Environmental Assessment Update (2017) of the MKI Southern Grand Banks Seismic Program, 2014–2018

Prepared by

for

Multi Klient Invest AS

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TGS-NOPEC Geophysical Company ASA

April 2017
LGL Report No. FA0119

Environmental Assessment Update (2017) of the MKI Southern Grand Banks Seismic Program, 2014–2018

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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 Southern Grand Banks area. This document also serves as an Update of the associated EA Addendum (LGL 2014b) and Amendments (LGL 2015a; PGS 2016). In 2017, MKI is proposing to conduct 2D and 3D seismic surveying in the Southern Grand Banks Project Area (Figure 1.1). This EA Update document addresses the validity of the EA and its Amendments (Table 1.1) as they pertain 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 EA Updates associated with this program were prepared in 2015 (LGL 2015b) and 2016 (LGL 2016).

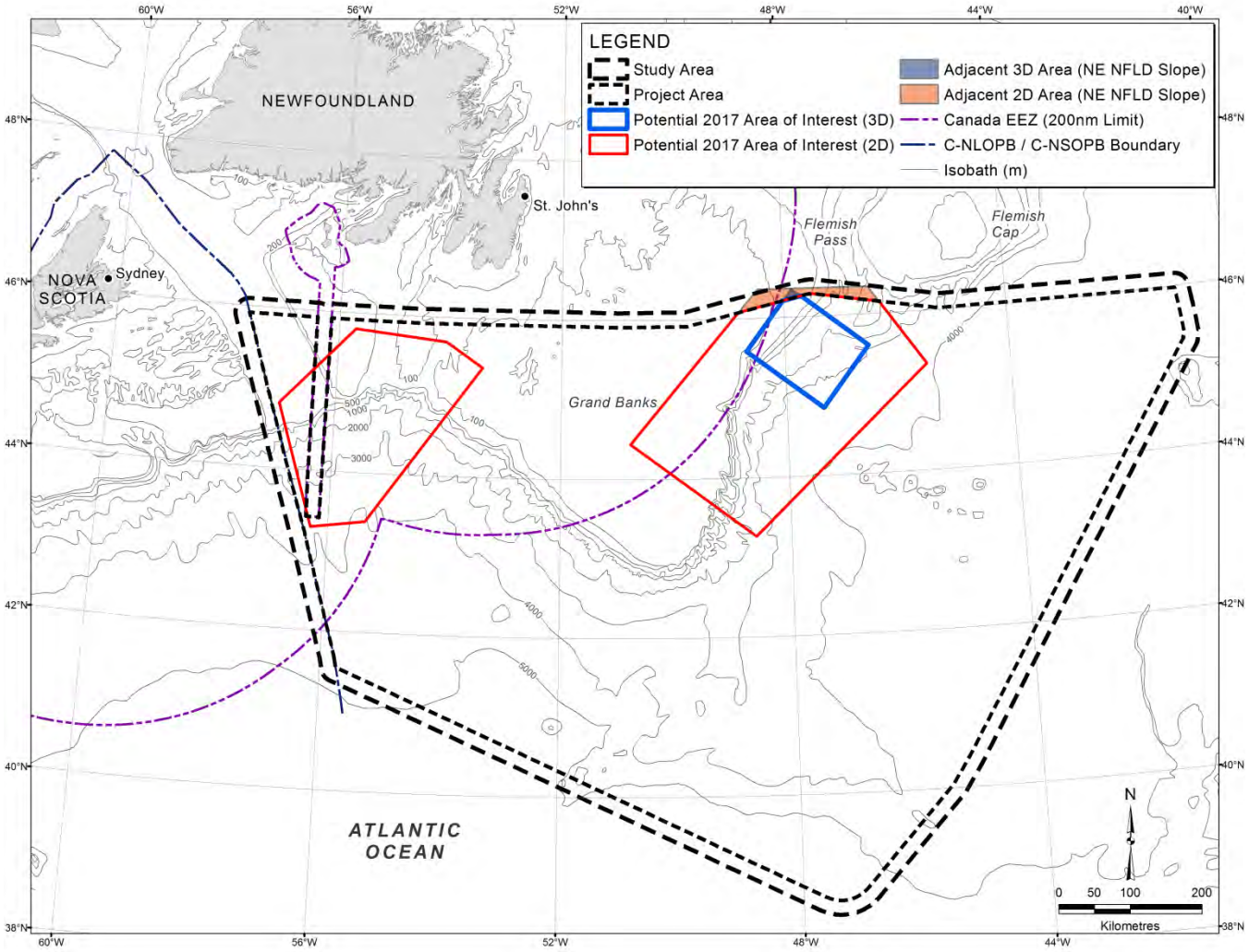

FIGURE 1.1. Locations of the Project Area, Study Area and 2017 Areas of Interest (AOI) for MKI's Southern Grand Banks Seismic Program, 2014–2018. Also shown are the adjacent portions of the 3D and 2D AOI that fall entirely within the boundaries of MKI's Northeast Newfoundland Slope Project Area (see LGL 2017a).

TABLE 1.1. Environmental Assessment documents for the MKI Southern Grand Banks Seismic Program, 2014–2018. Screening determination reference number C-NLOPB File No. 45006-020-004.

Temporal Scope	EA Document
May 1 to November 30, 2014–2018	Environmental Assessment of MKI Southern Grand Banks Seismic Program, 2014–2018 and EA Addendum (LGL 2014a,b)[a]
May 1 to November 30, 2015–2018	Amendment to the Environmental Assessment of MKI's Southern Grand Banks Seismic Program, 2014–2018 (LGL 2015a)[b]
May 1 to November 30, 2015	Environmental Assessment Update of the MKI Southern Grand Banks Seismic Program, 2014–2018 (LGL 2015b)[c]
May 1 to November 30, 2016–2018	Amendment to the Environmental Assessment of MKI's Southern Grand Banks Seismic Program, 2014–2018 (PGS 2016)[d]
May 1 to November 30, 2016	Environmental Assessment Update of the MKI Southern Grand Banks Seismic Program, 2014–2018 (LGL 2016)[e]

[a] On 24 July 2014, the C-NLOPB made a positive determination on this EA and EA Addendum.
[b] On 9 June 2015, the C-NLOPB made a positive determination on this EA Amendment.
[c] Originally submitted to the C-NLOPB in April 2015, and finalized in May 2015.
[d] On 2 June 2016, the C-NLOPB made a positive determination on this EA Amendment.
[e] Originally submitted to the C-NLOPB in May 2016.

The following sections provide the information necessary to confirm the validity of the EA and its associated documents (see Table 1.1), including assessment of the potential effects of 2D, 3D and 4D seismic survey activities within the defined Project Area (see 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.

2.0 Project Description

2.1 Vessels and Equipment

In addition to the seismic vessel, 2D and/or 3D seismic surveys generally use of 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 2D and 3D 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 and 3D surveys consists of three or four sub-arrays with a total volume of 4130 or 4808 in^3, operated at a pressure of 2000 psi. These arrays are generally towed at a depth of 8 or 9 m and produce peak-to-peak pressures of 140–179 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 10–15 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.

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 (LGL 2014a) remain unchanged (see 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) as 1 May–30 November during each year of the 2014–2018 period remains unchanged.

2.4 Seismic Survey Activities Planned for 2017

In 2017, MKI plans to conduct about 18,000 km of 2D seismic surveying in the Project Area. Figure 1.1 shows the two Areas of Interest (AOI) for the proposed 2D seismic surveying. Two-dimensional seismic lines are oriented NE-SW and NW-SE. In addition, MKI is proposing to conduct about 4,000 km^2 of 3D seismic surveying in the Project Area (see Potential 2017 AOI 3D in Figure 1.1). Note that the westernmost 2D AOI overlaps the southern portion of the Exclusive Economic Zone of Saint-Pierre et Miquelon. MKI has obtained permission from the French Government to acquire data within its EEZ. MKI is also in communication with the Canada-Nova Scotia Offshore Petroleum Board (C-NSOPB) regarding the proximity of seismic operations to its jurisdiction. MKI has confirmed that its seismic survey will not cross the NL-NS jurisdictional border. All seismic activities, including turning of the vessel and gear, will be conducted in the Project Area.

As was the case in 2014–2016, the MV *Atlantic Explorer* (Figure 2.1) will 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.

In 2017, MKI will use the MV *Ramform Titan* or a similar vessel for the 3D seismic survey. The MV *Ramform Titan* was built in 2013 and is a Bahamian flagged vessel (Figure 2.2). It is 104.2 m long, with a beam of 70 m and a draft of 6.9 m. The *Ramform Titan* has cruising and maximum speeds of ~28 km/h (15 knots) and ~30 km/h (16 knots), respectively, but will travel at a speed of ~9 km/h (4.9 knots) while conducting seismic surveying. During the 3D seismic survey in the 3D AOI, 2D seismic surveys would only occur in the western 2D AOI. That is, simultaneous 2D and 3D seismic surveys by MKI will not occur in the eastern 2D AOI.

Other project details presented in § 2.0 of the EA apply to MKI's seismic survey activities in 2017.

2.5 Mitigation Measures

Mitigation measures implemented during seismic surveys carried out under this Project will follow those described in the EA (LGL 2014a,) and its associated documents (LGL 2014b, 2015a,b; PGS 2016) and defined in Appendix 2 of *Geophysical, Geological, Environmental and Geotechnical Program Guidelines* (CNLOPB 2016). 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.

FIGURE 2.1. MV *Atlantic Explorer.*

FIGURE 2.2. MV *Ramform Titan.*

3.0 Physical Environment

A comprehensive report describing the physical environment of the Study Area (i.e., bathymetry, geology, climatology, physical oceanography, and sea ice and icebergs) was prepared for MKI in 2014 (Oceans 2014). A summary of that report was provided in § 3.0 of the EA (LGL 2014a). 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 regarding the relationship between planktonic communities, oceanic conditions, and benthos of the Southern Grand Banks area, as well as for snow crab (*Chionoecetes opilio*), northern shrimp (*Pandalus borealis*) and Atlantic cod (*Gadus morhua*).

The new information presented here does not change the effects predictions made in the EA (LGL 2014a), Addendum (LGL 2014b), and associated Amendments (LGL 2015a; PGS 2016).

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 to 2015 with above average concentrations of copepods present throughout much of the zone;
- Sea ice volumes on the Newfoundland and Labrador Shelf were above normal during March and April 2015 off eastern Newfoundland. These ice volumes persisted up to five weeks later than normal, thereby affecting the opening dates of the snow crab and lobster fisheries;
- The abundances of non-copepod taxa (e.g., larval stages of benthic invertebrates that feed on other zooplankton) were above normal throughout most of the zone; and
- The abundances of zooplankton species (e.g., *Calanus finmarchicus*) were above normal throughout the zone 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). One new sponge area within the Study Area was identified (see Figure 4.1). A new large gorgonian coral area was also identified in the Study Area, northwest of the NAFO Div. 3O Coral Closure Area (see Figure 4.2). Likewise, new small gorgonian coral areas were identified on the Newfoundland and Labrador Slope and northern boundary of the NAFO Div. 3O Coral Closure Area (see Figure 4.3). Kenchington et al. (2016) also identified significant concentrations of sea pens in the Laurentian Channel (NAFO Div. 3Ps) and new sea pen fields in the northwest corner of the NAFO Div. 3O Coral Closure Area (see Figure 4.4).

Murillo et al. (2016) identified twelve epibenthic megafaunal assemblages using data collected during research trawls on the tail of the Grand Bank, the upper slope of the Grand Bank, the top of Flemish Cap, and the lower slopes of the Grand Bank and Flemish Cap. This study contributes more knowledge of the distributions of epibenthic megafaunal assemblages within the Study Area, and relates that distributional information to local environmental conditions and trawling intensity within the selected regions.

4.1.3 Snow Crab

Offshore snow crab landings in NAFO Div. 3LNO in 2015 reached a high of 28,750 t. While effort declined from 2011 to 2013, it has increased in recent years. Landings in NAFO Div. 3Ps have decreased from a peak of 6,700 t in 2011 to 2,500 t in 2015. Only 60% of the Total Allowable Catch (TAC) was taken in this area in 2015 (DFO 2016b). A recent stock assessment for snow crab in Newfoundland and Labrador waters concludes 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

The catches and estimated biomass of shrimp from European Union-Spain bottom trawl surveys in Div. 3NO have decreased considerably in recent years. In 2016, the estimated biomass in Div. 3NO was 2.36 t (Casas et al. 2016). In NAFO Division 3M, analyses of stratified random bottom trawl surveys completed on the Flemish Cap in 2016 showed that although total biomass and abundance indices increased from 2015 (63% and 61%, respectively), they still remain at very low levels. The total biomass estimated in 2016 for Flemish Cap surveys was 2,479 t (Casas 2016). Subsequently, NAFO recommends no directed fishing for shrimp in Divs. 3MNO (NAFO 2017a). DFO recently completed an assessment of northern shrimp in early February 2017 and concluded that shrimp in Shrimp Fishing

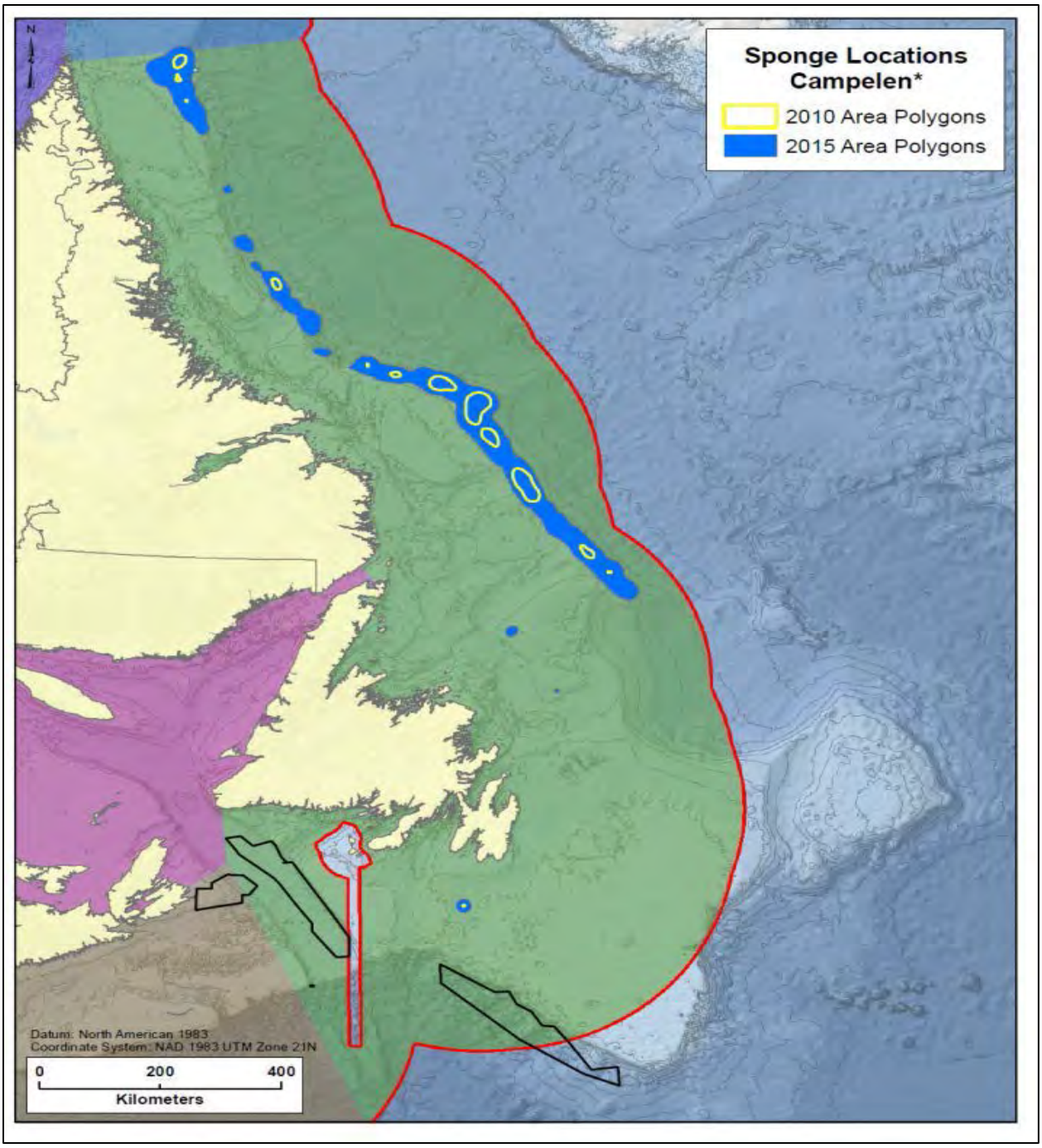

FIGURE 4.1. A comparison of the locations of significant concentrations of sponge areas as identified in 2010 (yellow outline) and 2015 (blue polygons). Areas closed to protect benthic habitat are indicated in black outline. Red lines indicate the EEZs of Canada and France (St. Pierre and Miquelon) (Source: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

Area (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.

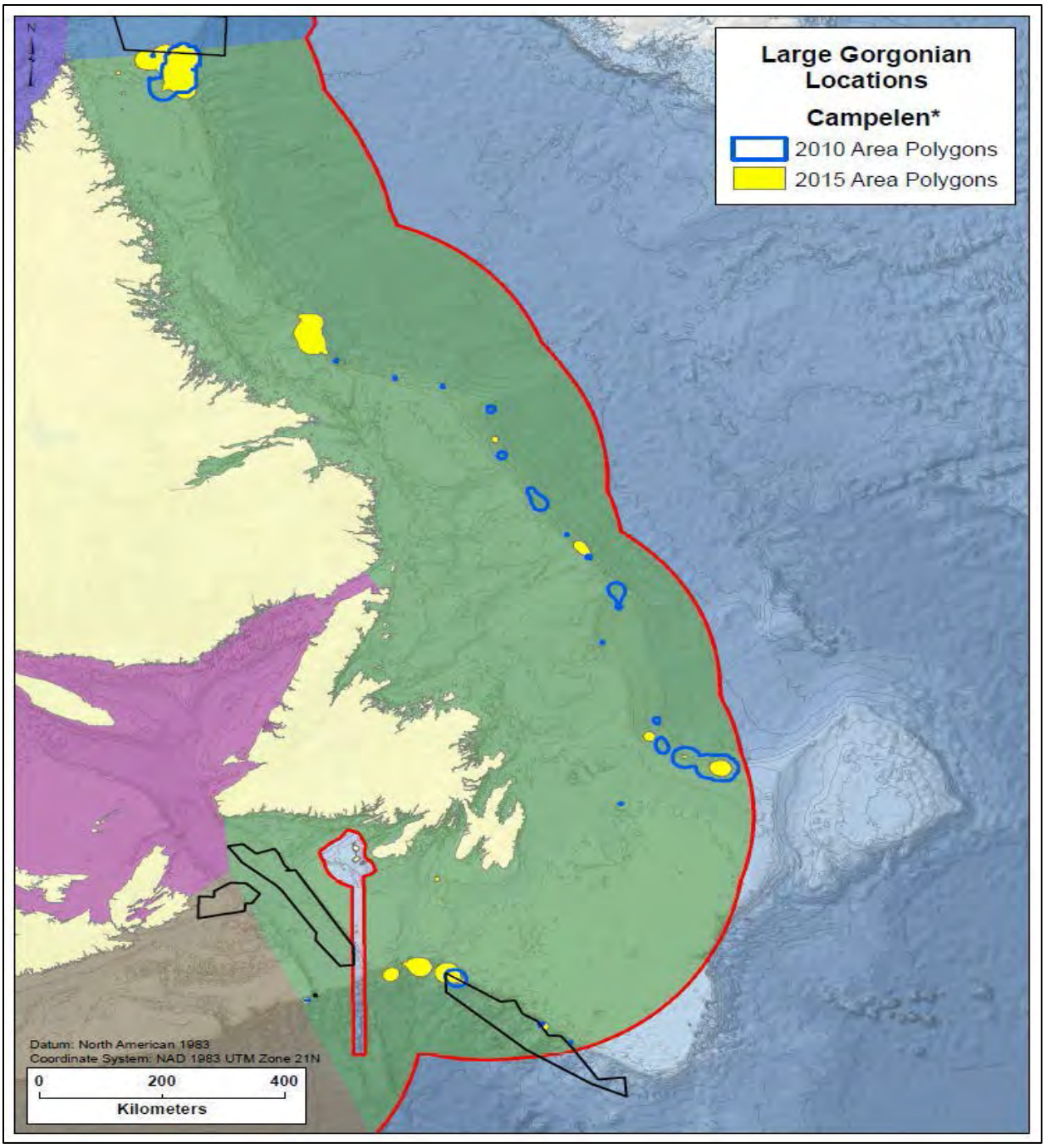

FIGURE 4.2. A comparison of the locations of significant concentrations of large gorgonian coral areas as identified in 2010 (blue outline) and 2015 (yellow polygons). Areas closed to protect benthic habitat are indicated in black outline. Red lines indicate the EEZs of Canada and France (St. Pierre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

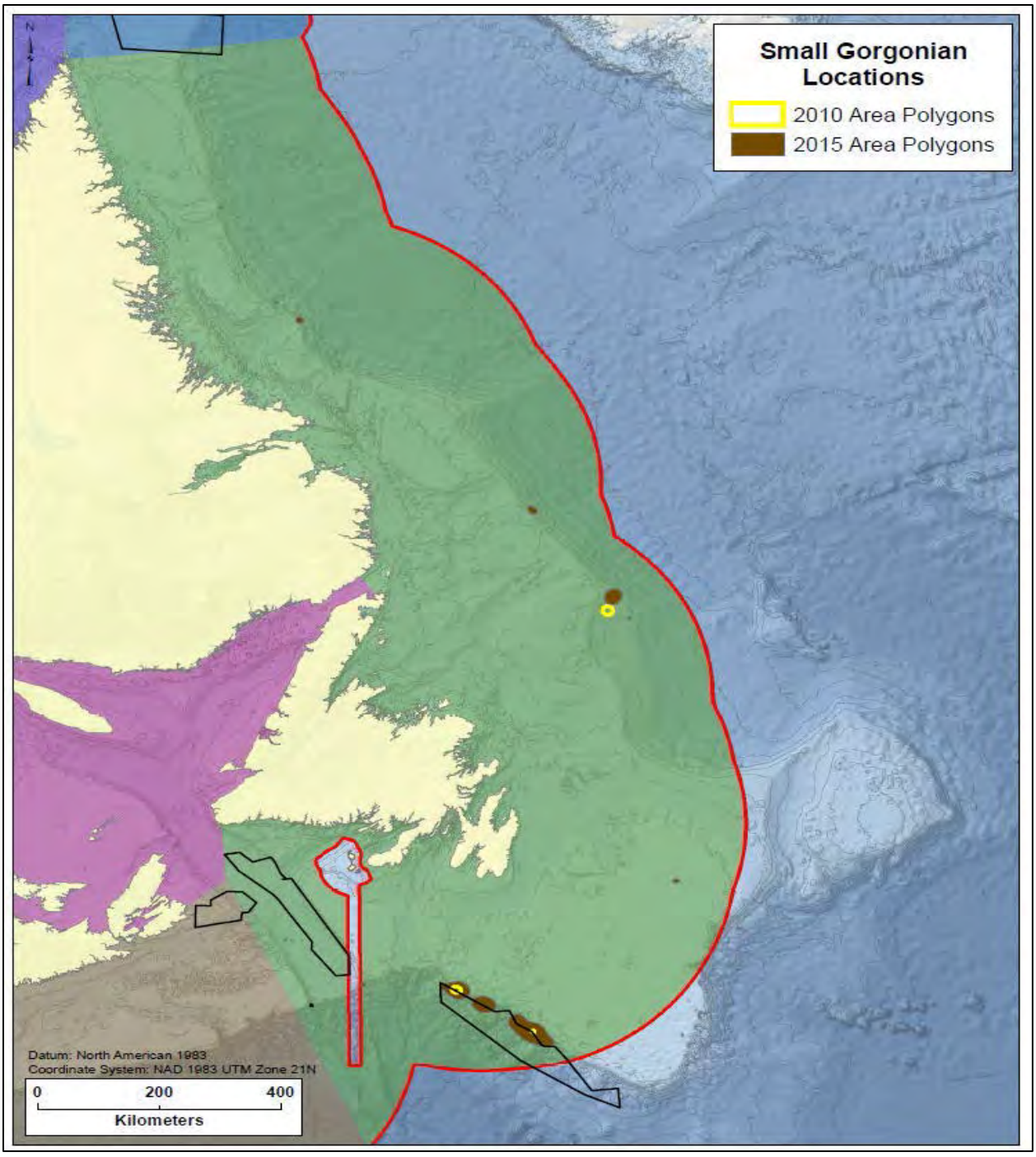

FIGURE 4.3. A comparison of the locations of significant concentrations of small gorgonian coral areas as identified in 2010 (yellow outline) and 2015 (brown polygons). Areas closed to protect benthic habitat are indicated in black outline. Red lines indicate the EEZs of Canada and France (St. Pierre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

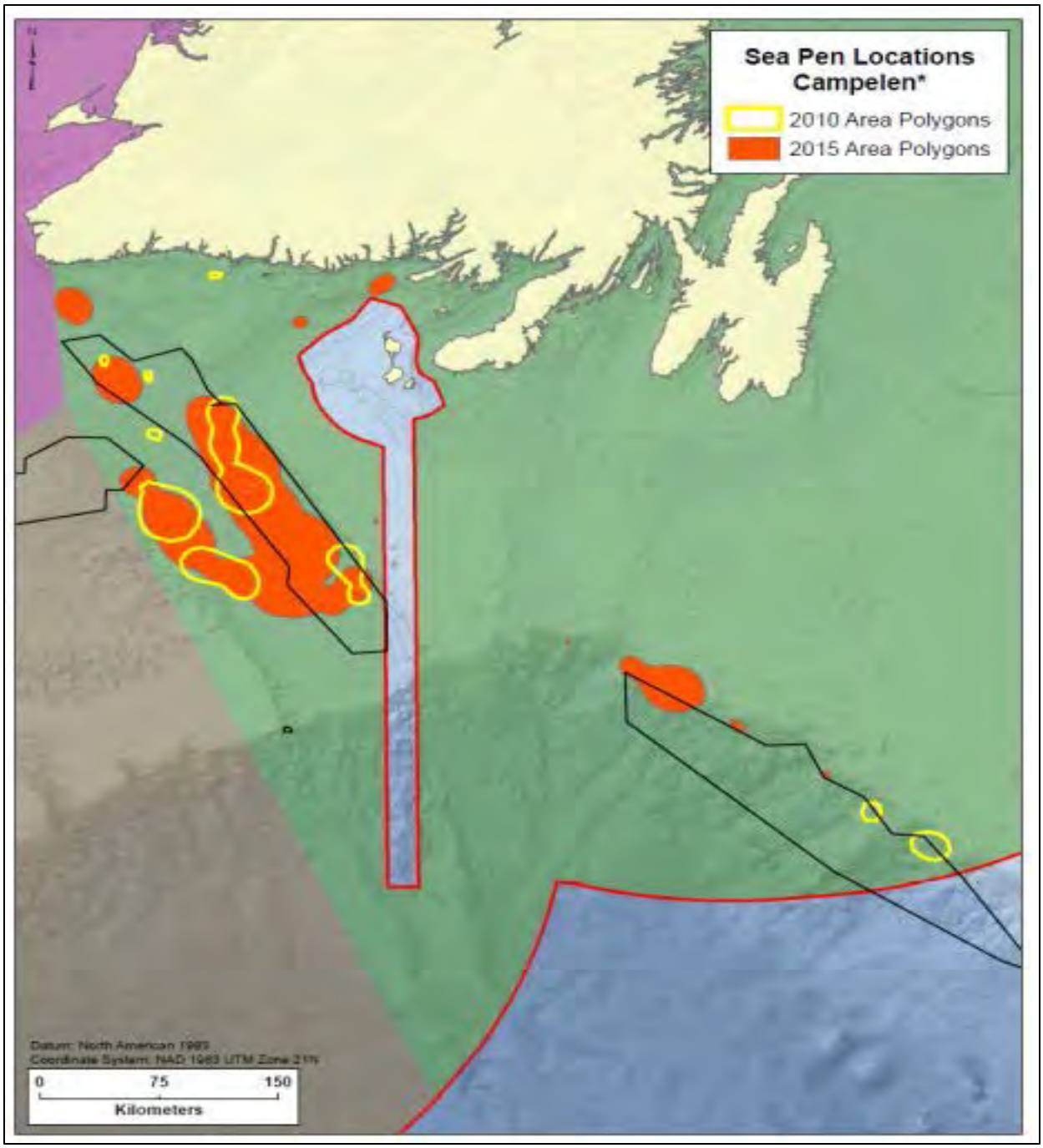

FIGURE 4.4. A comparison of the locations of significant concentrations of sea pens as identified in 2010 (yellow outline) and 2015 (orange polygons). Areas closed to protect benthic habitat are indicated in black outline. Red lines indicate the EEZs of Canada and France (St. Pierre and Miquelon) (Source: Kenchington et al. [2016]).

4.1.5 Atlantic Cod

A recent study by Rose and Rowe (2015) considered the comeback of the northern cod stock. 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).

According to recent assessments, Atlantic cod stocks remain at low levels although spawning biomass has increased in recent years. In 2010, after a decade-long moratorium, a cod fishery on the Flemish Cap (Div. 3M) was re-opened. However, the moratoria on directed cod fisheries will continue for Div. 3NO and Div. 3L until at least 2018 (NAFO 2017a). During the 2014–2015 season, only 54% of the 13,225 t TAC for 3Ps was landed. Based on preliminary Atlantic cod landings for 2015–2016, it was anticipated that a large portion of the allocated TAC for that management year would likely not be taken. The 3Ps stock is currently in the "cautious zone" as defined by the DFO Precautionary Approach Framework (DFO 2016c).

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). The new information presented here does not change the effects predictions made in the EA (LGL 2014a), Addendum (LGL 2014b), and associated Amendments (LGL 2015a; PGS 2016).

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 to 4.5 *in* LGL 2014a, and Figure 4.1 *in* LGL 2015b, 2016). Figures 4.5–4.10 show the distribution of May–November 2015 harvest locations for all species, snow crab, Atlantic halibut, Atlantic cod, groundfishes and invertebrates, respectively. Most of the harvesting in the Study Area was conducted in areas where water depths were <1,000 m. Harvesting primarily occurred within the northwest portion of the proposed 2017 3D Area of Interest (AOI), the northern portion of the western 2D AOI and the western portion of the eastern 2D AOI. As in previous years (see Table 4.2 *in* LGL 2014a, and Table 4.1 *in* LGL 2015b, 2016), snow crab (19% of total catch in the Study Area in terms of total catch weight quartile code counts), Atlantic halibut (*Hippoglossus hippoglossus*) (13%) and Atlantic cod (12%) accounted for the highest commercial catches in the Study Area during May–November 2015. Other notable species caught commercially in 2015 include American plaice (*Hippoglossoides platessoides*) (8%), yellowtail flounder (*Pleuronectes ferruginea*) (8%), white hake (7%), Atlantic haddock (*Melanogrammus aeglefinus*) (4%), whelk (Gastropoda) (4%), cusk (*Brosme*

brosme) (4%) and redfish (*Sebastes* sp.) (3%). Catch weight and value quartile counts, months of effort and gear types for species harvested in the Study Area and the 2017 AOIs are presented in Tables 4.1 and 4.2, respectively.

As in 2013 and 2014, yellowtail flounder and redfish accounted for smaller proportions of the May–November 2015 catches compared to previous years. There were similarly no reported catches of cockles in the Study Area during May–November 2013 or 2015, unlike previous years.

4.2.1.1 Snow Crab

During May–November 2015, the distribution of harvest locations for snow crab in the Study Area was consistent with that observed during May–November 2005–2012, 2013 and 2014 (see Figure 4.6, Figures 4.10 to 4.12 *in* LGL 2014a, and Figure 4.2 *in* LGL 2015b, 2016). The catches occurred primarily in the central and northern portions of the Study Area, in areas where water depths are <500 m. Catches mainly occurred in the northwestern portion of the 2017 3D AOI, northern portion of the western 2D AOI and western central and northern portions of the eastern 2D AOI. The total allowable catch (TAC) for snow crab Northwest Atlantic Fisheries Organization (NAFO) Divisions (Div.) 3LNO decreased from 35,698 mt in 2015 to 33,486 mt in 2016 and 24,787 mt in 2017, while in Div. 3Ps, the TAC decreased from 4,299 mt in 2015 to 3,010 mt in 2016 and 1,505 mt in 2017 (DFO 2016d, 2017a).

4.2.1.2 Atlantic Halibut

During May–November 2015, Atlantic halibut catch locations were similar to those observed during 2006 and 2007 (see Figure 3.36 *in* C-NLOPB 2010). Within the Study Area, harvest locations during May–November 2015 were primarily along the slope of the southern Grand Banks between the 100 and 1,000 m isobaths and to a lesser extent on the shelf, principally within Div. 3Nc (Figure 4.7). There was only one harvest location in the northern portion of the 2017 3D AOI during this period, while catches principally occurred in the central and western portions of the western and eastern 2D AOIs, respectively, in water depths <1,000 m. The 2015 TAC levels for Atlantic halibut in Div. 3NOPs4VWX+5 increased from 2,563 mt in 2014/2015 to 2,738 mt in 2015/2016 (DFO 2015).

4.2.1.3 Atlantic Cod

Atlantic cod harvest locations were similar during May–November 2005–2010, 2011, 2012 and 2015 (see Figure 4.8, and Figures 4.30–4.32 *in* LGL 2014a), with catches distributed along the slope and shelf (particularly within Div. 3Nc) in waters <1,000 m depth within the Study Area. There were two harvest locations within the 3D AOI (western and northern portions), and several locations within the western and northern portions of both the western and eastern 2D AOIs. The TAC for Atlantic cod in Div. 3M increased from 13,795 mt in 2015 to 13,931 mt in 2016/2017, while in Div. 3Ps it increased from 13,225 mt in 2014/2015 to 13,490 mt in 2015/2016; fishing bans are in place in Div. 3LNO (DFO 2016d; NAFO 2017b).

4.2.1.4 Other Notable Commercial Species

In addition to those species described above, as noted in the 2015 and 2016 EA Updates (see § 4.2.1 *in* LGL 2015b and § 4.2.1.2 *in* LGL 2016), American plaice, yellowtail flounder and redfish have also been identified as important commercial species in the Study Area, along with white hake, Atlantic haddock, whelk, cusk, witch flounder and monkfish (see Table 4.1 below, Table 4.3 *in* LGL 2014a and Table 4.1 *in* LGL 2015b, 2016). Of these species, the groundfishes are harvested primarily in areas where water depths are <1,000 m (i.e., northwestern and north-central portions of the Study Area; including the northwestern, northern and western central/northwestern portions of the 3D, western 2D and eastern 2D AOIs, respectively); the invertebrate species are chiefly harvested in water depths <500 m, in the same portions of the Study Area and 2017 AOIs as listed above (see Figures 4.9–4.10).

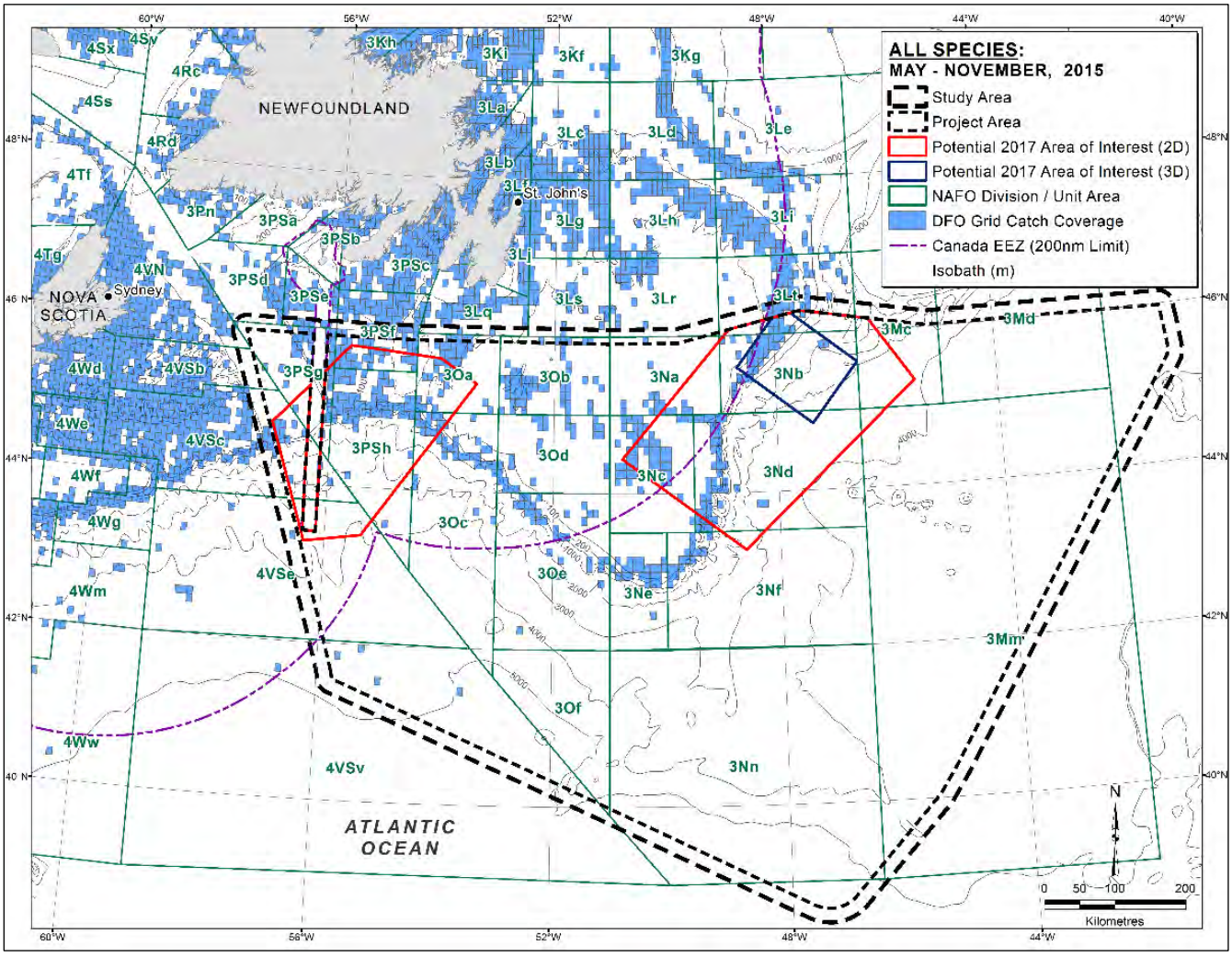

FIGURE 4.5. Distribution of commercial fishery harvest locations, all species, May–November 2015 (derived from DFO commercial landings database, 2015).

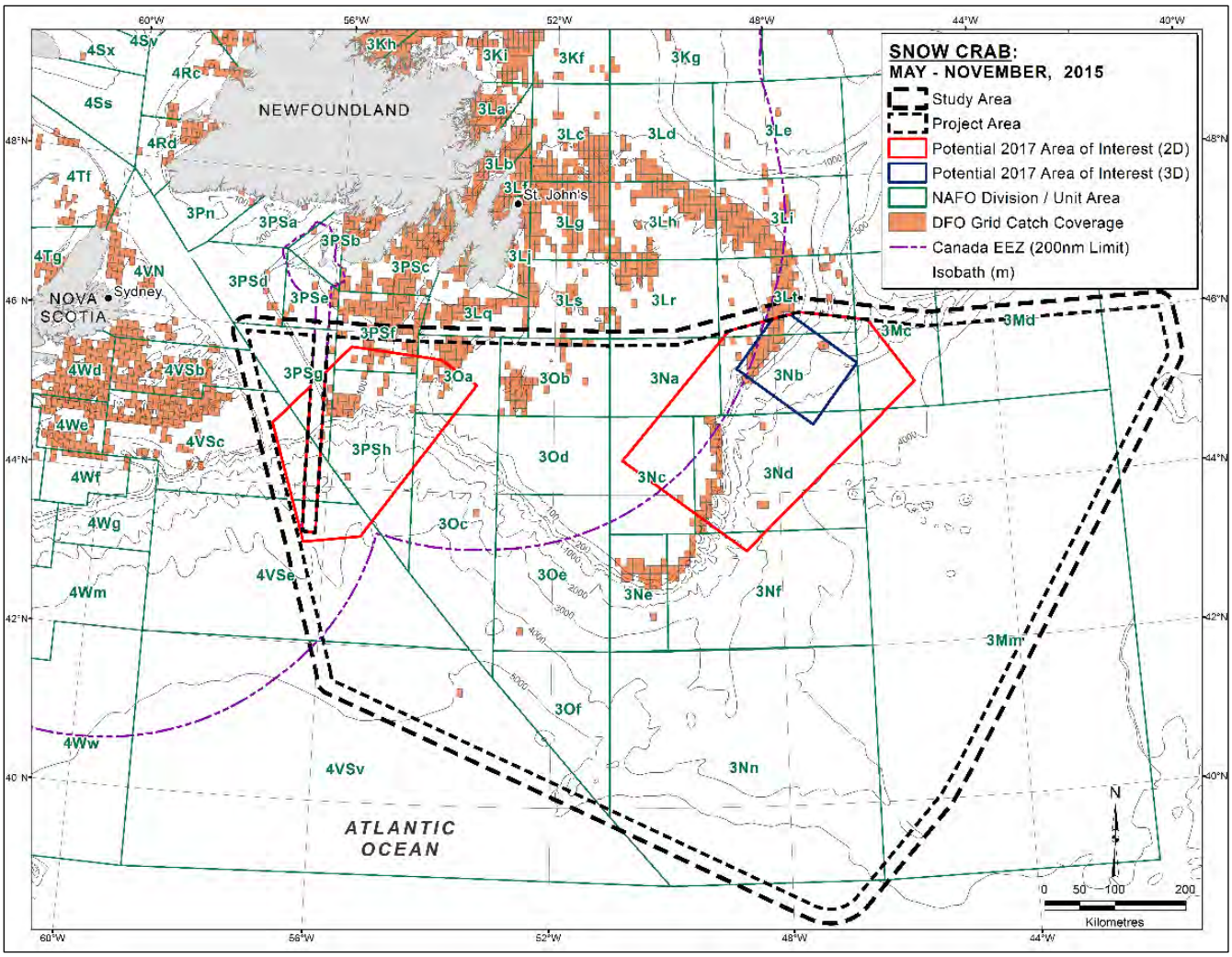

FIGURE 4.6. Distribution of commercial fishery harvest locations, snow crab, May–November 2015 (derived from DFO commercial landings database, 2015).

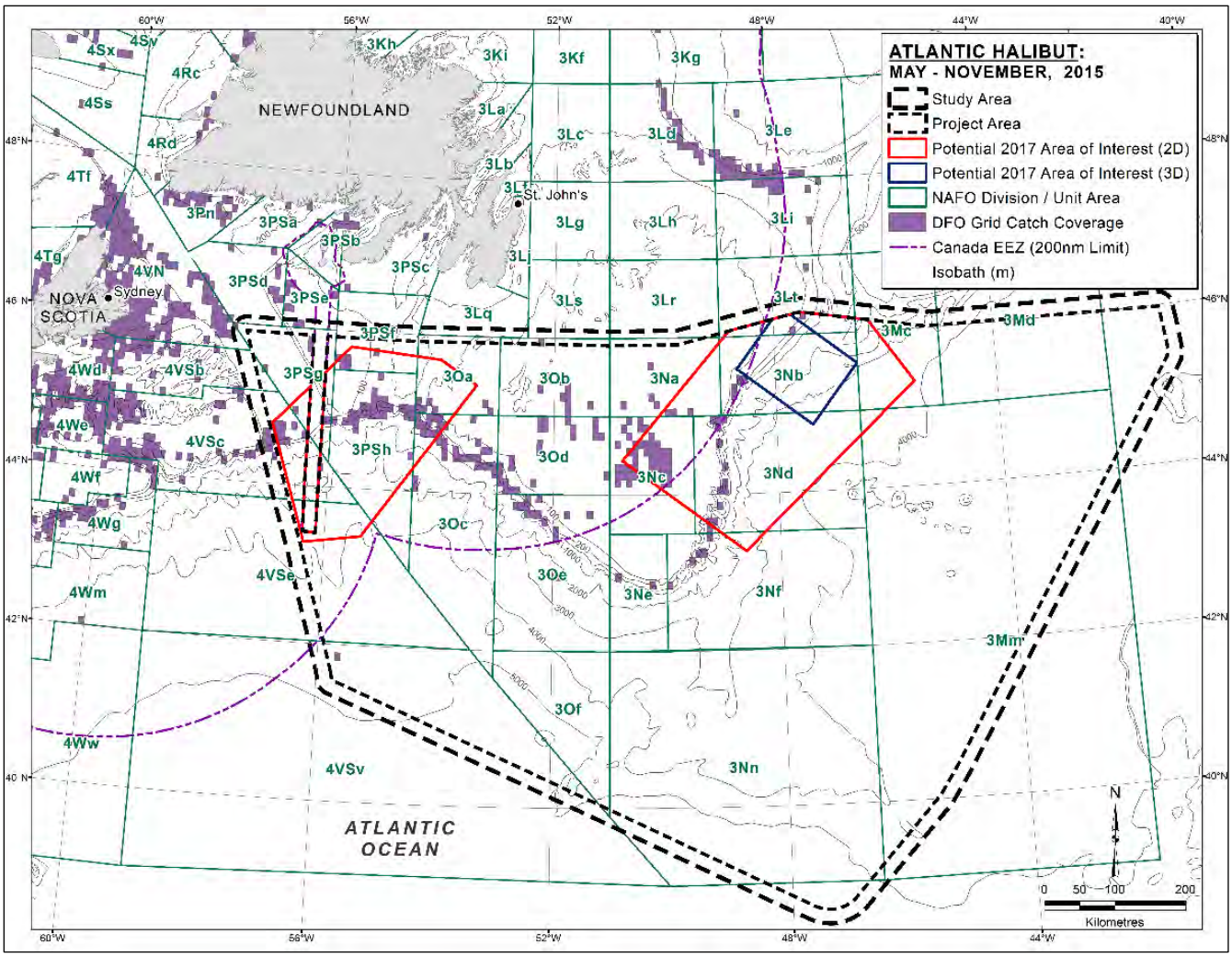

FIGURE 4.7. Distribution of commercial fishery harvest locations, Atlantic halibut, May–November 2015 (derived from DFO commercial landings database, 2015).

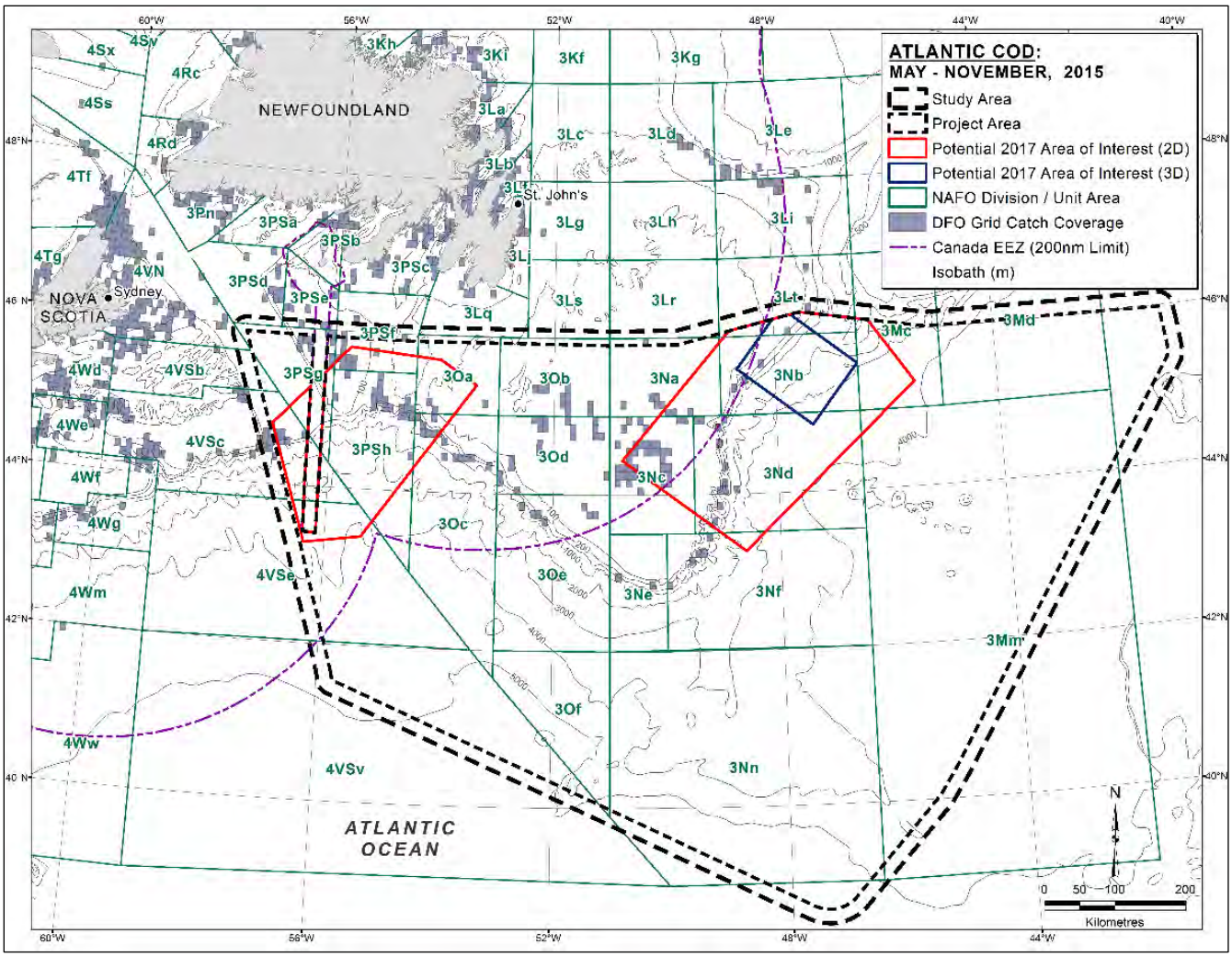

FIGURE 4.8. Distribution of commercial fishery harvest locations, Atlantic cod, May–November 2015 (derived from DFO commercial landings database, 2015).

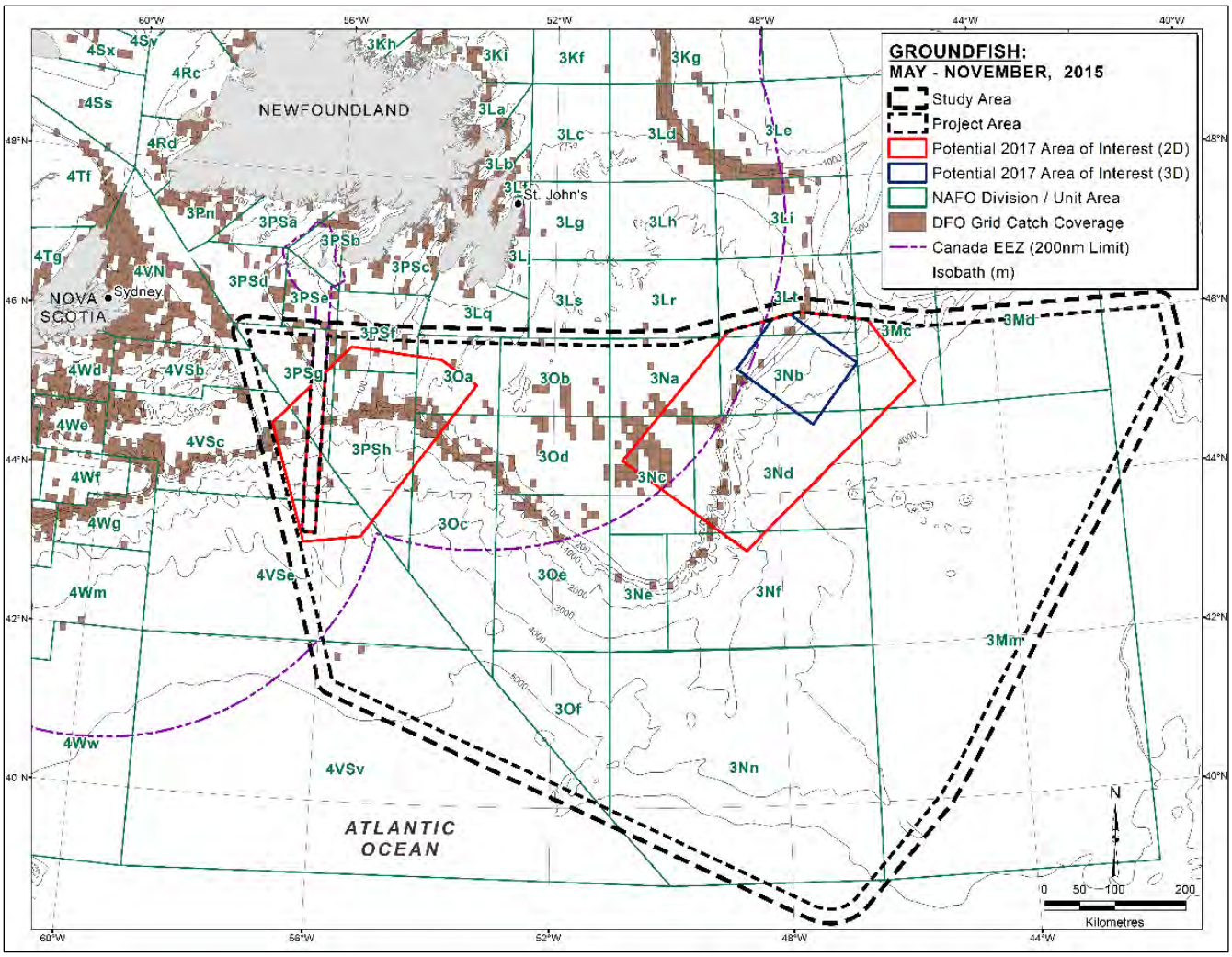

FIGURE 4.9. Distribution of commercial fishery harvest locations, all groundfishes, May–November 2015 (derived from DFO commercial landings database, 2015).

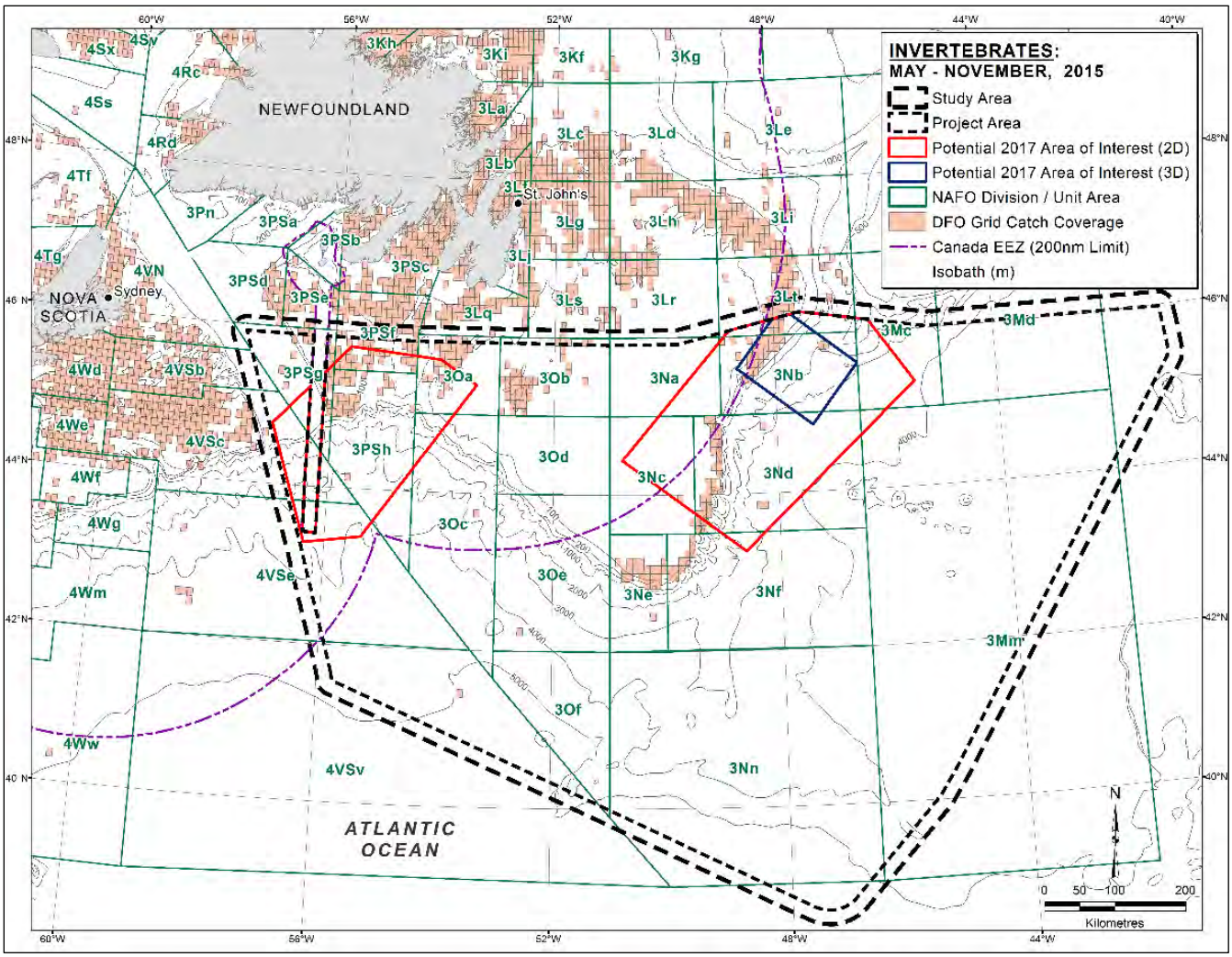

FIGURE 4.10. Distribution of commercial fishery harvest locations, all invertebrates, May–November 2015 (derived from DFO commercial landings database, 2015).

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
Snow Crab	128	200	196	34	100	185	198	75	558	May–Aug	Pot	-
Atlantic Halibut	144	143	80	27	147	149	88	10	394	May–Nov	Gillnet; Longline	Trawl
Atlantic Cod	70	119	117	48	97	147	94	16	354	May–Aug	Gillnet; Longline; Pot	Trawl; Rod and Reel (trolling)
American Plaice	33	79	89	40	92	91	48	10	241	May–Jun; Aug–Nov	Gillnet	Trawl
Yellowtail Flounder	39	82	76	34	98	81	43	9	231	May–Jun; Aug–Nov	Gillnet; Longline	Trawl
White Hake	88	77	51	4	117	81	21	1	220	May–Nov	Gillnet; Longline	Trawl
Atlantic Haddock	30	35	37	14	48	40	23	5	116	May–Nov	Gillnet; Longline	Trawl
Whelk	18	31	44	20	35	33	33	12	113	May–Oct	Pot	-
Cusk	50	37	16	2	50	46	9	0	105	May–Nov	Gillnet; Longline	Trawl
Witch Flounder	15	28	41	16	34	38	21	7	100	May–Jun; Aug–Nov	-	Trawl
Monkfish	25	36	24	9	56	24	11	3	94	May–Nov	Gillnet	Trawl
Redfish sp.	23	36	28	2	48	33	7	1	89	May–Nov	Longline	Trawl
Pollock	10	20	27	3	27	26	7	0	60	Jun–Nov	Gillnet; Longline	Trawl
Greenland Halibut	26	20	7	2	21	28	6	0	55	May–Aug; Oct–Nov	Longline	Trawl
Swordfish	21	15	10	1	16	10	14	7	47	Aug–Oct	Longline	-
Mako Shark	10	11	9	1	7	7	11	6	31	Aug–Oct	Longline	-
Bluefin Tuna	4	5	12	6	5	6	9	7	27	Aug–Nov	Longline	Troller Lines; Rod and Reel (trolling); Electric Harpoon
Skate sp.	7	9	8	0	13	8	3	0	24	May–Nov	Gillnet; Longline	Trawl
Whitefish	6	9	1	2	2	11	4	1	18	May–Jul; Sep	Gillnet; Longline	-
Albacore Tuna	8	3	3	1	7	2	4	2	15	Aug–Oct	Longline	-
Bigeye Tuna	2	3	6	1	1	1	5	5	12	Aug–Oct	Longline	-
Atlantic (striped) Wolffish	3	8	0	0	1	9	1	0	11	Jul	Longline	-
Arctic Skate	2	5	0	0	2	5	0	0	7	Jul	Longline	-
Silver Hake	1	1	2	0	2	1	0	1	4	Oct	-	Trawl
Capelin	0	2	1	0	3	0	0	0	3	Jul	-	Seine
Yellowfin Tuna	0	2	1	0	0	1	1	1	3	Sep	Longline	-

Table 4.1. (continued).

Species	Catch Weight Quartile Code Counts [a]				Catch Value Quartile Code Counts [b]				Total Counts [c]	Month Caught	Gear Type	
Stimpson's Surf Clam	0	1	1	0	0	2	0	0	2	May; Oct	-	Dredge
Sea Cucumber	0	1	1	0	1	1	0	0	2	Aug–Sep	-	Unspecified
Sea Scallop	2	0	0	0	2	0	0	0	2	Jul–Aug	-	Dredge
Mahi Mahi (dolphinfish)	1	0	1	0	1	0	0	1	2	Aug; Oct	Longline	-
Hagfish	0	0	1	0	0	1	0	0	1	May	Trap Net	-
Propeller Clam	0	0	1	0	0	1	0	0	1	May	-	Dredge
Total	**766**	**1,018**	**891**	**267**	**1,033**	**1,068**	**661**	**180**	**2,942**	-	-	-

Source: DFO commercial landings database, 2015.

Notes:

[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 Areas of Interest (AOIs), 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
3D AOI												
Snow Crab	9	25	40	15	7	23	29	30	89	May–Aug	Pot	-
Redfish sp.	1	1	1	0	1	2	0	0	3	Aug	-	Trawl
Greenland Halibut	1	1	0	0	1	1	0	0	2	Aug	-	Trawl
Atlantic Cod	1	1	0	0	1	1	0	0	2	Aug	-	Trawl
Witch Flounder	0	1	0	0	0	1	0	0	1	Aug	-	Trawl
Atlantic Halibut	0	0	1	0	0	1	0	0	1	Aug	-	Trawl
Total	**12**	**29**	**42**	**15**	**10**	**29**	**29**	**30**	**98**	-	-	-
2D AOI (west)												
White Hake	37	46	36	2	67	43	11	0	121	May–Nov	Gillnet; Longline	Trawl
Atlantic Halibut	43	46	26	2	58	39	19	1	117	May–Nov	Gillnet; Longline	Trawl
Snow Crab	40	39	22	0	32	34	31	4	101	May–Aug	Pot	-
Atlantic Cod	11	28	35	20	34	29	24	7	94	May–Nov	Gillnet; Longline	Trawl; Rod and Reel (trolling)
Whelk	8	19	33	19	15	27	25	12	79	May–Oct	Pot	-
Cusk	23	24	10	0	36	17	4	0	57	May–Sep; Nov	Gillnet; Longline	Trawl
Monkfish	9	21	18	7	27	18	8	2	55	May–Nov	Gillnet	Trawl
Atlantic Haddock	13	8	23	7	19	20	10	2	51	May–Nov	Gillnet; Longline	Trawl

Table 4.2. (continued).

Species	Catch Weight Quartile Code Counts [a]				Catch Value Quartile Code Counts [b]				Total Counts [c]	Month Caught	Gear Type	
Pollock	8	13	16	1	19	16	3	0	38	Jul–Nov	Gillnet; Longline	Trawl
Redfish sp.	5	20	12	0	20	15	2	0	37	May–Aug; Oct–Nov	Longline	Trawl
American Plaice	4	2	10	7	5	9	7	2	23	May–Jun; Aug–Nov	Gillnet	Trawl
Bluefin Tuna	1	2	9	5	1	5	7	4	17	Oct–Nov	Longline	Troller Lines; Rod and Reel (trolling); Electric Harpoon
Greenland Halibut	4	9	3	0	5	9	2	0	16	Jun–Aug; Nov	Longline	Trawl
Yellowtail Flounder	0	3	3	2	3	2	2	1	8	Oct–Nov	Gillnet	Trawl
Skate sp.	1	3	4	0	4	4	0	0	8	Jun–Jul; Oct	Gillnet	-
Witch Flounder	5	0	2	0	5	1	1	0	7	Aug	-	Trawl
Whitefish	1	1	0	2	1	1	2	0	4	Jun–Jul; Sep	Gillnet; Longline	-
Arctic Skate	0	2	0	0	1	1	0	0	2	Jul	Longline	-
Hagfish	0	0	1	0	0	1	0	0	1	May	Trap Net	-
Sea Scallop	1	0	0	0	1	0	0	0	1	Jul	-	Dredge
Atlantic (striped) Wolffish	0	1	0	0	0	1	0	0	1	Jul	Longline	-
Total	**214**	**287**	**263**	**74**	**353**	**292**	**158**	**35**	**838**	-	-	-
2D AOI (east)												
Snow Crab	13	56	58	17	11	49	47	37	144	May–Aug	Pot	-
Atlantic Halibut	30	29	20	10	22	37	27	3	89	May–Nov	Longline	Trawl
Yellowtail Flounder	8	32	22	13	30	28	15	2	75	May–Jun; Aug–Nov	Longline	Trawl
American Plaice	3	25	23	13	21	27	14	2	64	May–Jun; Oct–Nov	-	Trawl
Atlantic Cod	17	20	17	7	12	29	17	3	61	May–Nov	Longline	Trawl
Greenland Halibut	6	2	1	0	4	4	1	0	9	May–Jun; Aug	Longline	Trawl
Redfish sp.	1	2	3	0	1	4	1	0	6	May; Aug	Longline	Trawl
Skate sp.	3	2	1	0	1	3	2	0	6	Jun; Aug–Sep	Longline	-
White Hake	0	3	2	0	0	1	4	0	5	May	Longline	-
Witch Flounder	0	1	0	1	0	1	0	1	2	Jun; Aug	-	Trawl
Atlantic (striped) Wolffish	1	0	0	0	0	1	0	0	1	Jul	Longline	-
Atlantic Haddock	1	0	0	0	0	1	0	0	1	Jul	Longline	-
Whitefish	1	0	0	0	0	1	0	0	1	Jul	Longline	-
Total	**84**	**172**	**147**	**61**	**102**	**186**	**128**	**48**	**464**	-	-	-

Table 4.2. (continued).

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.

Yellowtail flounder and white hake are managed by NAFO, American plaice, redfish and witch flounder are jointly managed by NAFO and DFO, and DFO sets TAC values for the remaining four species. The TAC for yellowtail flounder in Div. 3LNO has remained steady at 17,000 mt in recent years (NAFO 2017b). White hake TAC in Div. 3NO decreased from 6,000 mt and 5,000 mt in 2011 and 2012, respectively, and has remained at 1,000 mt since 2013 (NAFO 2017b). Fishing bans are in place in Div. 3MLNOPs for American plaice (DFO 2015; NAFO 2017b). Redfish TAC increased in Div. 3LN from 10,400 mt in 2015/2016 to 14,200 mt in 2017, increased in Div. 3M from 6,700 mt in 2015 to 7,000 mt in 2016/2017, remained steady at 20,000 mt in recent years in Div. 3O and remained at 8,500 mt in Div. 3Ps (at least until 2015, the latest available year) (DFO 2015; NAFO 2017b). A fishing ban is in effect for witch flounder in Div. 3L, while the TAC in Div. 3NO increased from 1,000 mt in 2015 to 2,225 mt in 2017; the TAC remained at 650 mt in recent years (at least until 2015) (DFO 2015; NAFO 2017b). There is a moratorium for Atlantic haddock in Div. 4TVW and cusk in Div. 4VWX; these species are only allowed to be taken as by-catch (DFO 2015). Whelk are not to be taken in Div. 3L, while the TAC in Div. 3Ps increased from 4,965 mt in 2013 to 5,000 mt in 2014/2015/2016 (DFO 2016e). An integrated fisheries management plan for groundfish effective as of 2013 indicates there is no TAC for monkfish within Div. 3Ps (DFO 2014).

Northern Shrimp.—As noted in the 2015 and 2016 EA Updates (LGL 2015b, 2016), northern shrimp harvesting in the Study Area has declined during recent years to the point of being effectively banned. The 2010 moratorium on this fishery in Div. 3M remains in effect during 2017, as does the 2015 shrimp fishery closure in Shrimp Fishing Area (SFA) 7 (includes portions of Div. 3LNOPs and 4VnVs); there has been a ban on fishing shrimp in Div. 3NO since at least 2004 (DFO 2016d, 2017a; NAFO 2017b). As observed in 2014, no northern shrimp harvests in the Study Area were reported during May–November 2015 (see Table 4.1).

4.2.1.5 Timing and Gear Types

Similar to previous years, most of the May–November 2015 harvesting in the Study Area and 2017 AOIs occurred during the May–August period (see Figure 4.11 below, Figure 4.8 *in* LGL 2014a, and Figure 4.5 *in* LGL 2015b, 2016). Gear types used in the Study Area in 2015 were typical of those used during previous years (see Table 4.1, Figures 3.19–3.20 and Table 3.5 in C-NLOPB 2010, and Table 4.1 *in* LGL 2015b, 2016). The May–November 2015 harvest locations for both fixed and mobile gears are shown in Figures 4.12–4.13.

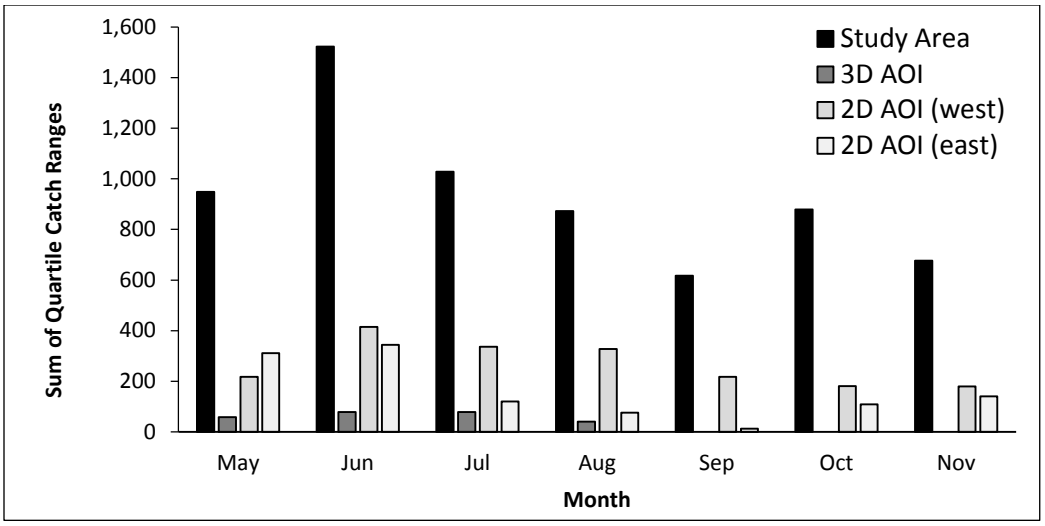

FIGURE 4.11. Monthly sums of catch weight quartile codes in the Study Area and 3D, 2D (west) and 2D (east) Areas of Interest (AOIs), All Species, May–November 2015 (derived from DFO commercial landings database, 2015). Sum of catch weight quartile codes is the summation of quartile codes (i.e., 1–4) for all catch records for all species; the greater the sum of quartile code counts, the greater the catch weight for a given month.

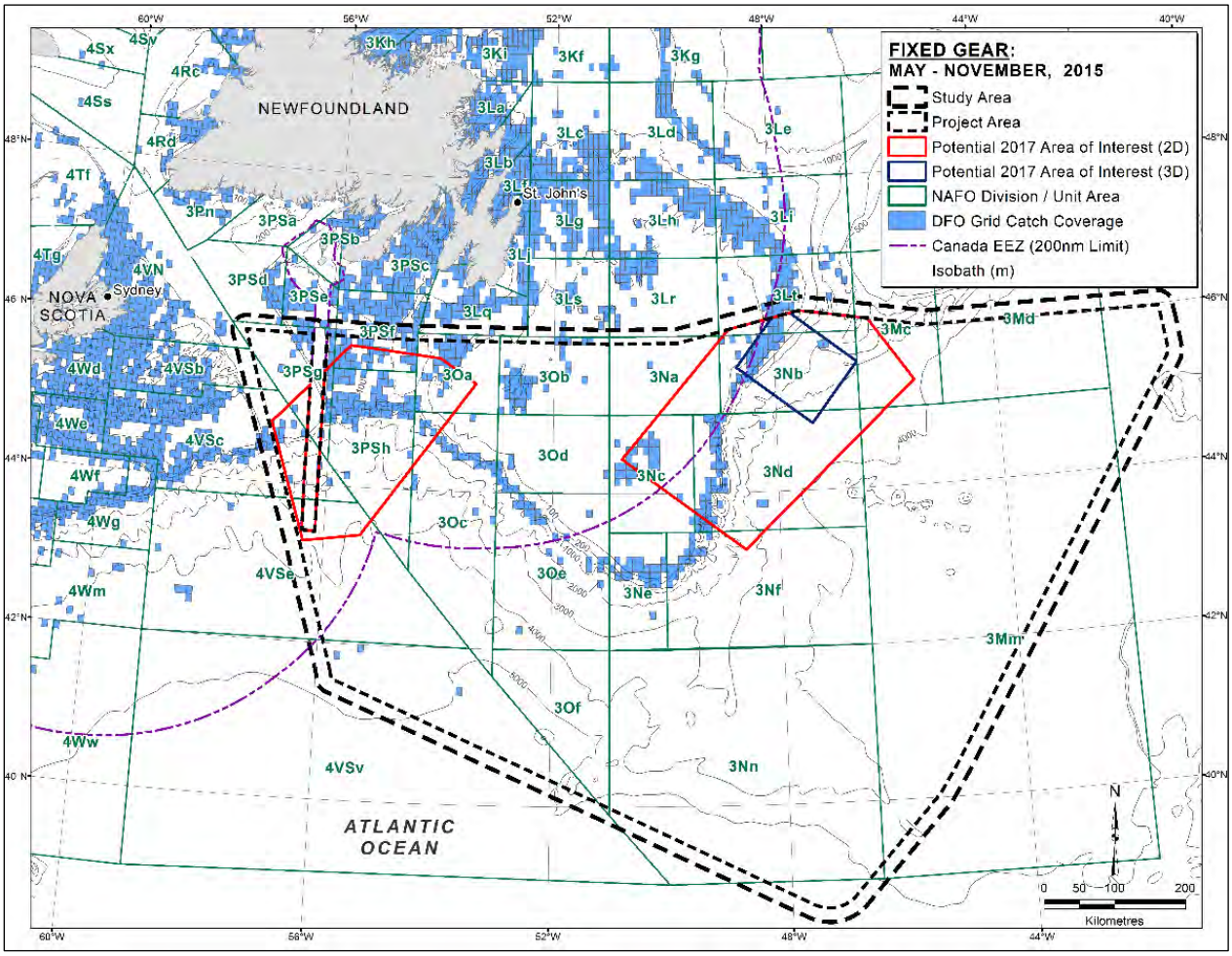

FIGURE 4.12. Harvest locations using fixed gear in the Study Area and 3D, 2D (west) and 2D (east) AOIs, all species, May–November 2015 (derived from DFO commercial landings database, 2015).

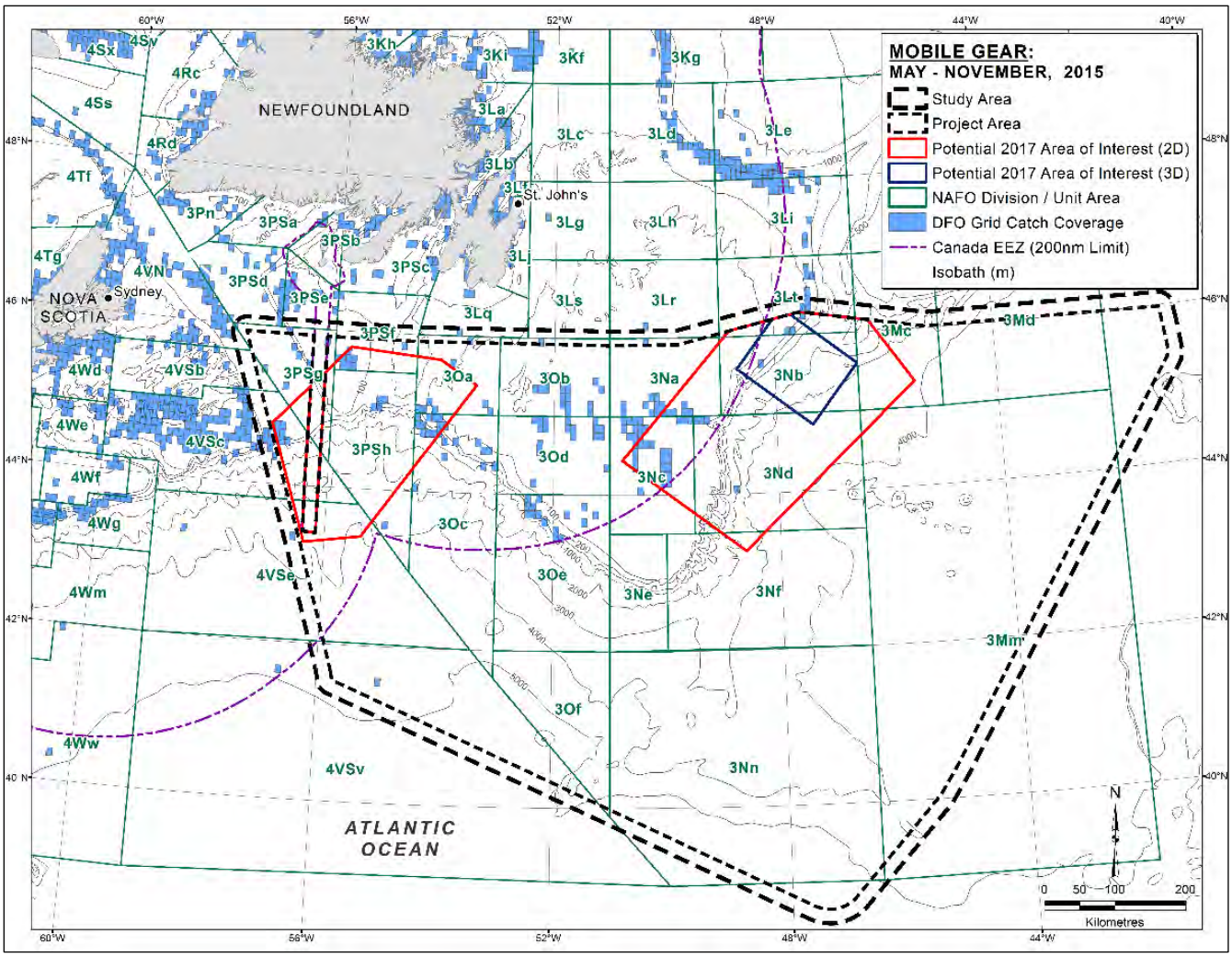

FIGURE 4.13. Harvest locations using mobile gear in the Study Area and 3D, 2D (west) and 2D (east) AOIs, all species, May–November 2015 (derived from DFO commercial landings database, 2015).

4.2.2 Traditional and Aboriginal Fisheries

Traditional and Aboriginal fisheries, including communal fisheries licences held by Aboriginal groups in the Study Area, are described in § 4.2.2 of the 2016 EA Update (LGL 2016), § 4.3.4 of the EA (LGL 2014a) and § 3.3.4 of the Southern Newfoundland SEA (C-NLOPB 2010). There is no new information regarding traditional and Aboriginal fisheries in the Study Area since the preparation of the aforementioned documents, and according to the Southern and Eastern Newfoundland SEAs (C-NLOPB 2010, 2014), there are no other Aboriginal fisheries that occur in the Study Area.

4.2.3 Recreational Fisheries

Recreational fisheries in Newfoundland and Labrador are described in § 3.3.3 of the Southern Newfoundland SEA (C-NLOPB 2010), § 4.3.5 of the EA (LGL 2014a), and § 4.2.3 of the 2015 and 2016 EA Updates (LGL 2015b, 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 Eastport (northeast Newfoundland) and Gilbert Bay (southeast Labrador) Marine Protected Areas (MPAs) (DFO 2016d). Portions of Div. 3LPs overlap the Study Area.

As per § 4.2.3 *in* LGL (2015b, 2016), given the Study Area's distance from shore it is highly unlikely that any recreational fisheries will be conducted within it.

4.2.4 Aquaculture

As indicated in the Southern Newfoundland SEA (see § 3.3.2 *in* C-NLOPB 2010) and 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). The 2012 and 2013 RV data were analyzed in the 2015 and 2016 EA Updates, respectively (LGL 2015b, 2016). During the May–November 2014 period, RV surveys occurred within the Study Area during the spring (May–June); unlike previous years, there were no RV surveys in the Study Area during the fall. Results of analysis of the 2014 dataset did not indicate any major differences in either the predominant species caught or the harvest locations compared to previous survey years (see Table 4.4 and Figure 4.34 *in* LGL 2014a). Similar to previous years, no RV survey data were collected in the Study Area during July 2012, 2013 or 2014 (LGL 2015b, 2016). During 2014, few RV survey locations were within the western portion of the 2017 3D AOI, while there were numerous locations within the northern and western portions of the western and eastern 2D AOIs, respectively, in areas where water depths are <1,000 m (Figure 4.14).

Fisheries research surveys conducted by DFO and the fishing industry were described in § 4.3.8 of the EA (LGL 2014a). 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, with surveys potentially occurring in the Study Area throughout this period. DFO fall RV surveys will begin at the end of August and end in early-December, and may occur in the Study Area throughout this time, with the least amount of survey activity potentially during late-October to early-November.

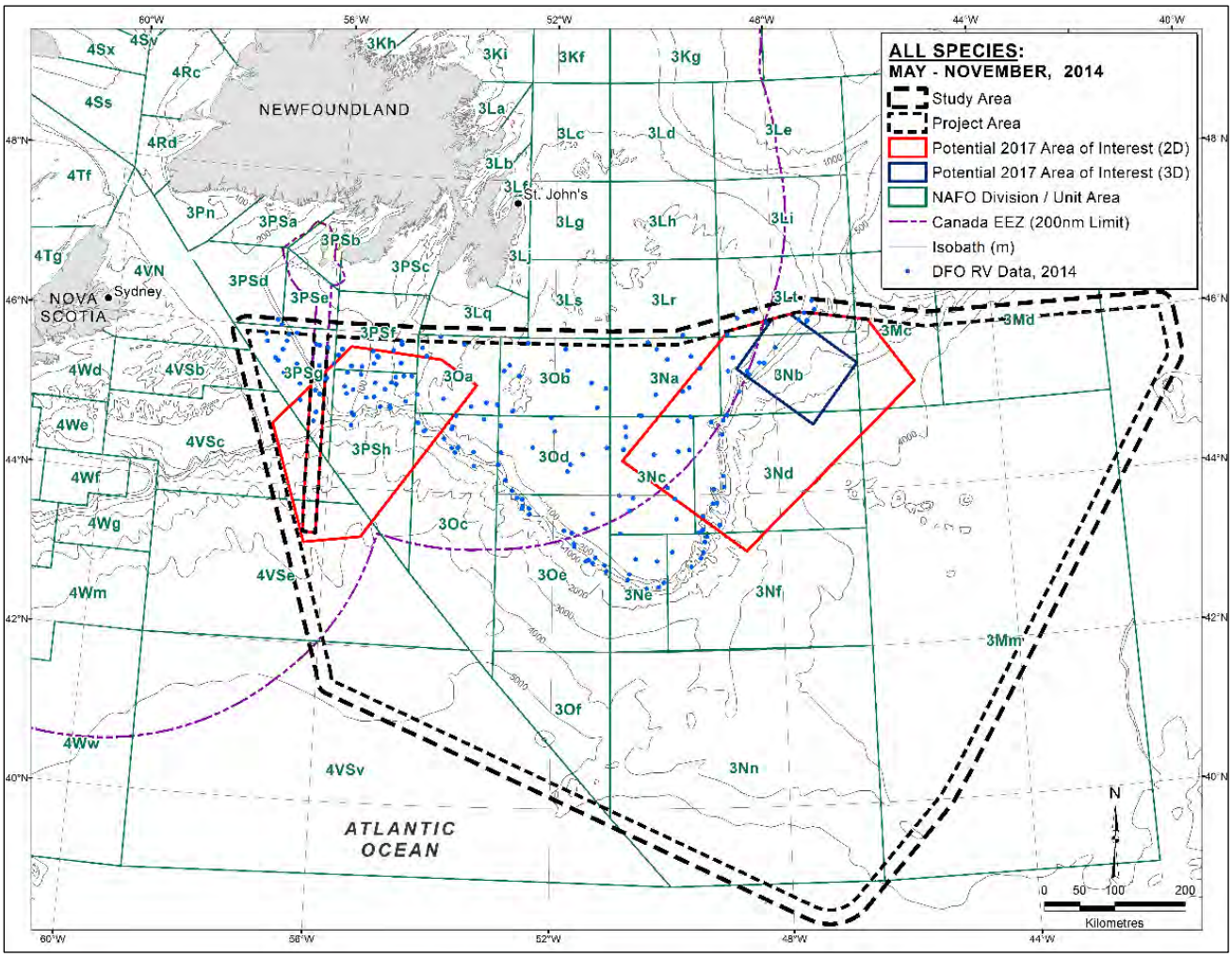

FIGURE 4.14. Distribution of DFO RV survey catch locations in the Study Area and 3D, 2D (west) and 2D (east) AOIs, May–November 2014 (derived from DFO RV survey database, 2014).

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*

The Industry-DFO Collaborative Post-season Trap Survey for Snow Crab was described in § 4.3.8 of the EA (LGL 2014a). The total number of sample 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. As indicated in Figure 4.15, 69 and 54 survey stations are located in the northwest and north-central portions of the Study and Project Areas, respectively, in Div. 3LNOPs. Five stations occur in the northern portion of the 2017 3D AOI, while 16 and six stations occur in the northern portions of the western and eastern 2017 2D AOIs, respectively. Sampling at these stations is anticipated to occur annually during the September–November period. The 2017 TAC for the Trap Survey is 470 mt (DFO 2017a).

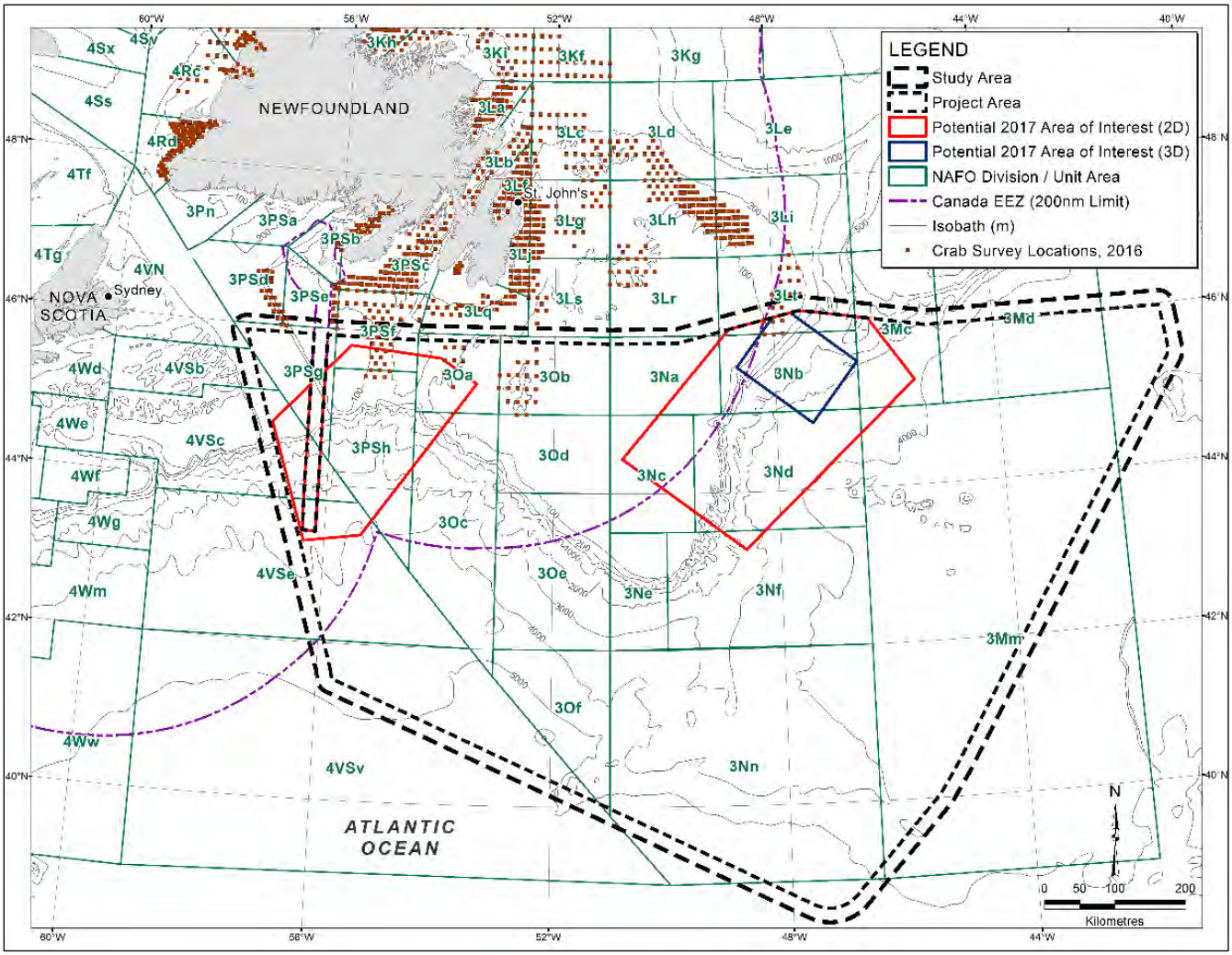

FIGURE 4.15. Locations of sampling stations associated with the industry-DFO collaborative post-season trap survey for snow crab (derived from DFO database, 2017).

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 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), Addendum (LGL 2014b), and associated Amendments (LGL 2015a; PGS 2016).

4.3.1 Breeding Colonies

The 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; EC-CWS, unpublished data). The numbers of Leach's Storm-Petrels on the Green Island IBA are now reported as 48,000 vs. 103,833 breeding pairs in the 2016 EA Update. Similarly, a substantial decrease in Leach's Storm-petrels was reported for the Middle Lawn IBA (8,773 pairs vs. 13,879 pairs). As discussed in LGL (2016), scientific evidence suggests the population of Newfoundland Leach's Storm-Petrels is experiencing a significant decline. The cause of the decline is unknown at present.

4.3.2 Murre Distribution and Movements

Frederiksen et al. (2016) analyzed compiled tagging data for Thick-billed Murres (n=320) from 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 showed 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 core winter habitat (McFarlane Tranquilla et al. 2015).

4.3.3 Seabird Hearing

Crowell (2016) measured auditory brainstem response in seabird species that included Lesser Scaup (*Aythya affinis*), Long-tailed Duck (*Clangula hyemalis*), Red-throated Loon (*Gavia stellata*), and Northern Gannet (*Morus bassanus*). 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.

TABLE 4.4. Estimated numbers of pairs of colonial seabirds nesting at Important Bird Areas (IBAs) and other important sites along Newfoundland's south coast.

Species	Witless Bay Islands IBA[m]	Mistaken Point IBA[m]	Western Head	Cape St. Mary's IBA[m]	Corbin Island IBA	Middle Lawn Island IBA	Green Island IBA	Grand Colombier Island IBA	Miquelon Cape IBA	Penguin Islands	Ramea Colombier Island
Northern Fulmar	60[a]			9[d]	-	-	-				
Manx Shearwater	-			-	-	7[e]	-				
Leach's Storm-Petrel	313,902[a]			-	100,000[b]	8,773[a]	48,000[a]	363,787[h]		100[b]	1,000[b]
Northern Gannet	-			13,515[a]	-	-	-				
Herring Gull	2,266[a]		100[b]	39[f]	50[g]	20[b]	Present[b]	113[b]	265[b]		
Great Black-backed Gull	15[a]		15[b]	Present[b]	25[b]	6[b]	-	5[b]			Present[b]
Black-legged Kittiwake	11,787[a]	4,170[f]	1,100[b]	10,000[b]	50[b]	-	-	196[b]	2415[b]		Present[i]
Arctic and Common Terns	-			-	-	-	Present[b]			Present[c]	100[b]
Common Murre	252,667[a]	84[f]	27[b]	15,484[a]	-	-	-	7,176[h]			
Thick-billed Murre	243[a]			1000[f]	-	-	-				
Razorbill	846[a]	22[f]	7[b]	100[b]	-	-	-	1,443[h]			
Black Guillemot	20[b]	Present[f]	20[b]	Present[b]	-	-	-	95[i]	Present[b]		
Atlantic Puffin	304,042[a]	79[f]		-	-	-	-	9,543[i]			75[b]
TOTALS	**885,848**	**4,355**	**1,269**	**40,147**	**100,125**	**8,806**	**48,000**	**382,358**	**2680**	**100**	**1,175**

Sources: [a] EC-CWS unpublished data; [b] Cairns et al. (1989); [c] Fraser et al. (2013); [d] Stenhouse and Montevecchi (1999); [e] Lormée et al. (2012); [f] Parks and Natural Areas Division, unpublished data; [g] Thomas et al. (2014); [h] Lormée et al. (2015); [i] Lormée et al. (2008); www.ibacanada.ca.

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 2015b, 2016). The new information presented below does not change the effects predictions made in the EA (LGL 2014a), Addendum (LGL 2014b), and its Amendments (LGL 2015a; PGS 2016).

4.4.1 Updated COSEWIC Designations

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) are presented in § 4.5.

4.4.2 Updated Population/Abundance Estimates

There are at least 524 North Atlantic right whales and perhaps as many as 716 catalogued individuals in the western North Atlantic (Pettis and Hamilton 2016).

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 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 described in § 4.5.1.1 of LGL (2014c).

Cetacean and sea turtle 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 4.5. Sightings include baleen whales, large toothed whales, dolphins and porpoises, and sea turtles.

TABLE 4.5. Cetacean and sea turtle sightings in the Study Area and 2017 Areas of Interest during the temporal period of the Project (compiled from the DFO sightings database, 1947–2015).

Species	Study Area			2017 Areas of Interest		
	Number Sightings	Number Individuals	Months Sighted	Number Sightings	Number Individuals	Months Sighted
Mysticetes						
Humpback Whale	527	1,649	May-Nov	348	1,131	May-Nov
Blue Whale	80	105	May-Nov	57	65	May-Oct
Fin Whale	167	271	May-Nov	103	137	May-Nov
Sei Whale	12	15	May-Sept,Nov	9	9	May-Jun, Aug-Sep,Nov
Fin/Sei Whale	6	6	Jul-Sep	6	6	Jul-Sep
Minke Whale	85	149	May-Nov	44	63	May-Sep,Nov
Unidentified Baleen Whale	71	97	May-Oct	43	57	May-Sep
Odontocetes						
Sperm Whale	77	131	May-Nov	51	87	Jun-Oct
Pygmy Sperm Whale	1	2	Jun	1	2	Jun
Northern Bottlenose Whale	18	79	May-Oct	6	24	May-Aug
Cuvier's Beaked Whale	1	1	Jul	0	0	–
White-beaked Dolphin	57	530	May-Aug,Nov	32	159	Jun-Aug,Nov
Atlantic White-sided Dolphin	197	3,053	May-Nov	100	2,041	May-Nov
Bottlenose Dolphin	8	121	Aug-Sep	5	86	Aug-Sep
Common Dolphin	195	3,450	Jun-Nov	112	2,130	Jun-Nov
Striped Dolphin	5	217	Aug-Sep	4	187	Aug-Sep
Atlantic Spotted Dolphin	1	1	Jun	0	0	–
Risso's Dolphin	6	42	Jun-Aug	4	35	Jul
Killer Whale	44	164	May-Nov	19	89	May-Nov
Long-finned Pilot Whale	347	3,895	May-Nov	227	2,262	May-Nov
Harbour Porpoise	66	318	May-Nov	25	100	May-Oct
Unidentified Dolphin	315	9,111	May-Nov	189	2,992	May-Nov
Unidentified *Stenella*	1	1	Jun	0	0	–
Unidentified Toothed Whale	6	16	Jul-Aug	4	10	Jul-Aug
Others						
Unidentified Cetacean	2	16	Jun	1	1	Jun
Unidentified Whale	151	360	May-Nov	60	189	May-Nov
Unidentified Large Whale	239	469	May-Nov	193	360	May-Nov
Unidentified Medium Whale	4	5	Jun,Oct	0	0	–
Unidentified Small Whale	10	174	Jun-Aug,Oct	6	20	Jun-Aug
Sea Turtles						
Leatherback Sea Turtle	37	50	Jun-Nov	12	13	Jun-Sep,Nov
Loggerhead Sea Turtle	3	16	May,Jul-Aug	0	0	–
Green Sea Turtle	2	2	Jul	0	0	–

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

Humpbacks were the most commonly recorded mysticete in the Study Area and 2017 Areas of Interest in the DFO sightings database (1,649 and 1,131 individuals, respectively; Table 4.5; Figure 4.16). Blue whales were recorded in the Study Area during all months within the temporal boundary of the Project and in the 2017 Areas of Interest during all months within the temporal boundary of the Project except November (see Table 4.5; Figure 4.16). North Atlantic right whales were not recorded in the Study Area. Long-finned pilot whales were the most commonly recorded identified odontocetes in the Study Area and 2017 Areas of Interest in the DFO sightings database (3,895 and 2,262 individuals, respectively; Table 4.5; Figure 4.17). Common dolphins and Atlantic white-sided dolphins were also commonly recorded in the Study Area and 2017 Areas of Interest in the DFO sightings database (3,450 and 3,053 individuals, respectively in the Study Area; Table 4.5; Figure 4.18). Sperm whales and northern bottlenose whales were also frequently recorded large odontocetes in the Study Area (131 and 79 individuals, respectively; Table 4.5; Figure 4.17).

Sea turtles were frequently recorded in the western 2D 2017 Area of Interest (Figure 4.19). Leatherback sea turtles were the most commonly recorded sea turtles in the Study Area in the DFO sightings database (50 individuals) and the only sea turtle species recorded in the 2017 Areas of Interest (see Table 4.5; Figure 4.19). Most of the leatherback sea turtles in the Study Area (40 of 50) were recorded in July and August. Loggerhead sea turtles were recorded in the Study Area from May to August and green sea turtles were recorded in the Study Area in July (see Table 4.5; Figure 4.19).

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/.

A female blue whale that was tagged in the St. Lawrence Estuary in November 2014 travelled through the western portion of the Study Area during March; another individual tagged in the Gulf of St. Lawrence in September 2013 also travelled through the western portion of the Study Area during October before being recorded a final time along the southern Grand Banks in early December (Lesage et al. 2016). Results from this study suggest that underwater seamounts and the deep ocean structures along the shelf edge may be important habitat for blue whales.

Blue whales, humpback whales, minke whales, Atlantic white-sided dolphins and common dolphins were sighted within the Study Area off southern Newfoundland 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 Study Area during this survey.

A juvenile loggerhead equipped with a satellite tag in the Canary Islands was tracked to the southwest of the Study Area (Varo-Cruz et al. 2016).

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 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.

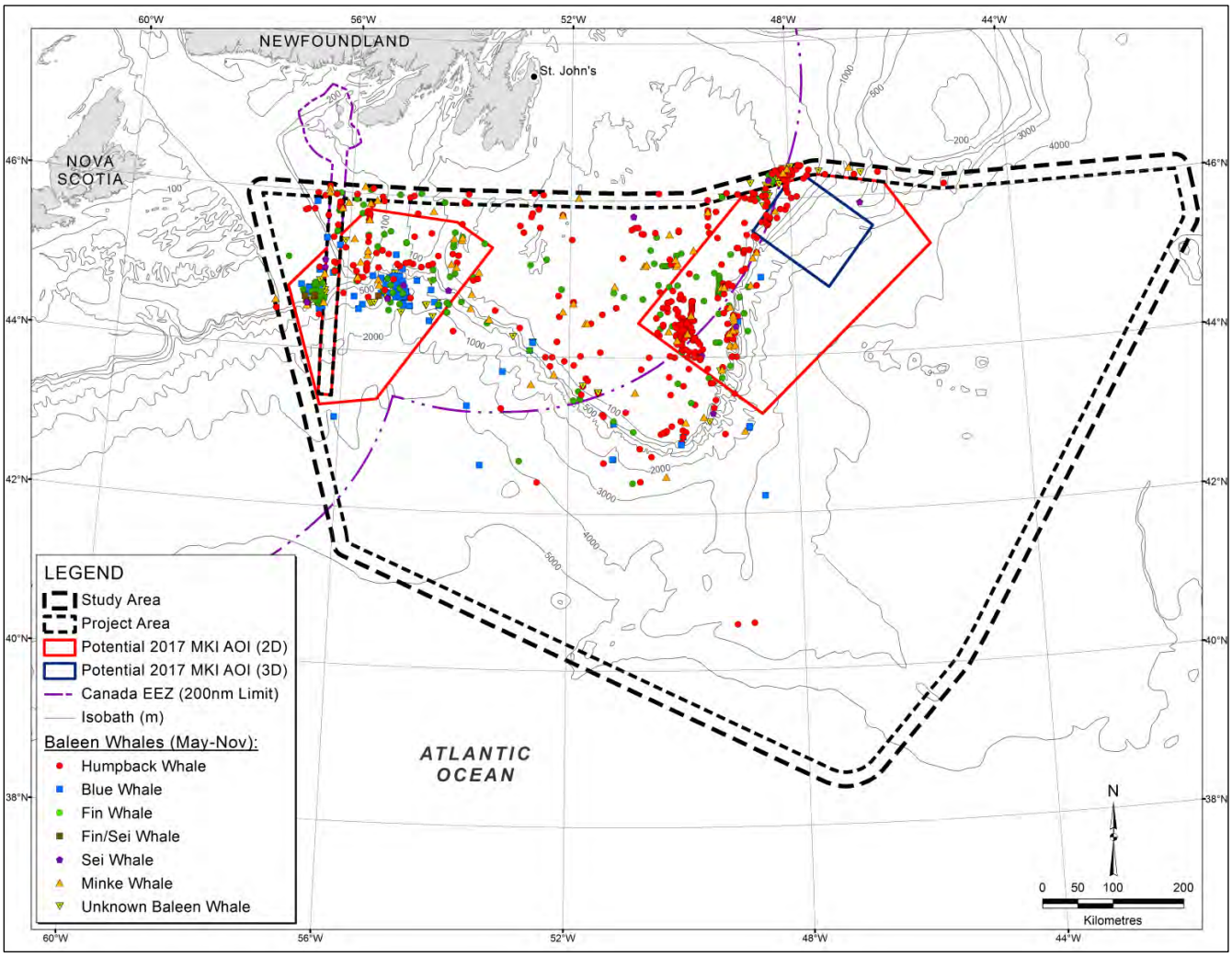

FIGURE 4.16. Baleen whale sightings in the Study Area during May–November (compiled from the DFO sightings database, 1947–2015).

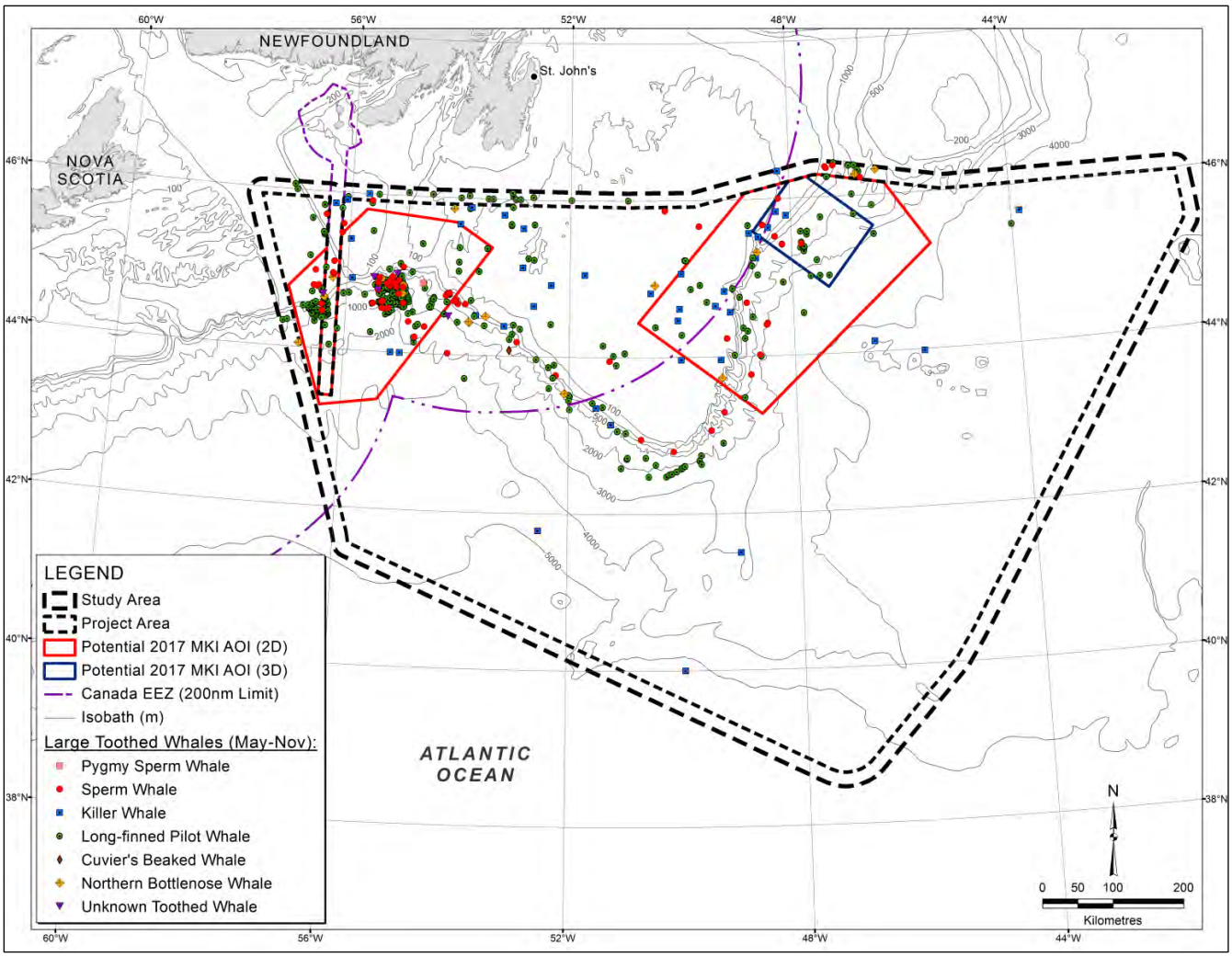

FIGURE 4.17. Large toothed whale sightings in the Study Area during May–November (compiled from the DFO sightings database, 1947–2015).

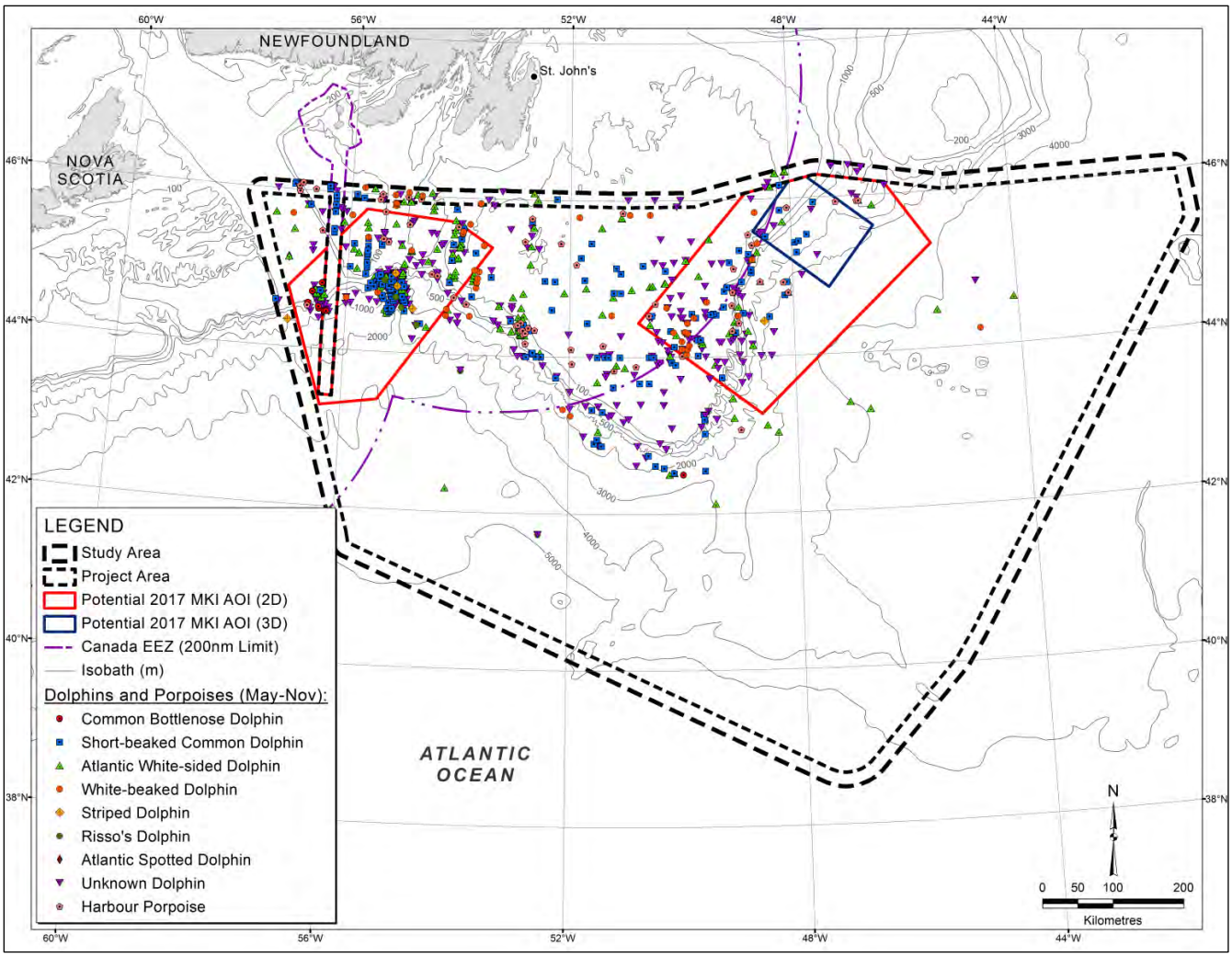

FIGURE 4.18. Dolphin and porpoise sightings in the Study Area during May–November (compiled from the DFO sightings database, 1947–2015).

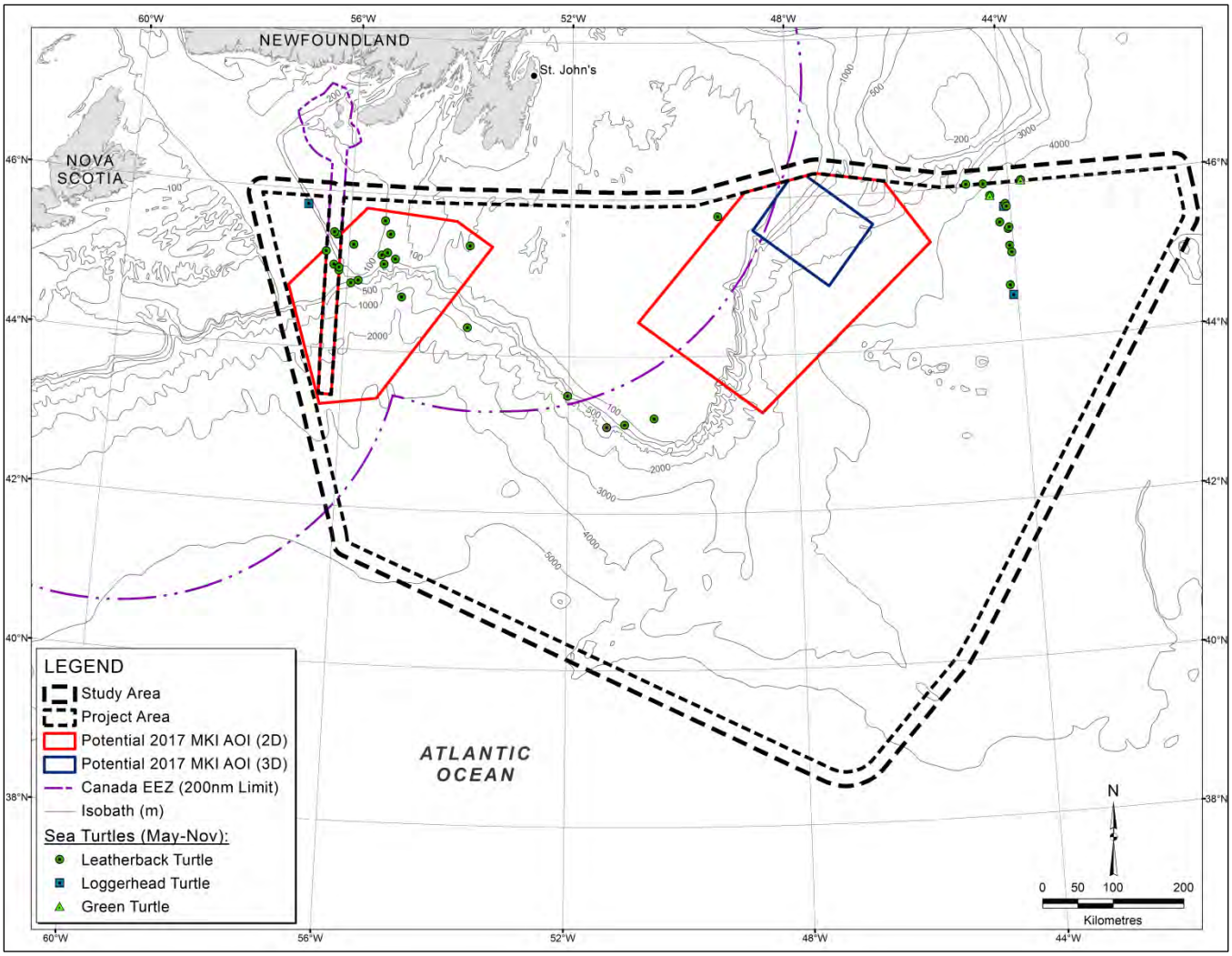

FIGURE 4.19. Sea turtle sightings in the Study Area during May–November (compiled from the DFO sightings database, 1947–2015).

4.5 Species at Risk

The new information presented in this subsection does not change the effects predictions made in the EA (LGL 2014a), Addendum (LGL 2014b), and its associated Amendments (LGL 2015a; PGS 2016).

Table 4.6 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 April 2017. Changes in species status since preparation of the 2016 EA Update (LGL 2016) are described below and noted in bold blue font in Table 4.6.

- Blue shark (Atlantic population; *Prionace glauca*) was removed as it is no longer considered at risk by COSEWIC and has no status under *SARA*;
- Northwest Atlantic lumpfish (*Cyclopterus lumpus*) was removed as it is no longer considered a candidate species by COSEWIC and has no status under *SARA*;

TABLE 4.6. *SARA*-listed and COSEWIC-assessed marine species that potentially occur in the Study Area.

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 (St. Lawrence Estuary population)	*Delphinapterus leucas*		Schedule 1		X			
Fin Whale (Atlantic population)	*Balaenoptera physalus*			Schedule 1			X	
Sowerby's Beaked Whale	*Mesoplodon bidens*			Schedule 1			X	
Harbour Porpoise (Northwest Atlantic population)	*Phocoena phocoena*		Schedule 2				X	
Humpback Whale (Western North Atlantic population)	*Megaptera novaeangliae*			Schedule 3				
Killer Whale (Northwest Atlantic/ Eastern Arctic population)	*Orcinus orca*						X	
Sei Whale (Atlantic population)	*Balaenoptera borealis*							High priority
Ringed Seal	*Phoca hispida*							High priority
Cuvier's Beaked Whale	*Ziphius cavirostris*							High priority
Hooded Seal	*Cystophora cristata*							Mid priority
Bearded Seal	*Erignathus barbatus*							Mid priority
Sperm Whale	*Physeter microcephalus*							Mid priority
Harp Seal	*Phoca groenlandica*							Low priority
Sea Turtles								
Leatherback Sea Turtle	*Dermochelys coriacea*	Schedule 1						
Leatherback Sea Turtle (Atlantic population)	*Dermochelys coriacea*				X			
Loggerhead Sea Turtle	*Caretta caretta*				X			
Kemp's Ridley Sea Turtle	*Lepidochelys kempii*							Low priority
Green Turtle	*Chelonia mydas*							Low priority
Fishes								
White Shark (Atlantic population)	*Carcharodon carcharias*	Schedule 1			X			
Northern Wolffish	*Anarhichas denticulatus*		Schedule 1			X		
Spotted Wolffish	*Anarhichas minor*		Schedule 1			X		
Atlantic Wolffish	*Anarhichas lupus*			Schedule 1			X	

SPECIES		*SARA*[a]			COSEWIC[b]			
Common Name	**Scientific Name**	**Endangered**	**Threatened**	**Special Concern**	**Endangered**	**Threatened**	**Special Concern**	***Candidate Species***
Atlantic Cod	*Gadus morhua*			Schedule 3				
Atlantic Cod (Newfoundland and Labrador population)	*Gadus morhua*				X			
Atlantic Bluefin tuna	*Thunnus thynnus*				X			
Porbeagle Shark	*Lamna nasus*				X			
Roundnose Grenadier	*Coryphaenoides rupestris*				X			
Cusk	*Brosme brosme*				X			
Winter Skate (Eastern Scotian Shelf – Newfoundland population)	*Leucoraja ocellata*				X			
Atlantic Salmon (various populations)	*Salmo salar*				X	X	X	
American Eel	*Anguilla rostrata*					X		
Shortfin Mako Shark (Atlantic population)	*Isurus oxyrinchus*					X		
American Plaice (Newfoundland and Labrador population)	*Hippoglossoides platessoides*					X		
Acadian Redfish (Atlantic population)	*Sebastes fasciatus*					X		
Deepwater Redfish (Northern population)	*Sebastes mentella*					X		
White Hake (Atlantic and Northern Gulf of St. Lawrence population)	*Urophycis tenuis*					X		
Smooth Skate (Laurentian-Scotian population)	*Malacoraja senta*						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
Alewife	*Alosa pseudoharengus*							Mid priority
Birds								
~~**King Eider**~~	~~***Somateria spectabilis***~~							~~**Low priority**~~

Sources: [a] *SARA* website (http://www.sararegistry.gc.ca/sar/index/default_e.cfm), accessed April 2017; [b] COSEWIC website (http://www.cosewic.gc.ca/default.asp?lang=En&n=A9DD45B7-1); accessed April 2017.

- Spinytail skate (*Bathyraja spinicauda*) was removed as it is no longer considered a candidate species by COSEWIC and has no status under *SARA*; and
- King Eider (*Somateria spectabilis*) was removed as it is no longer considered a candidate species by COSEWIC and has no status under *SARA*.

As of April 2017, no other species/populations that could potentially occur 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 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 2017b). A management plan was also proposed for Sowerby's beaked whales 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 2016f). 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 2016g; see also § 4.5 of the 2015 EA Update [LGL 2015b]). 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 2016h,i).

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.

4.6 Sensitive Areas

The new information presented in this subsection does not change the effects predictions made in the EA (LGL 2014a), Addendum (LGL 2014b), and its associated Amendments (LGL 2015a; PGS 2016).

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 2016j). 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 § 4.7.1 of the EA [LGL 2014a]), along with geospatially-referenced data layers of sub-components for both the PB-GB LOMA and NL Shelves EBSAs (DFO 2016j). 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 2016k). 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 2017c). 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 (DFO 2016l). 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).

No additional Ecologically and Biologically Significant Areas (EBSAs) have been designated or modified in either the Placentia Bay-Grand Banks Large Ocean Management Area (PG-GB LOMA) or the Scotian Shelf Bioregion since the 2015 or 2016 EA Updates were prepared (see § 4.6 of LGL 2015a, 2016). The six PB-GB LOMA EBSAs (Virgin Rocks, Lilly Canyon-Carson Canyon, Southeast Shoal and Tail of the Banks, Southwest Shelf Edge and Slope, St. Pierre Bank, and Laurentian Channel and Slope) and five Scotian Shelf Bioregion EBSAs (Eastern Shoal, Stone Fence and Laurentian Environs, Laurentian Channel Slope, Laurentian Channel Cold Seep, and Scotian Slope) that overlap the Study Area are shown in Figure 4.20. The key attributes of these EBSAs are presented in Tables 4.14 and 4.15 of the EA (LGL 2014a). One EBSA, Lilly Canyon-Carson Canyon, is partially within the western portion of the 2017 3D AOI; the Laurentian Channel Cold Seep, Laurentian Channel Slope, Scotian Slope, Laurentian Channel and Slope, and Southwest Shelf Edge and Slope EBSAs overlap the western 2D AOI; and the Lilly Canyon-Carson Canyon and Southeast Shoal and Tail of the Banks EBSAs overlap the eastern 2D AOI (Figure 4.20).

No NAFO Conservation and Enforcement Areas, including Seamount Closure Areas, have been newly designated or modified since the 2016 EA Update (NAFO 2017b). Three NAFO seamount closure areas occur in the Study Area: Fogo Seamounts 1 and 2, and Newfoundland Seamounts (Figure 4.20). These closure areas are beyond the 2017 3D and 2D AOIs, and are briefly described in § 4.6 of LGL (2015a). These areas are closed to all bottom fishing activities until at least 31 December 2020 (NAFO 2017b).

One new Coral/Sponge Closure Area was designated by the NAFO Scientific Council since the 2016 EA Update (see § 4.6 of LGL 2016; NAFO 2017b). Four of the 14 Coral/Sponge Closure Areas overlap with the Study Area, with one partially within the 2017 3D AOI and three partially or entirely within the eastern 2D AOI; there are no Coral/Sponge Closure Areas within the western 2D AOI. These Coral/Sponge Closure Areas are closed to all bottom fishing activities until at least 31 December 2020 (NAFO 2017b).

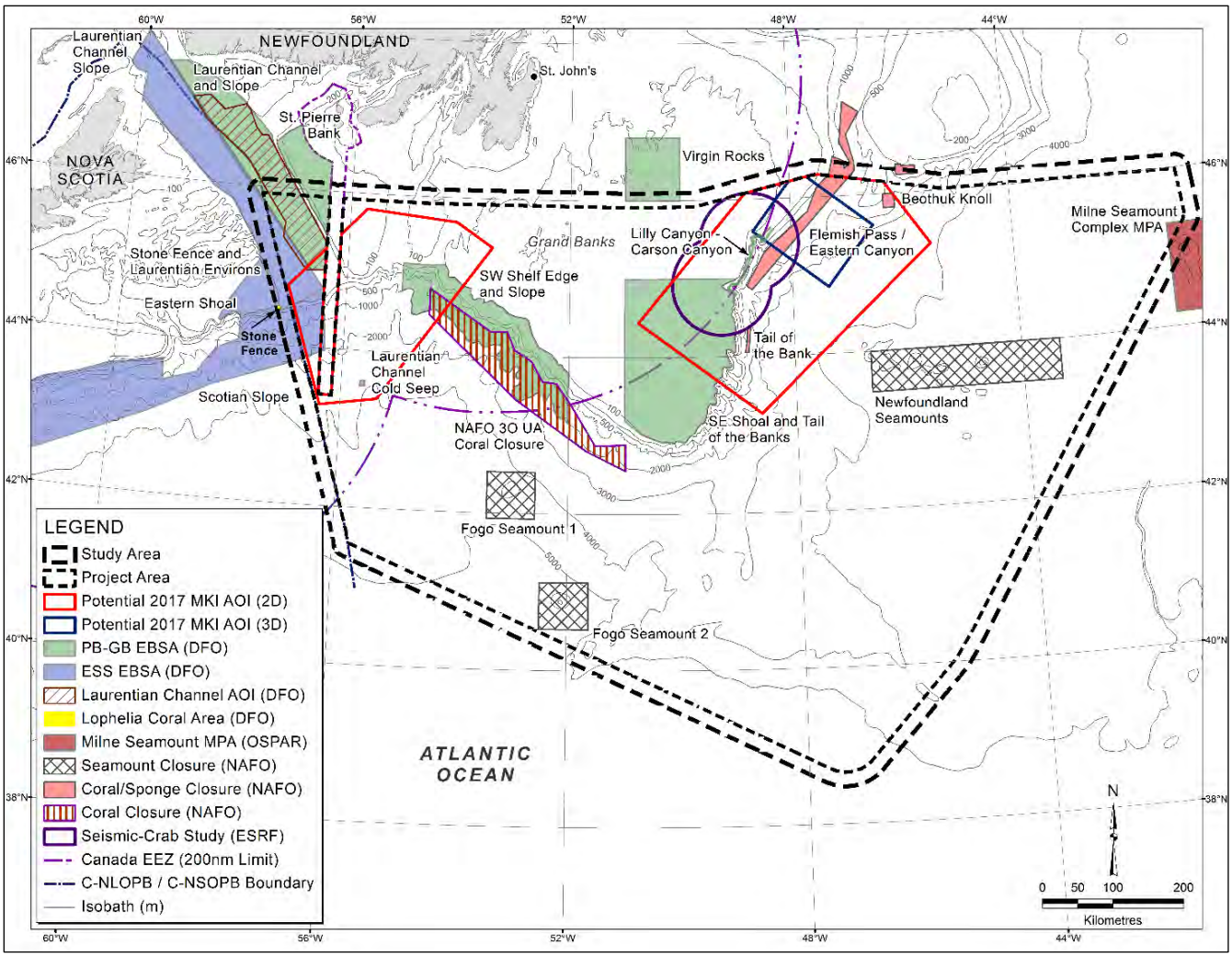

FIGURE 4.20. Sensitive areas that occur in and near the Study Area relative to the Potential 2017 AOIs.

The NAFO 3O UA Coral Closure Area described in § 4.6.3 of LGL (2015a) has mandatory closure to all bottom fishing activities on the slope of the Grand Bank in NAFO Div. 3O at depths ranging from 800–2,000 m (see Figure 4.20). A small portion of this Closure Area is located within the eastern portion of the western 2D AOI. The purpose of the closure is to protect corals found in the area and 'freeze the footprint' of fishing activities in deeper waters. This area is closed to all bottom fishing activities until at least 31 December 2020 (NAFO 2017b).

The Milne Seamount Complex MPA (Milne), a small portion of which is located in the northeastern portion of the Study and Project Areas (see Figure 4.20), encompasses an area of 20,914 km^2 and is a component of the Oil Spill Prevention, Administration and Response (OSPAR) Network of MPAs (MPAtlas n.d.; OSPAR 2015). This MPA was designated in 2010 with the goal to "protect and conserve the biodiversity and ecosystems of the seabed and superjacent waters of the site," and consists of near-pristine oceanic seamount ecosystems (MPAtlas n.d.; OSPAR 2010), including coral gardens, deep-sea sponge aggregations, *Lophelia pertusa* reefs and seamounts (OSPAR 2016). It serves as

habitat for a variety of marine fishes, mammals, sea turtles and seabirds, including orange roughy (*Hoplostethus atlanticus*), gulper shark (*Centrophorus granulosus*), leafscale gulper shark (*Centrophorus squamosus*), Portuguese dogfish (*Centroscymnus coelolepis*), sperm whale, leatherback sea turtle, and Cory's Shearwater (*Calonectris diomedea*) (OSPAR 2016). No area within Milne has been closed to bottom fisheries or exploratory/extraction activities of non-living resources (OSPAR 2015, 2016).

A study area associated with an ongoing seismic-snow crab ESRF study in the Carson Canyon area will have a 70-km radius 'no-go' zone around its control and treatment stations during August–October 2017 (C. Morris, DFO, pers. comm., February 2017). This zone is located in the central northern portion of the Study Area, and overlaps the western portions of the 2017 3D and eastern 2D AOIs (see Figure 4.20).

5.0 Consultations

Newsletters describing the seismic activities proposed for 2017 were distributed during the week of April 17, 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 January 25, 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 2017 season.

6.0 Environmental Assessment

6.1 Mitigation Measures

The mitigation measures described in the EA (LGL 2014a) and associated documents (LGL 2014b, 2015a,b; PGS 2016) remain applicable to MKI's seismic survey activities planned for 2017.

6.2 Validity of Significance Determinations

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), Addendum (LGL 2014b), and its Amendments (LGL 2015a; PGS 2016) remain valid for the seismic survey activities planned by MKI in 2017. This includes consideration of cumulative effects—see below.

6.2.1 Cumulative Effects

Section 5.9 of the original Southern Grand Banks EA (LGL 2014a) provides an assessment of cumulative effects from other activities in the Regional Area including fishing, vessel traffic, and other oil and gas exploration and development activities. There are no indications that the levels of fishing and vessel traffic offshore Newfoundland and Labrador 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 to conduct two concurrent seismic surveys (2D and 3D) in the Southern Grand Banks Project Area. As noted in §2.4, during the 3D seismic survey in the 3D AOI, 2D seismic surveys would only occur in the western 2D AOI; these areas are separated by >350 km. Of the potential seismic proponents with Project Areas in the southern Grand Banks, there have been no EA Updates submitted to the C-NLOPB to indicate they plan to conduct surveys there this year. In 2017, MKI is also proposing to conduct seismic surveying offshore northeastern Newfoundland and Labrador (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 in the Regional Area. 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 Labrador Sea 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 proposed by MKI for 2017 have been reviewed and determined to be within the scope of the EA (LGL 2014a), its Addendum (LGL 2014b), and its Amendments (LGL 2015a; PGS 2016). The environmental effects predicted in the EA and its associated Addendum and Amendments 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.

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Personal Communication

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

C. Morris. Research Biologist, DFO. February 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

Southern Grand Banks Seismic Program 2017

Resumption of the Program in 2017

This news update is to inform stakeholders and other interested parties of the continuation of MKI's 2D seismic program, started in 2014 and continued through 2016, in the offshore waters of the Southern Grand Banks. 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 again be acquiring the survey data between June and October 2017.

In addition the Ramform Titan will be conducting a 3D survey in the area indicated in Figure 1.

Figure 1: Atlantic Explorer

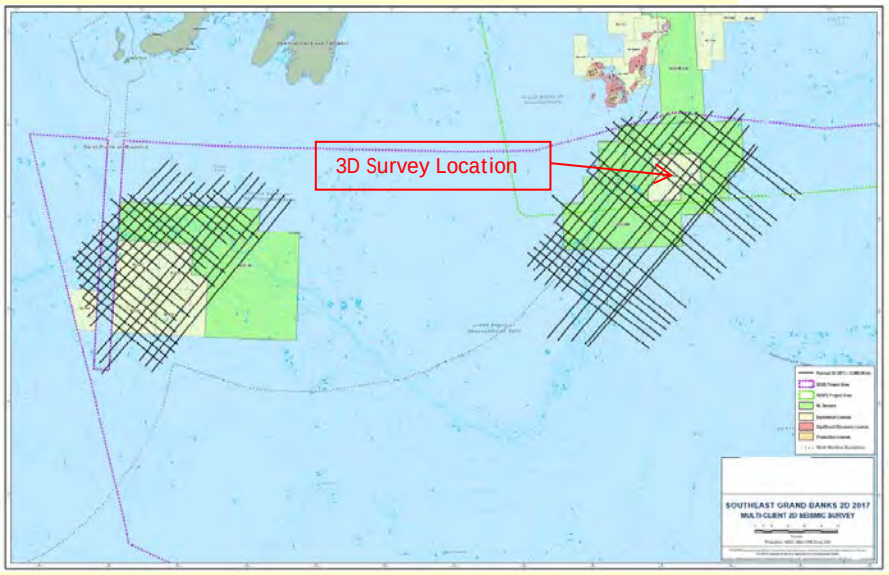

Figure 2: Provisionally planned 2017 2D survey lines and 3D project location

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 Southern Grand Banks 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 "*MKI Southern Grand Banks Seismic 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 Southern Grand Banks 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
Aquaforte			
Aquaforte Town Council	rhondaokeefe@aim.com	Rhonda O'Keefe	
Argentia			
Argentia Management Authority Inc.	w.brenton@argentia.ca	Harvey Brenton	
Arnold's Cove			
Town of Arnold's Cove	acadmin@bellaliant.com	Angie Gale	
Avalon Ocean Products Inc.	Avalon.ocean@nf.aibn.com	Aloysius Wadman	
Hopkins & Quinton Fisheries Ltd.			
Icewater Seafoods Inc.	awareham@icewaterseafoods.com	Alberto Wareham	
Bay Bulls			
Town of Bay Bulls	townofbaybulls@nf.aibn.com	Sandra	
Burin			
Town of Burin	lhartson@townofburin.com	Leo Hartson, Town Manager	
Department of Fisheries and Oceans- Coast Guard			
Burin Harbour Authority	morrisfudge@yahoo.ca	Morris Fudge	
Burin Peninsula Environmental Reform Committee	info@greenburin.ca		
Goff Fisheries Limited			
College of North Atlantic			
Wave Energy Research Centre	mike.graham@cna.nl.ca	Michael Graham, Administrator	
Come by Chance			
Town of Come by Chance	townofcbc@eastlink.ca	Stephanie Eddy, Clerk	
Conne River			
Miaqpukek First Nation	thowse@mfngov.ca	Tracey Howse, Director, Training and Economic Development	
Corner Brook			
Qalipu Mi'kmaq First Nation Band	reldridge@qalipu.ca	Ralph Eldridge, Manager of Community Economic Development	
Ferryland			
Town of Ferryland	Town.ferryland@nf.aibn.com		
M. & A. Fisheries Limited	Ma.fisheries@nf.aibn.com	Angus O'Connell	
Ferryland Fisheries Limited			
Ferryland Fisheries Committee Limited->Now Ferryland Harbour Authority			
Fortune			
Town of Fortune	norma@townoffortune.ca	Norma Stacey, Clerk	
Fortune Harbour Authority	fortuneharbour@hotmail.com		
Ocean Choice International (fish plant)			
Atlantic Ocean Farms Limited	walsheslogybay@nl.rogers.com	David Walsh, President	

Organization or Group Name	Email Address	Contact Name	Engagement Type
Grand Bank			
Town of Grand Bank	Sdurnford@townofgrandbank.net	Sheila Durnford Office Administrator	
Clearwater Fisheries Limited			
Grand Bank Harbour Authority	hagb@bellaliant.com	Arch Evans	
Newfoundland and Labrador Department of Fisheries and Aquaculture			
Marystown			
Town of Marystown	info@townofmarystown.ca	Dennis Kelly, Clerk	
Burin Peninsula Community Business Development Corporation	Audrey.hennebury@cbdc.ca	Audrey Hennebury, Admin Assistant	
Burin Peninsula Chamber of Commerce	administration@bpchamber.ca		
Burin Peninsula Environmental Reform Committee			
Marystown Shipyard and Offshore Facilities	butlerwa@hotmail.com	Wayne Butler, President	
Department of Fisheries and Oceans			
Placentia			
Town of Placentia	dgear@placentia.ca	Debbie Gear, Executive Assistant	
Department of Fisheries and Oceans			
Newfoundland and Labrador Department of Industry, Trade and Rural Development			
Placentia Area Chamber of Commerce	Eugene.collins@placentiachamber.ca	Eugene Collins, Executive Director	
Harbour Authority of Placentia Area	cnrpomeroy@bellaliant.com	Carter Pomeroy	
Avalon Gateway Regional Economic Development Inc.	contact@avalongateway.ca	Michael Mooney, Executive Director	
Avalon West Community Business Development Corporation	Tanya.white@cbdc.ca	Tanya White, Administrative Assistant	
Placentia Area Development Association	Pada44@hotmail.com	Tiffany Seay-Hepditch, Executive Director	
Southern Harbour			
Town of Southern Harbour	twnsouthernhr@nf.aibn.com	Renee Hickey	
St. Brides			
Town of St. Brides	Joanmorrissey01@yahoo.ca	Joan Morrissey, Clerk	
Ocean Choice International-Fish Plant			

Organization or Group Name	Email Address	Contact Name	Engagement Type
St. Bride's Harbour Authoirty	Lorettaconway59@gmail.com	Loretta Conway	
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 Environment and Conservation			
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, Petroleum Industry Liaison	
One Ocean	Maureen.murphy@mi.mun.ca	Director	
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Association of Seafood Producers	dbutler@seafoodproducers.org	Derek Butler, Executive Director	
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Beothic Fish Processors Ltd.	pgrant@beothic.com	Paul Grant, Executive Vice President	
Breakwater Fisheries Limited	rrbarnes@nf.sympatico.ca	Randy Barnes	
Canada Bay Seafoods Limited – Quinlin Brothers Subsidiary			
Conche Seafoods Inc.- Quinlin Brothers Subsidiary	dphilpott@quinsea.com	Derrick Philpott, Director	
Deep Atlantic International Inc.	Martha@deepatlanticsea.com	Martha Mullowney, Director	

Dorset Fisheries Limited – Quinlin Brothers Subsidiary			
GC Rieber Carino Ltd.	John.c.kearley@carino.ca	John Kearley, CEO	
Gulf Shrimp Limited – Quinlin Brothers Subsidiary			
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	
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Ocean Choice International-Fish Plant			
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Csi Sea Products			
Deep Atlantic Sea Products (plant manager in St. Johns)	Martha@deepatlanticsea.com	Martha Mullowney, Plan Manager	
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Trepassey			
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Southern Avalon Development Association	southernavalondev@nf.aibn.com	Anita Molloy, VP and Board Member	
Department of Fisheries and Oceans			
Witless Bay			
Town of Witless Bay	townofwitlessbay@nl.rogers.com	Geraldine Caul, Clerk	
Shawmut Fisheries Ltd.			