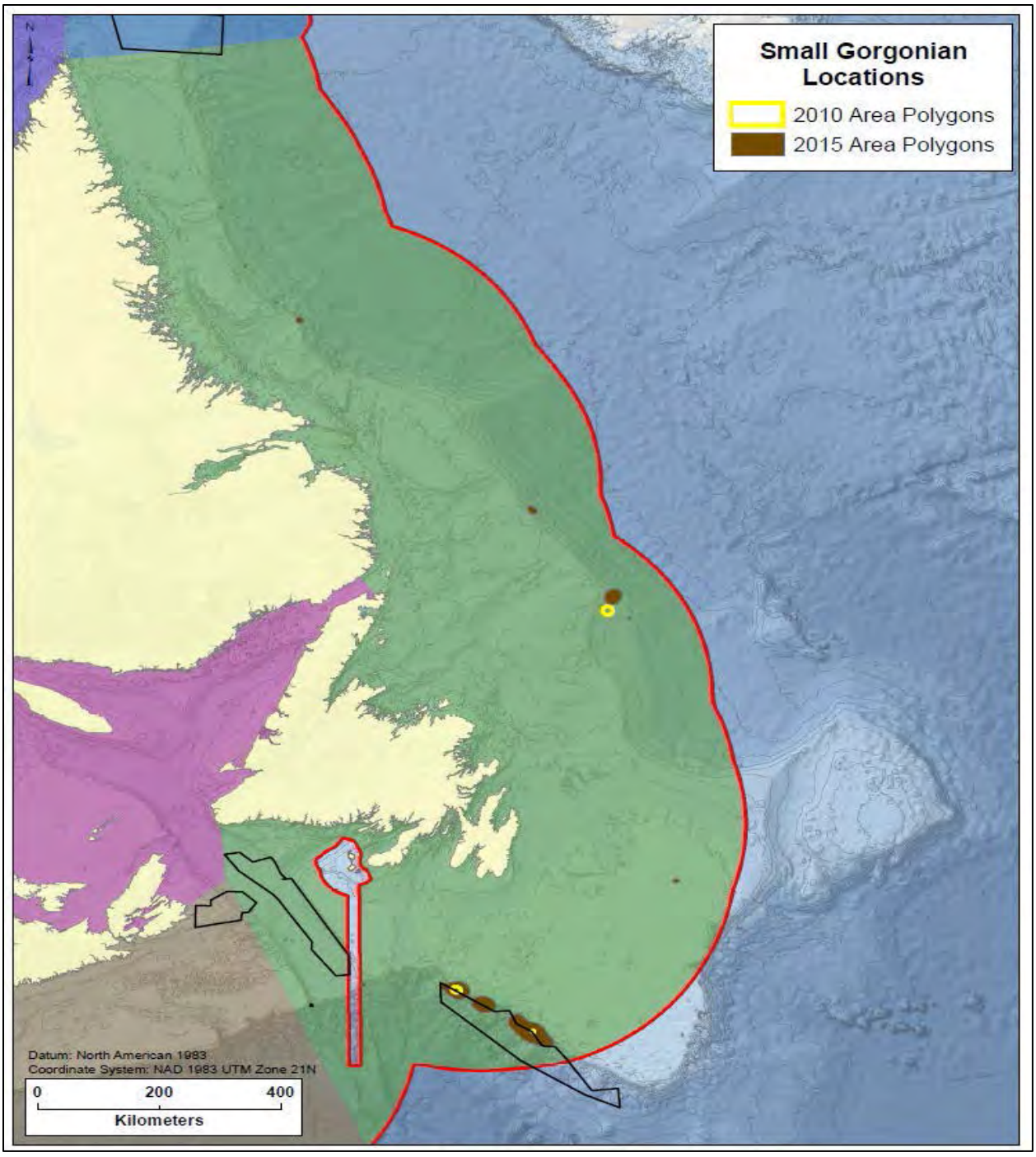

FIGURE 4.3. A comparison of the locations of significant concentrations of small gorgonian coral areas as identified in 2010 (yellow outline) and 2015 (brown polygons; from Kenchington et al. [2016]). Areas closed to protect benthic habitat are indicated in black outline. Red lines indicate the EEZs of Canada and France (St. Pierre and Miquelon).

4.1.6 Atlantic Cod

A recent study by Rose and Rowe (2015) discussed the comeback of northern cod. Using data collected during acoustic-trawl surveys of the main pre-spawning and spawning components of the stock, they showed that biomass has increased from tens of thousands of tonnes to >200 thousand tonnes during the last decade. The increase was indicated by observation of massive schooling behaviour in late winter 2008 in the southern range of the stock (i.e., Bonavista Corridor), after a 15-year absence. In the spring of 2015, large increases in cod abundance and individual fish length and weight were observed for the first time since 1992 in the more northerly spawning groups of the stock complex (i.e., outer Notre Dame Channel, southern Hamilton Bank and Hawke Channel).

The latest DFO stock assessments indicate that the northern cod stocks in NAFO Divs. 2J3KL have increased considerably over the past decade. Overall biomass has increased between 2005 and 2012 but has remained somewhat constant since then. In 2015, the greatest abundance (87%) and biomass (84%) of cod observed during DFO RV surveys was in Divs. 2J and 3K. DFO continues to manage the stock using the precautionary principle, keeping removals at the lowest possible level until assessments indicate the stock has cleared the critical zone (DFO 2016c).

The new information presented on fish and fish habitat does not change the effects predictions made for this VEC in the EA (LGL 2014a) and Addendum (LGL 2014b).

4.2 Fisheries

The fisheries section has been updated to include 2015 commercial landings data, 2014 DFO Research Vessel (RV) data, and new information on Total Allowable Catch (TAC).

4.2.1 Commercial Fisheries

Results of analyses of the 2015 commercial fisheries landings data did not indicate any major differences in distribution of harvest locations between May–November 2005–2012, 2013, 2014 or 2015 (see Figures 4.3–4.5 *in* LGL 2014a, Figure 4.1 *in* LGL 2015a, and Figures 4.1–4.2 *in* LGL 2016). Figures 4.4–4.7 show the distribution of May–November 2015 harvest locations for all species, northern shrimp, snow crab and Greenland halibut.

Most of the 2015 harvesting was conducted in the western portions of the Study Area and 2017 2D AOI, in areas where water depths are <1,000 m. As in previous years (see Table 4.2 *in* LGL 2014a, Table 4.1 *in* LGL 2015a and Table 4.1 *in* LGL 2016), northern shrimp (59% of total catch in the Study Area in terms of total catch weight quartile code counts), snow crab (27%) and Greenland halibut (7%) dominated commercial catches in the Study Area during May–November 2015. Other notable species caught in 2015 include striped shrimp (5%), roughhead grenadier (0.5%) and redfishes (0.4%). Catch weight and value quartile counts, months of effort and gear types for species harvested in the Study Area and the 2017 2D AOI in 2015 are presented in Tables 4.1 and 4.2, respectively.

As during May–November 2014, but unlike previous years, there were no reported catches of Atlantic mackerel (*Scomber scombrus*), Atlantic cod or yellowtail flounder (*Pleuronectes ferruginea*) in the Study Area in 2015 (see Table 4.2 *in* LGL 2014a, Table 4.1 *in* LGL 2015a and Table 4.1 *in* LGL 2016).

4.2.1.1 Northern Shrimp

Although northern shrimp harvesting declined in the Study Area during the May–November period in recent years (see Table 4.1 below, and Table 4.1 *in* LGL 2015a, 2016), this invertebrate remained the dominant commercial species in the Study Area in terms of catches. The Total Allowable Catch (TAC) for northern shrimp in Shrimp Fishing Area (SFA) 4 (includes NAFO Divisions [Div.] 2GH) increased from 14,971 mt in 2013–2016 to 15,725 mt in 2017, decreased in SFA 5 (includes portions of Div. 2HJ) from 25,630 mt in 2016 to 22,000 mt in 2017, and decreased from 27,825 mt in 2016 to 10,400 mt in 2017 in SFA 6 (includes 3K and a portion of 2J) (DFO 2016d; DFO 2017b). Northern shrimp harvested during May–November 2015 were harvested primarily in the western and southwestern portions of the Study Area and 2017 2D AOI, respectively, in areas where water depths range between 200 and 500 m (Figure 4.5). This harvest location pattern observed in May–November 2015 is consistent with those observed during May–November in previous years (see Figures 4.11–4.13 *in* LGL 2014a, Figure 4.2 *in* LGL 2015a and Figure 4.1 *in* LGL 2016).

4.2.1.2 Snow Crab

The distribution of harvest locations for snow crab in the Study Area during May–November 2015 (Figure 4.6) was consistent with that observed during May–November 2005–2012, 2013 and 2014 (see Figures 4.16–4.18 *in* LGL 2014a, Figure 4.3 *in* LGL 2015a and Figure 4.2 *in* LGL 2016). The catches occurred primarily in the southwestern portions of the Study Area and 2017 2D AOI, in areas where water depths are <500 m. There were very few 2015 catch locations reported in the 2017 2D AOI (Figure 4.6). The TAC for snow crab in Div. 2J (1,765 mt) was consistent during 2013–2015 while in 2017 a snow crab TAC of 1,865 mt was released for Div. 2GHJ combined, the TAC in Div. 3K has decreased from 8,449 mt in 2013 to 5,889 mt in 2016 and 5,794 mt in 2017 (DFO 2016d; DFO 2017b).

4.2.1.3 Greenland Halibut

The distribution of harvest locations for Greenland halibut in the Study Area during May–November 2015 (Figure 4.7) was consistent with that observed during May–November 2005–2012, 2013 and 2014 (see Figures 4.21 to 4.23 *in* LGL 2014a, Figure 4.4 *in* LGL 2015a and Figure 4.2 *in* LGL 2016). Harvesting occurred primarily in the central and central-western portions of the Study Area and 2017 2D AOI, in areas where water depths range between 500 and 1,000 m. As noted in the 2015 and 2016 EA Updates (LGL 2015a, 2016), there are no TAC quotas set for this species within the Study Area (DFO 2016d; NAFO 2017).

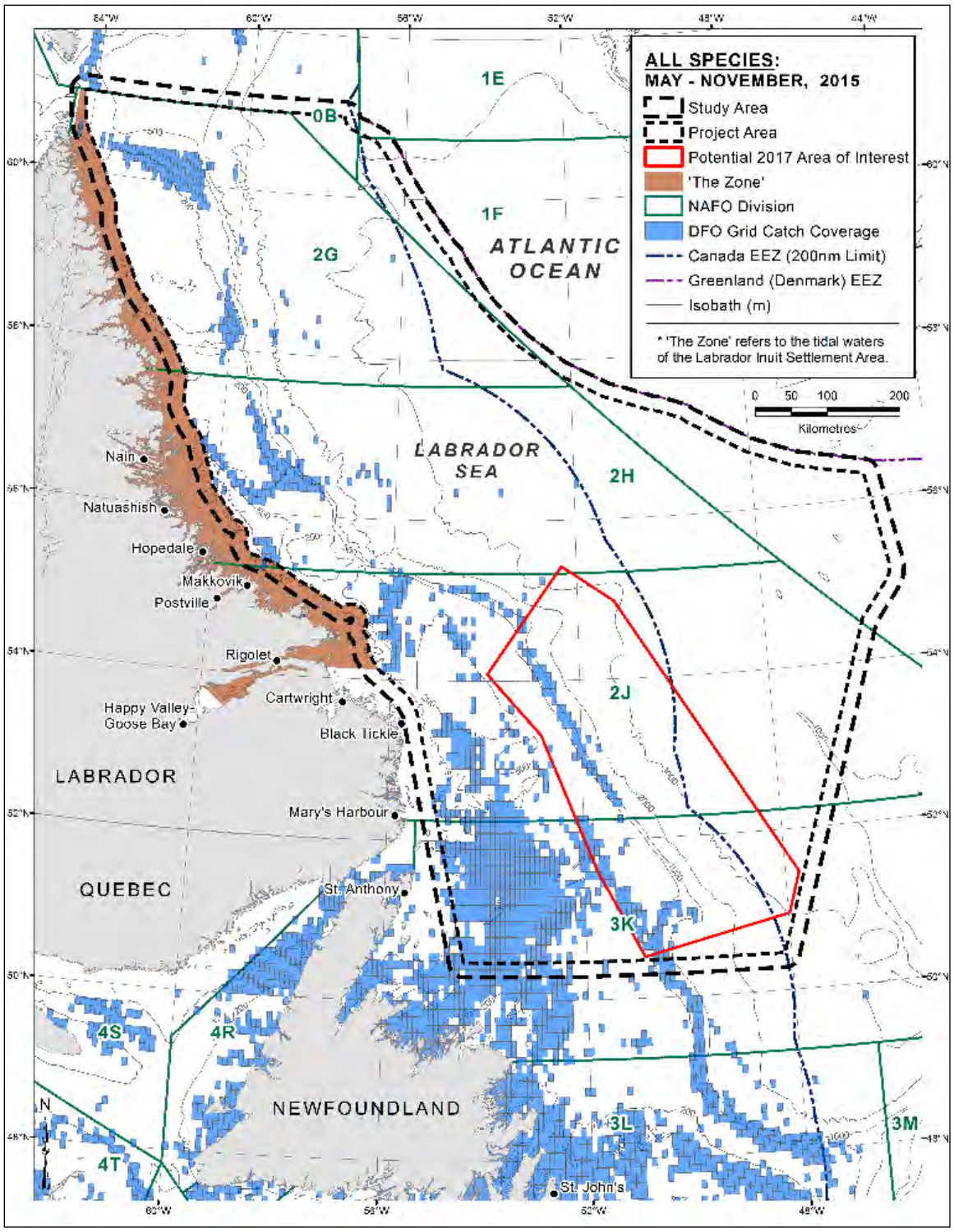

FIGURE 4.4. Distribution of commercial fishery harvest location, all species combined, May–November 2015 (derived from DFO commercial landings database, 2015).

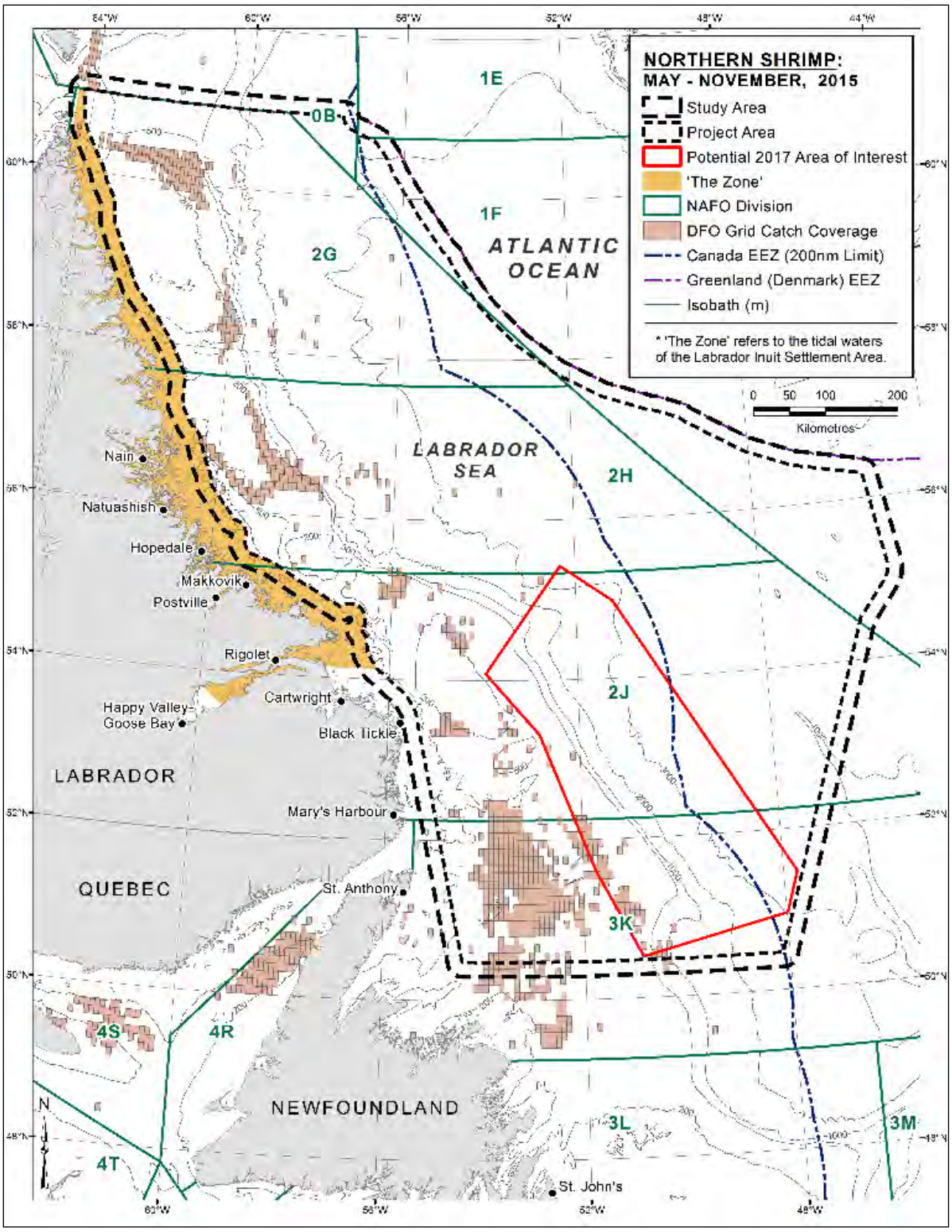

FIGURE 4.5. Distribution of commercial fishery harvest locations, northern shrimp, May–November 2015 (derived from DFO commercial landings database, 2015).

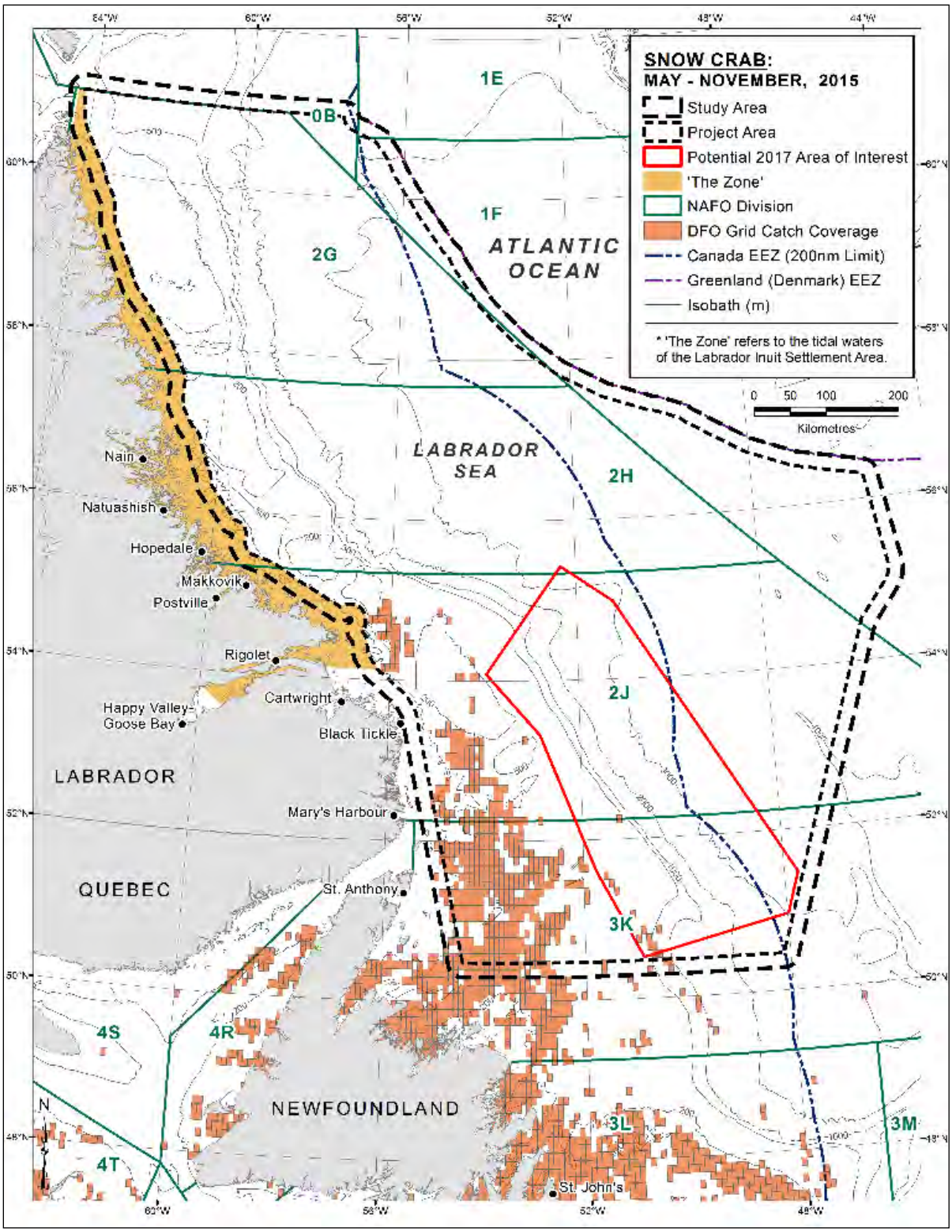

FIGURE 4.6. Distribution of commercial fishery harvest locations, snow crab, May–November 2015 (derived from DFO commercial landings database, 2015).

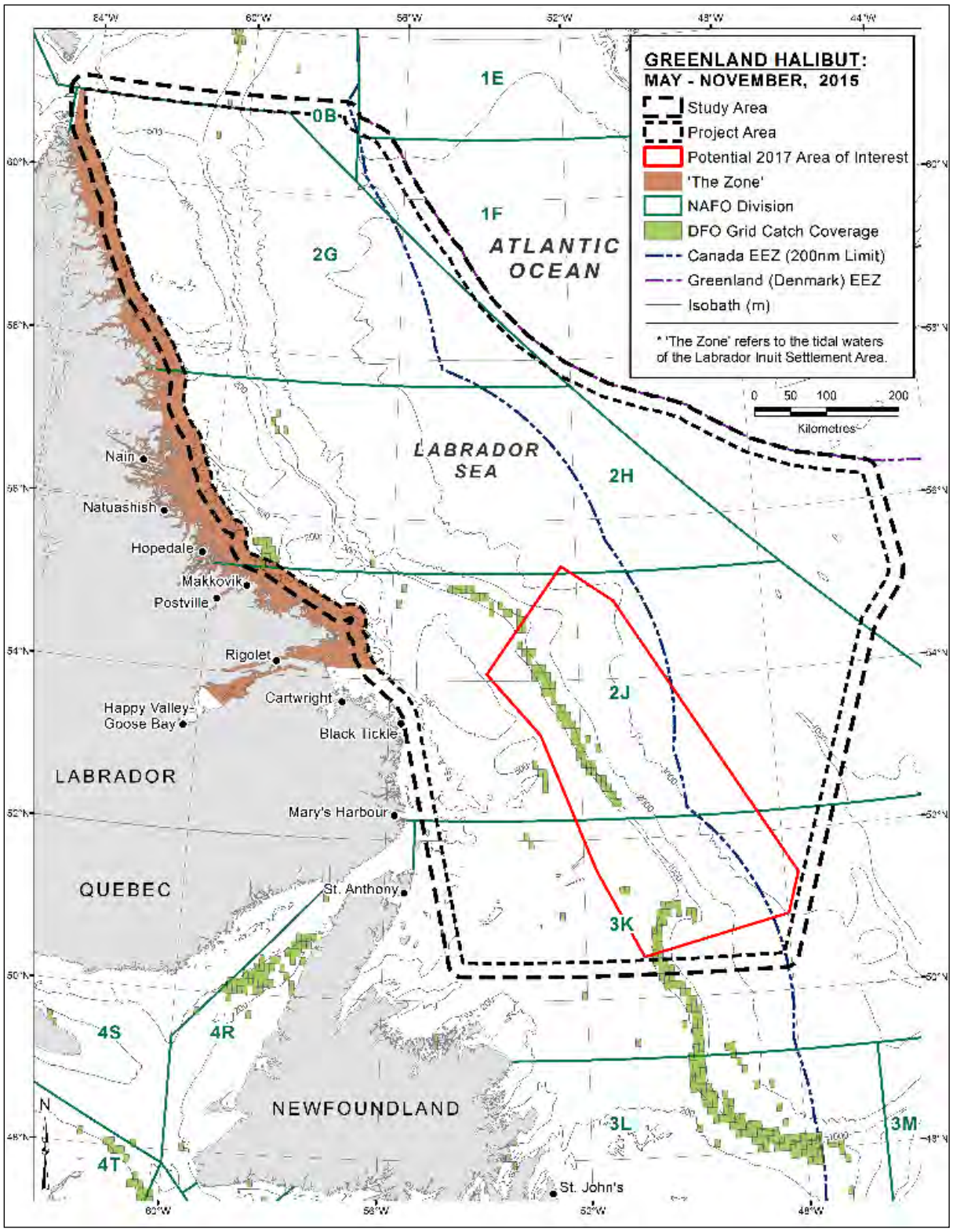

FIGURE 4.7. Distribution of commercial fishery harvest locations, Greenland halibut, May–November 2015 (derived from DFO commercial landings database, 2015).

TABLE 4.1. Commercial catch weights and values in the Study Area, May–November 2015. Values indicate the frequency of catch weight quartile codes (i.e., 1–4) attributed to each species. Gear types and months of effort are also indicated.

Species	Catch Weight Quartile Code Counts [a]				Catch Value Quartile Code Counts [b]				Total Counts [c]	Month Caught	Gear Type	
	1	2	3	4	1	2	3	4			Fixed	Mobile
Northern Shrimp	305	499	571	758	325	451	498	859	2,133	May–Nov	-	Trawl
Snow Crab	271	386	268	67	231	358	273	130	992	May–Aug	Pot	-
Greenland Halibut	7	135	101	5	10	116	112	10	248	May–Sep	Gillnet	Trawl
Striped Shrimp	16	40	68	65	18	40	53	78	189	May–Nov	-	Trawl
Roughhead Grenadier	0	10	6	2	0	2	13	3	18	Jun–Aug	Gillnet	Trawl
Redfish sp.	0	3	10	3	0	2	10	4	16	May–Aug	Gillnet	Trawl
Witch Flounder	0	1	2	1	0	0	3	1	4	May	-	Trawl
American Plaice	0	0	1	2	0	0	1	2	3	Jun	-	Trawl
Atlantic Halibut	0	0	2	0	0	0	2	0	2	Jul	Gillnet	-
Porcupine Crab	0	1	0	0	0	0	1	0	1	Jul	Gillnet	-
Capelin	0	1	0	0	1	0	0	0	1	Jul	-	Seine
Skate sp.	0	1	0	0	0	0	1	0	1	Jul	Gillnet	-
Total	**599**	**1,077**	**1,029**	**903**	**585**	**969**	**967**	**1,087**	**3,608**	**-**	**-**	**-**

Source: DFO commercial landings database, 2015.

[a] Quartile ranges provided by DFO (quartile ranges calculated annually by DFO based on total catch weights in a given year, all species combined). 2015 quartile ranges: 1 = 0 – 2,253 kg, 2 = 2,254 – 9,535 kg, 3 = 9,536 – 40,703 kg, 4 = ≥ 40,704 kg.

[b] Quartile ranges provided by DFO (quartile ranges calculated annually by DFO based on total catch values in a given year, all species combined). 2015 quartile ranges: 1 = $0 – $9,539, 2 = $9,540 – $37,526, 3 = $37,527 – $134,094, 4 = ≥ $134,095.

[c] Total counts of the number of catch records per species; the total quartile code counts for catch weight and catch value are equal.

TABLE 4.2. Commercial catch weights and values in the 2017 AOI, May–November 2015. Values indicate the frequency of catch weight quartile codes (i.e., 1–4) attributed to each species. Gear types and months of effort are also indicated.

Species	Catch Weight Quartile Code Counts [a]				Catch Value Quartile Code Counts [b]				Total Counts [c]	Month Caught	Gear Type	
	1	2	3	4	1	2	3	4			Fixed	Mobile
Greenland Halibut	3	84	68	5	5	68	78	9	160	May–Aug	Gillnet	Trawl
Northern Shrimp	29	41	17	0	30	39	18	0	87	May–Nov	-	Trawl
Roughhead Grenadier	0	10	6	2	0	2	13	3	18	Jun–Aug	Gillnet	Trawl
Snow Crab	8	5	1	0	8	5	1	0	14	May–Jul	Pot	-
Redfish sp.	0	1	8	3	0	1	7	4	12	May–Aug	Gillnet	Trawl
Witch Flounder	0	0	2	1	0	0	2	1	3	May	-	Trawl
American Plaice	0	0	1	2	0	0	1	2	3	Jun	-	Trawl
Atlantic Halibut	0	0	2	0	0	0	2	0	2	Jul	Gillnet	-
Skate sp.	0	1	0	0	0	0	1	0	1	Jul	Gillnet	-
Total	**40**	**142**	**105**	**13**	**43**	**115**	**123**	**19**	**300**	**-**	**-**	**-**

Source: DFO commercial landings database, 2015.

[a] Quartile ranges provided by DFO (quartile ranges calculated annually by DFO based on total catch weights in a given year, all species combined). 2015 quartile ranges: 1 = 0 – 2,253 kg, 2 = 2,254 – 9,535 kg, 3 = 9,536 – 40,703 kg, 4 = ≥ 40,704 kg.

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[c] Total counts of the number of catch records per species; the total quartile code counts for catch weight and catch value are equal.

4.2.1.4 Other Notable Commercial Species

As noted in the 2015 and 2016 EA Updates (see § 4.2.1 *in* LGL 2015a and § 4.2.1.4 *in* LGL 2016), redfish (*Sebastes* sp.), American plaice (*Hippoglossoides platessoides*), Atlantic halibut (*H. hippoglossus*), yellowtail flounder and Atlantic cod have also been identified as important commercial species in the Study Area (see Table 4.2 *in* LGL 2014a and Table 4.1 *in* LGL 2015a). Of these species, harvests of redfish, American plaice and Atlantic halibut were reported during May–November 2015. These species are harvested primarily in areas where water depths are <500 m (i.e., western portions of the Study Area and 2017 2D AOI). Atlantic halibut are managed by DFO while NAFO sets annual TAC values for the remaining four species. A fishing ban has been in place for redfish in Sub-area 2 and Div. 1F + 3K since 2012. There are no TAC quotas set for redfish, American plaice, Atlantic halibut or yellowtail flounder within the Study Area (DFO 2016d; NAFO 2017). During the 2016 fishing season, base harvesting limits for Atlantic cod in Div. 2J3KL were ~0.9 and 1.4 mt per week during 15 August–4 September and from 4 September until the end of the season, respectively (DFO 2016d).

4.2.1.5 Timing and Gear Types

As in previous years, most of the harvesting in the Study Area in 2015 occurred during the June–August period (see Figure 4.8 below, Figure 4.8 *in* LGL 2014a, Figure 4.5 *in* LGL 2015a and Figure 4.3 *in* LGL 2016). The majority of harvest within the 2017 2D AOI also occurred during June–August 2015. Gear types used in the 2015 harvest were typical of those used during previous years (see Table 4.1 above and *in* LGL 2016; and § 4.10.2.3 in the Labrador Shelf SEA [C-NLOPB 2008]). The 2015 harvest locations for both fixed and mobile gear are shown in Figures 4.9 and 4.10.

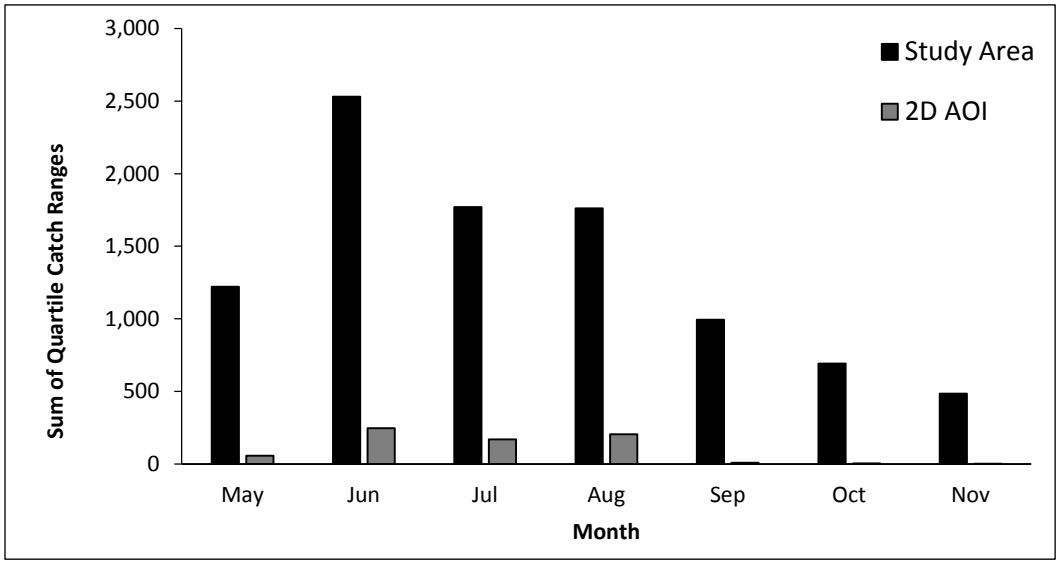

FIGURE 4.8. Monthly sums of catch weight quartile codes in the Study Area and 2017 AOI, all species combined, May–November 2015 (derived from DFO commercial landings database, 2015). The sum of catch weight quartile codes is the summation of quartile codes (i.e., 1–4) for all catch records for all species; the greater the sum of quartile code counts, the greater the catch weight for a given month.

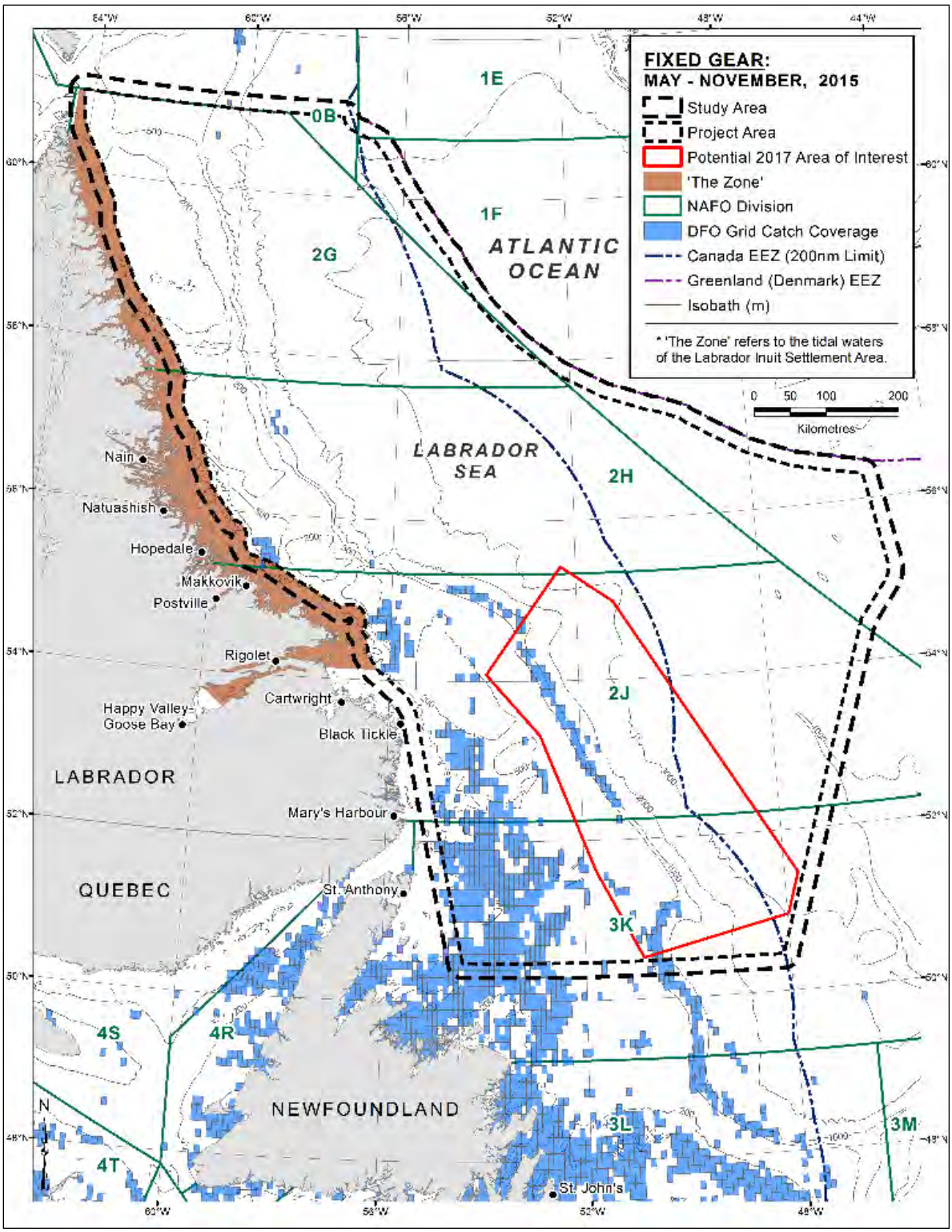

FIGURE 4.9. Harvest locations using fixed gear in the Study and Project areas, all species combined, May–November 2015 (derived from DFO commercial landings database, 2015).

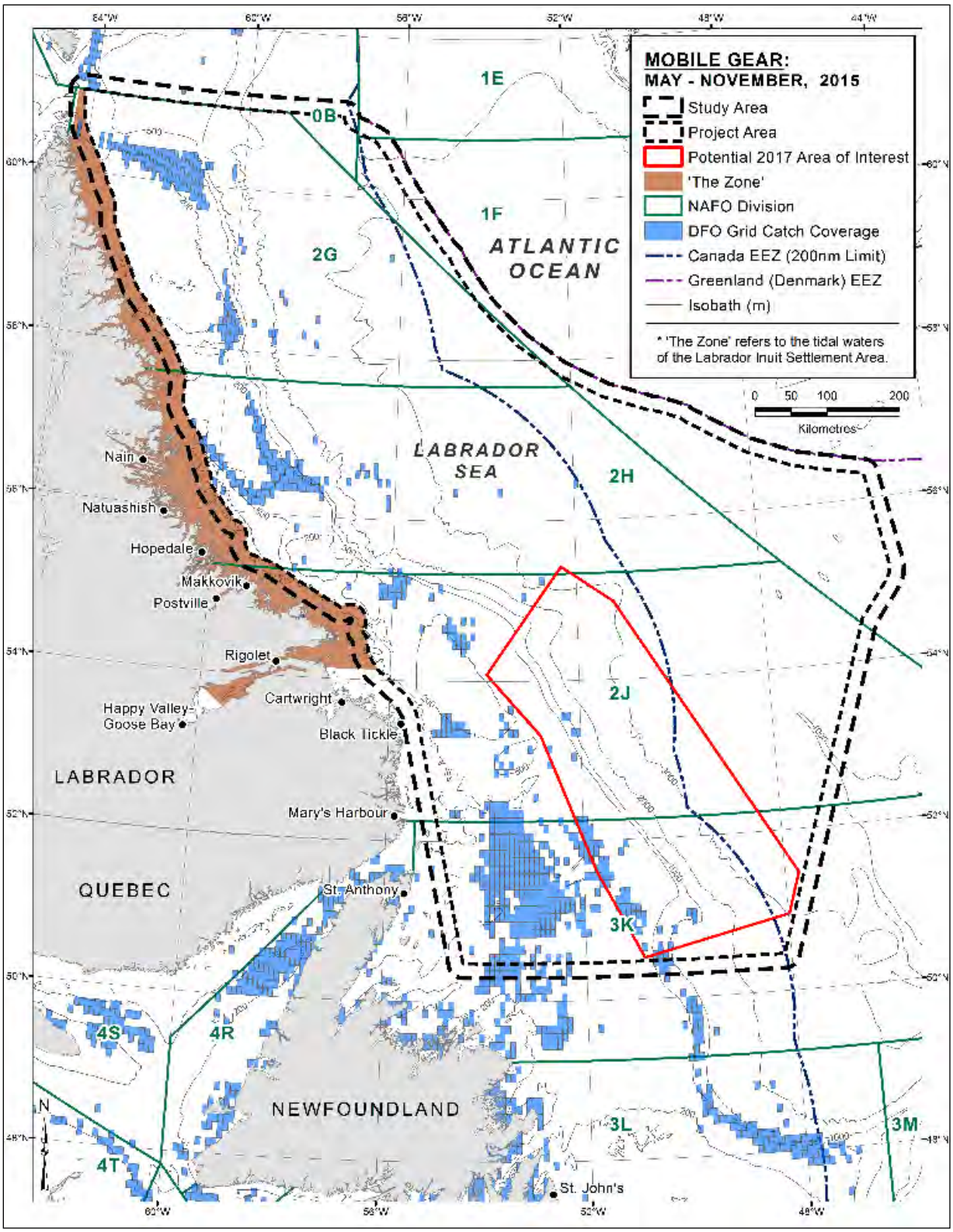

FIGURE 4.10. Harvest locations using mobile gear in the Study and Project areas, all species combined, May–November 2015 (derived from DFO commercial landings database, 2015).

4.2.2 Traditional and Aboriginal Fisheries

Traditional and aboriginal fisheries are described in § 4.3.4 of the EA (LGL 2014a), § 5.8.3 of the Labrador Shelf SEA (C-NLOPB 2008), and § 4.2.2 of the 2015 and 2016 EA Updates, respectively (LGL 2015a, 2016). In an effort to increase Indigenous access to the northern shrimp fishery in SFA 5 (within the central-western portion of the Study Area), three Indigenous groups (Innu, the NunatuKavut Community Council and Nunatsiavut Government) will receive "increased stable and predictable shares", beginning in the 2016/2017 fishing season (DFO 2016d), which combined accounts for ~21% of the TAC among all fleets/interests this season. The communal snow crab quotas for the 2016/2017 seasons were 100 mt within Div. 2GH north of 56ºN and 310 mt within 2J (north) between 54º40'N and 56ºN (DFO 2016d, 2017b).

Other than the northern shrimp and snow crab fisheries mentioned above and the fisheries presented in § 4.2.2 of the 2016 EA Update (LGL 2016), according to the Labrador Shelf and Eastern Newfoundland SEAs (C-NLOPB 2008, 2014), there are no additional Aboriginal fisheries that occur in the Study Area.

4.2.3 Recreational Fisheries

Recreational fisheries in Newfoundland and Labrador are described in § 3.10.3 of the Labrador Shelf SEA (C-NLOPB 2008), § 4.3.4.4 of the Eastern Newfoundland SEA (C-NLOPB 2014), § 4.3.5 of the EA (LGL 2014a), and § 4.2.3 of the 2015 and 2016 EA Updates (LGL 2015a, 2016). In 2016, the recreational groundfish fishery was set to open for a total of 46 days, an increase of 14 days from previous years, from the first weekend in July to early-October (DFO 2016d). This extension is considered a transitional measure that was implemented ahead of the upcoming licence and tag regime for all recreational fishery participants, which is anticipated prior to the 2017 season (DFO 2016d).

The recreational fishery occurs in all NAFO areas around Newfoundland and Labrador, including NAFO Divisions 2GHJ, 3KLPsPn and 4R, with the exception of the Gilbert Bay (southeast Labrador) and Eastport (northeast Newfoundland) Marine Protected Areas (MPAs) (DFO 2016d). Of these NAFO Divisions, portions of Div. 2GH, 2J and 3K overlap the Study Area.

Recreational fisheries may be conducted in the shallower Labrador Shelf waters in the western portion of the Study Area. Given the 2017 2D AOI's distance from shore, it is highly unlikely that any recreational fisheries will be conducted in it.

4.2.4 Aquaculture

As indicated in the Labrador Shelf SEA (see § 4.10.4 *in* C-NLOPB 2008) and the Eastern Newfoundland SEA (see § 4.3.4.3 *in* C-NLOPB 2014), there are no approved aquaculture sites in the Study Area. Currently, all aquaculture sites in Newfoundland and Labrador are located on the coast, west of the Study Area (see Figure 4.150 *in* C-NLOPB 2014; DFFA 2016).

4.2.5 DFO and Industry Science Surveys

DFO Research Vessel (RV) data collected during annual multi-species trawl surveys between 2007–2011 were presented in the EA (see § 4.3.7 *in* LGL 2014a), while RV data collected in 2012 and 2013 were analyzed in the 2015 and 2016 EA Updates, respectively (see § 4.2.4 *in* LGL 2015a; § 4.2.5 *in* LGL 2016). Results of the analysis of the RV dataset during May–November 2014 RV surveys in the Study Area did not indicate any major differences in either dominant species caught or the harvest locations compared to previous survey years (see Table 4.4 and Figure 4.30 *in* LGL 2014a), with the majority of catch consisting of northern shrimp (24% of total catch weight), Greenland halibut (19%) and deepwater redfish (19%) during 2014, and all harvest locations within water depths <2,000 m, in the western portion of the Study and Project Areas and 2017 2D AOI in NAFO Div. 2HJ and 3K. As in 2012 but contrary to 2013, there were no RV data collected in the Study Area during spring in 2014 (LGL 2015a, 2016); 2014 RV surveys were conducted within the Study Area during October and November. The 2017 2D AOI overlaps numerous RV harvest locations in 2014, particularly in areas where water depths are <1,000 m (Figure 4.11).

The tentative schedule of the 2017 DFO multispecies science surveys (RV surveys) is presented below (Table 4.3) (D. Power, DFO, NAFO Senior Science Advisor/Coordinator, pers. comm. 16 February 2017). Spring RV surveys are currently set to begin at the end of March and continue into early-June. Spring RV surveys are anticipated to occur in the Study Area during May and late-August. DFO fall RV surveys will begin at the end of August and end in early-December, possibly occurring in the Study Area throughout this period.

The Industry-DFO Collaborative Post-season Trap Survey for Snow Crab was described in § 4.3.8 of the EA (LGL 2014a). As indicated in Figure 4.12, numerous stations associated with this survey are located in the southwestern portions of the Study Area in Div. 2J and 3K. The total number of stations remained consistent from year to year up to and including the 2016 survey year; in 2017, the total number of stations increased from 1,257 to 1,316, with 183 and 160 stations occurring within the Study and Project Areas, respectively. Thirteen stations occur within the central-western portion of the 2017 2D AOI. Sampling at these stations is anticipated to occur during September–November in 2017, and the 2017 TAC for this survey is 470 mt (DFO 2017b).

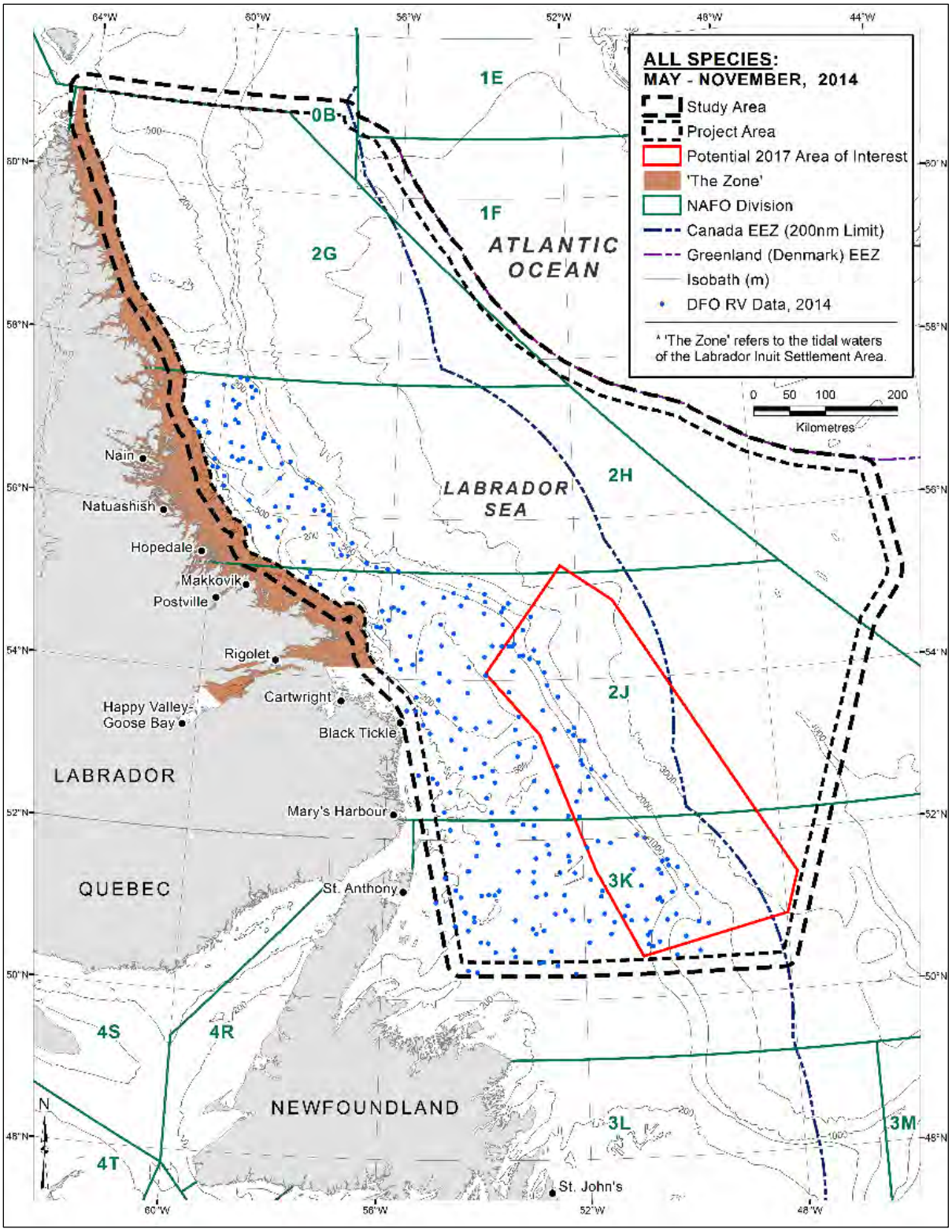

FIGURE 4.11. Distribution of DFO RV survey catch locations in the Study Area and 2017 AOI, May–November 2014 (derived from DFO RV survey database, 2014).

TABLE 4.3. Tentative schedule of DFO RV surveys in 2017.

NAFO Division	Start Date	End Date	Vessel
3P	31 March	11 April	*Needler*
3L	4 April	25 April	*Teleost*
3P + 3KLMNO	26 April	1 May	*Teleost*
3P	12 April	25 April	*Needler*
3P + 3O	26 April	9 May	*Needler*
3KL	2 May	23 May	*Teleost*
3O + 3N	9 May	23 May	*Needler*
3L + 3N	24 May	10 June	*Needler*
2J + 4R	31 August	12 September	*Needler*
3O	13 September	26 September	*Needler*
3O + 3N	26 September	10 October	*Needler*
2H	5 October	10 October	*Teleost*
3N + 3L	11 October	24 October	*Needler*
2H + 2J	11 October	24 October	*Teleost*
3L	24 October	7 November	*Needler*
2J + 3K	24 October	7 November	*Teleost*
3K + 3L	8 November	21 November	*Needler*
3K	8 November	21 November	*Teleost*
3K + 3L Deep	21 November	5 December	*Teleost*

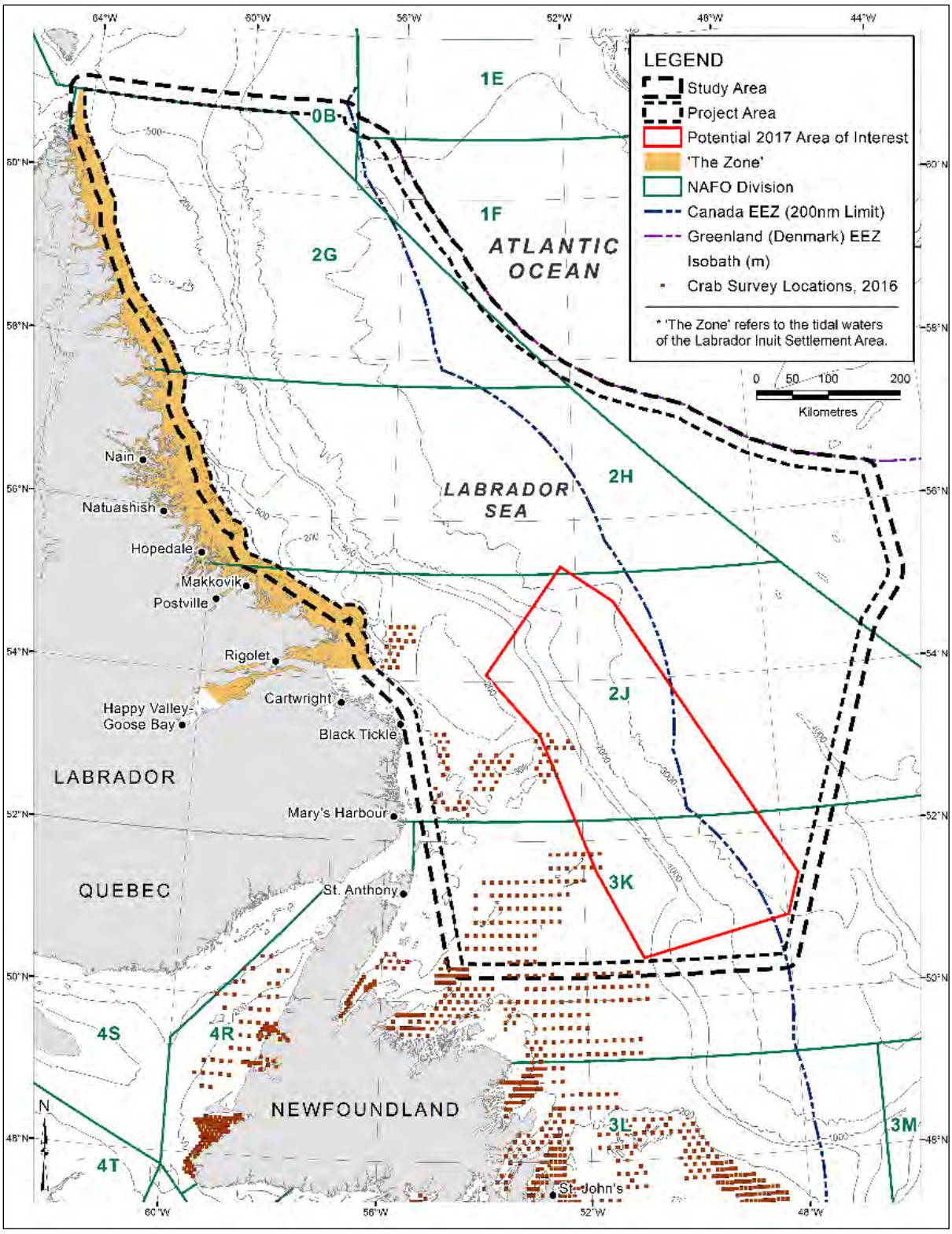

FIGURE 4.12. Locations of sampling stations associated with the industry-DFO collaborative post-season trap survey for snow crab in relation to the Study and Project areas, and 2017 AOI (source: DFO 2016b).

The new information presented on fisheries does not change the effects predictions for this VEC made in the EA (LGL 2014a) and Addendum (LGL 2014b).

4.3 Seabirds

This section includes updates to the description of the Seabird VEC described in Section 4.4 of MKI's EA (LGL 2014a), the associated Addendum (LGL 2014b) and Updates (LGL 2015a; LGL 2016). The new/updated information presented on breeding colonies (§4.3.1), murre distribution and movements (§4.3.2), and seabird in-air hearing (§4.3.3) does not change the effects predictions made in the EA (LGL 2014a) and Addendum (LGL 2014b).

4.3.1 Breeding Colonies

Environment and Climate Change Canada (ECCC)–Canadian Wildlife Service (CWS) provided updated information on numbers of breeding seabird pairs in Important Bird Areas bordering or adjacent to the Study Area (Table 4.4; ECCC-CWS, unpublished data). The numbers of breeding birds on Gannet Islands, the largest breeding colony in Labrador, are now reported as 86,000 vs. 91,000 pairs in the original EA. This decrease is attributable to a lower number reported for Common Murres. Similarly, the numbers of breeding pairs of Atlantic Puffin on Labrador colonies from Groswater Bay to the islands off Nain are lower than previously reported (69,000 pairs vs. 82,000 pairs).

4.3.2 Murre Distribution and Movements

Frederiksen et al. (2016) analyzed data from geologgers placed on Thick-billed Murres (*n*=320) at 18 colonies in Canada (Arctic and Labrador only), Greenland, Iceland, Svalbard and mainland Norway to enhance our understanding of this species movements between colonies and wintering areas. There was a strong correlation between where tagged birds bred and wintered. Breeding populations from the eastern Canadian Arctic and northwest Greenland wintered mainly offshore Newfoundland and Labrador, including a portion of the Study Area. Small numbers of Thick-billed Murres from Iceland, Svalbard and Norway also wintered offshore Newfoundland and Labrador, but primarily wintered off Greenland and around Iceland. The tagging data also revealed that some females migrate south (with the aid of prevailing currents) to areas offshore Labrador earlier than males, which move south with flightless young (Frederiksen et al. 2016).

A study involving attaching geolocators to Thick-billed Murres and Common Murres in Canadian breeding colonies revealed the core wintering areas and movements within wintering areas for both species of murre (McFarlane Tranquilla et al. 2015). The core wintering area for Thick-billed Murres tagged at breeding colonies in the eastern Arctic (Coats, Digges, Minarets, and Prince Leopold colonies) was primarily off Labrador and northern Newfoundland. Thick-billed Murres and Common Murres tagged in Labrador (Gannet Island colony) primarily wintered off northeastern Newfoundland south to the tail of the Grand Banks. Common Murres tagged at Funk and Gull islands had a smaller, more southerly core winter habitat (McFarlane Tranquilla et al. 2015).

TABLE 4.4. Breeding pairs of pelagic seabirds at Important Bird Areas near the Study Area.

Species	Southeast of Nain	Quaker Hat	Northeast Groswater Bay	Gannet Islands	Bird Island	Northern Groais Island	Wadham Islands	Funk Island	Cape Freels/ Cabot Island	TOTALS
Northern Fulmar *Fulmarus glacialis*	-	-	-	24[d]	-	-	-	6[a]	-	30
Leach's Storm-Petrel *Oceanodroma leucorhoa*	-	-	10[a]	20[a]	Present[a]	-	200[a]	-	250[a]	480
Northern Gannet *Morus bassanus*	-	-	-	-	-	-	-	10,159[a]	-	10,159
Herring Gull *Larus argentatus*	30[a]	-	220[a]	-	-	-	-	150[a]	-	400
Glaucous Gull *L. hyperboreus*	385[a]	-	-	-	-	-	-	-	-	385
Great Black-backed Gull *L. marinus*	90[a]	-	125[a]	30[d]	20[a]	-	-	75[a]	-	340
Black-legged Kittiwake *Rissa tridactyla*	-	4[a]	-	72[a]	-	1,050[f]	-	95[a]	-	1221
Arctic (*Sterna paradisaea)* and Common Terns (*S. hirundo)*	-	-	-	-	-	-	22[f]	-	250[a]	272
Common Murre *Uria aalge*	87[a]	648[a]	2,360[a,c]	31,170[a]	3,100[a]	-	-	472,259[g]	9,897[a]	519,521
Thick-billed Murre *U. lomvia*	5,200[a]	126[a]	365[a]	1,846[a]	Present[a]	-	-	250[a]	-	7,787
Razorbill *Alca torda*	815[a]	450[a]	1,520[a,c]	14,801[a]	1,530[a]	-	273[e]	200[a]	25[a]	19,614
Black Guillemot *Cepphus grylle*	1,850[a]	-	present	110[a]	-	-	50[a]	1[b]	-	2,011
Atlantic Puffin *Fratercula arctica*	2,470[a,c]	2,100[a]	18,210[a,c]	38,666[d]	8,070[a]	-	6,190[e]	2,000[a]	20[a]	77,726
Totals	**10,927**	**3,328**	**22,810**	**86,739**	**12,720**	**1,050**	**6,735**	**485,195**	**10,442**	**639,946**

Source: [a] ECCC-CWS unpublished data, [b] Cairns et al. (1989), [c] Robertson et al. (2002), [d] Robertson and Elliot (2002a), [e] Robertson and Elliot (2002b), [f] Thomas et al. (2014), [g] Wilhelm et al. (2015).

4.3.3 Seabird Hearing

Crowell (2016) measured auditory brainstem response in seabird species for the first time; these species were: Lesser Scaup (*Aythya affinis*), Long-tailed Duck (*Clangula hyemalis*), Red-throated Loon (*Gavia stellata*), and Northern Gannet. The study found that in-air hearing sensitivity of these species is greatest between 1,500 and 3,000 Hz, which is in the range of hearing of other bird species that have been tested.

4.4 Marine Mammals and Sea Turtles

This section includes updates to the description of the Marine Mammal and Sea Turtle VEC described in Section 4.5 of MKI's EA (LGL 2014a) and the associated Addendum (LGL 2014b), and in Section 4.4 of the 2015 and 2016 EA Updates (LGL 2015a, 2016).

4.4.1 Updated *SARA* Listings and COSEWIC Designations

Table 4.5 provides the current updated *SARA* and COSEWIC status of all marine mammal and sea turtle species included in Tables 4.10 and 4.12 of the MKI EA (LGL 2014a). One species, the North Atlantic right whale, was added to the list of species originally outlined in the EA (LGL 2014a) on the basis of a reported sighting of two individuals within the Study Area in the updated DFO sightings database (see Section 4.4.3). The North Atlantic right whale currently has an *endangered* status under both Schedule 1 of *SARA* and COSEWIC (Table 4.5). There are at least 524 and perhaps as many as 716 catalogued individuals in the western North Atlantic (Pettis and Hamilton 2016). Profiles of this species at risk are provided in § 4.6.1.3 of LGL (2015b,c). The North Atlantic right whale is expected to be rare in the Study Area.

Reports on the progress of the recovery strategy for the North Atlantic right whale and blue whale (DFO 2016e,f) and management plans for the Sowerby's beaked whale (proposed; DFO 2016g) and fin whale (DFO 2017c) were recently released. A proposed action plan for the North Atlantic right whale with regards to fisheries interactions (DFO 2016h) was also released. A management plan for the polar bear will not be available until 2018 (DFO 2016i).

TABLE 4.5. Marine mammal and sea turtle *SARA* and COSEWIC updated status.

Species	*SARA* Status[a]	COSEWIC Status[b]
Baleen Whales (Mysticetes)		
North Atlantic Right Whale (*Eubalaena glacialis*)	Schedule 1: Endangered	E
Humpback Whale (*Megaptera novaengliae*)	Schedule 3: Special Concern	NAR
Blue Whale (*Balaenoptera musculus*)	Schedule 1: Endangered	E
Fin Whale (*B. physalus*)	Schedule 1: Special Concern	SC

Species	*SARA* Status[a]	COSEWIC Status[b]
Sei Whale (*B. borealis*)	NS	DD; HPC
Minke Whale (*B. acutorostrata*)	NS	NAR
Toothed Whales (Odontocetes)		
Sperm Whale (*Physeter macrocephalus*)	NS	NAR; MPC
Northern Bottlenose Whale (*Hyperoodon ampullatus*)	NS [c]	SC [c]
Sowerby's Beaked Whale (*Mesoplodon bidens*)	Schedule 1: Special Concern	SC
Beluga Whale (*Delphinapterus leucas*)[d]	NS	E
White-beaked Dolphin (*Lagenorhynchus albirostris*)	NS	NAR
Atlantic White-sided Dolphin (*L. acutus*)	NS	NAR
Killer Whale (*Orcinus orca*)	NS	SC
Long-finned Pilot Whale (*Globicephala melas*)	NS	NAR
Harbour Porpoise (*Phocoena phocoena*)	Schedule 2: Threatened	SC
True Seals (Phocids)		
Harp Seal (*Pagophilus groenlandicus*)	NS	NC; LPC
Hooded Seal (*Cystophora cristata*)	NS	NAR; MPC
Grey Seal (*Halichoerus grypus*)	NS	NAR
Harbour Seal (*Phoca vitulina*)	NS	NAR
Ringed Seal (*Phoca hispida*)	NS	NAR; HPC
Bearded Seal (*Erignathus barbatus*)	NS	DD;MPC
Bears (Ursids)		
Polar Bear (*Ursus maritimus*)	Schedule 1: Special Concern	SC
Sea Turtles		
Leatherback Sea Turtle (*Dermochelys coriacea*)	Schedule 1: Endangered	E
Loggerhead Sea Turtle (*Caretta caretta*)	NS	E
Kemp's Ridley Sea Turtle (*Lepidochelys kempii*)	NS	NC; LPC

[a] Species designation under the *Species at Risk Act* (GC 2017); NS = No Status.

[b] Species designation by COSEWIC (Committee on the Status of Endangered Wildlife in Canada; COSEWIC 2017); E = Endangered, SC = Special Concern, DD = Data Deficient, NAR = Not at Risk, NC = Not Considered, LPC = Low-priority Candidate, MPC = Mid-priority Candidate, HPC = High-priority Candidate.

[c] Davis Strait-Baffin Bay-Labrador Sea population.

[d] Population affiliation is unclear, but individuals presumably represent the Ungava Bay and/or eastern Hudson Bay populations (DFO 2005).

4.4.2 Updated Population/Abundance Estimates

Delarue et al. (2014) suggested that there are four distinct fin whale stocks in the NW Atlantic based on geographic differences in fin whale calls. According to Edwards et al. (2015), highest densities of fin whales occur in offshore waters off Newfoundland and Labrador during June–August.

The NW Atlantic harp seal population appears to have levelled off since 2008 at ~7.4 million (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).

4.4.3 DFO Sightings Database

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). The content of this database has recently been updated, and has been made available for the purposes of describing species sightings within the Study Area. These data have been opportunistically gathered and have no indication of survey effort. Therefore, while these data can be used to indicate what species may occur in the Study Area, they cannot be used to predict species abundance, distribution, or fine-scale habitat use in the area.

The caveats that should be considered when using data from the DFO sightings database were provided in § 4.5.1.1 of LGL (2014a).

Cetacean sightings in the Study Area within the temporal boundary of the project (May–November) compiled from the DFO sightings database (1947–2015) are summarized in Table 4.6. Sightings include baleen whales, large toothed whales, and dolphins and porpoises. No sea turtles were recorded within the boundaries of the Study Area in the DFO sightings database.

Humpback whale was the most commonly recorded mysticete in the Study Area and 2017 Area of Interest in the DFO sightings database (5,155 and 240 individuals, respectively; Table 4.6; Figure 4.13). One sighting of two North Atlantic right whales was recorded in August 2015 in the 2017 Area of Interest. No blue whales were recorded in the 2017 Area of Interest, but eight individuals were recorded in the Study Area between July and September. Long-finned pilot whale was the most commonly recorded odontocete in the Study Area and in the 2017 Area of Interest in the DFO sightings database (4,923 and 548 individuals, respectively; Table 4.6; Figure 4.14). Sperm whale and northern bottlenose whale were also frequently recorded large odontocetes in the Study Area (681 and 639 individuals, respectively; Table 4.6; Figure 4.14). White-beaked dolphin was the most commonly recorded dolphin species in the Study Area (855 individuals), but were not as commonly recorded in the 2017 Area of Interest (20 individuals; Table 4.6; Figure 4.15). Atlantic white-sided dolphin and common dolphin were the most frequently recorded dolphin species in the 2017 Area of Interest in the DFO sightings database (403 and 206 individuals, respectively; Table 4.6; Figure 4.15).

TABLE 4.6. Cetacean sightings in the Study Area and 2017 Area of Interest during the temporal period (May–November) of the Project (compiled from the DFO sightings database, 1947–2015).

Species	Study Area			2017 Area of Interest		
	No. of Sightings	No. of Individuals	Months Sighted	No. of Sightings	No. of Individuals	Months Sighted
Mysticetes						
North Atlantic Right Whale	1	2	Aug	1	2	Aug
Humpback Whale	750	5,155	May-Nov	64	240	Jun-Nov
Blue Whale	7	8	Jul-Sep	0	0	–
Fin Whale	1,979	2,484	May-Nov	49	61	Jul-Sep
Sei Whale	130	236	May, Jul-Nov	4	4	Sept-Oct
Fin/Sei Whale	7	19	Jul-Oct	1	2	Oct
Minke Whale	189	384	May-Nov	23	72	May, Jul-Nov
Unidentified Baleen Whale	39	64	Jul-Oct	5	10	Aug-Oct
Odontocetes						
Sperm Whale	207	681	May-Nov	41	144	July-Sep, Nov
Northern Bottlenose Whale	132	639	May-Nov	24	70	May-Aug, Oct
Sowerby's Beaked Whale	1	7	Nov	0	0	–
Beluga	4	34	Jul	0	0	–
White-beaked Dolphin	152	855	Jul-Aug, Oct-Nov	5	20	Aug, Oct
Atlantic White-sided Dolphin	58	769	Jul-Nov	16	403	Aug-Oct
Bottlenose Dolphin	1	1	Oct	1	1	Oct
Common Dolphin	54	716	Jul-Sep, Nov	2	206	Jul-Aug
Risso's Dolphin	20	36	Aug, Oct-Nov	0	0	–
Killer Whale	69	626	May-Nov	4	46	May-Jul
Long-finned Pilot Whale	239	4,923	May-Nov	32	548	Jun-Nov
Harbour Porpoise	55	159	Jun-Nov	6	36	Jun, Aug-Oct
Unidentified Dolphin	148	1,151	Jun-Nov	16	252	Jun-Nov
Unidentified *Stenella*	1	1	Oct	1	1	Oct
Unidentified *Mesoplodon*	1	2	Aug	0	0	–
Others						
Unidentified Cetacean	16	48	Jul-Oct	1	2	Aug
Unidentified Whale	144	687	May, Jul-Nov	30	119	Jun, Aug-Nov
Unidentified Large Whale	107	274	May-Nov	4	7	May, Aug-Sep
Unidentified Small Whale	16	37	May,Jul,Aug,Oct,Nov	1	3	May

Note: see § 4.3.3 for description of DFO sightings database and caveats associated with these data.

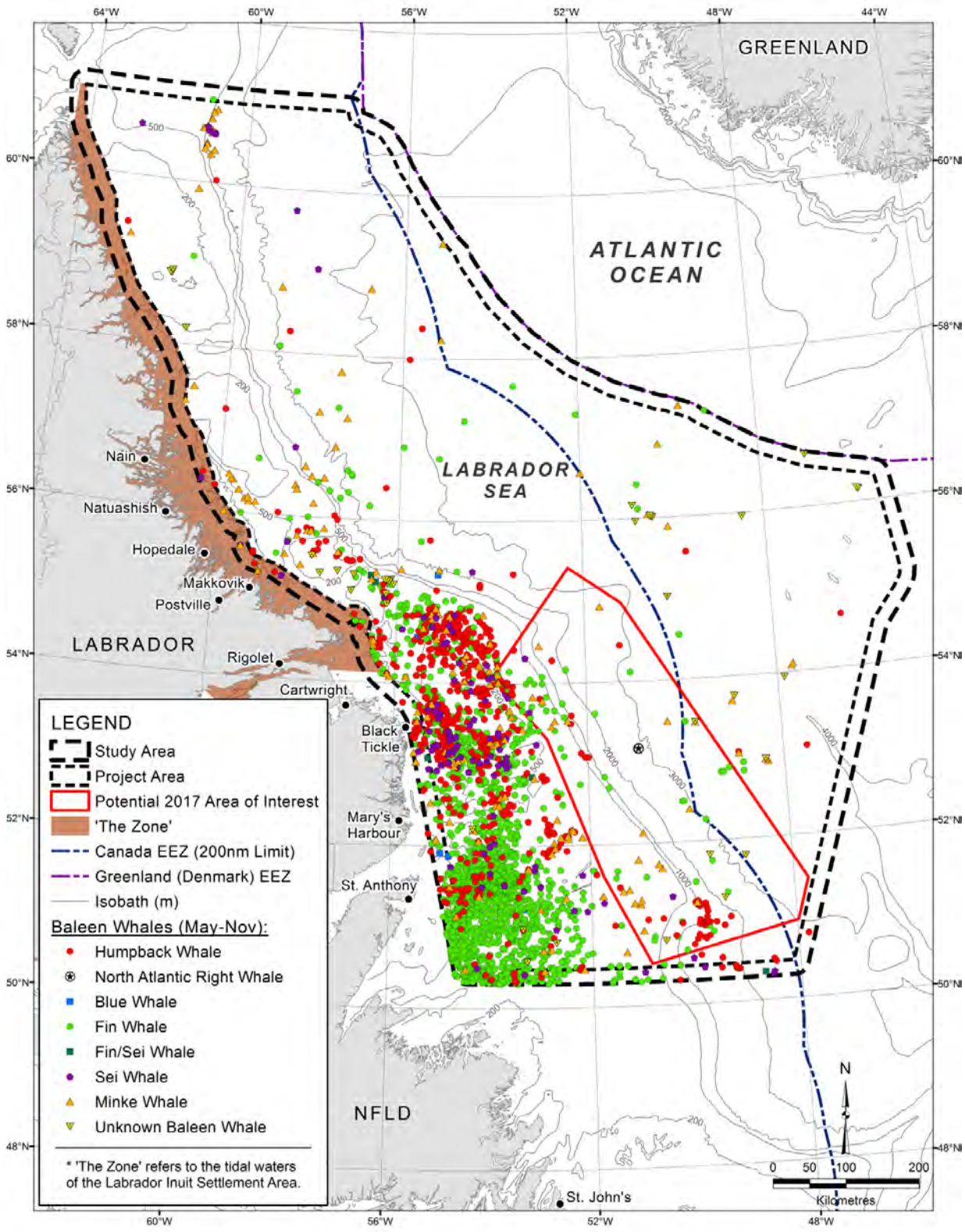

FIGURE 4.13. Baleen whale sightings in the Study Area during May–November (compiled from the DFO sightings database, 1947–2015).

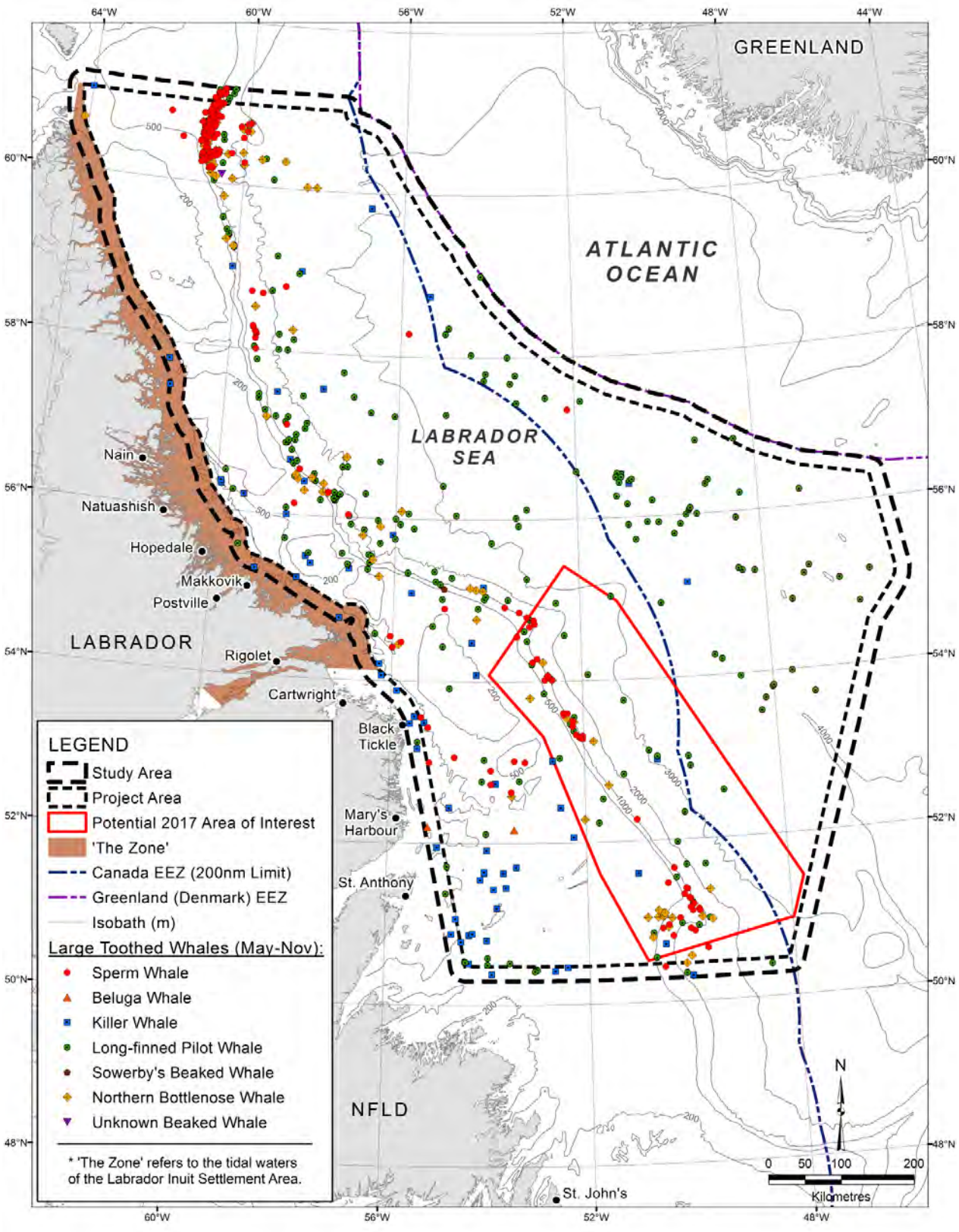

FIGURE 4.14. Large toothed whale sightings in the Study Area during May–November (compiled from the DFO sightings database, 1947–2015).

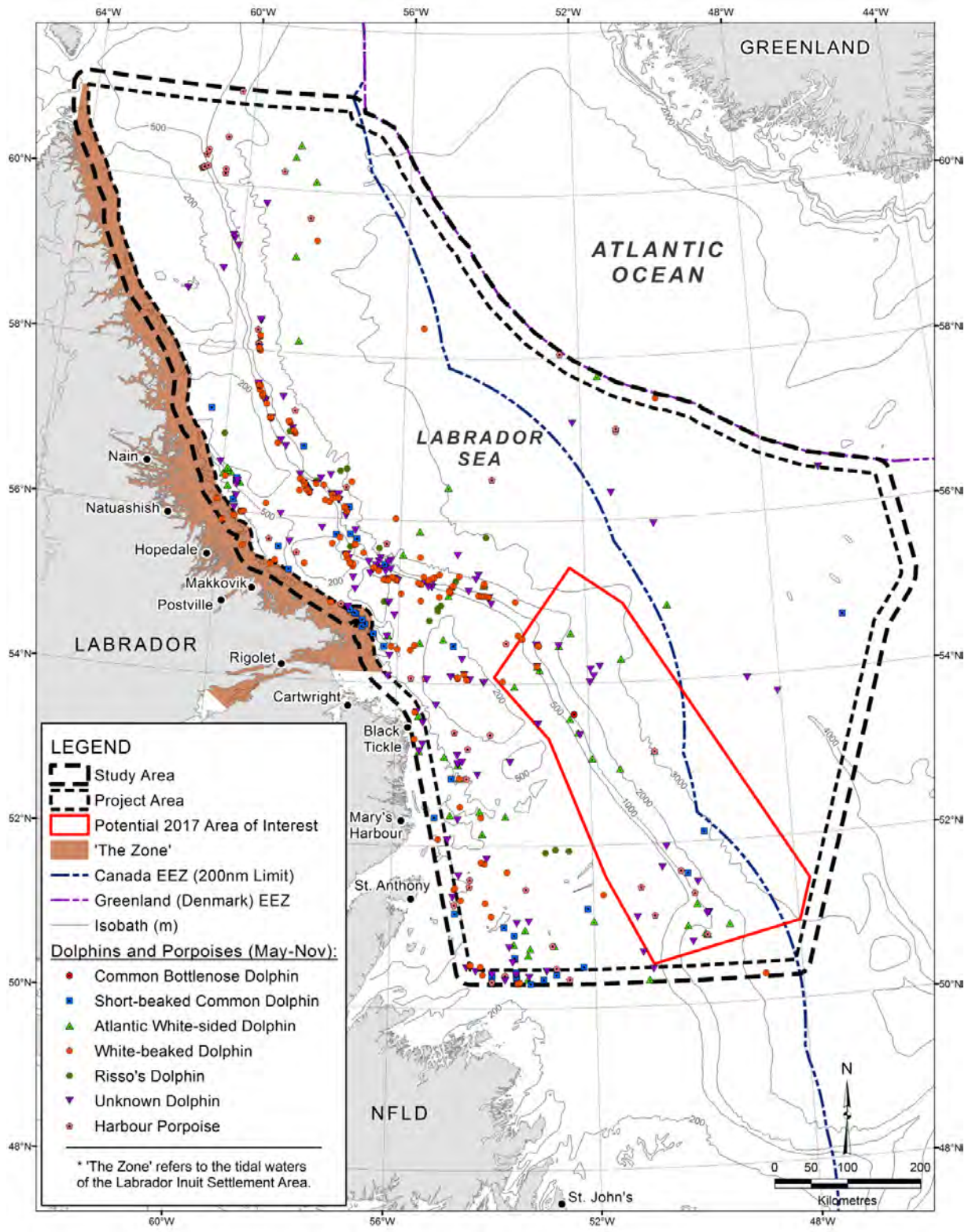

FIGURE 4.15. Dolphin and porpoise sightings in the Study Area during May–November (compiled from the DFO sightings database, 1947–2015).

4.4.4 Additional References

Mannocci et al. (2016) modelled cetacean densities using available line transect survey data and habitat covariates. The models extrapolate density estimates to the U.S. Navy Atlantic Fleet's training and testing area, which includes the Study Area. Density estimate maps for baleen whales species, sperm and beaked whales and dolphin species are provided at http://seamap.env.duke.edu/models/AFTT-2015/.

Long-finned pilot whales within the Study Area were sighted in the southern portion of the Study Area during a July 2012 vessel survey from Boston, U.S., to Reykjavik, Iceland (Ryan et al. 2013). Harbour porpoises were also detected acoustically in the southern portion of the Study Area during this survey.

Archibald and James (2016) assessed the relative abundance of leatherback sea turtles over 14 years off the coast of Nova Scotia. The study indicated that although the relative abundance of leatherback sea turtles exhibited high inter-annual variability, it was likely stable. Preliminary estimates of absolute abundance ranged from 18.3 leatherback sea turtles in 2015 to 569.5 leatherback sea turtles in 2007. Highest abundance of leatherback sea turtles were near the 200 m isobaths.

A study comparing the underwater and aerial hearing sensitivities of juvenile green sea turtles (*Chelonia mydas*) indicated that green sea turtles responded to underwater stimuli between 50 and 1,600 Hz, with maximum sensitivity between 200 and 400 Hz (Piniak et al. 2016). The lowest pressure sensitivity recorded was 85 dB re 1 μPa_{rms} at 300 Hz.

The new information presented on marine mammals and sea turtles does not change the effects predictions for this VEC made in the EA (LGL 2014a) and Addendum (LGL 2014b).

4.5 Species at Risk

Table 4.7 includes the species/populations at risk that could potentially occur in the Study Area, based on available information at the websites for *SARA* and COSEWIC as of March 2017. Changes in species status since preparation of the 2016 EA Update are listed below and noted in blue/bold font in Table 4.7.

- Humpback whale (western North Atlantic population) is listed as *special concern* under Schedule 3 of *SARA* but has no designation by COSEWIC. This species was described in § 4.5.1.1 of the EA (LGL 2014a);
- Blue shark (Atlantic population) was removed because it is currently designated *not at risk* by COSEWIC based on a November 2016 assessment and it is not listed under *SARA*;
- Northwest Atlantic lumpfish was removed because it is no longer a candidate species by COSEWIC and is not listed under *SARA*;
- Spinytail skate was removed because it is no longer a candidate species by COSEWIC and is not listed under *SARA*;

TABLE 4.7. *SARA*-Listed and COSEWIC-assessed marine species that may occur in the Study Area. Changes from the 2016 EA Update indicated with blue/bold font.

SPECIES		*SARA*[a]			COSEWIC[b]			
Common Name	**Scientific Name**	**Endangered**	**Threatened**	**Special Concern**	**Endangered**	**Threatened**	**Special Concern**	***Candidate Species***
Marine Mammals								
Blue Whale (Atlantic population)	*Balaenoptera musculus*	Schedule 1			X			
North Atlantic Right Whale	*Eubalaena glacialis*	Schedule 1			X			
Northern Bottlenose Whale (Scotian Shelf population)	*Hyperoodon ampullatus*	Schedule 1			X			
Beluga Whale (Eastern Hudson Bay population)	*Delphinapterus leucas*				X			
Beluga Whale (Ungava Bay population)	*D. leucas*				X			
Polar Bear	*Ursus maritmus*			Schedule 1			X	
Fin Whale (Atlantic population)	*B. physalus*			Schedule 1			X	
Sowerby's Beaked Whale	*Mesoplodon bidens*			Schedule 1			X	
Humpback Whale (Western North Atlantic population)	***Megaptera novaeangliae***			**Schedule 3**				
Harbour Porpoise (Northwest Atlantic population)	*Phocoena phocoena*		Schedule 2				X	
Northern Bottlenose Whale (Davis Strait-Baffin Bay-Labrador Sea population)	*H. ampullatus*						X	
Killer Whale (Northwest Atlantic/ Eastern Arctic population)	*Orcinus orca*						X	
Sei Whale (Atlantic population)	*B. borealis*							High priority
Ringed Seal	*Phoca hispida / Pusa hispida hispida*							High priority
Hooded Seal	*Cystophora cristata*							Mid priority
Bearded Seal	*Erignathus barbatus*							Mid priority
Sperm Whale	*Physeter macrocephalus*							Mid priority
Harp Seal	*Phoca groenlandica*							Low priority
Sea Turtles								
Leatherback Sea Turtle	*Dermochelys coriacea*	Schedule 1						
Leatherback Sea Turtle (Atlantic population)	*D. coriacea*				X			
Loggerhead Sea Turtle	*Caretta caretta*				X			
Kemp's Ridley Sea Turtle	*Lepidochelys kempii*							Low priority
Fishes								
White Shark (Atlantic population)	*Carcharodon carcharias*	Schedule 1			X			
Northern Wolffish	*Anarhichas denticulatus*		Schedule 1			X		

SPECIES		*SARA*[a]			COSEWIC[b]			
Common Name	**Scientific Name**	**Endangered**	**Threatened**	**Special Concern**	**Endangered**	**Threatened**	**Special Concern**	***Candidate Species***
Spotted Wolffish	*A. minor*		Schedule 1			X		
Atlantic Wolffish	*A. lupus*			Schedule 1			X	
Atlantic Cod	*Gadus morhua*			Schedule 3				
Atlantic Cod (NL population)	*G. morhua*				X			
Atlantic Bluefin Tuna	*Thunnus thynnus*				X			
Porbeagle Shark	*Lamna nasus*				X			
Roundnose Grenadier	*Coryphaenoides rupestris*				X			
Cusk	*Brosme brosme*				X			
Smooth Skate (Funk Island Deep population)	*Malacoraja senta*				X			
Atlantic Salmon (various populations)	*Salmo salar*				X	X	X	
American Eel	*Anguilla rostrata*					X		
American Plaice (NL population)	*Hippoglossoides platessoides*					X		
Acadian Redfish (Atlantic population)	*Sebastes fasciatus*					X		
Deepwater Redfish (Northern population)	*S. mentella*					X		
White Hake (Atlantic and Northern Gulf of St. Lawrence population)	*Urophycis tenuis*					X		
~~**Blue Shark (Atlantic population)**~~	~~***Prionace glauca***~~						~~**X**~~	
Basking Shark (Atlantic population)	*Cetorhinus maximus*						X	
Spiny Dogfish (Atlantic population)	*Squalus acanthias*						X	
Roughhead Grenadier	*Macrourus berglax*						X	
Thorny Skate	*Amblyraja radiata*						X	
~~**Northwest Atlantic Lumpfish**~~	~~***Cyclopterus lumpus***~~							~~**High priority**~~
~~**Spinytail Skate**~~	~~***Bathyraja spinicauda***~~							~~**Mid priority**~~
Pollock	*Pollachius virens*							Mid priority
Greenland Shark	*Somniosus microcephalus*							Mid priority
Atlantic Mackerel	*Scomber scombrus*							Mid priority
Birds								
Ivory Gull	*Pagophila eburnea*	Schedule 1			X			
Harlequin Duck (Eastern population)	***Histrionicus histrionicus***			**Schedule 1**			**X**	
Barrow's Goldeneye (Eastern population)	***Bucephala islandica***			**Schedule 1**			**X**	
Red-necked Phalarope	***Phalaropus lobatus***						**X**	
~~**King Eider**~~	~~***Somateria spectabilis***~~							~~**Low priority**~~

[a] *SARA* website (http://www.sararegistry.gc.ca/default.asp?lang=En&n=24F7211B-1), accessed March 2017;
[b] COSEWIC website (http://www.cosewic.gc.ca/default.asp?lang=En&n=A9DD45B7-1), accessed March 2017.

- "Eastern population" was added for Harlequin Duck and Barrow's Goldeneye; both species are listed as *special concern* under Schedule 1 of *SARA* and are designated *special concern* by COSEWIC; and
- Red-necked Phalarope was added with the rationale that this species may occur in the Project Area during migration. This species is considered special concern by COSEWIC and it has no status under *SARA*. Additional information on this species is provided below.
- King Eider was removed because it is no longer a candidate species by COSEWIC and is not listed under *SARA*.

4.5.1 Red-necked Phalarope

The Red-necked Phalarope was designated a species of Special Concern in November 2014 (COSEWIC 2014). Unlike most other shorebirds, the Red-necked Phalarope spends much of the non-breeding season at sea. The Red-necked Phalarope breeds across the entire circumpolar sub- and low-Arctic. Its distribution at sea during the non-breeding season is not completely understood. The primary over-wintering sites for North American breeding Red-necked Phalaropes are believed to be off the western coast of Peru, with migration along the Pacific and Atlantic coasts of North America, and through the continent's interior towards the California shoreline.

This bird has declined over the last 40 years in an important staging area at the Bay of Fundy. Millions once passed through the area, with estimates of up to 3 million in the outer Bay of Fundy in the 1970s (COSEWIC 2014). By 1990, they had declined drastically. In the most recent surveys (2009-2010), an estimated 550,000 Red-necked Phalaropes occurred between Grand Manan and Brier Island in the Bay of Fundy. Despite the substantial uncertainty, experts generally agree that the species is less abundant in the Bay of Fundy than it once was. The overall Northern American population trends during the last three generations are unknown. The species faces potential threats on its breeding grounds including habitat degradation associated with climate change. It is also susceptible to pollutants and oil exposure on migration and during the winter. This is because birds gather in large numbers on the ocean, especially where currents concentrate pollutants.

While migrating and during the winter months, Red-necked Phalaropes concentrate at sea in areas where prey is forced to the surface (e.g., convergences and upwellings). There is potential for upwellings along the slope of the Labrador Sea and edge of the Grand Banks within the Study Area. The number of Red-necked Phalaropes using the Study Area is unknown but they may occur there during spring (May-June) and fall migration (July-September).

4.5.2 Other Species

As of March 2017, no other species/populations expected in the Study Area have been added to Schedule 1 of *SARA*.

Since the 2016 EA Update (LGL 2016) was prepared, a management plan was released for the Atlantic population of fin whale, highlighting the key objective of ensuring that anthropogenic threats within Canadian waters do not result in population decline or a reduction of the currently known Canadian distribution range (DFO 2017c). A management plan was also proposed for Sowerby's beaked whale in Canada, with the objectives of maintaining a stable population throughout Canadian waters and quantifying and mitigating the effects of identified threats on the population (DFO 2016g). An action plan was 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 2016j). A recovery strategy was amended and an action plan was proposed for the Scotian Shelf population of northern bottlenose whale in 2016, updating critical habitat measures (DFO 2016k,l).

MKI will monitor *SARA* issues through the law gazettes, the Internet, and communication with DFO and Environment Canada, and will adaptively manage any issues that may arise in the future. MKI will comply with relevant regulations pertaining to *SARA* Recovery Strategies and Action Plans, and continue to exercise due caution to minimize impacts on species at risk during all of its operations. MKI also understands that other species/populations may be given either *endangered* or *threatened* status under Schedule 1 of *SARA* during the course of the Project, and will continue to monitor for any status changes.

The new information presented on species at risk does not change the effects predictions for this VEC made in the EA (LGL 2014a) and Addendum (LGL 2014b).

4.6 Sensitive Areas

A Terms of Reference was released by DFO for 29 January 2016 in relation to Canada's agreement to the Convention on Biological Diversity Aichi Target 11, which includes the goal of conserving 10% of coastal and marine areas by 2020 (DFO 2016m). As such, DFO Oceans requested refinement regarding Ecologically and Biologically Significant Areas (EBSAs) identified in the Newfoundland and Labrador (NL) Bioregion; specifically, that DFO Science provide detailed descriptions of sub-components of each EBSA identified during the Placentia Bay – Grand Banks Large Ocean Management Area (PB-GB LOMA) identification process (see the EA addendum [LGL 2014b]), along with geospatially-referenced data layers of sub-components for both the PB-GB LOMA and NL Shelves EBSAs (DFO 2016m). In response, DFO reviewed relevant data and developed several geospatially-referenced layers of biological and ecological data for the PB-GB LOMA EBSAs, and compiled an atlas containing spatial data for all 26 EBSAs in the NL Bioregion; this information will be used as a tool in the identification of sub areas that may be of interest to DFO's Oceans program during MPA network development (DFO 2016n). DFO since released a Terms of Reference requesting an update and re-evaluation of the PB-GB LOMA to identify EBSAs using the most recent and relevant data available (DFO 2017d). However, to date there have been no newly designated or modified EBSAs in association with the PG-GB LOMA or the NL Shelves Bioregion since the 2015 or 2016 EA Updates (see § 4.6 *in* LGL 2015a, 2016).

The 11 EBSAs of the Newfoundland and Labrador (NL) Shelves Bioregion (DFO 2013) that overlap the Study Area are: (1) Northern Labrador; (2) Outer Shelf Saglek Bank; (3) Outer Shelf Nain Bank; (4) Nain Area; (5) Hopedale Saddle; (6) Labrador Slope; (7) Labrador Marginal Trough; (8) Hamilton Inlet; (9) Orphan Spur (10) Notre Dame Channel; and (11) Grey Islands (Figure 4.16). The Labrador Slope and Orphan Spur EBSAs are partially within the 2017 AOI. The key attributes of the 11 NL Shelves EBSAs are presented in Table 2 of the EA Addendum (LGL 2014b). A Terms of Reference released by DFO detailed a national peer review in March 2016 in Halifax, NS, to address the needs of DFO Ecosystems and Fisheries Management in seeking scientific advice to develop clear guidance on how to use location data of coral and sponge concentrations in Canadian waters in order to aid the delineation of EBSAs for these species, and to relate these concentrations to the NAFO fishing footprint of bottom contact fisheries (see § 4.6 *in* LGL 2016; DFO 2016o). To this end, DFO released a Research Document in November 2016 updating the delineation of significant concentrations and predicted densities of corals and sponges on the east coast of Canada as an essential initial task in the identification of sensitive/significant benthic areas (Kenchington et al. 2016).

Table 4.14 of the EA (LGL 2014a) provided information on Sensitive Areas, including DFO Fishery Closure Areas, Coral Protection Zones, Marine Protected Areas, Candidate National Marine Conservation Areas, and Important Bird Areas. These areas are shown in Figure 4.16. One new Coral/Sponge Closure Area was designated by the NAFO Scientific Council since the 2016 EA Update, southeast of the Study Area (see Figure 4.16 below and § 4.6 of LGL 2016; NAFO 2017). No NAFO Conservation and Enforcement Areas, including Seamount Closure Areas, have been newly designated or modified within or near the Study Area since the 2015 or 2016 EA Updates (see § 4.6 *in* LGL 2015a, 2016).

The new information presented on sensitive areas does not change the effects predictions for this VEC made in the EA (LGL 2014a) and Addendum (LGL 2014b).

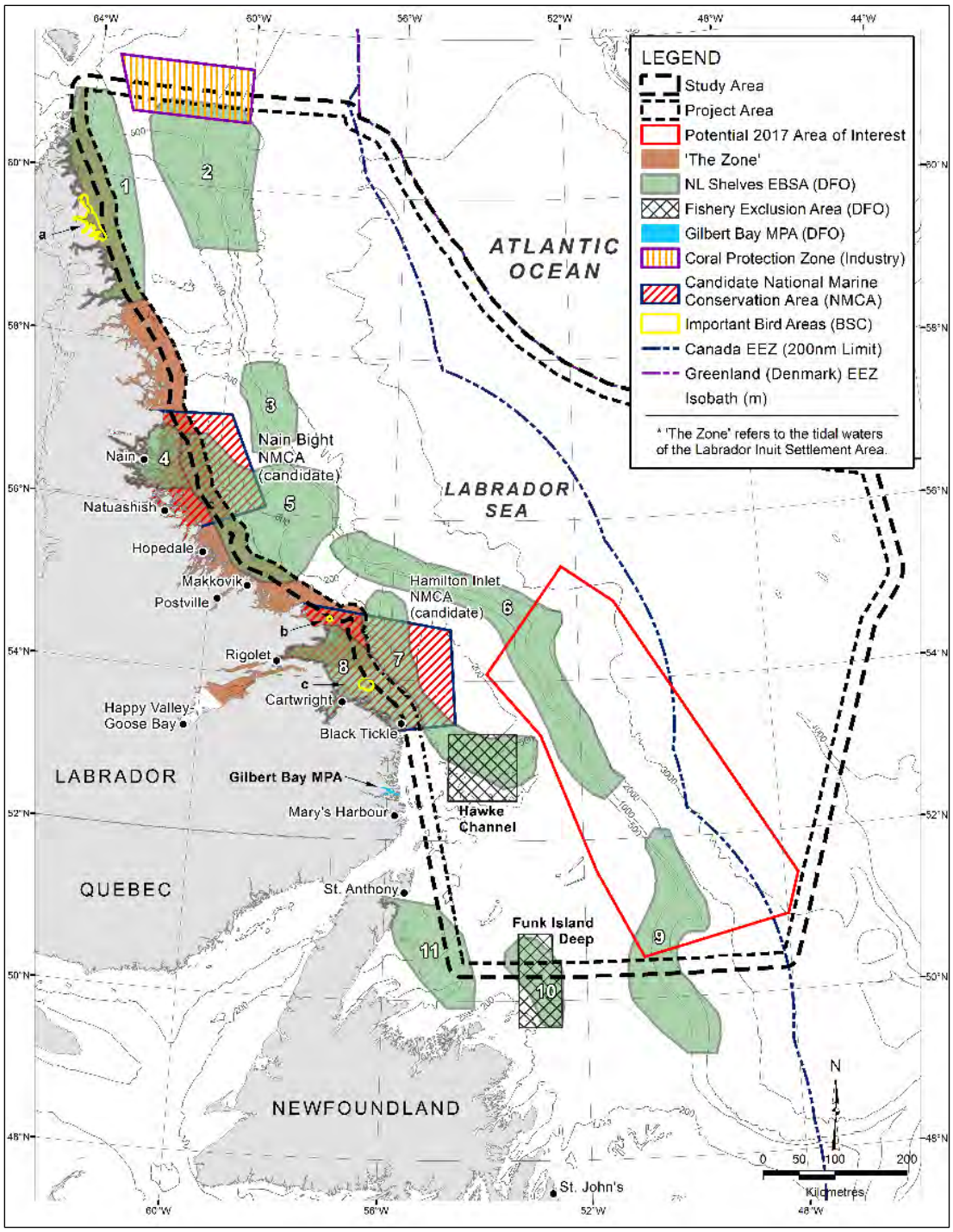

FIGURE 4.16. Sensitive Areas in and near the Study Area. EBSAs shown include: (1) Northern Labrador, (2) Outer Shelf Saglek Bank, (3) Outer Shelf Nain Bank, (4) Nain Area, (5) Hopedale Saddle, (6) Labrador Slope, (7) Labrador Marginal Trough, (8) Hamilton Inlet, (9) Orphan Spur,(10) Notre Dame Channel, (11) Grey Islands.

5.0 Consultations

Newsletters describing the seismic activities proposed for 2017 were distributed during the week of 17 April 2017 to the same stakeholders/groups consulted in previous years. The newsletter and details of those consulted by MKI are presented in Appendices 1 and 2, respectively.

Face-to-face meetings were held with DFO, the Fish, Food and Allied Workers Union/Unifor (FFAW/Unifor), and Ocean Choice International (OCI) on 24 January 2017. The discussion with DFO focused on MKI's acquisition plans with respect to the Industry-DFO Collaborative Post-season Trap Survey for Snow Crab. During MKI's meeting with the FFAW/Unifor, the focus of conversation was related to routine communication and coordination between MKI and the fishing industry. The meeting with OCI involved discussion of scheduling of MKI's activities around OCI's anticipated activities during the early part of the season.

6.0 Environmental Assessment

6.1 Mitigation Measures

The mitigation measures described in the EA (LGL 2014a) and the associated Addendum (LGL 2014b) remain applicable to MKI's seismic survey activities proposed for 2017. A summary of mitigation measures and commitments made in EA documents for the Project is provided below along with commentary on the status of implementing the mitigation measures and commitments (Table 6.1). This summary serves as a tracking table as per § 5.1.4.1 of the C-NLOPB's *Geophysical, Geological, Environmental and Geotechnical Program Guidelines* (C-NLOPB 2017).

6.2 Validity of Significance Determination

Based on consideration of newly available biological environment information presented in § 4.0 and results of consultations with stakeholders, the determinations of significance of the residual effects of seismic survey activities on VECs presented in the EA (LGL 2014a) and the associated Addendum (LGL 2014b) remain valid for the seismic survey activities proposed by MKI in 2017. This includes consideration of cumulative effects—see below.

TABLE 6.1. Summary of environmental commitments and mitigation measures and the current status of these commitments and measures.

VEC(s)	Potential Effect(s)	Mitigation Measures & Commitments	Status (11 May 2017)
Fisheries	Interference with fishing vessels/mobile and fixed gear fisheries	• Upfront communications, liaison and planning to avoid fishing activity • Continuing communications throughout program • 2 FLOs (1 FFAW, 1 representing Inuit/Nunatsiavut interests) • SPOC • Advisories and communications • VMS data • Avoidance • No gear deployment outside of Project Area • Start-up meetings on ships • Provision of Project update, receive report(s) of any issue(s) during follow-up discussions with all interested groups, and present results of FLO (and MMO) reports after the survey is complete each year	• Upfront planning with DFO, Nunatsiavut Govt. (NG), FFAW & OCI complete – notice of survey sent to other stakeholders • Planned upon commencement. Includes using Torngat Fish Producers Cooperative as link for communications between Inuit fishers and MKI. • Contract in place • Contract in place • Planned upon commencement • Arranged through DFO • Meetings held with DFO, NG, FFAW and OCI and agreed planning in place • Confirmed • Confirmed – FLO will be present and SPOC to be invited • Confirmed/ongoing
Fisheries	Fishing gear damage	• Upfront communications, liaison and planning to avoid fishing gear • Use of escort vessel • SPOC • Advisories and communications • 2 FLOs (1 FFAW, 1 representing Inuit/Nunatsiavut interests) • Compensation program and damage/loss incident response procedures in place • Reporting and documentation • Start-up meetings on ships	• Upfront planning with FFAW, NG, & OCI complete – notice of survey sent to other stakeholders • Confirmed • Contract in place • Planned upon commencement • Contract in place • Document sent to FFAW • Planned upon commencement • Confirmed – FLOs will be present and SPOC to be invited

VEC(s)	Potential Effect(s)	Mitigation Measures & Commitments	Status (11 May 2017)
Fish & Fish Habitat Marine Mammals & Sea Turtles Species At Risk	Temporary or permanent hearing damage, and/or disturbance, injury, oiling, or death to marine animals, including Species at Risk	• Pre-watch of safety zone for minimum of 30 minutes • Delay start-up if any marine mammals or sea turtles are within 500 m • Ramp-up of airguns • Shut-down of airgun arrays for *endangered* or *threatened* marine mammals & sea turtles within 500 m • Use of qualified and experienced, dedicated MMO(s) to monitor for marine mammals and sea turtles during daylight seismic operations and implement shut downs/ramp up delays of the airgun array when appropriate. One MMO will be Inuit representing Nunatsiavut interests. • Complete shut-down of air source array(s) or reduction to single source element during line changes, maintenance or other operational reasons • Monitoring for updates for *Species at Risk Act* (*SARA*) issues, species at risk and critical habitat, and compliance with relevant regulations within *SARA* Recovery Strategies/Action Plans • Immediate filing of report with C-NLOPB in the event of injury/death of marine mammals, turtles or seabirds by Project equipment or accidental fuel spills, and assessment of need for follow-up monitoring • Use of solid streamer	• Confirmed • Confirmed • Confirmed • Confirmed • Confirmed • Confirmed • Confirmed • Confirmed • Confirmed
Seabirds	Injury (mortality) to stranded seabirds, disturbance to migratory birds from helicopter flights	• Daily monitoring of vessel • Handling and release protocols (live seabird handling permit required) • Minimize lighting if safe • Ramp-up of airguns • Minimum helicopter flight altitude of 300-450 m • Avoidance of helicopter use near seabird colonies from 1 May–31 Aug (–30 Sep for Northern Gannet colonies), including Gannet Islands Ecological Reserve	• Confirmed • Confirmed • Confirmed • Confirmed • Confirmed • Confirmed
Seabirds	Seabird oiling	• Adherence to MARPOL • Spill contingency plans and response plans • Use of solid streamer	• Confirmed • Confirmed • Confirmed

VEC(s)	Potential Effect(s)	Mitigation Measures & Commitments	Status (11 May 2017)
Seabirds	Data collection and/or stranded seabirds	• Seabird observations and monitoring/mitigation for stranded birds will also be carried out by qualified experienced biologists according to established CWS protocols throughout the seismic survey at regular daily intervals • Results of on-board seabird observation program sent to ECCC-CWS annually • MKI to contact CWS regarding mobile version of ECSAS database	• Confirmed • Confirmed • Ongoing
Sensitive Areas	Alteration or disruption of sensitive habitat	• Monitor for updates regarding designated sensitive areas and avoid contact with the seabed [no bottom contact anticipated for duration of Project, and no critical habitat has been identified in or near the Study Area.] • No portion of the survey will be acquired within Gilbert Bay, Nain Bight, Hawke Channel or Hamilton Inlet • No acquisition within the Nunatsiavut Zone, and seismic survey lines will end 20 km short of the Zone boundary to ensure that line turns can be made without entering the Zone	• Confirmed • Confirmed • Confirmed
	Interference with shipping and/or Department of National Defence (DND) naval or air operations	• Advisories and at-sea communications • FLOs • Use of guard vessel • SPOC • VMS data	• Planned upon commencement • Contract in place • Confirmed • Contract in place • Arranged through DFO
	Interference with DFO/FFAW research program(s) and/or joint DFO-industry collaborative post-season snow crab trap survey	• Communications and scheduling • Avoidance	• Meetings held with FFAW and DFO and agreed planning in place
	Canada-Newfoundland and Labrador benefits	• Canada-Newfoundland and Labrador (NL) Benefits Plan submitted and approved by C-NLOPB • First consideration given to personnel, support and other services, and goods provided/manufactured within NL in compliance with Canada-NL Benefits Plan	• Confirmed • Contracts in place (annually)

VEC(s)	Potential Effect(s)	Mitigation Measures & Commitments	Status (11 May 2017)
	Discharges	• Vessel discharges within standard vessel operations and in adherence to all applicable regulations	• Confirmed
	Waste Management	• Waste management procedures filed with C-NLOPB • Wastes managed in accordance with MARPOL and vessel-specific waste management procedures, including on-board waste log • Use only ports with licensed waste contractors for waste returned from offshore	• Confirmed • Confirmed • Confirmed
	Atmospheric emissions	• Vessels will have International Air Pollution Prevention Certificate, and sulphur content of diesel/gasoil follows MARPOL (*International Convention for the Prevention of Pollution from Ships*, Annex VI)	• Confirmed
	Accidental releases	• Shipboard Oil Pollution Emergency Plans filed with C-NLOPB • MKI's emergency response plan also filed with C-NLOPB • Adherence to International Convention for the Prevention of Pollution from Ships (MARPOL) • Bunkering at sea procedures • Use of solid streamer	• Confirmed • Confirmed • Confirmed • Confirmed • Confirmed • Confirmed

6.2.1 Cumulative Effects

Section 6.0 of the original Labrador EA (LGL 2014a) provides an assessment of cumulative effects from other activities in the Regional Area including fishing, vessel traffic, hunting, and other oil and gas exploration and development activities. There are no indications that the level of fishing, vessel traffic and hunting activity offshore Labrador (and Newfoundland) have increased since 2014. The original EA noted that based on historical levels of exploration activities, there typically would be no more than two or three seismic programs operating simultaneously off Newfoundland and Labrador during any one season. In 2017, MKI is proposing a single 2D seismic survey in the Project Area and at present, it seems unlikely that there will be other seismic surveys offshore Labrador in 2017. Of the potential seismic proponents (Seitel, CGG) with Project Areas offshore Labrador there have been no EA Updates (or Amendments) submitted to the C-NLOPB to indicate they plan to conduct surveys this year. In 2017, MKI is also proposing to conduct seismic surveying offshore northeastern and southern Newfoundland (LGL 2017a, b). It is possible that MKI will have three seismic surveys operating simultaneously for at least a portion of the 2017 seismic season. Based on a review of the C-NLOPB website and our current understanding of potential seismic survey work offshore Newfoundland, it seems unlikely that there would be a fourth simultaneous seismic survey offshore Newfoundland and Labrador in 2017.

In 2017, in most situations, concurrent MKI surveys would be separated by 100s of kilometres. Based on the locations of MKI AOIs in the Northeast Newfoundland Slope Project Area (LGL 2017a) and the Southern Newfoundland Project Area (LGL 2017b), the minimum separation distance between AOIs is ~45 km. The cumulative effects of seismic sound on fish and fish habitat, fisheries, seabirds, marine mammals, sea turtles, species at risk and sensitive areas are predicted to be *not significant*. However, there are uncertainties regarding this prediction—particularly regarding effects of masking and disturbance on marine mammals from sound produced during multiple seismic surveys. As discussed in the original EA, negative effects (auditory, physical, and behavioural) on key sensitive VECs, such as marine mammals, appear unlikely beyond a localized area from the sound source. In addition, all programs will use mitigation measures such as ramp-ups, delayed startups, and shutdowns of the airgun arrays as well as spatial separation between seismic surveys. Thus, it seems likely that while some animals may receive sound from multiple seismic programs, the current prediction is that *no significant residual effects* will result. The level of confidence associated with this prediction is rated as *medium*.

7.0 Concluding Statement

The seismic survey activities that MKI plans to conduct in 2017 have been reviewed and determined to be within the scope of the EA (LGL 2014a) and its Addendum (LGL 2014b). The environmental effects predicted in the EA and its Addendum remain valid. MKI reaffirms its commitment to implement the mitigation measures proposed in these assessment documents and in the Screening Decisions made by the C-NLOPB.

8.0 References

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Personal Communications

J. Lawson. Research Scientist, DFO. January 2017.

D. Power. NAFO Senior Science Advisor/Coordinator, DFO. February 2017.

List of Appendices

Appendix 1 – MKI Newsletter Distributed to Consultees

Appendix 2 – List of Consultees Contacted by MKI

Appendix 1 – MKI Newsletter Distributed to Consultees

Multiklient Invest AS

Labrador Seismic Program 2017 Update

Resumption of the Program in 2017

This news update is to inform stakeholders and other interested parties of the continuation of MKI's current seismic program, started in 2011 and continued through 2016, in Labrador offshore waters. The Project Area is within the regulatory jurisdiction of the Canada-Newfoundland and Labrador Offshore Petroleum Board (C-NLOPB) and it is expected that the Atlantic Explorer will be acquiring the survey between July and September 2017.

Figure 1: Atlantic Explorer

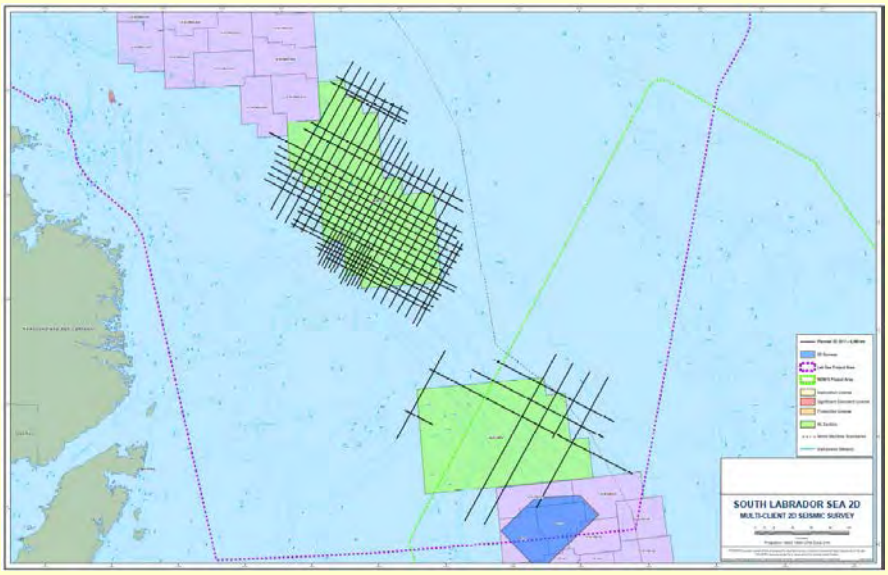

Figure 2: Planned lines for 2017 focusing primarily on the NL02-LS sector due to be part of a Call for Bids scheduled to take place in 2019

Ongoing Communication

As a component of the ongoing communications between MKI and local fisheries organizations, MKI will be providing weekly briefing materials including information such as updated schedules, maps, and/or revised timelines.

Employment Opportunities

Employment opportunities associated with this year's operating season have been considered and it has been determined that there will be possible hiring opportunities as part of the maritime crew. The recruitment process through a local agency will commence in the coming weeks and interested parties should look out for notices posted in community employment offices and other advertisements

How to Access Environmental Information about the Project

The Environmental Assessment (EA) for the Labrador Sea Seismic Program 2014-2018 along with additional documentation including the Annual EA Update can be accessed on the C-NLOPB website (www.cnlopb.ca).

From the C-NLOPB homepage, click on the "*Environment*" link near the bottom of the page. Then click on the "Project-Based Environmental Assessment" link. Click on the "*Completed*" link. Once this page has opened, scroll down to the project titled "*Multi Klient Invest AS Labrador Sea Seismic Program 2014-2018*"and click on the link. Here you can find all environmental documents related to this project.

The EA provides a comprehensive and detailed overview of the project. The overview includes: information on the Physical and Biological Environment, including Fisheries, Fish and Fish Habitat, Marine Mammals and Species at Risk, and a Cumulative Effects Assessment.

Upon the completion of every acquisition season an Environmental Report is supplied to the C-NLOPB and other government agencies. This report summarizes the marine mammal observations, bird observations and interactions.

Contact Information

If you have any inquiries regarding the Labrador Seismic Program (2014-2018) please feel free to contact:

Petroleum Geo-Services
15375 Memorial Drive, Suite 100
Houston, Texas, 77079
(P) 1-281-509-8000
(F) 1-281-509-8500
canada@pgs.com

Appendix 2 – List of Consultees Contacted by MKI

Organization or Group Name	Email Address	Contact Name	Engagement Type
Section 1: Cartwright			
Municipality of Cartwright	twcouncil@bellaliant.com	Shirley Hopkins	
Labrador Fishermen's Union Shrimp Company Limited	Generalmanager@lfuscl.com	Gilbert Linstead	
Pratt Falls Salmon Lodge	Dwight@prattfallslodge.com	Dwight Lethbridge	
Cloud 9 Salmon Lodge	Cloud9salmonlodge@hotmail.com	Norman Lethbridge	
Southeastern Aurora Development Corporation	bgillis@nf.sympatico.ca	Blair Gillis	
Section 2: Charlottetown			
Town of Charlottetown	ctown@nf.aibn.com	Charmaine Powell	
Labrador Choice Seafoods Ltd.	pwalsh@labchoice.net	Pius Walsh	
Fishers' Committee	ddkippenhuck@nf.sympatico.ca	Don Kippenhuck	
Section 3: Forteau			
Forteau Community Council	forteautowncouncil@hotmail.com	Lauralee James	
Section 4: Happy Valley-Goose Bay			
Town of Happy Valley-Goose Bay	development@happyvalley-goosebay.com	Karen Wheeler	
Newfoundland and Labrador Department of Innovation, Business, and Rural Development	rkean@gov.nl.ca	Reg Kean	
Newfoundland and Labrador Department of Labrador and Aboriginal Affairs	Michellewatkins@gov.nl.ca	Michelle Watkins	
Nunatukavut Community Council Inc. (Labrador Metis Nation)	grussell@nunatukavut.ca	George Russell	
Nunacor Development Corporation	andy@nunacor.com	Andy Turnbull	
Torngat Fish Producers Co-operative Society Ltd.	gm@torngatfishcoop.com	Keith Watts	
Torngat Secretariat	Julie.whalen@torngatsecretariat.com	Julie Whalen	
Nunatsiavut Government Department of Lands and Natural Resources	Carl.mclean@nunatisiavut.com	Carl Mclean	
Nunatsiavut Government Non-Renewable Resources	harry_borlase@nunatsiavut.com	Harry Borlase	
Nunatsiavut Government Department of Education and Economic Development	Gary.mitchell@nunatsiavut.com	Gary Mitchell	
Labrador Friendship Centre	Jhefler-elson@lfchvgb.ca	Jennifer Hefler-Elson	
Section 5: Hopedale			
Hopedale Inuit Community Government	Wayne.piercy@nunatsiavut.com	Wayne Piercy	
Section 6: L'Anse au Clair			
L'Anse au Clair Community	townoflanseauclair@hotmail.com		
Section 7: L'Anse au Loup			
Town of L'Anse au Loup	lanseauloup@nf.aibn.com	Janice Normore	
Labrador Fishermen's Union Shrimp Company Limited	generalmanager@lfuscl.com	Gilbert Linstead	
Section 8: Mary's Harbour			
Town of Mary's Harbour	maryshbr@nf.aibn.com	Glenys Rumbolt	
Labrador Fishermen's Union Shrimp Company Limited	Generalmanager@lfuscl.com	Gilbert Linstead	
Section 9: Makkovik			
Makkovik Inuit Community Government	Herbert.jacque@nunatsiavut.com	Herbert Jacque	
Section 10: Mud Lake			
Mud Lake Community	Dave.raeburn@xplornet.ca	Dave Rayburn	

Section 11: Nain			
Nain Inuit Community Government	tony.andersen@nunatsiavut.com	Tony Andersen	
Fishers' Committee	jangnatok@hotmail.com	Joey Angnatok	
Section 12: Natuashish			
Mushuau Innu Band Council	Kanikue@gmail.com	Gregory Rich	
Innu Nation	Ppoker@innu.ca	Prote Poker	
Section 13: North West River			
Town of North West River	manager@townofnwr.ca	Arthur Williams	
Sivunivut Inuit Community Corporation Inc.	Ed.tuttauk@nunatsiavut.com	Ed Tuttauk	
Innu Nation	Preid@innu.ca	Paula Reid	
Section 14: Pinsent's Arm			
Community of Pinsent's Arm	localservicepa@yahoo.ca	Mildred Clark (secretary)	
Labrador Fishermen's Union Shrimp Company Limited	generalmanager@lfuscl.com	Gilbert Linstead	
Section 15: Port Hope Simpson			
Town of Port Hope Simpson	porthopesimpson@nf.aibn.com	Michelle Clark	
Labrador Southeast Coastal Action Program	lscap@nf.aibn.com	Rex Turnbull	
Section 16: Postville			
Postville Inuit Community Government	Diane.gear@nunatsiavut.com	Diane Gear	
Nunatsiavut Government Department of Lands and Natural Resources	Harry.borlase@nunasiavut.com	Harry Borlase	
Nunatsiavut Government Department of Lands and Natural Resources	Glen.sheppard@nunatsiavut.com	Glen Sheppard	
Section 17: Rigolet			
Rigolet Inuit Community Government	townmanager@rigolet.ca	Sherri Wolfrey	
Fishers' Committee	richardrich749@gmail.com	Richard Rich	
Section 18: Sheshatshiu			
Sheshatshiu Innu First Nation Band Council	jandrew@innu.ca	Jeremy Andrew	
Innu Development Ltd. Partnership	madams@innudev.com	Melissa Adams	
Section 19: St. Anthony			
Town of St. Anthony	stanthony@nf.aibn.com	Ernest Simms	
Clearwater Fisheries Limited	lsmith@clearwater.ca		
St. Anthony Port Authority	Stanthonyportauthorityinc@bellaliant.com	Malcolm Campbell	
St. Anthony Basin Resources Inc.	s.elliott@nf.aibn.com	Sam Elliott	

Section 20: St. John's			
Fisheries and Oceans Canada- Coast Guard	Jason.kelly@dfo-mpo.gc.ca	Jason Kelly, Senior Fisheries Protection Biologist	
Environment Canada	Glenn.troke@ec.gc.ca	Glenn Troke. EA Coordinator	
Transport Canada	Clement.murphy@tc.gc.ca	Clement Murphy, Manager, Examinations, and Enforcement	
Parks Canada	Randy.thompson@pc.gc.ca	Randy Thompson, Resource Management Officer	
National Defence	information@forces.gc.ca		
St. Johns Port Authority	jmcgrath@sjpa.com	Jeff McGrath, Director of Marine Safety and Security	
Newfoundland and Labrador Fisheries and Aquaculture	Davidlewis@gov.nl.ca	David Lewis, Deputy Minister	
City of St. Johns	rellsworth@stjohns.ca	Ron Ellsworth, Deputy Mayor	
Food, Fish, and Allied Workers	dstreet@ffaw.net	Dwan Street, Industry Liaison	
One Ocean	Maureen.murphy@mi.mun.ca	Director	
Groundfish Enterprise Allocation Council	bchapman@sympatico.ca	Bruce Chapman, Executive Director	
Association of Seafood Producers	dbutler@seafoodproducers.org	Derek Butler, Executive Director	
Beothic Fish Processors Ltd.	pgrant@beothic.com	Paul Grant, Executive Vice President	
Breakwater Fisheries Limited	rrbarnes@nf.sympatico.ca	Randy Barnes	
Conche Seafoods Inc.	dphilpott@quinsea.com	Derrick Philpott, Director	
Deep Atlantic International Inc.	Martha@deepatlanticsea.com	Martha Mullowney, Director	
Dorset Fisheries Limited	dphilpott@quinsea.com	Derrick Philpott, Director	
GC Rieber Carino Ltd.	John.c.kearley@carino.ca	John Kearley, CEO	
Gulf Shrimp Limited	Dphilpott@quinsea.com	Derrick Philpott, Director	
HSF Ocean Products Limited	todd@hsfgroup.ca	Todd Hickey, Director	
Nataaqnaq Fisheries	keith@natfish.ca	Keith Coady, Fleet Manager	
Newfound Resources Limited	jeff@nrl.nf.net	Jeff Simms, Operations Manager	
Notre Dame Seafoods Inc.	jeveleigh@notredameseafoods.com	Jason Eveleigh, President	
San-Can Fisheries Limited	sgoff@san-can.com	Sandra Goff, Director	
Ocean Choice International	rellis@oceanchoice.com	Rick Ellis, Director of Fleet Operations	
Quinlan Brothers Ltd.	dearle@quinlanbros.ca	David Earle, Chief Financial Officer	
Nature Newfoundland and Labrador	zedel@mun.ca	Len Zedel	