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Environmental Assessment Update (2020) of Multiklient Invest Labrador Offshore Seismic Program, 2018–2023

Prepared by:

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Prepared for:

Multiklient Invest AS

June 2020
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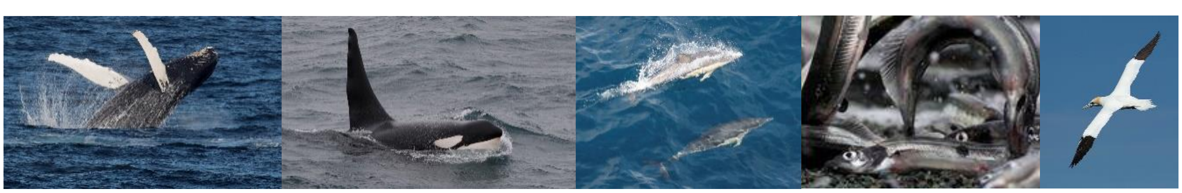

Environmental Assessment Update (2020) of Multiklient Invest Labrador Offshore Seismic Program, 2018–2023

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1.0 Introduction

This document is an Update of the Environmental Assessment (EA) of the Multiklient Invest AS (MKI) Labrador Offshore Seismic Program, 2018–2023 (LGL 2018), the associated Addendum (LGL 2019a), and 2019 EA Update (LGL 2019b). In 2020, MKI is proposing to conduct 3D seismic surveying in the Labrador Offshore Project Area (Figure 1.1). The EA Update document addresses the validity of the EA (Table 1.1) as it pertains to MKI's proposed seismic survey activities in 2020. 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 remain technically valid for proposed seismic survey operations in 2020.

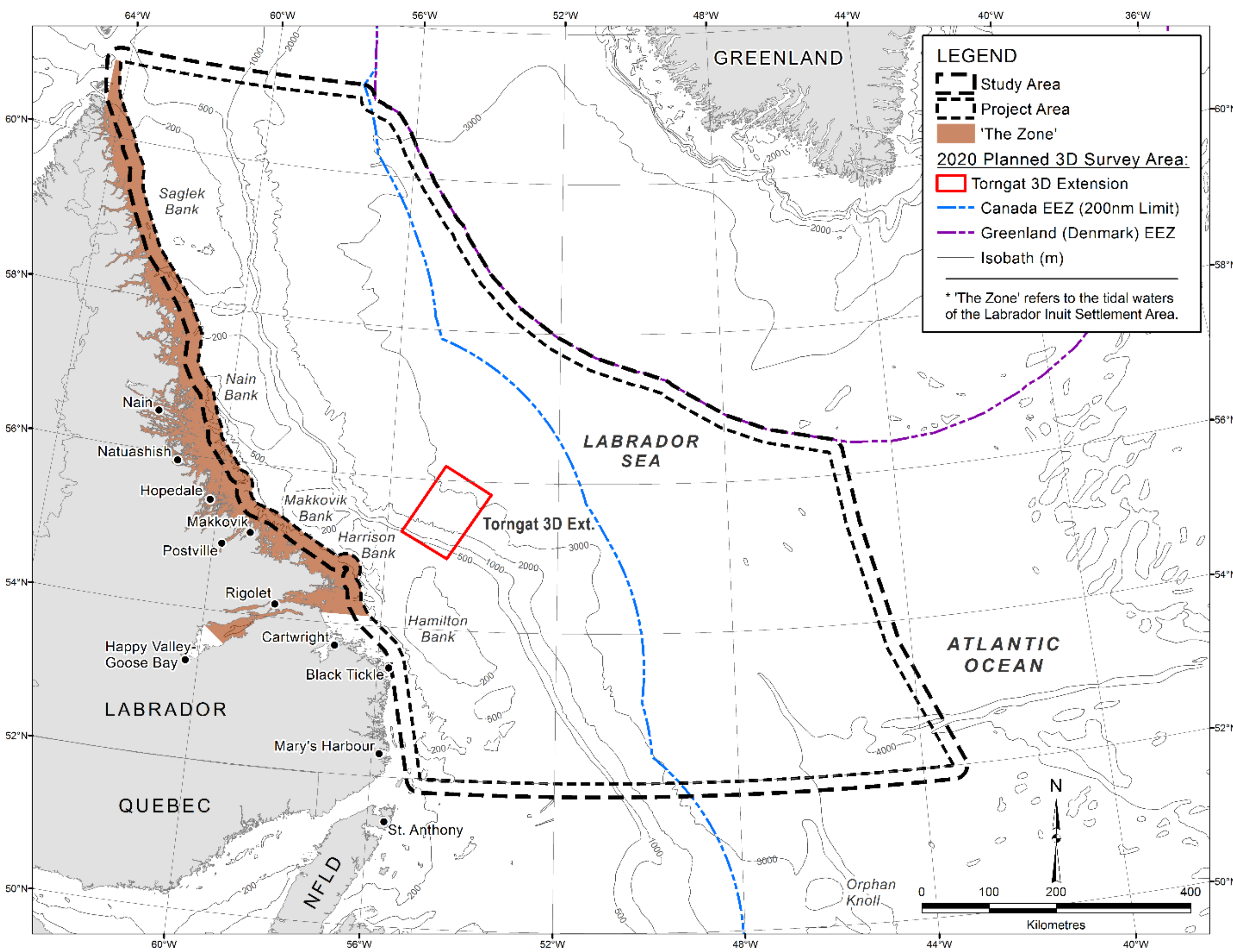


Figure 1.1. Locations of the Project Area, Study Area and 2020 Planned 3D Survey Area for MKI's Labrador Offshore Seismic Program.

Table 1.1. Environmental Assessment documents for the MKI Labrador Offshore Seismic Program, 2018–2023. Screening determination reference number C-NLOPB File No. 45006-020-006.

Temporal Scope	EA Document
May 1 to November 30, 2018–2023	Environmental Assessment Update (2019) of Multiklient Invest Labrador Offshore Seismic Program, 2018−2023 (LGL 2019b)
May 1 to November 30, 2018–2023	Environmental Assessment of Multiklient Invest Labrador Offshore Seismic Program, 2018–2023 (LGL 2018) and EA Addendum (LGL 2019a)[a]

Note:
[a] On 22 May 2019, the C-NLOPB made a positive determination on this EA and EA Addendum.

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 3D seismic survey activities within the defined Project Area (see Figure 1.1) on the following Valued Environmental Components (VECs): Fish and Fish Habitat; Fisheries; Marine-Associated Birds; Marine Mammals and Sea Turtles; Species at Risk; and Sensitive Areas. This Update includes new and relevant information not included in the EA, its Addendum, and the 2019 EA Update.

2.0 Project Description

2.1 Vessels and Equipment

The EA assessed a project that included a maximum of four simultaneous seismic surveys within a given year: three 3D surveys and one 2D survey. For 2020, MKI will conduct one survey in the Project Area; a 3D survey with the MV *Ramform Atlas*. All project description parameters described in the EA are applicable to MKI's 2020 activities. Specific details for 2020 are provided in Section 2.4.

2.2 Spatial Scope

The Project and Study areas defined in the EA (LGL 2018) remain unchanged (see Figure 1.1).

2.3 Temporal Scope

The temporal scope defined in the EA (LGL 2018) as 1 May to 30 November during each year of the 2018–2023 period remains unchanged.

2.4 Seismic Survey Activities Planned for 2020

In 2020, MKI plans to conduct 3D seismic surveying in the Project Area. A maximum of one seismic survey vessel will be used in 2020. MKI is proposing to conduct approximately 3,000 km^2

of 3D seismic surveying in the Project Area in 2020 (see Figure 1.1). There is one 3D survey area identified in the Project Area for 2020 (see Figure 1.1).

In 2020, MKI will use the MV *Ramform Atlas* for the 3D seismic surveying (Figure 2.1). The *Atlas* was built in 2013 and is flagged in the Bahamas. It is 104.2 m long, has a beam of 70 m, and a draft of 6.4 m. The vessel will travel at a speed of ~9 km/h (4.9 knots) while conducting the 3D seismic surveying.

FIGURE 2.1. MV *Ramform Atlas.*

All other project details presented in Section 2.0 of the EA remain applicable to MKI's seismic survey activities in 2020.

2.4.1 Seismic Energy Source Parameters

For 3D seismic surveying MKI will use a 4,130 in^3 array, operated at a pressure of 2,000 psi, towed at either 7 m or 9 m depth. The shotpoint interval will be one array pulse every 25 m.

2.4.2 Seismic Streamers

The *Atlas* will tow 14 streamers each 9.0 km in length. The streamers will be spaced 75 m apart for a total maximum spread of ~8.8 km^2. Streamers will be towed at depths ranging from 9–25 m.

2.4.3 Support Vessels

The MV *Thor Magni* will be used as a support vessel. The MV *Norcon Triton* or *Strait Hunter* will perform escort vessel duties. The operational objective is to have one of these vessels available with the seismic vessel and the support vessel will be used to fill in for escort duties as required.

2.4.4 Survey Locations and Timing

The planned timing of MKI's 3D survey in the Project Area is during mid-July to late-August. The maximum number of MKI seismic vessels acquiring data within the Project Area as part of the Project at any given time during 2020 would be one.

2.5 Mitigation Measures

Mitigation measures to be implemented during seismic surveys carried out for this Project will follow those described in the EA (LGL 2018) and its Addendum (LGL 2019a). Further details are provided in Table 6.1.

3.0 Physical Environment

A summary of the physical environment was provided in Section 3.0 of the EA (LGL 2018). There is no new relevant information available on the physical environment in the Study Area.

4.0 Biological Environment and Fisheries

The EA and associated Addendum (LGL 2018, 2019a) were submitted in July 2018 and April 2019, respectively. The Addendum addressed comments and data gaps identified by reviewers of the EA. The 2019 EA Update (LGL 2019b) was submitted in July 2019 and provided updated information since the EA and Addendum were accepted. The following subsections present new information since the 2019 EA Update on each of the VECs: Fish and Fish Habitat, Fisheries, Sea-Associated Birds, Marine Mammals and Sea Turtles, Species at Risk, and Sensitive Areas.

4.1 Fish and Fish Habitat

New information regarding invertebrate and fish species that occur within the Study Area is presented in this section. The new information does not change the effects predictions made in the EA (LGL 2018).

4.1.1 Fish

As in the EA, 'fish' includes macro-invertebrates that are targeted in the commercial fisheries and all fishes, either targeted in the commercial fisheries or otherwise. The focus in the EA is on key commercially- and ecologically-important fishes.

4.1.1.1 Principal Macro-invertebrates and Fishes Commercially Harvested

Macroinvertebrates

Snow Crab (Chionoecetes opilio)

Snow crab landings in Northwest Atlantic Fisheries Organization (NAFO) Divisions (Div.) 2HJ have remained at 1,700 t for the past four years and effort has remained consistent. The total mortality (i.e., fishery and natural mortality combined) was at its highest recorded levels in recent years; however, a slight decrease was observed in 2018 (DFO 2019a). The Total Allowable Catch (TAC) for NAFO Div. 2GHJ in 2019 was 1,865 t (DFO 2020a).

Northern Shrimp (Pandalus borealis)

In Shrimp Fishing Area (SFA) 4 (NAFO Div. 2HG), the northern shrimp TAC increased by 5% from 2016-2017 to 2017-2018 and remained the same in 2018-2019. The northern shrimp fishable biomass index was 42,100 t during 2018, a 46% decrease from 2017 and the lowest level recorded during the 1996−2018 time series (DFO 2019b). The TAC for northern shrimp in SFA 5 (NAFO Div. 2HJ) was 22,000 t for 2017-2018, a 14% reduction from 2016-2017, but was increased to 23,630 t (+17%) for 2018-2019. The northern shrimp fishable biomass index in SFA 5 was 80,100 t in 2018, a 43% decrease from 2017 and the second lowest level in the time series (DFO 2019b). In SFA 6 (NAFO Div. 2J), the TAC for northern shrimp was reduced by 63% and 16% from 2016-2017 to 2017-2018 and 2017-2018 to 2018-2019, respectively, and was set at 8,370 t for 2019. The northern shrimp fishable biomass index in SFA 6 was 89,600 t in 2018, an increase of 3% from the previous year (DFO 2019b).

Fishes

Greenland Halibut (Turbot) (Reinhardtius hippoglossoides)

There have been no further relevant updates on Greenland halibut since the information presented in subsection 4.1.1.1 of LGL (2019b).

Atlantic Halibut (Hippoglossus hippoglossus)

There have been no further relevant updates on Atlantic halibut since the information presented in subsection 4.1.1.1 of LGL (2019b).

Atlantic Cod (Gadus morhua)

The Atlantic cod stock in NAFO Div. 2J3KL is assessed using an integrated model (NCAM) which allows for the quantification of uncertainty in both estimated and projected stock status. In 2019, spawning stock biomass remained in the critical zone, at 48% (398,000 t) of the limit reference point (DFO 2019c).

American Plaice (Hippoglossoides platessoides)

There have been no further relevant updates on American plaice since the information presented in subsection 4.1.1.1 of LGL (2019b).

Yellowtail Flounder (Pleuronectes ferruginea)

There have been no further relevant updates on yellowtail flounder since the information presented in subsection 4.1.1.1 of LGL (2019b).

White Hake (Pleuronectes ferruginea)

The TAC for white hake in NAFO Div. 3NO was reduced to 1,000 t for 2013−2019, down from 6,000 and 5,000 t in 2011 and 2012, respectively. Reported landings in NAFO Div. 3NO decreased from 497 to 383 t from 2017 to 2018 (Simpson et al. 2019).

Redfishes (Sebastes sp.)

There have been no further relevant updates on redfishes since the information presented in subsection 4.1.1.1 of LGL (2019b).

4.1.1.2 Other Fishes of Note

Capelin (Mallotus villosus)

The TAC for capelin in NAFO Div. 2J3KL in 2018 was 19,823 t. Acoustic forecast modelling predicted that the amount of capelin available to the fishery in 2019 would be similar to that available in 2018 (DFO 2019d). In 2019, the TAC for capelin for 2J3KL was set at 22,796 t, which was divided into 90 t for Div. 2J, 8,013 t for Div. 3K, and 13,174 t for Div. 3L (DFO 2020b).

Wolffishes (Anarhichas sp.)

A Recovery Strategy for the northern (A. denticulatus) and spotted (A. minor) wolffishes and a Management Plan for Atlantic wolfish (A. lupus) were finalized by COSEWIC during 2020 (DFO 2020c). Additionally, an Action Plan was finalized for northern and spotted wolffishes (DFO 2020d). There were no changes between the final and proposed critical habitats for northern and spotted wolffishes as described in subsection 4.1.1.1 of LGL (2019b).

4.2 Fisheries

The new information presented in this subsection does not change the effects predictions made in the EA (LGL 2018) or its associated Addendum (LGL 2019a).

4.2.1 Commercial Fisheries

The most recent available commercial fisheries data are from the 2017 dataset [1], which were presented in the 2019 EA Update (see Section 4.2.1 *in* LGL 2019b). The 2017 commercial fisheries data for the Study and Project areas are not repeated here. The recent commercial fisheries within the planned Torngat 3D Extension (Torngat) survey area for 2020 are summarized below.

The distribution of May−November 2016 and 2017 harvest locations for all species in the Study Area and commercial species harvested in the Torngat survey area (i.e., northern shrimp, Greenland halibut, and striped shrimp) are shown in Figures 4.1−4.10). Harvesting was only conducted in the southern portion of the Torngat survey area, mainly in water depths ≤1,000 m. Catch weight and value quartile counts by vessel length classes and species harvested in the Torngat survey area are presented in Table 4.1. All commercial harvests within the Torngat survey area were caught by fishers from NL.

During May−November 2016, Northern shrimp were the main species caught (~58% of total catch in the Torngat survey area in terms of total catch weight quartile codes), followed by Greenland halibut (~33%) and striped (pink) shrimp (~8%). During May−November 2017, only Greenland halibut were harvested in the Torngat survey area. Northern and striped shrimp were harvested by vessels of the length class ≥125′, and Greenland halibut by vessels 45−64.9′ and 34−44.9′.

[1] Fisheries and Oceans Canada (DFO) is currently updating their digital infrastructure, which, in combination with the necessity for alternative work arrangements in response to the COVID-19 situation, has delayed their ability to release commercial fisheries data from the 2018 dataset and limited their capacity to respond to geo-spatial data requests (J. Hosein, Chief, Statistical Services, DFO, pers. comm., 16 March 2020).

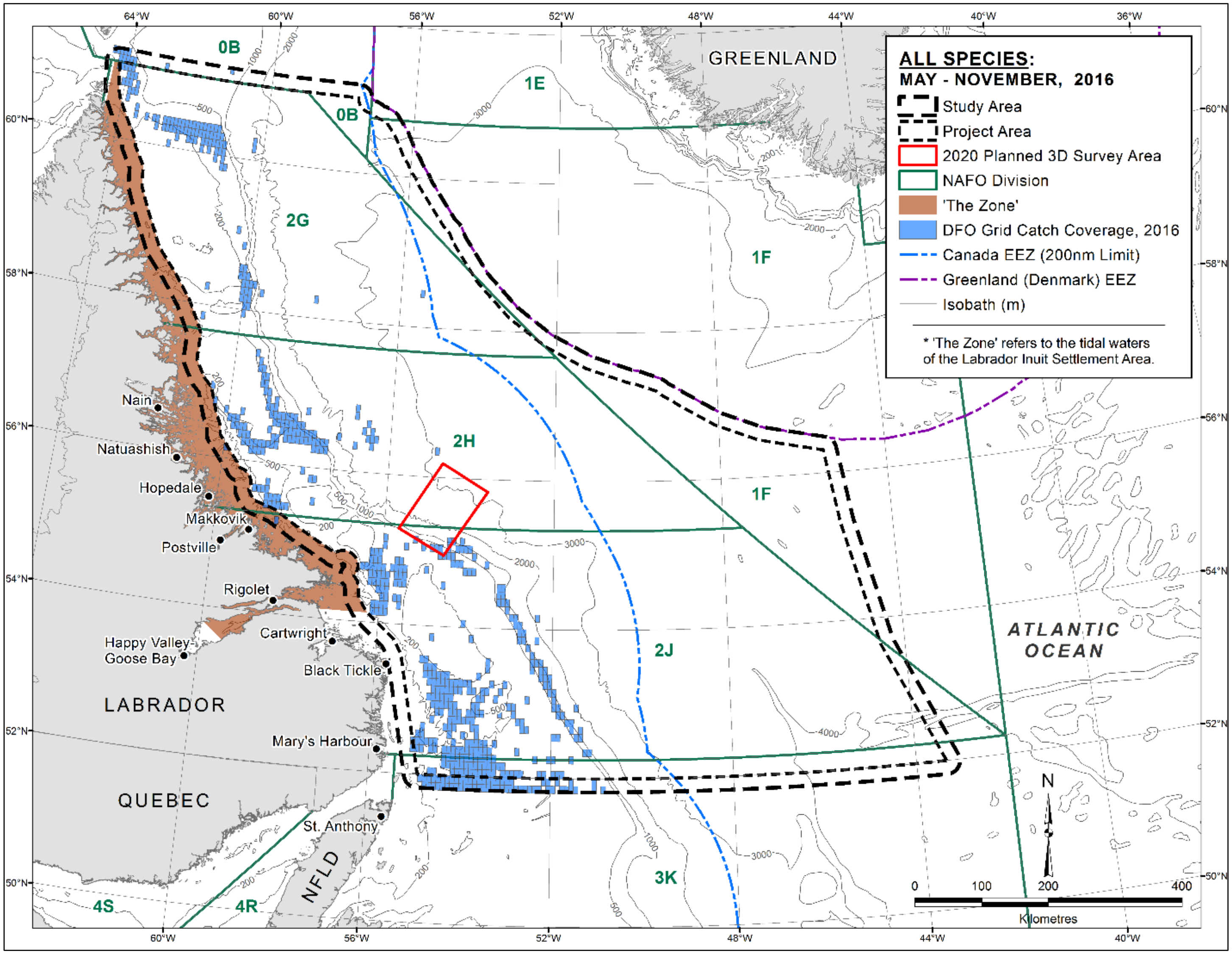


Figure 4.1. Distribution of commercial fishery harvest locations, all species, May–November 2016 (derived from DFO commercial landings database, 2016).

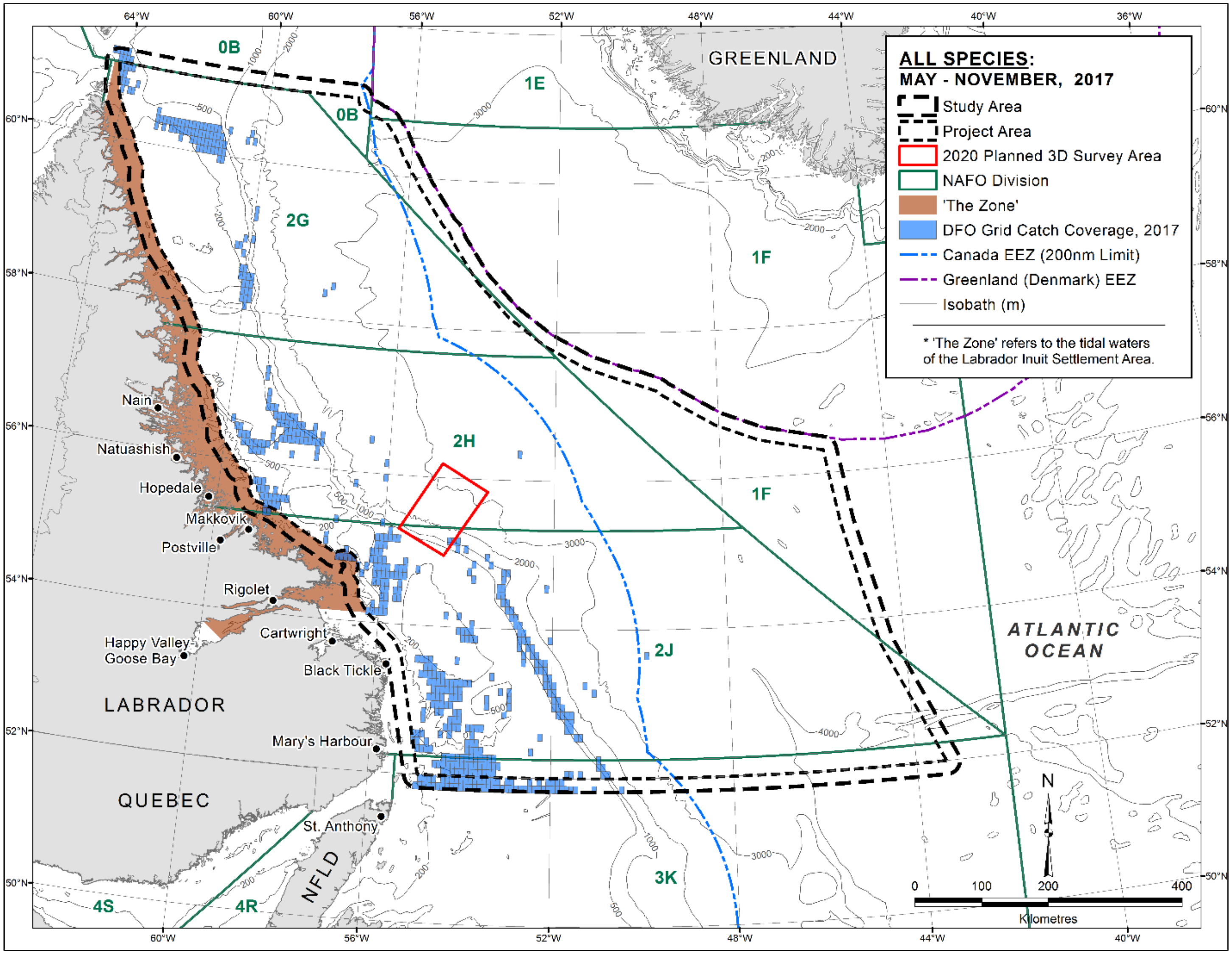


Figure 4.2. Distribution of commercial fishery harvest locations, all species, May–November 2017 (derived from DFO commercial landings database, 2017).

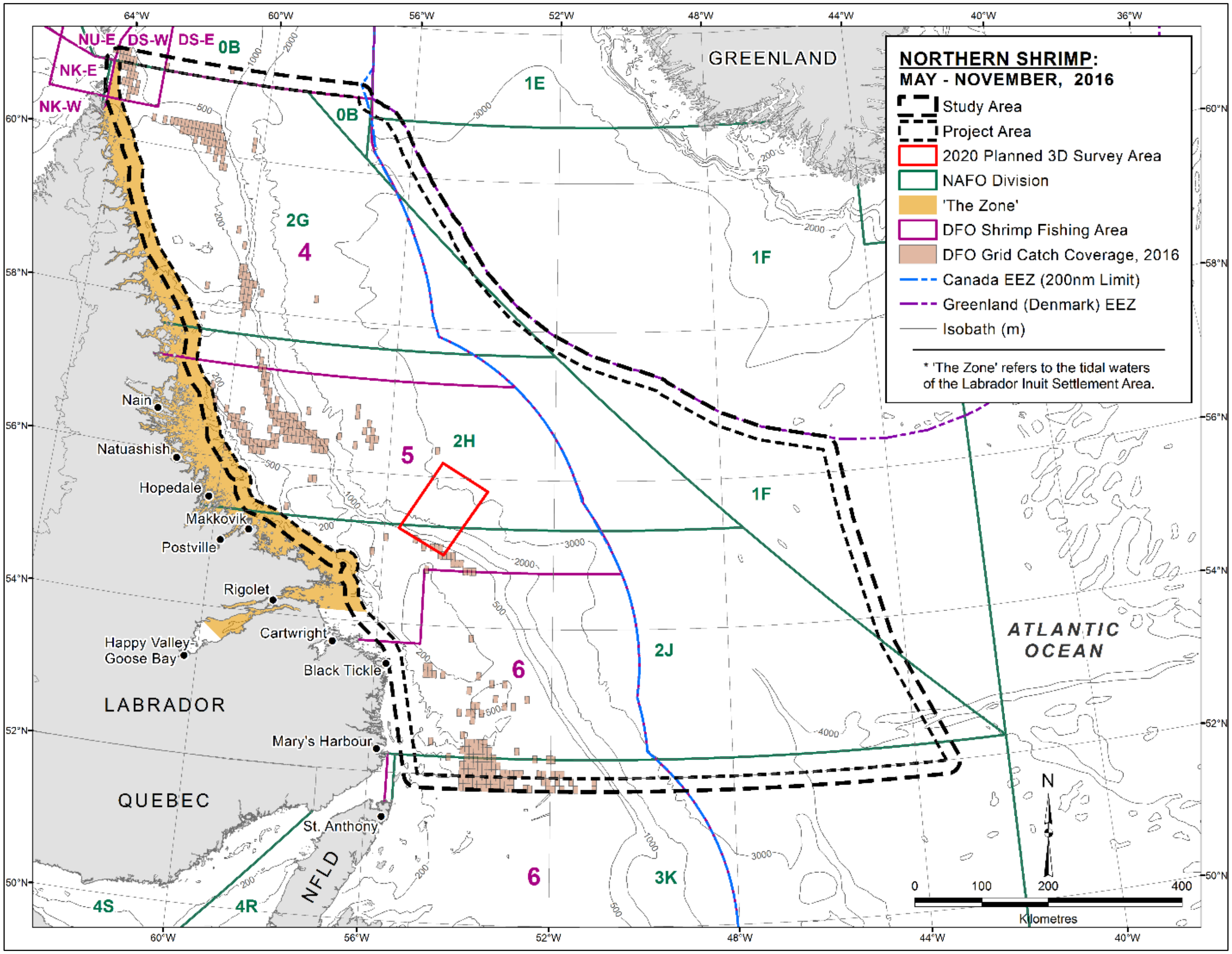


Figure 4.3. Distribution of commercial fishery harvest locations, northern shrimp, May–November 2016 (derived from DFO commercial landings database, 2016).

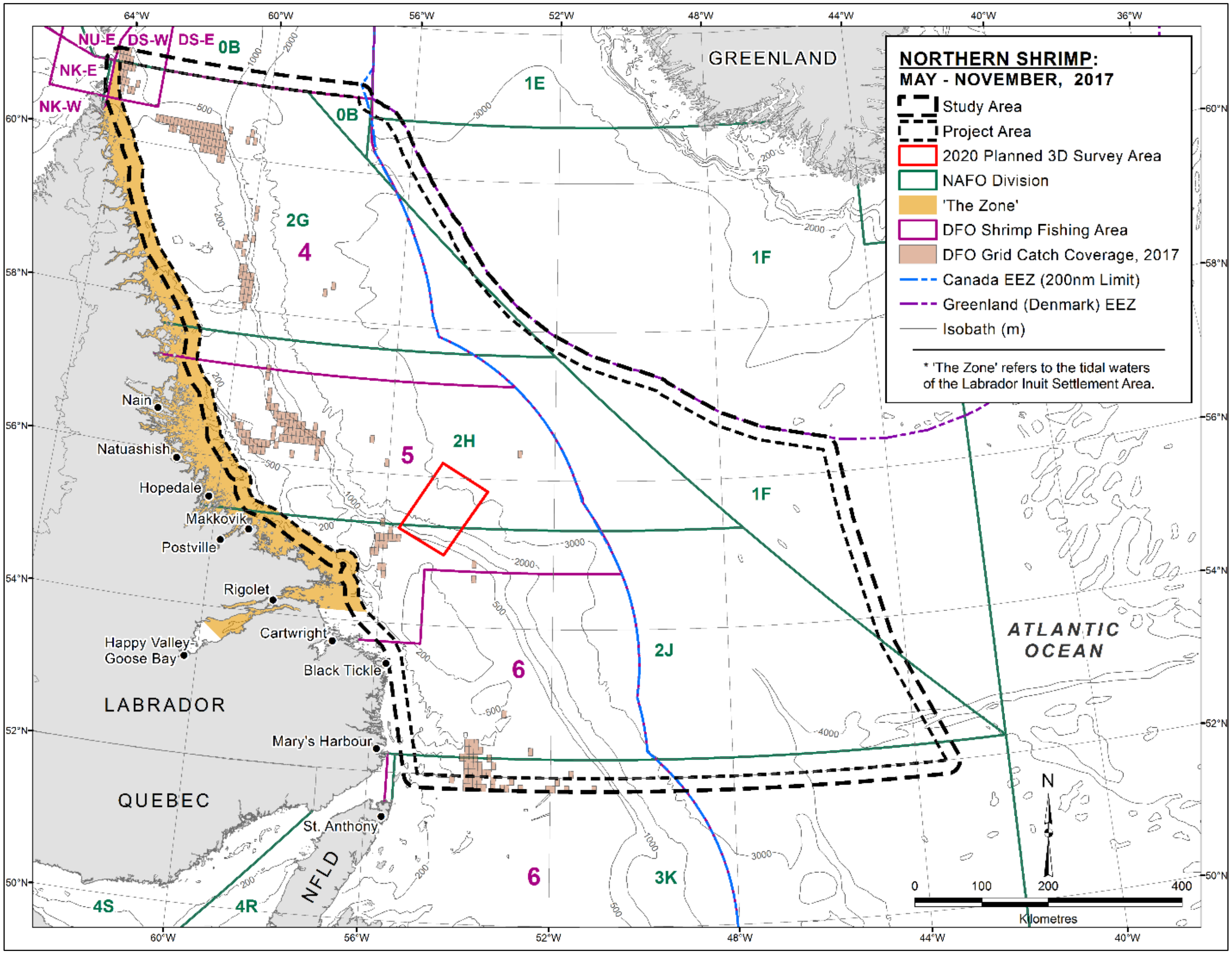


Figure 4.4. Distribution of commercial fishery harvest locations, northern shrimp, May–November 2017 (derived from DFO commercial landings database, 2017).

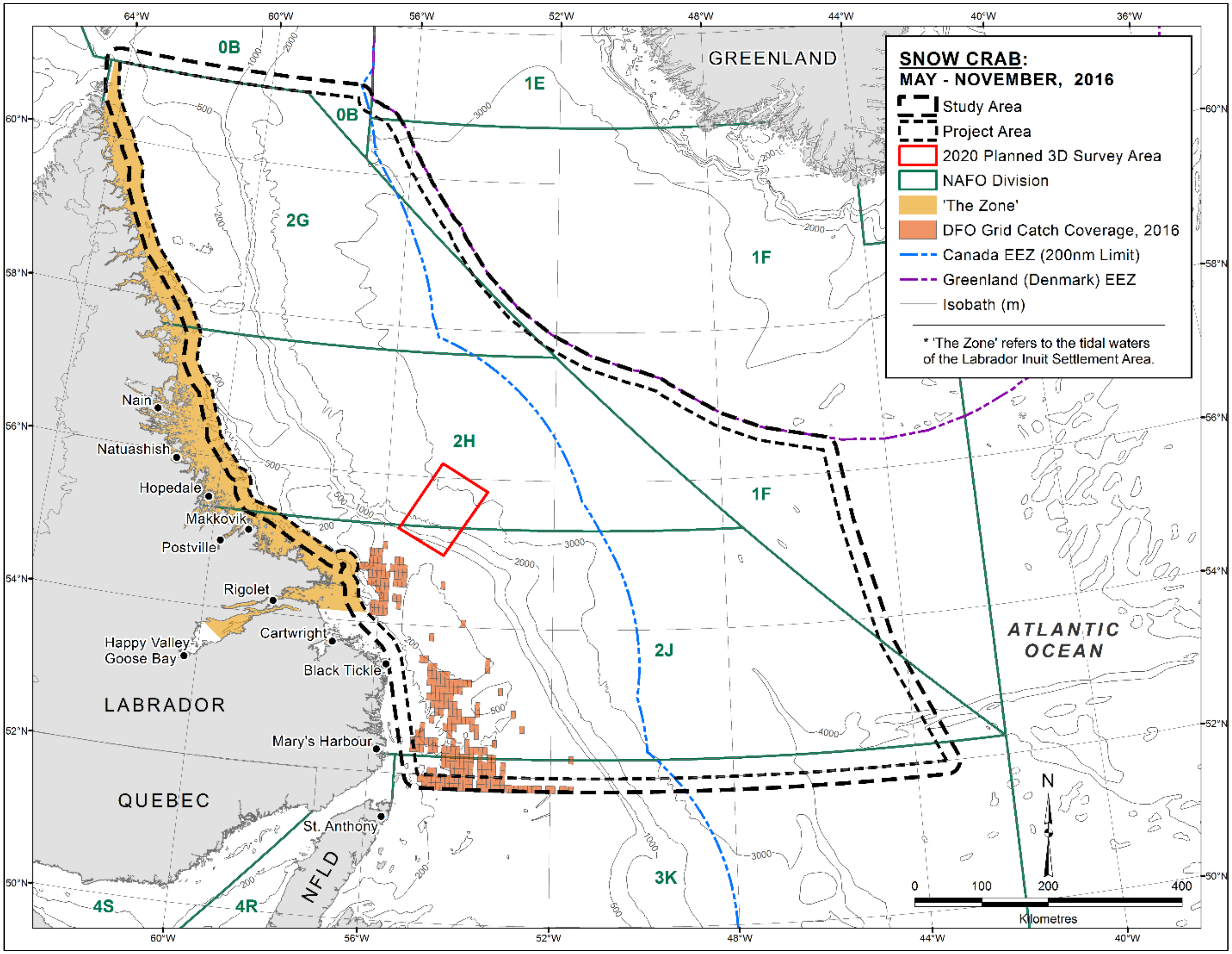


Figure 4.5. Distribution of commercial fishery harvest locations, snow crab, May–November 2016 (derived from DFO commercial landings database, 2016).

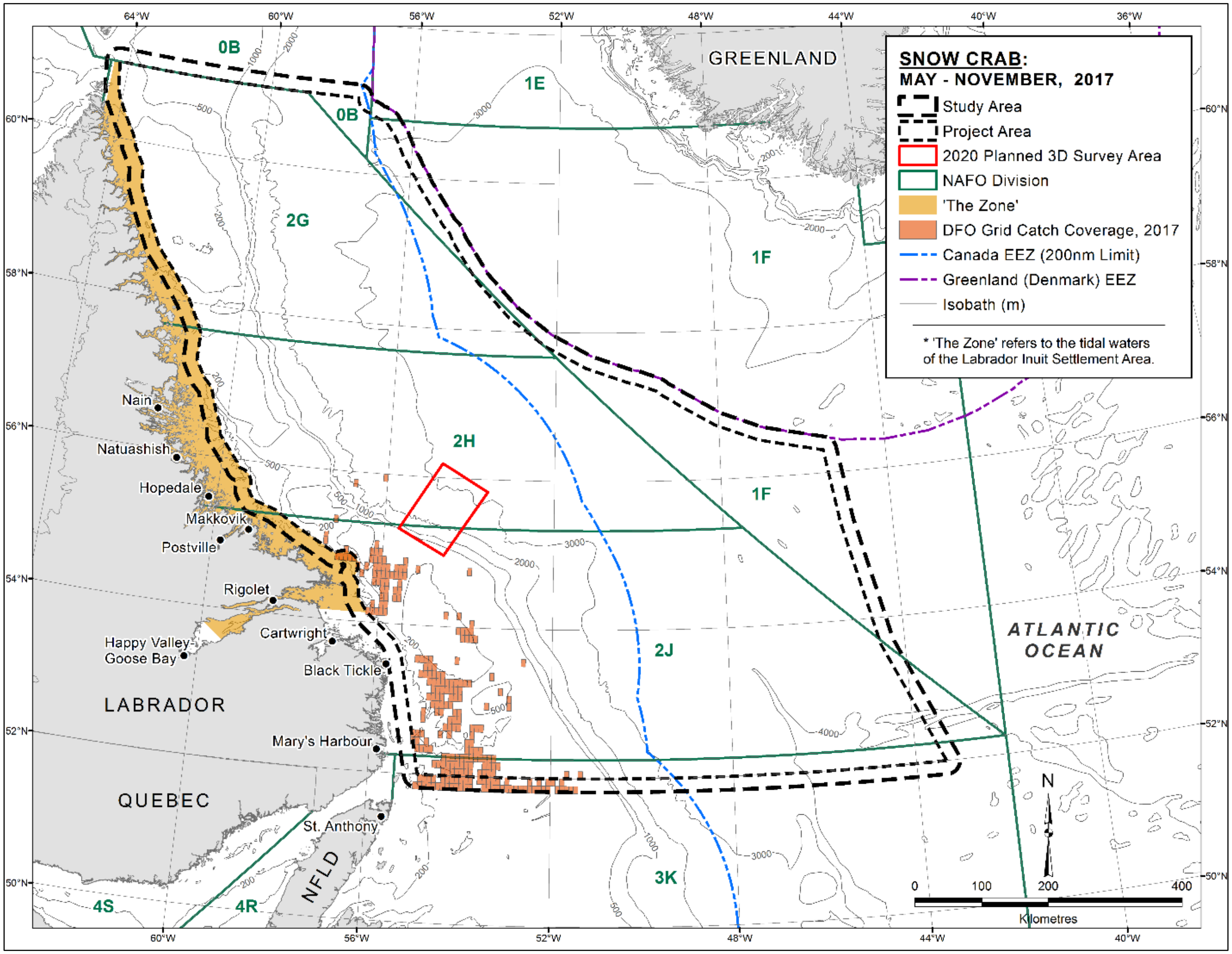


Figure 4.6. Distribution of commercial fishery harvest locations, snow crab, May–November 2017 (derived from DFO commercial landings database, 2017).

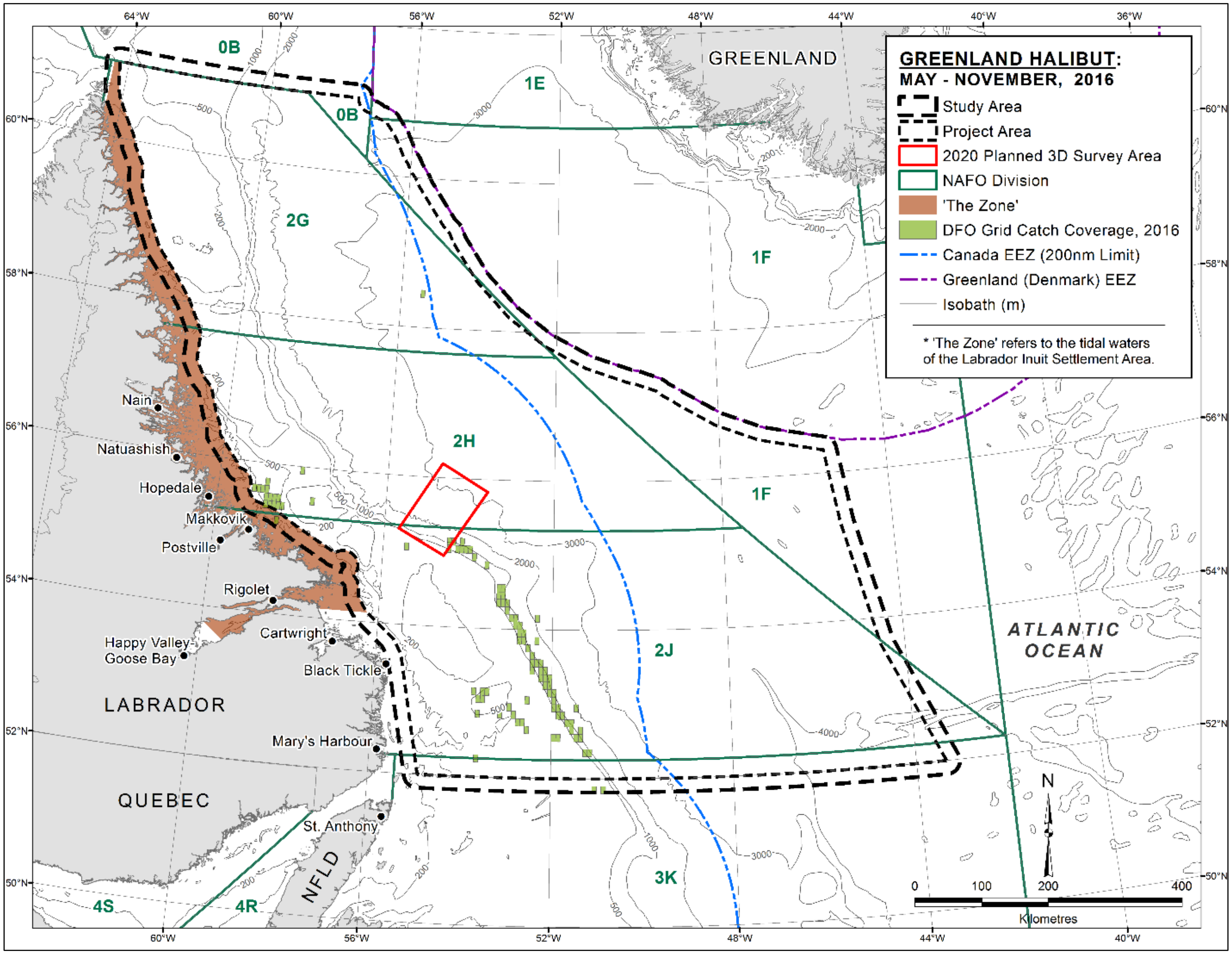


Figure 4.7. Distribution of commercial fishery harvest locations, Greenland halibut, May–November 2016 (derived from DFO commercial landings database, 2016).

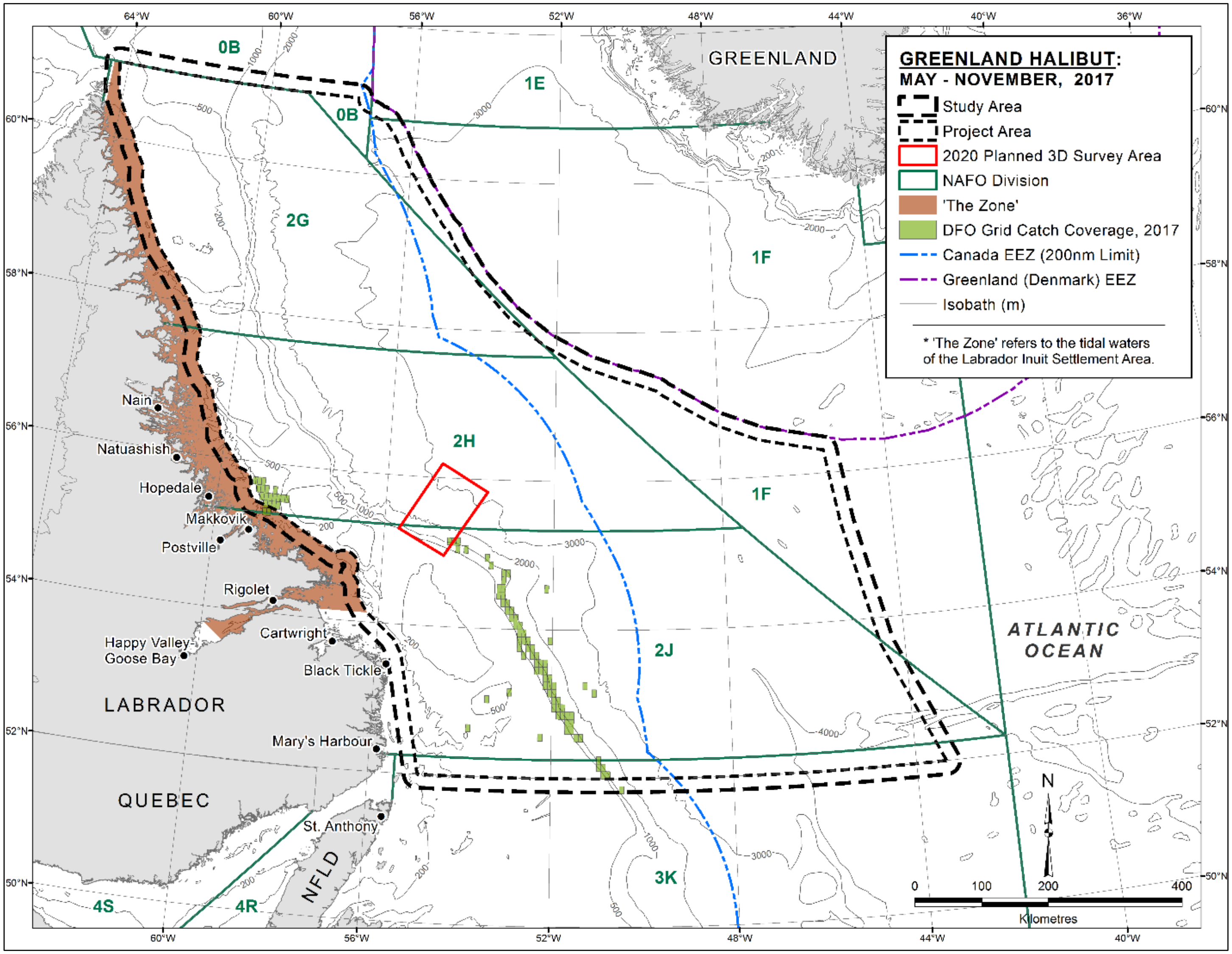


Figure 4.8. Distribution of commercial fishery harvest locations, Greenland halibut, May–November 2017 (derived from DFO commercial landings database, 2017).

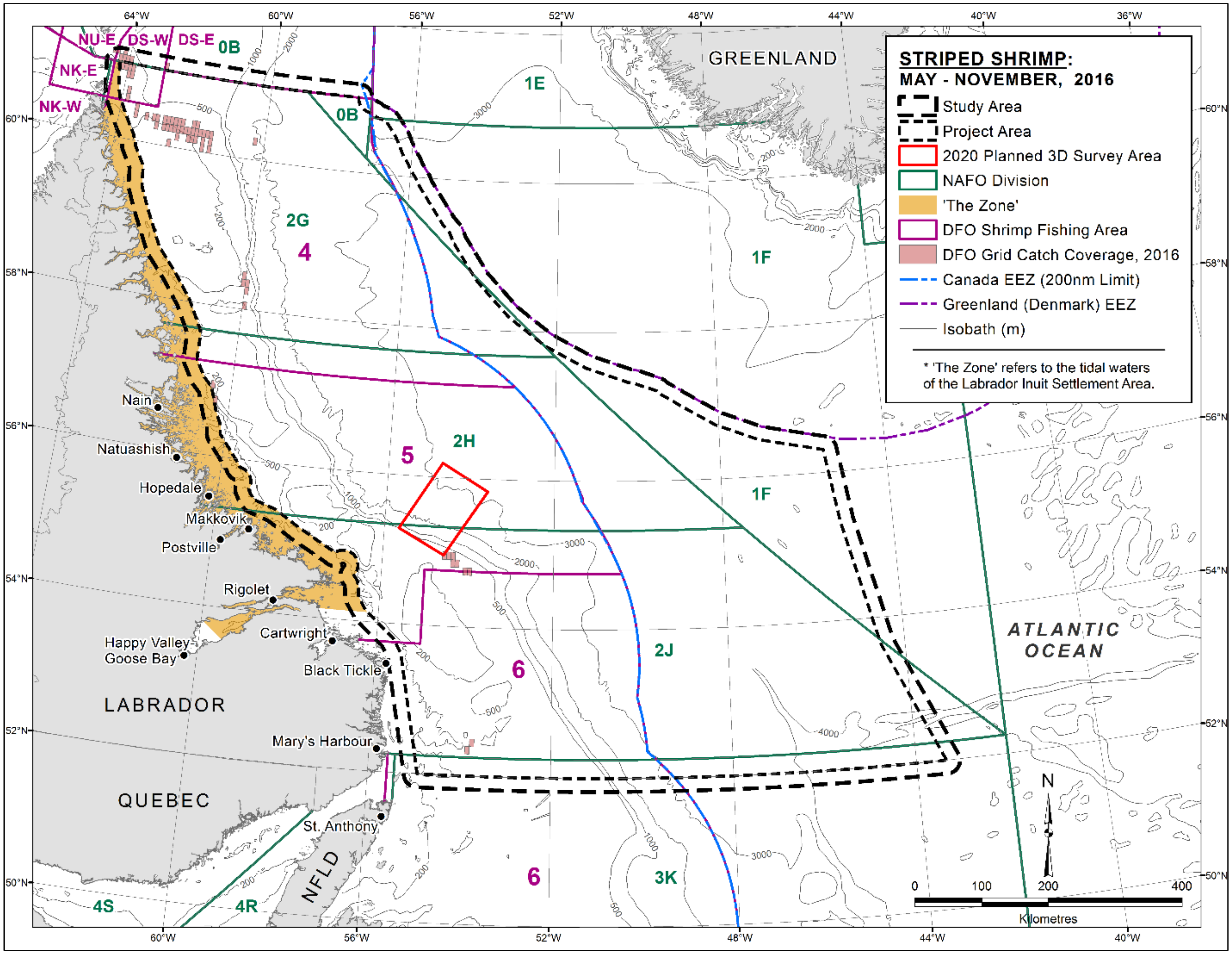


Figure 4.9. Distribution of commercial fishery harvest locations, striped (pink) shrimp, May–November 2016 (derived from DFO commercial landings database, 2016).

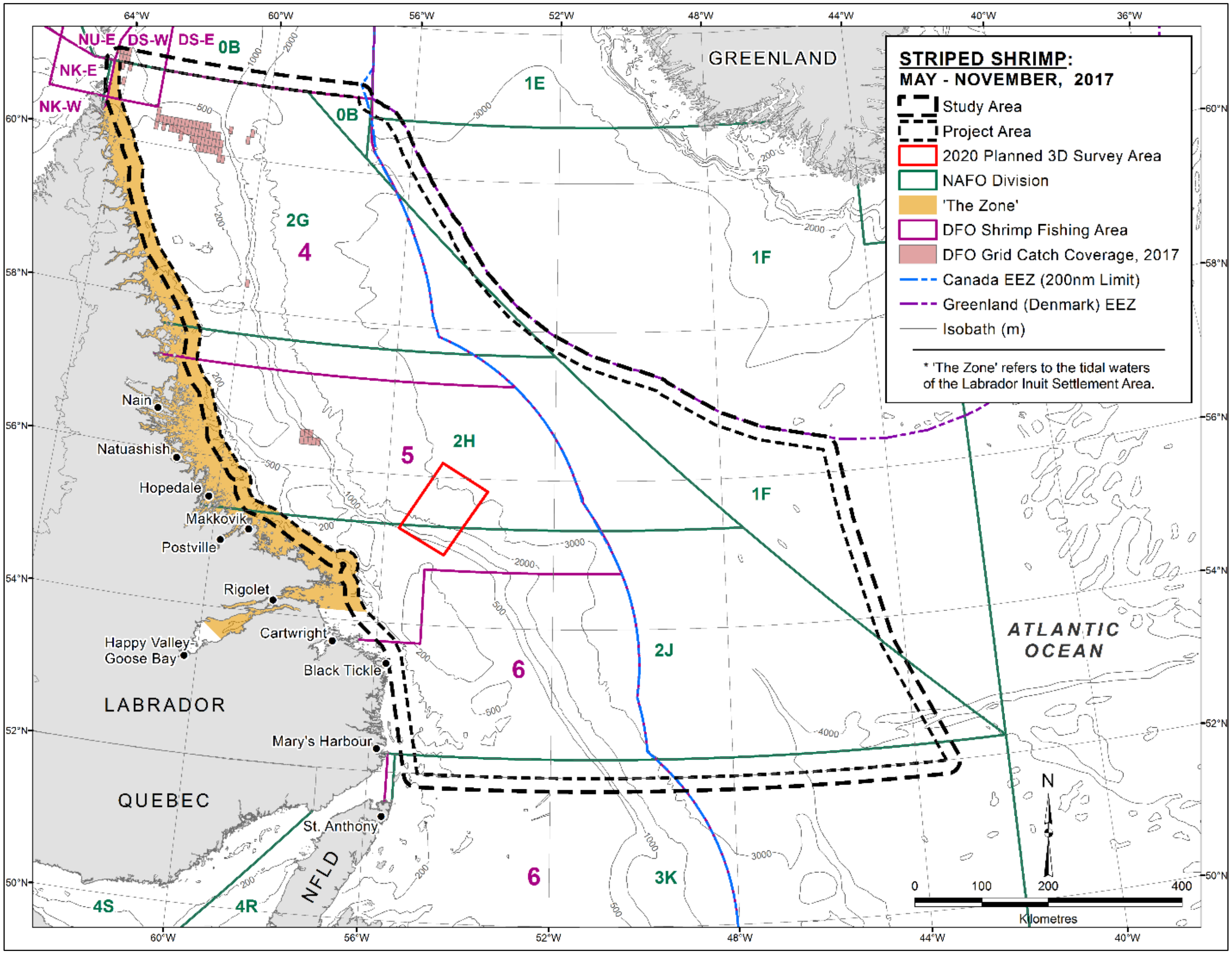


Figure 4.10. Distribution of commercial fishery harvest locations, striped (pink) shrimp, May–November 2017 (derived from DFO commercial landings database, 2017).

Table 4.1. Commercial catch weights and values in the Torngat 3D Extension survey area, May–November 2016 and 2017 (values indicate the frequency of catch weight quartile codes [i.e., 1–4] or vessel length classes attributed to each species; derived from DFO commercial landings database, 2016/2017).

Species	Catch Weight Quartile Code Counts [a]				Catch Value Quartile Code Counts [b]				Vessel Length Class Total Quartile Code Counts [c]						Total Counts [d]
	1	2	3	4	1	2	3	4	1–34.9’	35–44.9’	45–64.9’	65–99.9’	100–124.9’	≥125’	
2016															
Northern Shrimp	2	1	3	1	2	1	3	1	0	0	0	0	0	7	7
Greenland Halibut	0	3	1	0	0	3	1	0	0	2	2	0	0	0	4
Striped (pink) Shrimp	0	0	0	1	0	0	0	1	0	0	0	0	0	1	1
Total	**2**	**4**	**4**	**2**	**2**	**4**	**4**	**2**	**0**	**2**	**2**	**0**	**0**	**8**	**12**
2017															
Greenland Halibut	0	1	1	0	0	1	1	0	0	0	2	0	0	0	2
Total	**0**	**1**	**1**	**0**	**0**	**1**	**1**	**0**	**0**	**0**	**2**	**0**	**0**	**0**	**2**

Note:

[a] Quartile ranges provided by DFO (quartile ranges calculated annually by DFO based on total catch weights in a given year, all species combined). 2016 quartile ranges: 1 = 0 – 2,136 kg; 2 = 2,137 – 9,436 kg; 3 = 9,437 – 39,810 kg; 4 = ≥39,811 kg. 2017 quartile ranges: 1 = 0 – 1,912 kg; 2 = 1,913 – 8,828 kg; 3 = 8,829 – 35,206 kg; 4 = ≥35,207 kg.

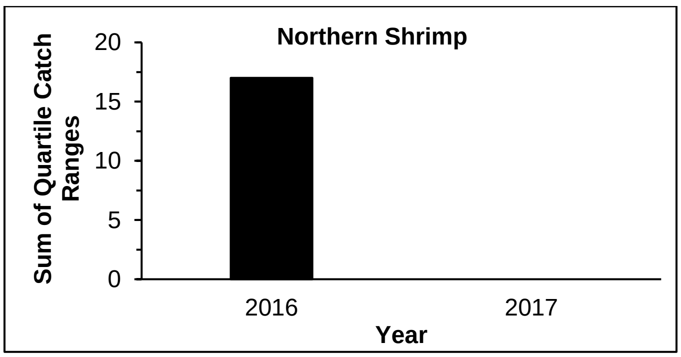
[b] Quartile ranges provided by DFO (quartile ranges calculated annually by DFO based on total catch value in a given year, all species combined). 2016 quartile ranges: 1 = \$0 – \$9,428; 2 = \$9,429 – \$41,474; 3 = \$41,475 – \$154,669; 4 = ≥\$154,670. 2017 quartile ranges: 1 = \$0 – \$9,811; 2 = \$9,812 – \$43,514; 3 = \$43,515 – \$166,502; 4 = ≥\$166,503.

[c] Includes the total quartile code count for ranges 1–4, combined; total counts for catch weight and catch value are equal.

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

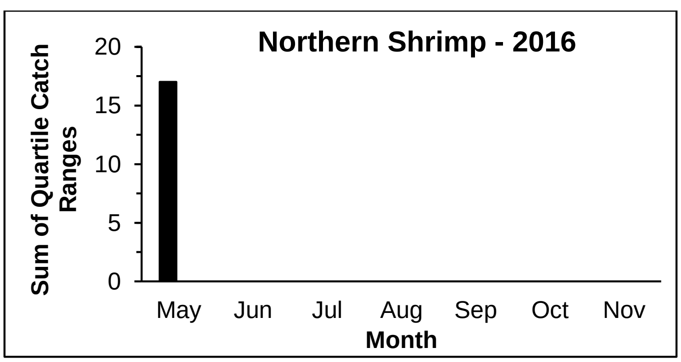
4.2.1.1 Northern Shrimp

During May–November 2016, harvest locations for northern shrimp occurred in the southern portion of the Torngat survey area, in water depths <500 m (see Figures 4.3−4.4). The 2020 TAC values for northern shrimp have not yet been released by DFO for the Study Area (DFO 2020a). TAC values for northern shrimp in SFA 4 (includes NAFO Div. 2G and portions of 0B, 1F, and 2H; north of the Torngat survey area) was 15,725 mt during 2019 (DFO 2020a). The TAC in SFA 5 (includes Div. 2H and a portion of 2J, and the Torngat survey area) was 25,630 mt in 2019 (DFO 2020a). The TAC in SFA 6 (includes Div. 2J; south of the Torngat survey area) was 8,730 mt in 2019 (DFO 2020a). Northern shrimp harvests only occurred within the Torngat survey area during May 2016 (Figures 4.11−4.12).



Note: Sum of quartile catch ranges is the summation of catch weight quartile ranges (i.e., 1–4) for all catch records for all species; the greater the sum of quartile range counts, the greater the catch for a given year).

Figure 4.11. Total annual catch weight quartile codes, May–November 2016–2017 for northern shrimp in the Torngat survey area (derived from DFO commercial landings database, 2016–2017).



Note: Sum of quartile catch ranges is the summation of catch weight quartile ranges (i.e., 1–4) for all species; the greater the sum of quartile range counts, the greater the catch weight for a given month).

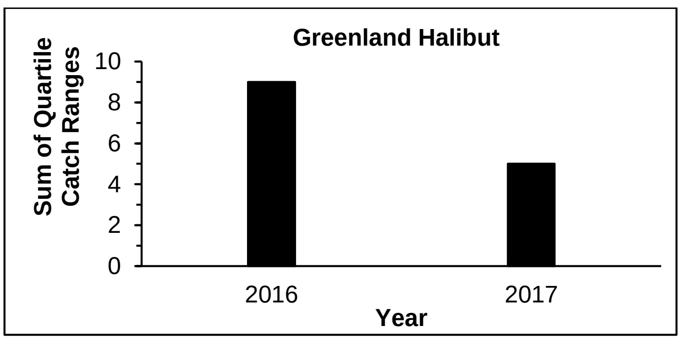
Figure 4.12. Total monthly catch weight quartile codes, May–November 2016 for northern shrimp in the Torngat survey area (derived from DFO commercial landings database, 2016).

4.2.1.2 Snow Crab

There were no snow crab harvest locations within the Torngat survey area during May–November 2016 and 2017 (see Figures 4.5−4.6). The 2020 TAC values for snow crab in the Study Area have not yet been released by DFO (DFO 2020a). The snow crab fishery TAC in NAFO Div. 2GHJ (includes the Torngat survey area) was 5,856 mt in 2019 (DFO 2020a).

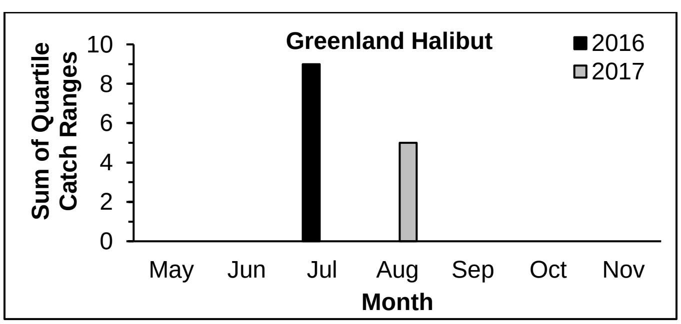
4.2.1.3 Greenland Halibut

During May−November 2016 and 2017, there were few harvest locations for Greenland halibut within the Torngat survey area in water depths <2,000 m in the southern portion of the area (see Figures 4.7–4.8). No TAC values for Greenland halibut have been set for the Torngat survey area; the nearest TAC for Greenland halibut was 8,592 mt for Div. 0B in 2019 (DFO 2020a). During May−November, commercial harvests within the Torngat survey area decreased from 2016 to 2017 (Figure 4.13). Catches occurred during July and August during 2016 and 2017, respectively (Figure 4.14).



Note: Sum of quartile catch ranges is the summation of catch weight quartile ranges (i.e., 1–4) for all catch records for all species; the greater the sum of quartile range counts, the greater the catch for a given year).

Figure 4.13. Total annual catch weight quartile codes, May–November 2016–2017 for Greenland halibut in the Torngat survey area (derived from DFO commercial landings database, 2016–2017).

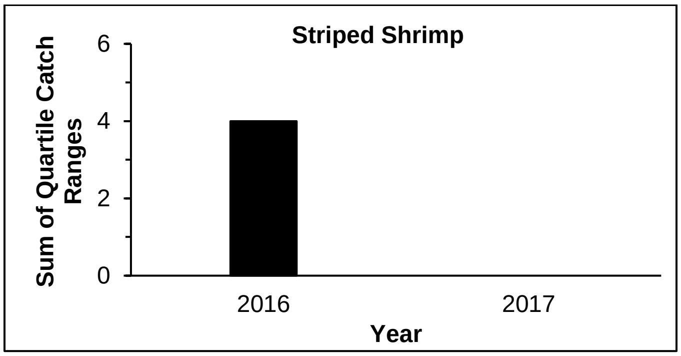


Note: Sum of quartile catch ranges is the summation of catch weight quartile ranges (i.e., 1–4) for all species; the greater the sum of quartile range counts, the greater the catch weight for a given month).

Figure 4.14. Total monthly catch weight quartile codes, May–November 2016–2017 for Greenland halibut in the Torngat survey area (derived from DFO commercial landings database, 2016–2017).

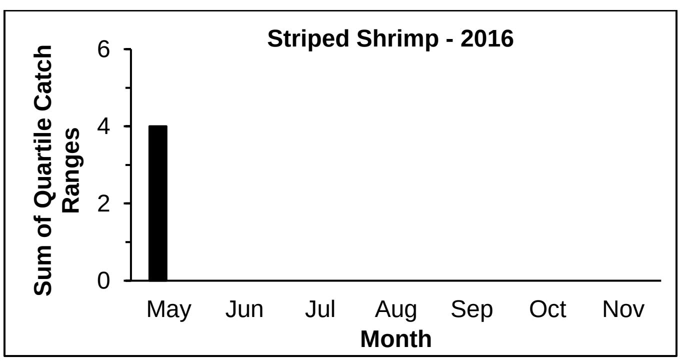
4.2.1.4 Striped (Pink) Shrimp

During May−November 2016 and 2017, striped shrimp were caught near the southernmost boundary of the Torngat survey area, in water depths <500 m (see Figures 4.9−4.10 and Figure 4.15). The 2020 bycatch limit for striped shrimp has not yet been set for the Study Area but was 4,033 mt during 2019 in SFA 4 (northern portion of Study Area, north of the Torngat survey area) (DFO 2020a). Striped shrimp were caught during May 2016 in the Torngat survey area, likely as bycatch in the northern shrimp fishery (Figure 4.16).



Note: Sum of quartile catch ranges is the summation of catch weight quartile ranges (i.e., 1–4) for all catch records for all species; the greater the sum of quartile range counts, the greater the catch for a given year).

Figure 4.15. Total annual catch weight quartile codes, May–November 2016–2017 for striped (pink) shrimp in the Torngat survey area (derived from DFO commercial landings database, 2016–2017).



Note: Sum of quartile catch ranges is the summation of catch weight quartile ranges (i.e., 1–4) for all species; the greater the sum of quartile range counts, the greater the catch weight for a given month).

Figure 4.16. Total monthly catch weight quartile codes, May–November 2016 for striped (pink) shrimp in the Torngat survey area (derived from DFO commercial landings database, 2016).

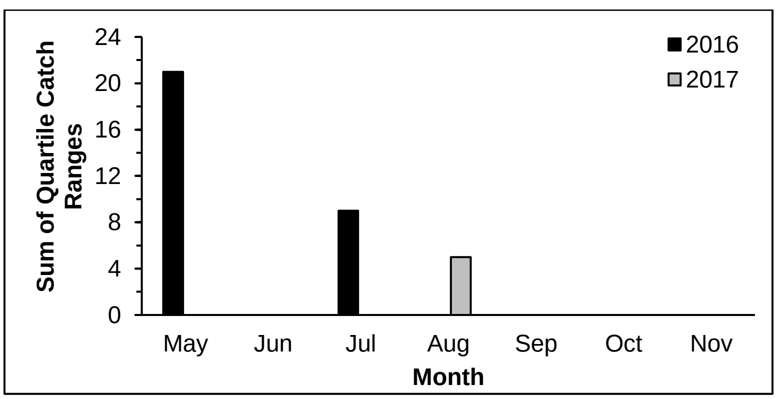
4.2.1.5 Other Notable Commercial Species

As noted in the EA (see Tables 4.3–4.8 *in* LGL 2018) and 2019 EA Update (see Section 4.2.1.5 *in* LGL 2019b), Atlantic halibut, redfish, and witch flounder are also important commercial species in the Study Area. These species are primarily harvested in areas where water depths are <1,000 m (see Figure 4.32 *in* LGL 2014, Figures 4.20–4.21 *in* LGL 2016, and Figures 4.19–4.20 *in* LGL 2018) (i.e., on the shelf slope along the western portion of the Study Area). During May−November 2016 or 2017, there were no catch locations for these species within the Torngat survey area (see Table 4.1). DFO sets annual TAC limits for Atlantic halibut, while both DFO and NAFO manage the fisheries for redfish and witch flounder.

No TAC has been set for Atlantic halibut or witch flounder within the Study Area in recent years (DFO 2020a; NAFO 2020). A fishing ban has remained in place for redfish in NAFO Subarea 2 and Div. 1F+3K (NAFO 2020). Commercial harvest locations and trends for these species in the Study Area were described in Section 4.2.1.5 *in* LGL (2019b).

4.2.1.6 Timing and Gear Types

Harvesting in the Torngat survey area occurred during late spring and summer (Figure 4.17). Gear types used in the Torngat survey area during 2016 and 2017 were typical of those used during previous years (see Table 4.1 *in* LGL 2015, Table 4.10 *in* LGL 2018, Table 4.3 *in* LGL 2019b, and Table 4.2 below). The May–November 2016 and 2017 harvest locations for fixed and mobile gears are shown in Figures 4.18–4.21.



Note: Sum of quartile catch ranges is the summation of catch weight quartile ranges (i.e., 1–4) for all species; the greater the sum of quartile range counts, the greater the catch weight for a given month).

Figure 4.17. Total monthly catch weight quartile codes in the Torngat survey area, for all species combined during May–November 2016 and 2017 (derived from DFO commercial landings database, 2016/2017).

Table 4.2. Summary of gear type used and timing of the commercial fishery in the Torngat 3D Extension survey area, May–November 2016 and 2017 (derived from DFO commercial landings database, 2016/2017).

Species	Harvest Month														Gear Type										
	2016							2017							Fixed				Mobile						
	M	J	J	A	S	O	N	M	J	J	A	S	O	N	P	G	L	N	T	D	TL	R	H	C	S
Northern Shrimp	●	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	●	○	○	○	○	○	○
Greenland Halibut	○	○	●	○	○	○	○	○	○	○	●	○	○	○	○	●	○	○	○	○	○	○	○	○	○
Striped (pink) Shrimp	●	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	●	○	○	○	○	○	○

Notes:

Fixed Gear Type: P = pot; G = gillnet; L = longline; N = trap net.

Mobile Gear Type: T = trawl ; D = dredge (boat); TL = troller lines; R = rod and reel (trolling); H = electric harpoon; C = sea cucumber drag; S = seine.

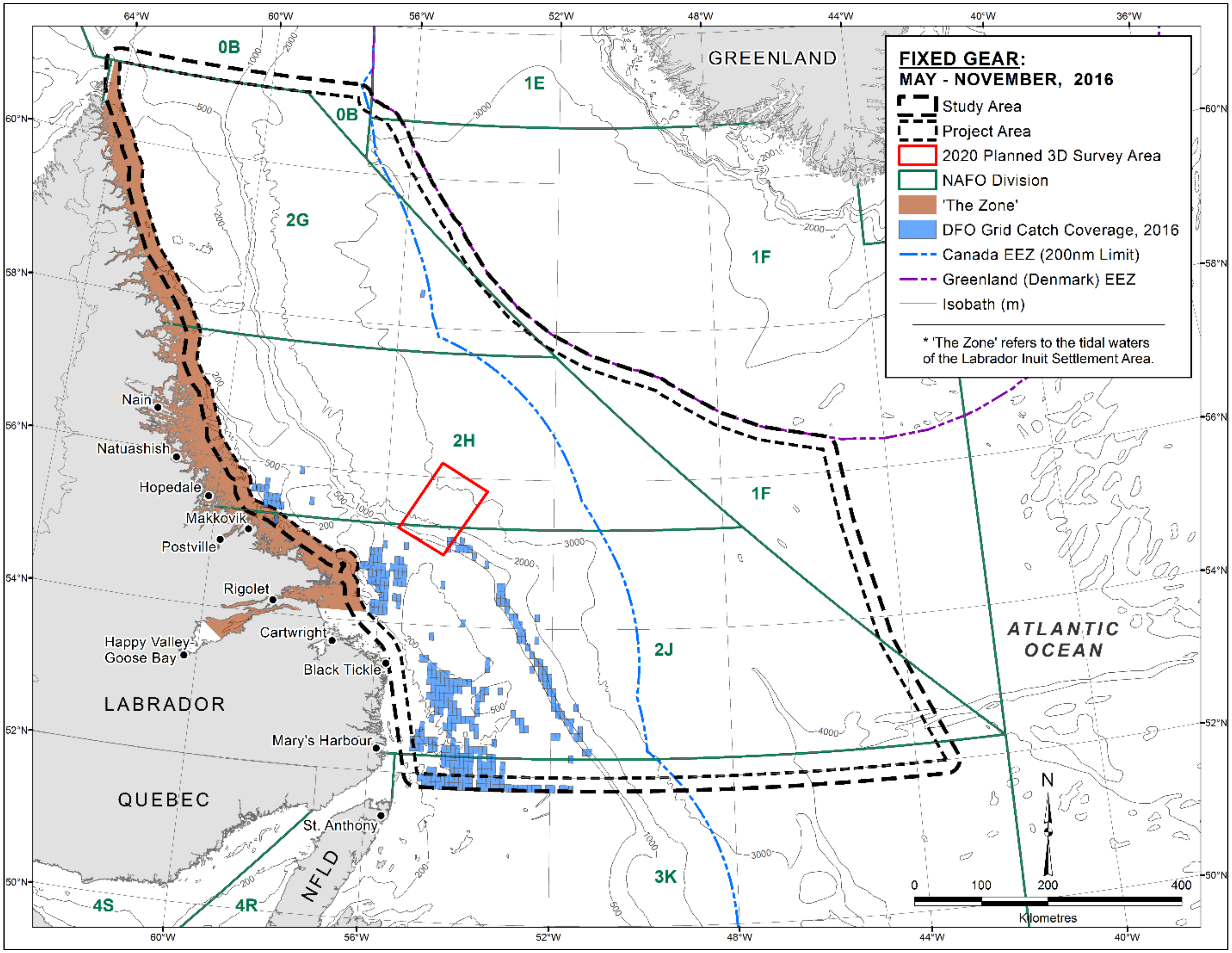


Figure 4.18. Harvest locations for fixed gear, all species, May–November 2016 (derived from DFO commercial landings database, 2016).

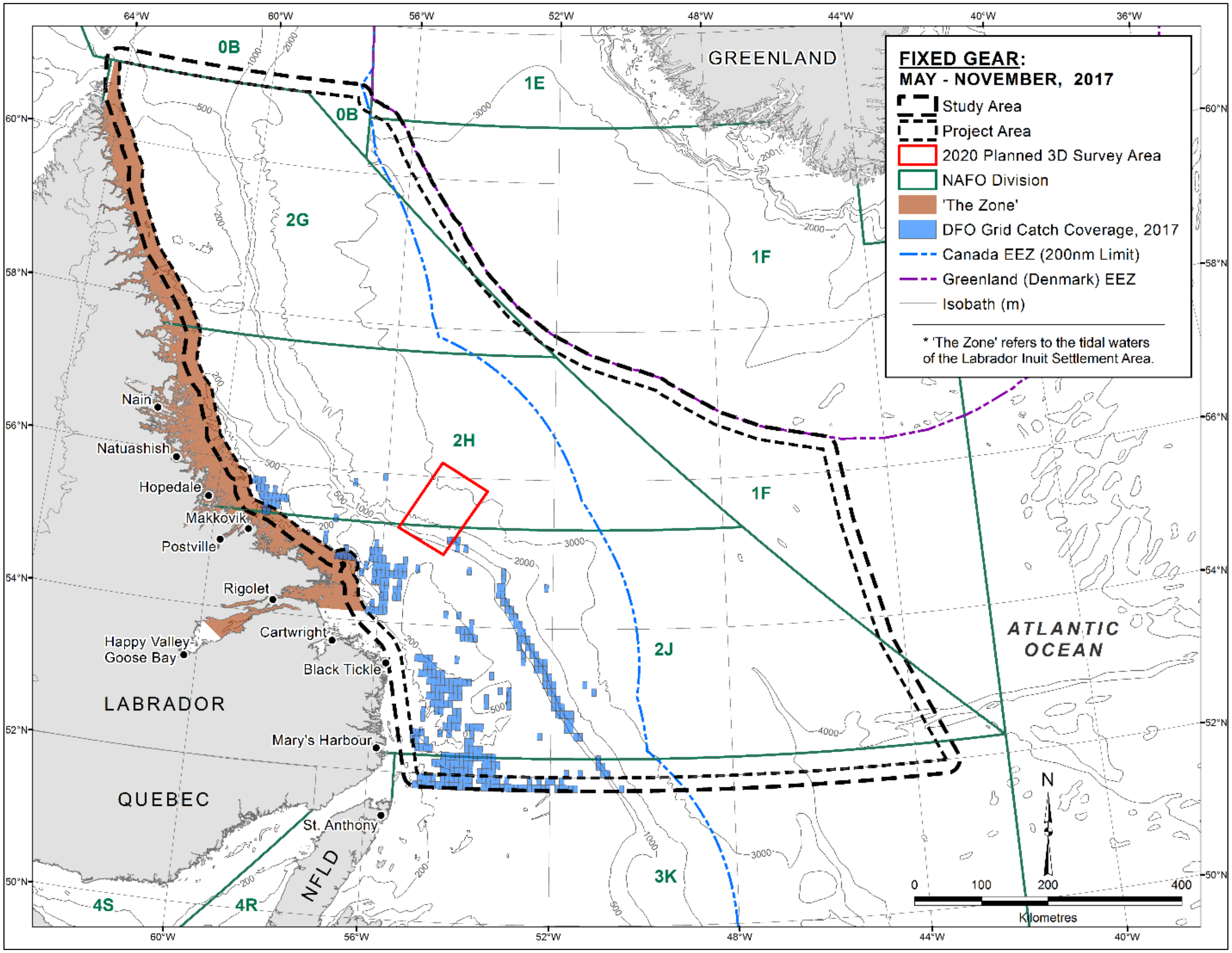


Figure 4.19. Harvest locations for fixed gear, all species, May–November 2017 (derived from DFO commercial landings database, 2017).

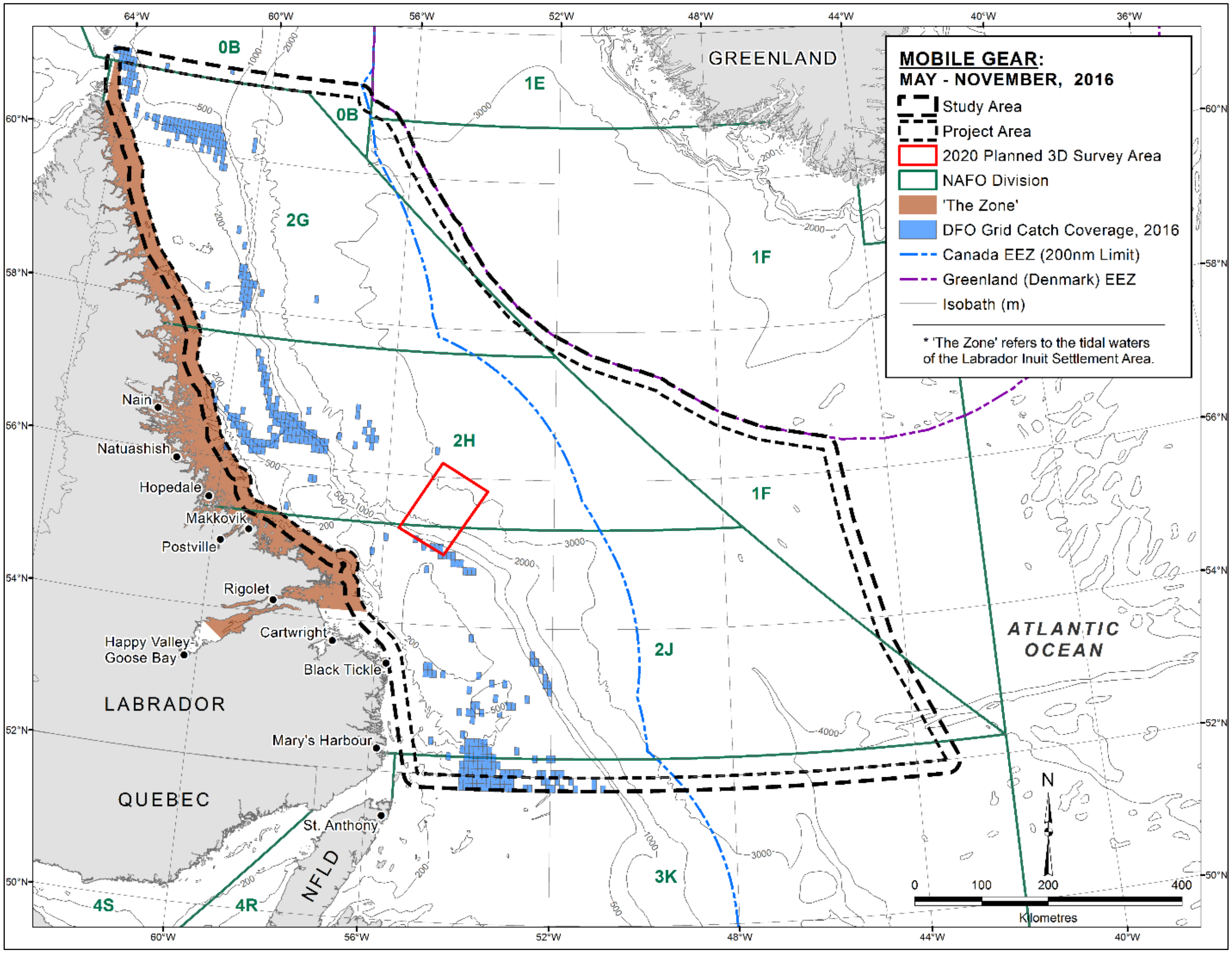


Figure 4.20. Harvest locations for mobile gear, all species, May–November 2016 (derived from DFO commercial landings database, 2016).

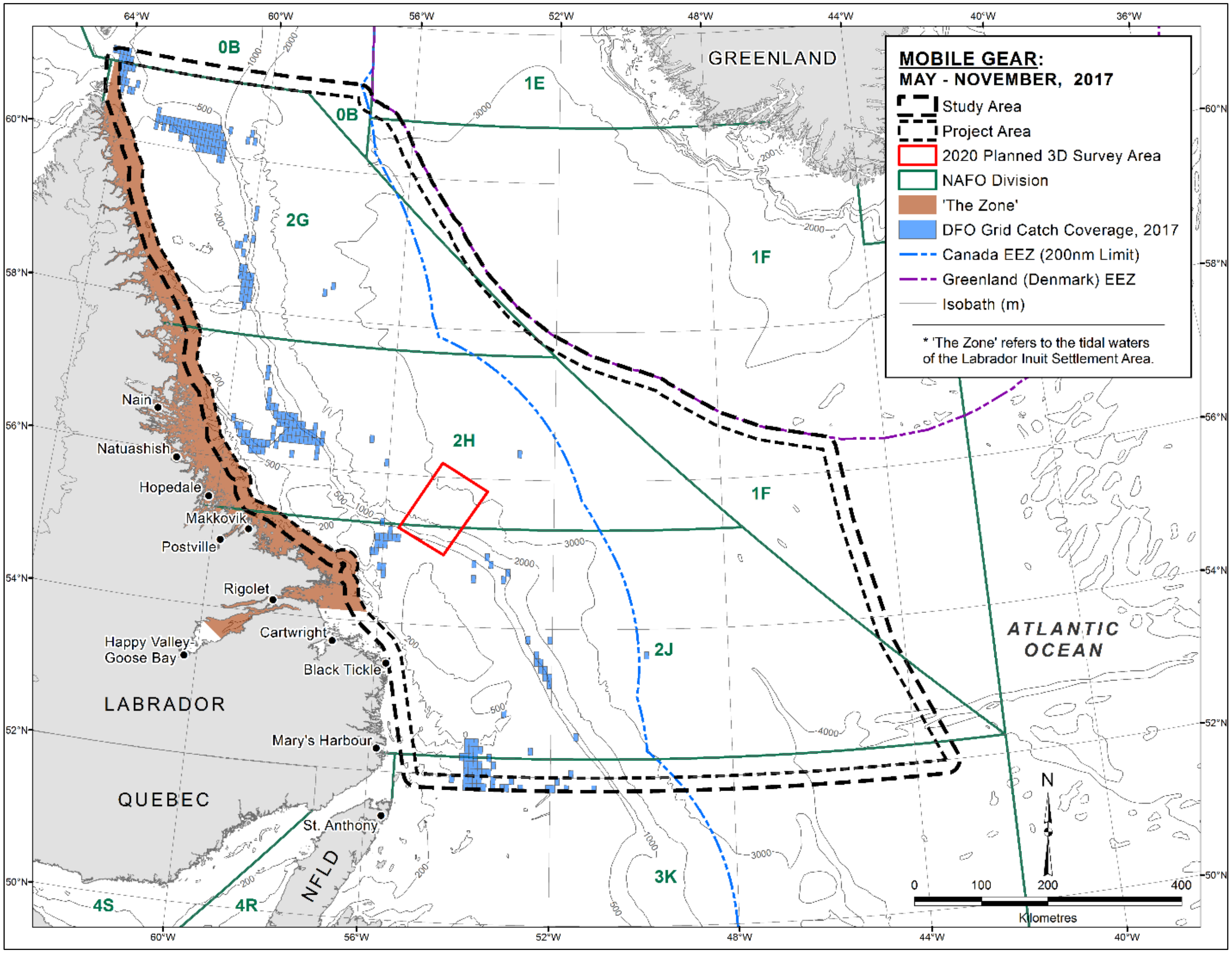


Figure 4.21. Harvest locations for mobile gear, all species, May–November 2017 (derived from DFO commercial landings database, 2017).

4.2.2 Indigenous Fisheries

The most recent (2019) Indigenous communal-commercial licences and allocations for NL-based groups and organizations providing commercial fisheries access within the Study Area are provided in Table 4.3. Indigenous commercial fisheries catches are included, but not differentiated, in the DFO commercial landings database, summarized above (see Section 4.2.1) (J. Hosein, Chief, Statistical Services, DFO, pers. comm., 15 April 2020).

Table 4.3. Indigenous communal-commercial licences and allocations for NL-based groups and organizations within the Study Area, 2019−2020.

Group/Organization	Licence	Quota Area (Fishing Area [FA]/NAFO Division [Div.])
Innu Nation	Groundfish	Div. 0, 2GHJ, 3K
	Groundfish (mobile)	Div. 2GHJ, 3K
	Herring	FA 3
	Mackerel	FA 1-3
	Shrimp	FA 4-6
Ueushuk Fisheries	Cod	Div. 2GHJ, 3K (M)
	Witch Flounder	Div. 3J, 3K (M)
	Greenland Halibut	Div. OB (C)
		Div. 2, 3K (EA)
	Shrimp	FA 6
NunatuKavut Community Council (NCC)	Bait	Area of Home Port or Lobster Area
	Capelin	FA 2
	Groundfish	Div. 2GHJ, 3K
	Herring	FA 1
	Scallop	FA 1-2
	Seal	FA 4-5
	Shrimp	FA 4-6
	Snow Crab	FA 2
	Whelk	Div. 2J
Imakpik (50/50 partnership NCC and Labrador Fishermen's Union Shrimp Co. Ltd. [LFUSCL])	Shrimp	FA 5
Nunatsiavut Government (NG)	Arctic Char	Cape Rouge to Cape Chidley
	Groundfish	Div. 2GHJ, 3K
	Greenland Halibut	Div. 0B, 2, 3K
	Scallop	FA 1
	Seal	FA 4-5
	Shrimp	FA 4-5
	Snow Crab	FA 1-2
	Snow Crab (Exploratory)	Div. 2H
Pikalujak Fisheries Ltd. (50/50 partnership NG/Ocean Prawns Canada Ltd.)	Shrimp	FA 4-6
Nunatsiavut Group of Companies (NGC) – Part of the Northern Coalition	Shrimp	FA 5

Group/Organization	Licence	Quota Area (Fishing Area [FA]/NAFO Division [Div.])
Miawpukek First Nation (MFN)	Bait	Area of Home Port or Lobster Area
	Capelin	FA 1-3
	Groundfish	Div. 2GHJ, 3K
	Groundfish (mobile)	Div. 2GHJ, 3K
	Mackerel	FA 1-3
	Seal	FA 4-5
Qualipu Mi'kmaq First Nation Band (QFNB)	Bait	Area of Home Port or Lobster Area
	Capelin	FA 3
	Capelin (mobile)	FA 1-3
	Groundfish	Div. 2GHJ, 3K
	Herring	FA 3
	Herring (mobile)	FA 3
	Lobster	FA 3
	Mackerel	FA 3
	Mackerel (mobile)	FA 1-3
	Scallop	FA 3
	Squid	FA 3
	Whelk	Div. 3K
Mi'kmaq Alsumk Mowimsikik Koqoey Association (MAMKA) (Aboriginal Aquatic Resource & Oceans Management [AAROM] Body – MFN and QFNB)	Bait	Area of Home Port or Lobster Area
	Groundfish	Div. 2GHJ, 3K

Source: D. Ball, Resource Management, DFO, pers. comm., 17 March 2020.
Notes:
Quota Area: M = moratorium; EA = enterprise allocation; SQ = science quota (use of fish); C = competitive/competitive reserve; B = bycatch.

There are several food, social and ceremonial (FSC) fisheries near the western boundary of the Study Area (D. Ball, Resource Management, DFO, pers. comm., 17 March 2020). The Innu Nation holds a FSC licence for salmon, trout and Arctic char for Sheshatshiu, from Fish Cove Point to Cape Harrison, including Lake Melville and the inland waters of Little Land and Grand Lake, and for Natuashish, including all tidal waters of Labrador extending north and east from Cape Harringan (55.86ºN, 60.35ºW) and south and east of Anaktalik Bay (56.34ºN, 61.69ºW). The NG holds a FSC licence for salmon, trout, and Arctic char for the Labrador Inuit Settlement Area, including for the community fishing areas of Rigolet, Makkovik, Postville, Hopedale, and Nain. The NG also holds a FSC licence for salmon, trout, Arctic char, smelt, and seal for Upper Lake Melville, including the tidal waters outside the Labrador Inuit Settlement Area. The NCC holds a FSC for salmon, trout, Arctic char, Atlantic cod, rock cod, herring, scallop, whelk, smelt, and seal for the South Coast of Labrador, including coastal areas from Fish Cove Point to Cape Charles. The NCC also holds a FSC licence for salmon, trout, and Arctic char for portions of the tidal waters of Upper Lake Melville.

4.2.3 Recreational Fisheries

Recreational fisheries in NL are described in Section 5.8.4 *in* C-NLOPB (2008), Section 4.3.5 *in* LGL (2014), Section 4.2.3 *in* LGL (2015), Section 4.3.5 *in* LGL (2018), and Section 4.2.3 *in* LGL (2019b). There have been no changes in the NAFO Div. in which the NL recreational fishery occurred, including 2GHJ, 3KLPsPn, and 4R but excluding the Eastport, Gilbert Bay, and Laurentian Channel Marine Protected Areas (MPAs), of which 2GHJ and the northern portion of 3K overlap with the Study Area.

The 2019 NL recreational groundfish fishery was open for 39 days, the same as during 2018, from 29 June to 29 September (DFO 2020a). As in the 2018 season, there was still no requirement for fishing licenses or tags during 2019 (DFO 2020a). The 2019 NL recreational scallop fishery was set to occur year-round and requires the possession of a recreational scallop licence (DFO 2020a).

A full science stock assessment for Atlantic salmon in NL occurred in March 2019 (DFO 2020a). During 2018, an estimated 13,600 and 25,000 Atlantic salmon were retained and released, respectively (Whiffen 2019). Although there was some improvement in stocks during 2018, many rivers showed declines in salmon returns and/or abundance relative to recent years (Whiffen 2019). As a result, DFO released the *Implementation Plan 2019 to 2021* to restore and sustain wild Atlantic salmon populations (DFO 2019e) and revised its management decision to allow the retention of one salmon on Class 2 rivers and two on Class 4/6 and unclassified rivers (DFO 2020a). The 2019 Atlantic salmon season was open from June–September (DFO 2020a). The 2019−2020 recreational trout season will be open from February−April and May−September in Zone 1 (northern Labrador), March−September in Zone 2 (southern Labrador), and February−September in Zone 3 (southern Labrador/Northern Newfoundland), with various retention limits depending on species (DFO 2020a).

It is possible that recreational fisheries may occur within the shallower portions of the Study Area. Due to water depth and distance from shore, no recreational fisheries are anticipated within the Torngat survey area.

4.2.4 Aquaculture

Aquaculture operations in NL are described in Section 4.10.4 *in* C-NLOPB (2008), Section 4.3.6 *in* LGL (2014), Section 4.2.3.1 *in* LGL (2015), and Section 4.3.6 *in* LGL (2018). All aquaculture sites within NL have remained coastally based within the island portion of the province. There are no approved aquaculture sites within the Study Area (FLR 2020; R.J. Keel, Manager of Aquaculture Licensing and Administration, Department of Fisheries and Land Resources, Government of Newfoundland and Labrador, pers. comm., 20 March 2020).

4.2.5 Science Surveys

4.2.5.1 DFO Research Vessel (RV) Surveys

The most recent DFO RV data available are from the 2017 dataset [2], which was presented for the Study Area in the 2019 EA Update (see Section 4.2.5.1 *in* LGL 2019b). The results of the analysis of DFO RV survey data within the Study and Project areas are not repeated here; instead, this section summarizes recent RV data within the Torngat survey area.

During May−November 2015−2017, RV survey catch locations occurred in the southern portion of the Torngat survey area, in water depths <1,000 m (Figures 4.22−4.24). Catch weights, numbers, and mean catch depths for species/groups contributing ≥0.1% of the total catch weight and predominant species for all species caught at various mean depth ranges in the Torngat survey area during May−November 2015−2017 are presented in Tables 4.4−4.6. Similar to DFO RV surveys described in the EA (LGL 2018) and 2019 EA Update (LGL 2019b), deepwater redfish (28% of total catch weight) and Greenland halibut (21%) comprised the majority of the total catch weight, followed by jellyfish (12%), roundnose grenadier (7%), Atlantic cod (7%), and roughhead grenadier (6%). Total catch weight across all species caught in the Torngat survey area during DFO RV surveys during May−November 2015−2017 was 1 mt, and the annual total catch weights decreased from 0.4 to 0.2 mt.

[2] DFO is undergoing changes in their RV data request protocols and is currently not releasing multispecies spring and fall RV survey data (B. Pye, Environmental Sciences, Science Branch, DFO, pers. comm., 17 March 2020).

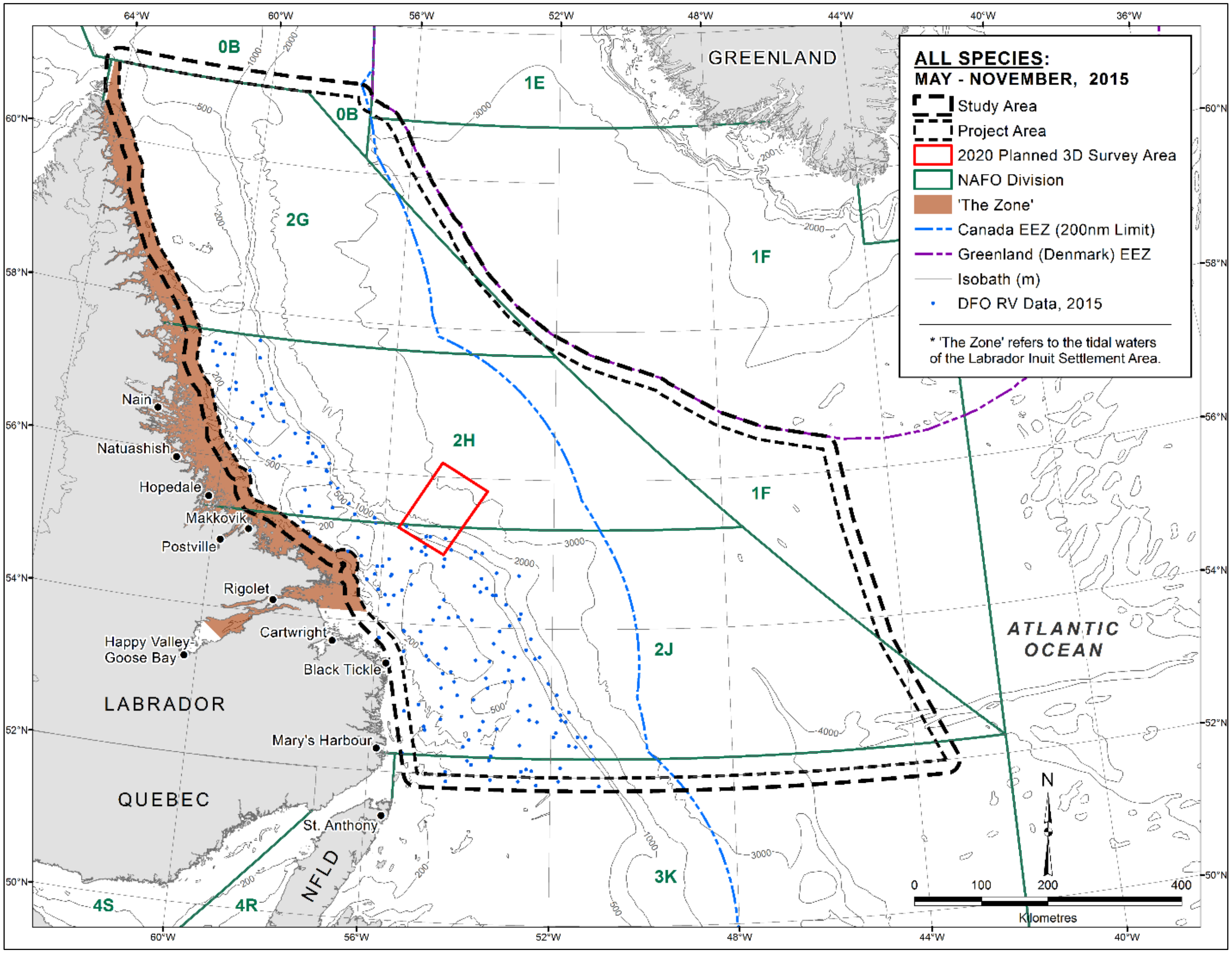


Figure 4.22. Distribution of DFO RV survey catch locations, all species, May–November 2015 (derived from DFO RV survey database, 2015).

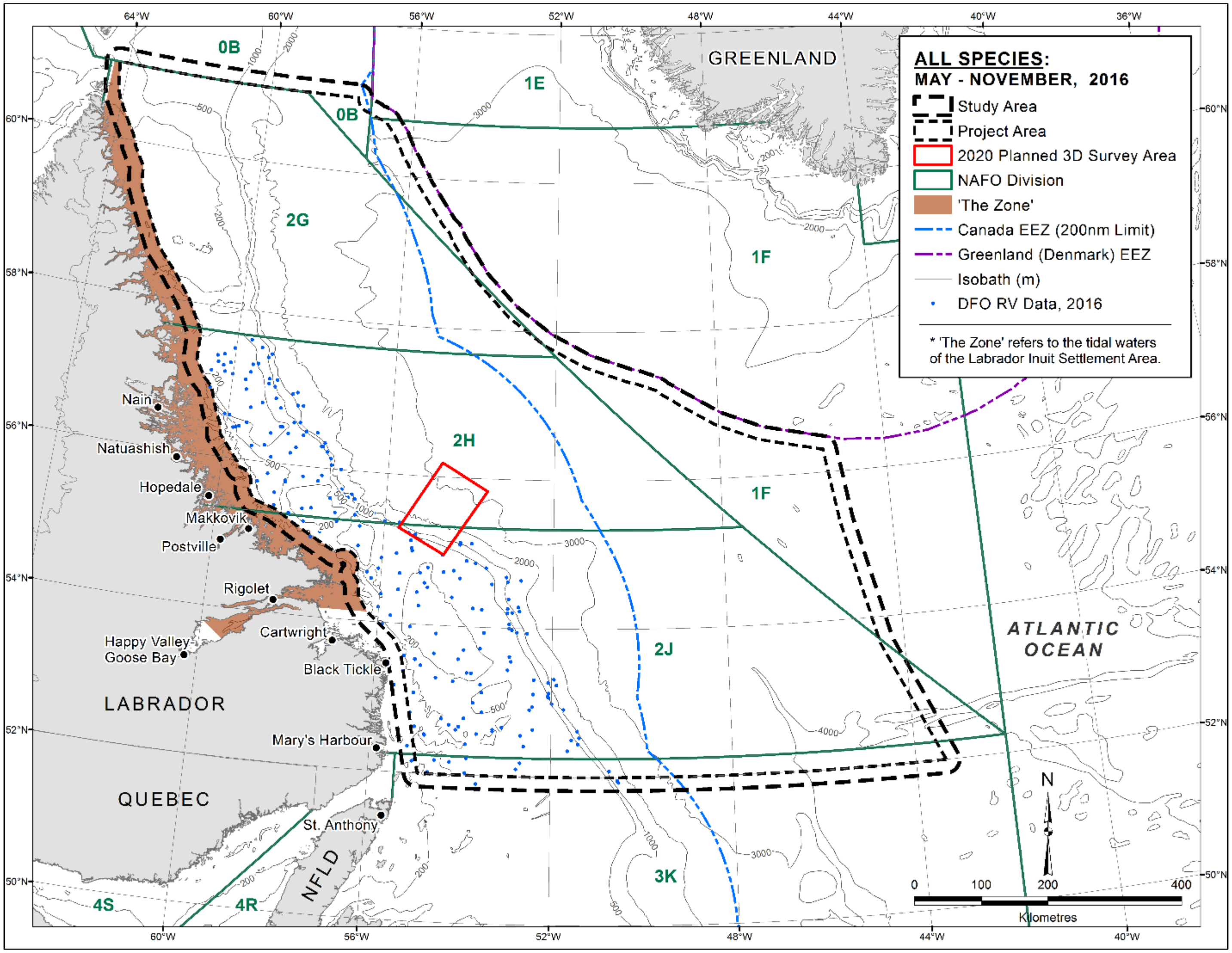


Figure 4.23. Distribution of DFO RV survey catch locations, all species, May–November 2016 (derived from DFO RV survey database, 2016).

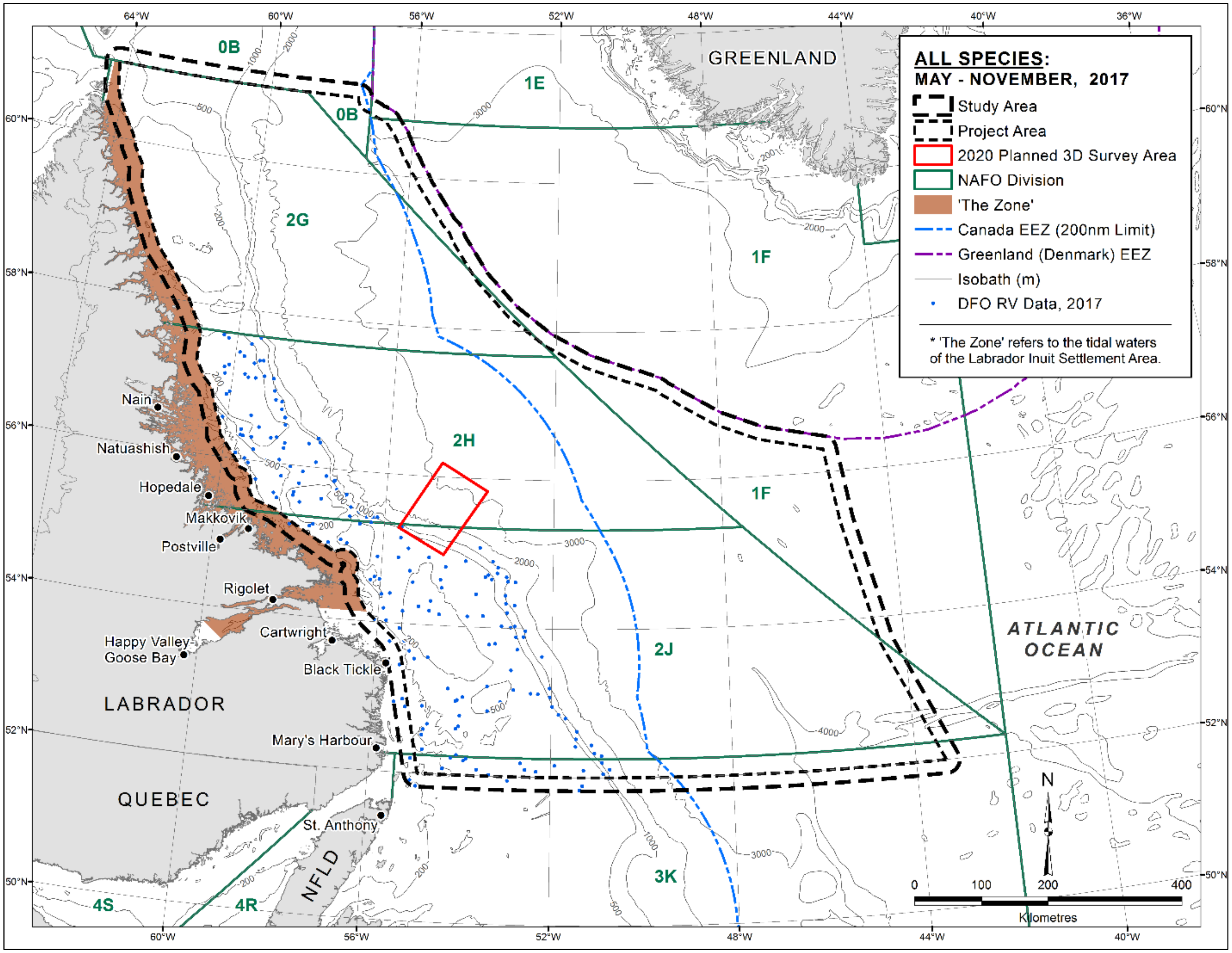


Figure 4.24. Distribution of DFO RV survey catch locations, all species, May–November 2017 (derived from DFO RV survey database, 2017).

Table 4.4 Catch weights and numbers of macroinvertebrates and fishes collected during DFO RV surveys in the Torngat survey area, May–November 2015–2017 (derived from DFO RV survey databases, 2015–2017).

Species	Catch Weight (mt)			Total Catch Weight (mt)	Catch Number			Total Catch Number
	2015	2016	2017		2015	2016	2017	
Deepwater Redfish (*Sebastes mentella*)	<0.1	0.2	0.1	**0.2**	18	455	118	**591**
Greenland Halibut	0.2	<0.1	<0.1	**0.2**	127	47	31	**205**
Jellyfish (Scyphozoa)	0.1	<0.1	<0.1	**0.1**	n/d	n/d	n/d	**n/d**
Roundnose Grenadier (*Coryphaenoides rupestris*)	<0.1	<0.1	<0.1	**0.1**	137	15	599	**751**
Atlantic Cod	0	0.1	0	**0.1**	0	50	0	**50**
Roughhead Grenadier (*Macrourus berglax*)	<0.1	<0.1	<0.1	**0.1**	155	54	35	**244**
Northern Wolffish (*Anarhichas denticulatus*)	<0.1	<0.1	<0.1	**0.1**	2	4	3	**9**
Sponge (Porifera)	<0.1	<0.1	<0.1	**<0.1**	n/d	n/d	n/d	**n/d**
Spinytail Skate (*Raja spinicauda*)	<0.1	0	0	**<0.1**	1	0	0	**1**
Black Dogfish (*Centroscyllium fabricii*)	<0.1	0	0	**<0.1**	12	0	0	**12**
Deepsea Cat Shark (*Apristurus profundorum*)	<0.1	0	0	**<0.1**	4	0	0	**4**
Northern Shrimp	<0.1	<0.1	0	**<0.1**	12	660	0	**672**
Octopus (Octopoda)	<0.1	0	0	**<0.1**	5	0	0	**5**
Sea Anemone (Actinaria)	<0.1	<0.1	<0.1	**<0.1**	8	51	30	**89**
American Plaice (*Hippoglossoides platessoides*)	0	<0.1	0	**<0.1**	0	15	0	**15**
Shrimp (*Acanthephyra pelagica*)	<0.1	<0.1	0	**<0.1**	337	5	0	**342**
Witch Flounder (*Glyptocephalus cynoglossus*)	0	<0.1	0	**<0.1**	0	3	0	**3**
Malacostracan (*Munidopsis curvirostra*)	<0.1	<0.1	<0.1	**<0.1**	14	120	10	**144**
White Hake (*Urophycis tenuis*)	0	0	<0.1	**<0.1**	0	0	1	**1**
Shrimp (*Sabinea sarsi*)	<0.1	<0.1	<0.1	**<0.1**	17	135	10	**162**
Total	**0.4**	**0.3**	**0.2**	**0.2**	**849**	**1,614**	**837**	**3,300**

Note: n/d denotes data unavailable

Table 4.5. Mean catch depths of macroinvertebrates and fishes collected during DFO RV surveys in the Torngat survey area, May–November 2015–2017 (derived from DFO RV survey databases, 2015–2017).

Species	Spring Mean Catch Depth (m) [a]				Fall Mean Catch Depth (m) [b]			
	2015	2016	2017	Total	2015	2016	2017	Total
Deepwater Redfish	-	-	-	**-**	622	446	576	**548**
Greenland Halibut	-	-	-	**-**	913	446	576	**712**
Jellyfish (Scyphozoa)	-	-	-	**-**	913	446	576	**712**
Roundnose Grenadier	-	-	-	**-**	913	561	576	**741**
Atlantic Cod	-	-	-	**-**	-	446	-	**446**
Roughhead Grenadier	-	-	-	**-**	913	446	576	**712**
Northern Wolffish	-	-	-	**-**	622	561	576	**586**
Sponge (Porifera)	-	-	-	**-**	913	446	576	**712**
Spinytail Skate	-	-	-	**-**	784	-	-	**784**
Black Dogfish	-	-	-	**-**	703	-	-	**703**
Deepsea Cat Shark	-	-	-	**-**	1,122	-	-	**1,122**
Northern Shrimp	-	-	-	**-**	622	422	-	**522**
Octopus (Octopoda)	-	-	-	**-**	887	-	-	**887**
Sea Anemone (Actinaria)	-	-	-	**-**	968	446	576	**739**
American Plaice	-	-	-	**-**	-	446	-	**446**
Shrimp (*Acanthephyra pelagica*)	-	-	-	**-**	913	561	-	**795**
Witch Flounder	-	-	-	**-**	-	561	-	**561**
Malacostracan	-	-	-	**-**	703	561	576	**636**
White Hake	-	-	-	**-**	-	-	576	**576**
Shrimp	-	-	-	**-**	703	446	576	**607**
Total	**-**	**-**	**-**	**-**	**867**	**462**	**576**	**693**

Note:

[a] No surveys occurred within the Study Area during spring 2015–2017.

[b] Fall survey months: 2015 = May−November; 2016 = November; 2017 = October.

Table 4.6. Total catch weights and predominant species caught at various mean catch depth ranges during DFO RV surveys in the Torngat survey area, May–November 2015–2017 (derived from DFO RV survey database, 2015–2017).

Mean Catch Depth Range (m)	Total Catch Weight (mt)			Predominant Species (% of Total Catch Weight)		
	2015	2016	2017	2015	2016	2017
<100	-	-	-	-	-	-
100–199	-	-	-	-	-	-
200–299	-	-	-	-	-	-
300–399	-	<0.1	-	-	Shrimp (*L. polaris*; 38%) Green Sea Urchin (25%) Brittle Star (*O. sarsi*; 13%)	-
400–499	-	0.3	-	-	Deepwater Redfish (60%) Atlantic Cod (20%) Greenland Halibut (6%)	-
500–599	-	<0.1	0.2	-	Northern Wolffish (88%) Witch Flounder (5%)	Deepwater Redfish (40%) Roundnose Grenadier (29%) Greenland Halibut (10%)
600–699	<0.1	-	-	Deepwater Redfish (60%) Northern Wolffish (39%)	-	-
700–799	<0.1	-	-	Spinytail Skate (60%) Black Dogfish (39%)	-	-
800–899	<0.1	-	-	Octopus (Octopoda; 98%) Corals (1%)	-	-
900–999	0.3	-	-	Greenland Halibut (46%) Jellyfish (26%) Sponges (12%)	-	-
≥1,000	<0.1	-	-	Deepsea Cat Shark (92%) Sea Star (*Paraniomorpha hispida*; 2%)	-	-

The tentative schedule for the 2020 DFO multispecies RV surveys is presented in Table 4.7. No DFO RV surveys are scheduled to occur within the Study Area during spring 2020. Fall RV within the Study Area will begin early October and end in late December. The DFO RV Capelin survey will occur in Div. 3K during mid spring, which may overlap the southern portion of the Study Area.

Table 4.7. Tentative schedule of DFO RV surveys within the Study Area during 2020.

NAFO Division	Start Date	End Date	Vessel
NL Spring/Fall RV Surveys			
2H	9 Oct	20 Oct	*Teleost*
2HJ	21 Oct	3 Nov	*Teleost*
2J	4 Nov	17 Nov	*Teleost*
3K	4 Nov	17 Nov	*Needler*
3K	18 Nov	1 Dec	*Teleost*
3K	2 Dec	18 Dec	*Teleost*
Other DFO RV Surveys			
3K	28 Apr	19 May	*Teleost* (Capelin Survey)

Source: L. Mello, Stock Assessment Biologist, Marine Fish Species at Risk and Fisheries Sampling, Northwest Atlantic Fisheries Centre, DFO, pers. comm., 17 March 2020.

4.2.5.2 Industry and DFO Science Surveys

The DFO-Industry collaborative post-season snow crab trap survey is described in Section 4.3.9 *in* LGL (2018) and Section 4.2.5.2 *in* LGL (2019b). The 2020 snow crab TAC for this survey has not yet been released by DFO, but it remained steady at 400 mt during 2018 and 2019 (DFO 2020a). A total of 87 survey stations occur within the Study Area. No survey stations occur within the Torngat survey area (Figure 4.25). As noted in the 2019 EA Update (LGL 2019b), survey stations within the Study Area will be randomly sampled each year.

4.3 Marine-Associated Birds

Since the EA, there is no new nesting colony information or density estimates for seabirds in the Study Area. Several seabird colony surveys are currently scheduled for 2020, but it is uncertain whether they will be conducted due to the ongoing COVID-19 situation (S. Wilhelm, Wildlife Biologist, ECCC-CWS, pers. comm., 30 March 2020).

4.4 Marine Mammals and Sea Turtles

The new information presented in this section does not change the effects predictions for the Marine Mammal and Sea Turtle VEC made in the EA (LGL 2018) or its Addendum (LGL 2019a).

4.4.1 General Cetacean and Sea Turtle Surveys

A large database of cetacean and sea turtle sightings in NL waters has been compiled from various sources by DFO in St. John's, and was made available during preparation of the EA (LGL 2018) for the purposes of describing species sightings within the Study Area. There have been no updates to that database since preparation of the original EA.

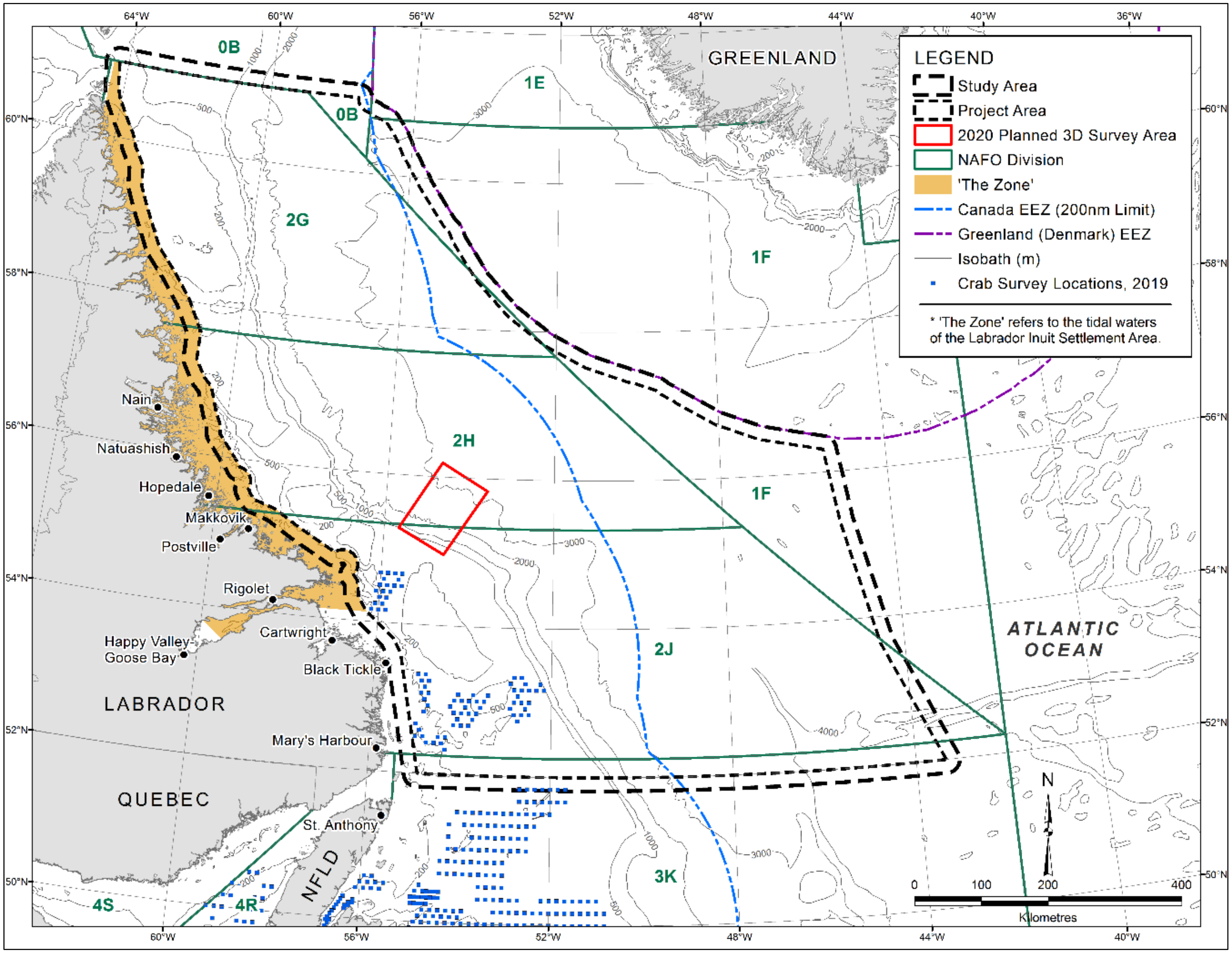


Figure 4.25. Locations of DFO-Industry collaborative post-season snow crab trap survey stations in relation to the Torngat survey area.

Although the DFO sightings database likely includes data from the mid-Labrador marine megafauna visual and acoustic study conducted by DFO during 2013 and 2014 within the Canadian Exclusive Economic Zone (EEZ) between Nain and Cartwright (Lawson et al. 2017), the data in that report is briefly summarized here as it was not directly cited in the original EA (LGL 2018) or subsequent update (LGL 2019b). During the fall DFO vessel and aerial surveys which occurred within the Study Area, the most frequently sighted marine mammal was the white-beaked dolphin (*Lagenorhynchus albirostris*), but minke (*Balaenoptera acutorostrata acutorostrata*), fin (*B. physalus*), humpback (*Megaptera novaeangliae*), northern bottlenose (*Hyperoodon ampullatus*), Sowerby's beaked (*Mesoplodon bidens*), and long-finned pilot whales (*Globicephala melas*), Risso's dolphins (*Grampus griseus*), and harbour porpoise (*Phocoena phocoena*) were also seen; white-beaked dolphin, Risso's dolphin, and long-finned pilot whale sightings were made within the Torngat 3D Extension 2020 survey area. During acoustic monitoring off Labrador, blue (*B. musculus*), sei (*B. borealis*), fin, humpback, sperm (*Physeter macrocephalus*), killer (*Orcinus orca*), and pilot whales were detected. Bearded (*Erignathus barbatus*) and harp (*Pagophilus groenlandicus*) seals were also sighted during fall and detected acoustically during fall and winter.

Habitat suitability modeling found highly suitable summer habitat for sperm, northern bottlenose, sei, and pilot whales in offshore areas off Labrador, and highly suitable summer habitat for minke whale and harbour porpoise off northern Labrador (Lawson et al. 2017). There appears to be moderate to highly suitable habitat for killer whale and white-beaked dolphin throughout the region during the summer. During the fall, there is highly suitable habitat for fin, humpback, and minke whales on the Labrador Shelf.

During summer 2016, aerial surveys of the Atlantic Canadian shelf and shelf break habitats from northern Labrador to southern Nova Scotia were flown, known as the Northwest Atlantic International Sightings Survey (NAISS) (NAMMCO 2018). A total of 1,073 sightings of 10,956 individuals were made in NL waters. Off Labrador, baleen whale sightings included fin, humpback, and minke whales (Lawson and Gosselin 2018 *in* Moore et al. 2019). The most common cetacean was the white-beaked dolphin. The data from this study have not yet been published.

Coté et al. (2019) reported on the biophysical and ecological characteristics of the Labrador Sea Frontier Area (LSFA), an area that covers 150,000 km^2 extending from the shelf/edge slope where water depths are >2,000 m to the edge of the Canadian EEZ. The LSFA includes the central part of the Study Area, including the Torngat survey area. They noted that the long-finned pilot whale was the most common cetacean in the LSFA. Other species that have been sighted in the LSFA include fin, sei, minke, humpback, blue, sperm, killer, and northern bottlenose whales; harbour porpoise; and white-beaked, Atlantic white-sided (*Lagenorhynchus acutus*), common (*Delphinus delphis*), and Risso's dolphins. The waters along the coast are migratory and overwintering areas for beluga whales (*Delphinapterus leucas*) from the eastern Hudson Bay population (Seiden 2016 *in* Coté et al. 2019).

4.4.2 Updated Species Information

4.4.2.1 Bowhead Whale

Bowhead whales (*Balaena mysticetus*) occur at higher latitudes during spring and summer, and at lower latitudes during fall and winter; these seasonal movements are associated with sea-ice retreat and increasing sea surface temperatures (Chambault et al. 2018). Whales that were satellite-tagged in Disko Bay, Greenland from 2001−2011 traveled to the waters off the northwestern Study Area off northern Labrador; none of the whales tagged in Foxe Basin and Cumberland Sound traveled to the Study Area.

4.4.2.2 Sei Whale

COSEWIC (2019a) released an assessment and status report on the sei whale in 2019; the population size is thought to be a few hundred animals. COSEWIC (2019a) summarized records off Labrador, including acoustic and visual detections in the Torngat survey area. Most detections were made in the southwestern Study Area, with only a few records reported north of 56°N.

4.4.2.3 Fin Whale

COSEWIC (2019b) released an assessment and status report on the fin whale in 2019; the population size in 2016 was estimated at 1,664 based on NAISS. Two sightings were made off Labrador during NAISS — one off southern and one off northern Labrador (COSEWIC 2019b).

4.4.2.4 Northern Bottlenose Whale

Overall, northern bottlenose whales show low genetic diversity (Feyrer et al. 2019). Based on genetic studies, the Scotian Shelf population is distinct from all others in the Atlantic (Feyrer et al. 2019). Although there is some genetic uncertainty, individuals that have been sampled off Newfoundland in the Flemish Cap/Pass region do not appear to be a distinct population or part of the Scotian Shelf population. Newfoundland waters may be an area of mixing, as some of these individuals appear to group genetically with those from northern Labrador and one animal was grouped with the Scotian Shelf population. The Davis Strait-Baffin Bay-Labrador Sea population did not show genetic distinction from other populations in the North Atlantic.

4.4.2.5 Sowerby's Beaked Whale

COSEWIC (2019c) released an assessment and status report on Sowerby's beaked whale in 2019. The report summarized detections off Labrador, including visual sightings near the Torngat survey area, and acoustic detections at the shelf edge just south of the Study Area.

4.4.2.6 Killer Whale

Jourdain et al. (2019) reviewed the current knowledge and threats for North Atlantic killer whales. They noted an urgent need for information on the abundance and population structure in eastern Canada. Based on North Atlantic Sighting Surveys in 2001, the abundance in the North Atlantic was estimated at 15,014 killer whales. Killer whales that were outfitted with satellite tracking devices off northern Baffin Island during summer 2009 and 2013 travelled southward and arrived in the waters off Labrador during October (Lefort et al. 2020), passing through the Study Area. Lefort et al. (2020) reported other sightings along the coast of Labrador, including in the northwestern portion of the Study Area. The Northwest Atlantic/Eastern Arctic population is currently under consideration for addition to Schedule 1 of SARA.

4.4.2.7 Polar Bear

The Davis Strait polar bear (*Ursus maritimus*) population, which occurs from Davis Strait through the Labrador Sea, appears to be increasing (Crockford 2018). Yurkowski et al. (2019) noted that there is a winter-spring hotspot for polar bears in western Davis Strait and Labrador Sea. Several individuals occurred along the coast of Labrador during winter/spring of 2017 and 2018 (Crockford 2018). Laidre et al. (2018) noted that there has been range contraction of polar bears in Baffin Bay over a 25-year period that experienced sea-ice loss. They reported that in the 1990s, some polar bears collared in Baffin Bay traveled to areas off northern Labrador during winter and spring, but none were reported to have done so in the 2000s.

4.4.2.8 Harp Seal

In 2017, 96% of harp seals pups (714,600) were born off the northeastern coast of Newfoundland (Front), an additional 18,300 pups were born in the southern Gulf of St. Lawrence, and another 13,600 pups were born in the northern Gulf of St. Lawrence, totaling 746,500 pups (DFO 2020e). The modeled pup production estimate for 2019 was 1.4 million, with a total population size of 7.6 million (DFO 2020e).

4.4.2.9 Leatherback Turtle

An Action Plan was finalized for the Atlantic leatherback turtle (*Dermochelys coriacea*) by DFO (2020f). The peak occurrence of leatherback turtles in Atlantic Canada appears to be in July, with leatherback seasonality corresponding to that of their jellyfish prey (Nordstrom et al. 2019). Mosnier et al. (2019) reported records for waters off Nova Scotia and Newfoundland, including adjacent to the Study Area along the coast of southwestern Labrador in August. However, most sightings occurred on the shelf off southern and eastern Newfoundland, as well as on the Scotian Shelf. A generalized additive model showed that their distribution in eastern Canadian waters was related with environmental characteristics, with turtle occurrence increasing when sea surface temperatures are >15°C, over flat bottoms, and in areas with low primary productivity; sea surface height was also correlated to turtle occurrence.

4.5 Species at Risk

The new information presented in this section does not change the effects predictions made in the EA (LGL 2018).

Updated species at risk that could potentially occur in the Study Area are provided in this section, based on available information on the *Species at Risk Act* (SARA) and COSEWIC websites as of April 2020. Changes in species status since the preparation of the EA (LGL 2018), its Addendum (LGL 2019a), and 2019 Update (LGL 2019b) are described below and noted in bold font in Table 4.8.

Table 4.8. SARA-listed and COSEWIC-assessed marine species that potentially occur in the Study Area.

Common Name	Scientific Name	SARA [a]			COSEWIC [a,b]		
		E	T	SC	E	T	SC
MARINE FISH							
Northern Wolffish	*Anarhichas denticulatus*		S1			X	
Spotted Wolffish	*Anarhichas minor*		S1			X	
Atlantic Wolffish	*Anarhichas lupus*			S1			X
~~Atlantic Cod~~	*Gadus morhua*			**~~S3~~**			
Atlantic Cod Newfoundland and Labrador population	*Gadus morhua*				X		
Cusk	*Brosme*				X		
Deepwater Redfish Northern population	*Sebastes mentella*					X	
Atlantic Bluefin Tuna	*Thunnus thynnus*				X		
Porbeagle Shark	*Lamna nasus*				X		
Roundnose Grenadier	*Coryphaenoides rupestris*				X		
Smooth Skate Funk Island Deep population	*Malacoraja senta*				X		
Winter Skate Eastern Scotian Shelf-Newfoundland population	*Leucoraja ocellata*				X		
Acadian Redfish Atlantic population	*Sebastes fasciatus*					X	
American Plaice Newfoundland and Labrador population	*Hippoglossoides platessoides*					X	
Lumpfish	*Cyclopterus lumpus*					X	
White Hake Atlantic and Northern Gulf of St. Lawrence population	*Urophycis tenuis*					X	
Atlantic Sturgeon St. Lawrence populations	*Acipenser oxyrinchus*					X	
American Eel	*Anguilla rostrata*					X	
Atlantic Salmon South Newfoundland population	*Salmo salar*					X	
Quebec Eastern North Shore population	*Salmo salar*						X

Common Name	Scientific Name	SARA [a]			COSEWIC [a,b]		
		E	T	SC	E	T	SC
Quebec Western North Shore population							X
Anticosti Island population					X		
Inner St. Lawrence population							X
Gaspe-Southern Gulf of St. Lawrence population							X
Eastern Cape Breton population					X		
Nova Scotia Southern Upland population					X		
Outer Bay of Fundy population					X		
Basking Shark Atlantic population	*Cetorhinus maximus*						X
Shortfin Mako Shark Atlantic population	***Isurus oxyrinchus***				**X**		~~X~~
Spiny Dogfish Atlantic population	*Squalus acanthias*						X
Thorny Skate	*Amblyraja radiata*						X
MARINE-ASSOCIATED BIRDS							
Ivory Gull	*Pagophila eburnea*	S1			X		
Red Knot *rufa* spp.	*Calidris canutus rufa*	S1			X		
Eskimo Curlew	*Numenius borealis*	S1			X		
Ross's Gull	*Rhodostethia rosea*		S1			X	
Harlequin Duck Eastern population	*Histrionicus histrionicus*			S1			X
Barrow's Goldeneye Eastern population	*Bucephala islandica*			S1			X
Buff-breasted Sandpiper	*Tryngites subruficollis*			S1			X
Red-necked Phalarope	***Phalaropus lobatus***			**S1**			**X**
MARINE MAMMALS							
Blue Whale Atlantic population	*Balaenoptera musculus*	S1			X		
Beluga Whale St. Lawrence Estuary population	*Delphinapterus leucas*	S1			X		
Cumberland Sound population			S1			X	
Eastern Hudson Bay population					X		
Ungava Bay population					X		
Eastern High Arctic-Baffin Bay population							X
Western Hudson Bay							X
Harbour Porpoise Northwest Atlantic population	*Phocoena phocoena*		S2				X
Fin Whale Atlantic population	*Balaenoptera physalus*			S1			X
Sei Whale Atlantic population	*Balaenoptera borealis*				X		
~~**Humpback Whale Western North Atlantic population**~~	~~***Megaptera novaeangliae***~~			~~**S3**~~			
Sowerby's Beaked Whale	*Mesoplodon bidens*			S1			X
Polar Bear	*Ursus maritimus*			S1			X
Northern Bottlenose Whale Davis Strait-Baffin Bay-Labrador Sea population	*Hyperoodon ampullatus*						X
Killer Whale Northwest Atlantic/ Eastern Arctic population	*Orcinus orca*						X
Bowhead Whale Eastern Canada-West Greenland population	*Balaena mysticetus*						X

Common Name	Scientific Name	SARA [a]			COSEWIC [a,b]		
		E	T	SC	E	T	SC
Atlantic Walrus Central/Low Arctic population	*Odobenus rosmarus rosmarus*						X
Ringed Seal	***Pusa hispida***						**X**
SEA TURTLES							
Leatherback Sea Turtle Atlantic population	*Dermochelys coriacea*	S1			X		
Loggerhead Sea Turtle	*Caretta caretta*	S1			X		

Note:
E = Endangered; T = Threatened; SC = Special Concern; S = Schedule.
[a] SARA website (https://www.canada.ca/en/environment-climate-change/services/species-risk-public-registry.html) accessed April 2020.
[b] COSWEIC website (http://cosewic.ca/index.php/en-ca/) accessed April 2020.

The Atlantic cod designated unit (DU) and western North Atlantic population of humpback whale were removed (indicated by strikethrough text in Table 4.8). They were originally listed as *special concern* under Schedule 3 of SARA but have since been deactivated. They have no designation under COSEWIC.

The Atlantic population of shortfin mako shark was reassessed from *special concern* to *endangered* by COSEWIC. It has no status under SARA.

Red-necked Phalarope was listed as *special concern* under SARA. Its designation as *special concern* under COSEWIC remains unchanged.

Ringed seal was added. It is listed as *special concern* under COSEWIC and has no designation under SARA. Ringed seal is described in Table 4.16 and Sections 4.5.1.4 and 5.7.7.1 *in* LGL (2018) and Section 4.9.3.6 *in* C-NLOPB (2008).

The Eastern Canada-West Greenland population of bowhead whale and the Central/Low Arctic population of Atlantic walrus are currently under consideration for addition to Schedule 1 of SARA.

The following recovery strategies, action plans and management plans have become available since the last EA Update (LGL 2019b):

- Recovery Strategy (final) for northern and spotted wolffishes (DFO 2020c);
- Action Plan (final) for northern and spotted wolffishes (DFO 2020d);
- Action Plan (final) for leatherback sea turtle, Atlantic population (DFO 2020f); and
- Management Plan (final) for Atlantic wolffish (DFO 2020c).

4.6 Sensitive Areas

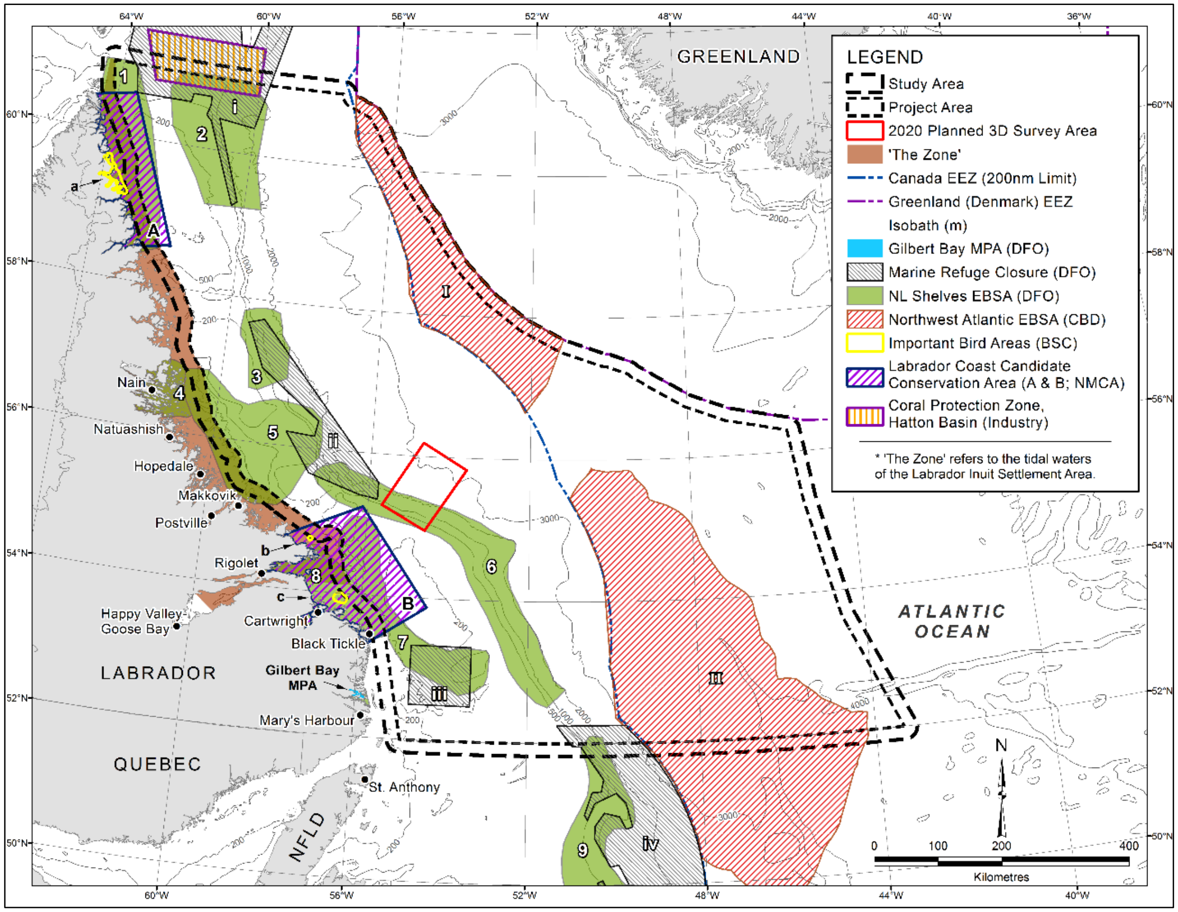
Sensitive areas within the Study Area are described in Section 4.11 *in* C-NLOPB (2008), Section 4.6 *in* LGL (2015), Section 4.7 *in* LGL (2014, 2016, 2018), and Section 4.6 *in* LGL (2019b). The information presented in this section does not change the effects predictions made in the EA (LGL 2018). Sensitive areas that overlap or are adjacent to the Study Area and planned Torngat 3D survey area are shown in Figure 4.26 and Figure 4.27 (below) and listed in Table 4.9.

4.6.1 New Sensitive Areas

DFO Significant Benthic Areas (SBAs) are "significant areas of cold-water corals and sponge dominated communities" (Kenchington et al. 2018a). DFO recently updated kernel density analyses and produced predictive coral and sponge hotspot distribution maps in eastern Canada to identify SBAs (Kenchington et al. 2018a,b). The resultant SBAs were developed for taxa considered by NAFO to be VME indicators, including large and small gorgonian corals (Alcyonacea), sea pens (Pennatulacea), and sponges (Porifera) (Kenchington et al. 2018a). SBAs do not receive legal protection but may serve as indicators for the designation of future special areas. A sponge SBA overlaps the southern portion of the Torngat survey area (Figure 4.27). SBAs for sponges, large and small gorgonians, and sea pens mainly occur in water depths ~500−2,000 m in the western portion of the Study Area. Some SBAs for large gorgonians, sea pens, and sponges also occur near the western boundary of the Project Area.

4.6.2 Critical Habitat

The 2019 EA Update indicated that critical habitats were proposed for northern and spotted wolffishes (DFO 2018e *in* LGL 2019b). The critical habitats were since finalized in an updated Recovery Strategy (DFO 2020c) and there were no changes in the final and proposed boundaries or habitat descriptions (see Section 4.6 and Figure 4.32 *in* LGL 2019b). The critical habitat for northern and spotted wolffishes on the NL Shelves is vulnerable to activities that would alter the habitat's thermal properties or cause habitat destruction, particularly a change in depth (DFO 2020c). Critical habitat for spotted wolffish overlaps the southern boundary of the Torngat survey area, and for northern wolffish overlaps the southern portion of the Torngat survey area (Figure 4.27). Project activities within the Project Area are not anticipated to affect bottom temperature within or otherwise cause destruction to the critical habitats.



Source: Wells et al. (2017); FLR (2019); Birds Canada (2020); CBD (2020); DFO (2020g,h); MCI (2020); C. Pierce, Ecosystem Geomatics Technician, Protected Areas Establishment Branch, Parks Canada, pers. comm., 18 March 2020. Protected Planet (2020).

Note:

NL (Bioregion) EBSA: 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.

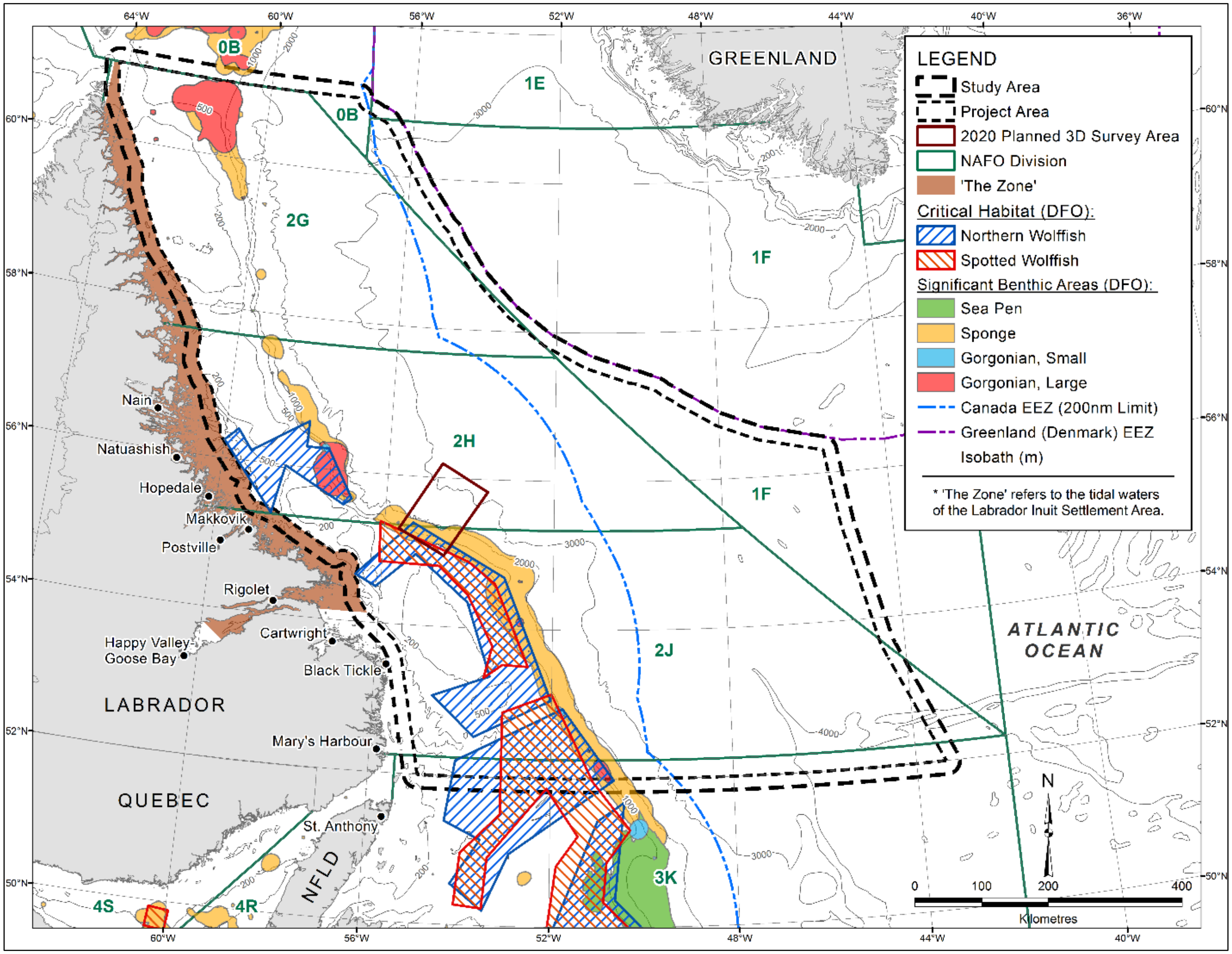
CBD EBSA: I = Labrador Sea Deep Convection Area; II = Seabird Foraging Zone in the Labrador Sea.

NMCA: A = Labrador Coast A; B = Labrador Coast B.

Marine Refuge: i = Hatton Basin Conservation Area; ii = Hopedale Saddle Closure; iii = Northeast Newfoundland Slope Closure; iv = Hawke Channel Closure.

Important Bird Areas (IBAs): a = Seven Islands Bay; b = Quaker Hat Island; c = Gannet Islands.

Figure 4.26. Sensitive areas that overlap or are adjacent to the Study Area.



Source: Kenchington (2018a,b); DFO (2020c).

Figure 4.27. Finalized northern and spotted wolffish critical habitats, and Significant Benthic Areas (SBAs).

Table 4.9. Sensitive areas that overlap or are adjacent to the Study Area (items marked with an Asterix [*] are newly added or have been revised since the EA, its Addendum [LGL 2018, 2019a], or the 2019 EA Update [LGL 2019b]).

Governing Body	Area Type	Area Name
DFO	Marine Protected Area	Gilbert Bay
	Significant Benthic Area (SBA)*	Large Gorgonians Small Gorgonians Sea Pens Sponges
	Marine Refuge (Fishery Exclusion Area)	Hatton Basin Conservation Area Hopedale Saddle Closure Northeast Newfoundland Slope Closure Hawke Channel Closure
	NL Shelves Bioregion Ecologically and Biologically Significant Area (EBSA)	Northern Labrador Outer Shelf Saglek Bank Outer Shelf Nain Bank Nain Area Hopedale Saddle Labrador Slope Labrador Marginal Trough Hamilton Inlet Orphan Spur
Convention on Biological Diversity (CBD)	EBSA	Labrador Sea Deep Convection Area Seabird Foraging Zone in the Southern Labrador Sea
Fishing Industry	Voluntary Fishery Closure Area	Coral Protection Zone, Hatton Basin
Government of Canada Government of NL Nunatsiavut Government	Fishery conservation and management area	"The Zone"
Parks Canada	Candidate National Marine Conservation Area (NMCA)	Labrador Coast A Labrador Coast B
Birds Canada	Important Bird Area (IBA)	Seven Islands Bay Quaker Hat Island Gannet Islands
Government of NL	Ecological Reserve	Gannet Islands [a]

[a] within Gannet Islands IBA.

5.0 Consultations

A newsletter describing the seismic activities proposed for 2020 was distributed during April 2020 to the same stakeholders/groups consulted by MKI in previous years for seismic surveys offshore Labrador. The newsletter and details of those consulted by MKI are presented in Appendices A and B, respectively. Video Conference (VC) meetings were held with the key Newfoundland stakeholders (FFAW, One Ocean & Ocean Choice International) and representatives from the Nunatsiavut Government (NG), the Torngat Fish Producers Co-operative, the Torngat Secretariat (TS), and the Nunatukavut Community Council (NCC) in May and June 2020. In all these meetings, MKI presented the 2020 seismic activity areas in relation to the fishing activity, timelines associated with the programs and a clear communication plan.

During the meeting with the NG representatives, no specific concerns were raised. The discussions centered on mammal detection with PAM and MKI's mitigating actions. In the event of a PAM detection within the safety zone, MKI will shut down the operation or delay ramp up as needed (see Section 6.0). A map with the planned acquisition lines was requested to be sent during the meeting. MKI later provided a map of the survey area along with shape files of the planned acquisition lines.

The Torngat Fish Producers Co-operative indicated that their snow crab fishing activity is planned for July 2020, in a similar time frame as MKI's activity. MKI indicated that closest snow crab fishing area is 45 km inshore from the planned seismic activity area and there are no major concerns. The Torngat Fish Producers Co-operative requested MKI to start the seismic activity in the southern part of the planned area and move up North. MKI will accommodate this request if possible.

The TS representative indicated that there was planned crab fishing late June/early July 2020 and a post-season survey scheduled for the last week of August 2020. MKI indicated that the fishing activity is farther inshore and is 45 km away from MKI's seismic activity area presenting no major concerns. The TS representative requested MKI to present the planned activity to the TS Board closer to third week or end of June 2020.

No major concerns were noted by the members of the NCC after a presentation from MKI on the planned seismic activity. A NCC member indicated that turbot is an expanding fishery in the area and MKI should note this for planning of future seismic activities.

6.0 Environmental Assessment

This section presents a summary of mitigation measures that will be employed by MKI during its 2020 seismic program. Additionally, it provides new and relevant literature for the effects assessment of Project activities on the following VECs: Fish and Fish Habitat, Marine-Associated Birds, and Marine Mammals and Sea Turtles.

6.1 Mitigation Measures

The mitigation measures described in the EA and EA Addendum (LGL 2018, 2019a) remain applicable to MKI's 3D seismic survey activities planned for 2020. 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 Section 5.1.4.1 of the C-NLOPB's *Geophysical, Geological, Environmental and Geotechnical Program Guidelines* (C-NLOPB 2019).

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

VEC, Potential Effects	Primary Mitigations	Status (11 June 2020)
Fisheries VEC: Interference with fishing vessels/mobile and fixed gear fisheries	• Pre-survey communications, liaison and planning to avoid fishing activity • Continuing communications throughout the program • FLOs • SPOC • Advisories and communications • VMS data • Avoidance of actively fished areas • Start-up meetings on ships that discuss fishing activity and communication protocol with fishers	• Upfront planning with Torngat Fish Producers Co-operative, FFAW, OCI • Daily communications and weekly meetings when project commences • Contract in place • Contract in place • Planned upon commencement • Planned upon commencement • Confirmed • To be addressed as part of survey start-up meeting
Fisheries VEC: Fishing gear damage	• Pre-survey communications, liaison and planning to avoid fishing gear • Use of escort vessel • SPOC • Advisories and communications • FLOs • Compensation program • Reporting and documentation • Start-up meetings on ships that discuss fishing activity, communication protocol with fishers, and protocol in the event of fishing gear damage	• Upfront planning with Torngat Fish Producers Co-operative, FFAW, OCI & OCI • Contracts in place • Contract in place • Planned upon commencement • Contract in place • In place • Upon commencement of program • To be addressed as part of survey start-up meeting
Interference with shipping [a]	• Advisories and at-sea communications • FLOs (fishing vessels) • Use of escort vessel • SPOC (fishing vessels) • VMS data	• Planned upon commencement • Contract in place • Contracts in place • Contract in place • Planned upon commencement
Fisheries VEC: Interference with DFO/FFAW research program and Torngat Secretariat Snow Crab Survey	• Communications and scheduling • DFO does not indicate an official spatial and/or temporal buffer mitigation method for seismic operations in the vicinity of survey stations. MKI will work cooperatively with FFAW|Unifor, DFO, and Torngat Secretariat in an effort to avoid survey stations prior to their sampling to the best extent possible.	• Planned upon commencement • Meetings held with FFAW and Torngat Secretariat
Fish and Fish Habitat, Marine Mammal and Sea Turtle, and Marine-associated Bird VECs: Temporary or permanent hearing damage/disturbance to marine animals (marine mammals, sea turtles, seabirds, fish, invertebrates)	• "Pre-watch" (30 minute) of 500 m safety zone using visual and PAM • Delay start-up if any marine mammals or sea turtles are detected within 500 m with visual and PAM • Ramp-up of airguns • Use of experienced, qualified MMSO(s) to monitor for marine mammals and sea turtles during all daylight periods when airguns are in use	• Confirmed • Confirmed • Confirmed • Confirmed
Species at Risk and Sensitive Areas VEC: Temporary or permanent hearing damage/ disturbance to Species at Risk or other key habitats	• "Pre-watch" (30 minute) of 500 m safety zone using visual and PAM • Delay start-up if any marine mammals or sea turtles are detected within 500 m with visual and PAM • Ramp-up of airguns • Shutdown of airgun arrays for endangered or threatened marine mammals and sea turtles, as well as beaked whales, detected visually or acoustically within 500 m	• Confirmed • Confirmed • Confirmed • Confirmed

VEC, Potential Effects	Primary Mitigations	Status (11 June 2020)
	• Use of experienced, qualified MMSO(s) to monitor for marine mammals and sea turtles during daylight seismic operations. • PAM will be used during pre-watch and during periods when visibility is <500 m in order to detect cetacean vocalizations • Minimum separation distance of 30 km for simultaneous seismic surveys in the Project Area based on separation distances required in other jurisdictions (see above).	• Confirmed • Confirmed • Confirmed
Marine-associated Bird VEC: Injury (mortality) to stranded seabirds	• Daily search of seismic and support vessels • Implementation of handling and release protocols • Minimize lighting if safe	• Confirmed • Confirmed • Confirmed
Marine-associated Bird VEC: Seabird oiling	• Adherence to MARPOL • Adherence to conditions of ECCC-CWS migratory bird permit • Spill contingency and response plans • Use of solid streamers	• Confirmed • Confirmed • Confirmed • Confirmed

Note:
[a] MKI has contacted Maritime Forces Atlantic (MARLANT) to obtain Director General Naval Strategic Readiness (DGNSR) details to ensure de-confliction with possible Allied submarine activities.

6.2 Fish and Fish Habitat

Recent publications relevant to the effects of airgun sound on the Fish and Fish Habitat VEC have become available since the original EA (LGL 2018) and the 2019 EA Update (LGL 2019b); these studies are summarized below.

A study conducted by Fields et al. (2019) tested whether exposure to pulses from airguns used in seismic surveys would affect mortality, predator escape response, or gene expression in the calanoid copepod species *Calanus finmarchicus*. The study concluded that within 10 m of a seismic pulse, limited effects on copepod mortality or predator escape response were observed, and when exposed to pulses at a distance >10 m, there were no measurable impacts (Fields et al. 2019).

Elliot et al. (2019) suggested that despite current scientific knowledge of the effects of industrial seismic surveys on marine vertebrates, critical data gaps remain. Although scientific studies have been published on the effects on individual organisms and species, little attention has been paid to population-level effects over large temporal and spatial scales. Elliot et al. (2019) suggest that these studies are needed in order to assess the effects of seismic activities on marine megafauna, especially those highly vulnerable to noise.

Slabbekoorn et al. (2019) reviewed published literature on the behavioural and physical response of fish to airgun sound exposure. They concluded that population-level behavioural and physiological stress effects are likely to be most relevant and should therefore be prioritized in research over effects on individuals. Slabbekoorn et al. (2019) determined that there is a strong need for data on the natural patterns of particle motion and pressure variation in fish habitat, as these data are needed to establish statistically significant conclusions. It has also been noted that it is difficult to reach clear conclusions on the extent to which anthropogenic sounds have on animal behavior and physiology due to data gaps (Popper and Hawkins 2019).

A study was conducted by Popper and Hawkins (2018) on the importance of particle motion to fishes and invertebrates, with the goal of ensuring that proper attention is given by scientists and regulators. The results of this study concluded that particle motion is substantially important to the lives of fishes and invertebrates in terms of sound and, to a certain degree, signals emanating from and within the substrate (Popper and Hawkins 2018).

A recent publication by Day et al. (2019) describes a field-based study of the potential physical impacts of exposure to airgun sound on rock lobster. Following exposure to the equivalent of a full-scale commercial seismic survey passing within 100−500 m, lobsters exhibited impaired righting and damage to the sensory hairs of the statocyst which persisted up to 365 days after exposure.

Davidsen et al. (2019) used Atlantic cod and saithe (*Pollachius virens*) to investigate the effects of sound exposure from an airgun on their behavior and physiology in a controlled, short-term (three-day period) field experiment. The heart rates and body temperatures of both species were recorded during experimental exposures (18−60 dB above ambient) in a sea cage (Davidsen et al. 2019). The study concluded that swimming behaviour of both species changed more frequently in response to airgun exposure. The authors concluded that the effects observed during the experiment would likely be limited in duration and would not lead to permanent physiological or behavioural changes (Davidsen et al. 2019).

A meta-analysis to predict the effects of anthropogenic sound on fish reproduction was conducted by de Jong et al. (2020) by reviewing existing literature and available data. These data were used to categorize the effects of sound into three mechanistic classes, stress, masking, and hearing loss, to test which sound types, i.e., continuous vs. intermittent and regular vs. irregular, would likely produce the strongest effects. The study concluded that continuous sounds, such as heavy ship traffic, may have the highest effect on stress, sound masking, and hearing loss, which could negatively affect fish reproduction (de Jong et al. 2020). It was also predicted that stress induced by sound exposure would mainly affect fish species that are not able to relocate or delay spawning, i.e., species that have specific spawning grounds or periods. However, high resiliency was observed in most species during the egg development and parental care stage even if they are unable to relocate away from the sound exposure.

Some species use sound to locate spawning grounds and may engage in acoustic communication during spawning (e.g., gobies, toadfishes, cichlids), so these species would be most affected by sound masking and hearing loss due to sound exposure. However, the severity of the effects would depend on the flexibility of the fish species' signaling capabilities (de Jong et al. 2020).

The new literature presented above does not change the effects assessment for the Fish and Fish Habitat VEC presented in the original EA (LGL 2018).

6.3 Marine-Associated Birds

Recent publications relevant to the effects of airgun sound and oiling on marine-associated birds have become available since the original EA (LGL 2018) and 2019 EA Update (LGL 2019b); these studies are summarized below.

6.3.1 Sound

Gentoo Penguins (*Pygoscelis papua*) under water show responses to a broadband sound (0.2 to 6 kHz) at sound pressure levels of 115 to 120 dB re 1 µPa rms in more than 60% of playbacks (Sørensen et al. 2020). The response is graded, with the response increasing in strength with increasing sound pressure levels. The response is directed away from the source, which suggests that this species may be sensitive to anthropogenic sounds. This new study does not present findings that would change the conclusions of the original EA.

6.3.2 Accidental Releases

There have been several new publications on the effects of oiling on marine birds since the original EA and the 2019 EA Update; the findings of these new studies confirm those from previous studies. External oiling has a significant detrimental effect on intermediate metabolites of energy metabolism, fatty and amino acid profiles, glycine, betaine, serine, and methionine, and hepatic bile acid metabolites (Dorr et al. 2019). However, Ring-billed Gulls (*Larus delawarensis*) externally oiled daily for three days to mimic the US Fish and Wildlife Service's moderate oiling classification, then cleaned and monitored for 31 days post-oiling, did not show significant signs of anemia (Dannemiller et al. 2019). Oiling also increases ketone body production. Polycyclic aromatic hydrocarbons orally dosed in a migratory species can impede lipid transport and metabolism, which can lead to reduced overall fat loads that are essential to staging duration, departure decisions, migratory speed, and flight range (Bianchini and Morrissey 2018).

These newly published studies do not change the conclusions of the effects assessment. The potential of accidental releases of hydrocarbons during the proposed seismic program is considered quite low and the evaporation/dispersion rate of any released hydrocarbons would be high.

6.4 Marine Mammals and Sea Turtles

Recent publications relevant to the effects of airgun sounds on marine mammals that have become available since the original EA (LGL 2018) and 2019 EA Update (LGL 2019b) are summarized below.

The potential effects of sounds from airguns on marine mammals could include masking, disturbance, hearing impairment, and non-auditory physical or physiological effects (e.g., Bröker 2019; Kyhn et al. 2019; Rako-Gospić and Picciulin 2019). Reactions to sound, if any, depend on sound levels and frequencies, exposure duration, state of maturity, experience, current activity, reproductive state, time of day, and many other factors (e.g., Rako-Gospić and Picciulin 2019). Behavioral reactions of marine mammals to sound are difficult to predict in the absence of site- and context-specific data (Ellison et al. 2018), and numerous data gaps remain regarding the consequences of those responses (Elliott et al. 2019). Dunlop et al. (2020) found that airgun sounds, and ship noise in general, reduced social interactions by humpbacks at greater distances than other behavioural changes, and at received sound levels <160 dB re 1 $\mu Pa^2 \cdot s$. As behavioural responses are not consistently associated with received levels, Tyack and Thomas (2019) along with other authors have made recommendations on different approaches to assess behavioural reactions.

Kavanagh et al. (2019) analyzed more than 8,000 hr of cetacean survey data in the northeastern Atlantic Ocean to determine the effects of the seismic surveys on cetaceans. They found that sighting rates of cetaceans was significantly lower during seismic surveys compared with control surveys. Similarly, sightings of toothed whales were lower during active airgun surveys compared with inactive periods during seismic surveys. Kastelein et al. (2019) reported that if disturbance by noise would displace harbour porpoises from a feeding area or otherwise impair foraging ability for a short period of time (e.g., 1 day), they would be able to compensate by increasing their food consumption following the disturbance.

Hastie et al. (2019) noted that the impulsive nature of sound is range-dependent, becoming less harmful (and non-impulsive) for marine mammals with distance from the source. Additionally, as SPLs for impulsive sounds are generally lower just below the water surface, animals (e.g., seals) swimming near the surface are likely to be exposed to lower sound levels than when swimming at depth (Kastelein et al. 2018). However, the underwater sound hearing sensitivity for seals is the same near the surface and at depth (Kastelein et al. 2018).

Recent assessments and status reports for sei, fin, and Sowerby's beaked whales, reported the threat from noise from seismic exploration as medium-low (COSEWIC 2019a,b,c). In the Action Plan for Atlantic leatherback turtles, one of the measures listed therein was to "Reduce leatherback sea turtle exposure to potentially harmful levels of underwater noise…..and evaluate the use of the *Statement of Canadian practice with respect to the mitigation of seismic sound in the marine environment* with respect to leatherback sea turtles" (DFO 2020f).

The new literature presented above does not change the effects assessment for the Marine Mammal and Sea Turtle VEC presented in the original EA (LGL 2018).

6.5 Validity of Significance Determinations

Based on MKI's planned survey activities in 2020 and the new information related to the biological environment and effects literature, the determinations of significance of the residual effects of seismic survey activities on VECs presented in the EA (LGL 2018) and its Addendum (LGL 2019a) remain valid for the seismic survey activities planned by MKI in 2020 offshore Labrador. This includes consideration of cumulative effects; see below.

6.5.1 Cumulative Effects

Section 5.8 of the original EA (LGL 2018) provides an assessment of cumulative effects from other activities in the Regional Area including fisheries, vessel traffic, and other oil and gas exploration and development activities. Additional information and information specific to 2020 activities are summarized below followed by an assessment that considers the combined effects of offshore activities.

6.5.1.1 Fisheries

Fishing activity (commercial, traditional and Indigenous, and recreational) in the Study and Project areas were summarized in the 2019 EA Update (LGL 2019b) and in the Torngat survey area considered in this EA Update, including the most recent commercial fisheries data (from 2017) available. In 2020, it is anticipated that the commercial harvest species, and the timing and locations of commercial fisheries within the Study Area will be similar to previous years. This has also been confirmed during consultations with the fishing industry.

6.5.1.2 Vessel Traffic

Marine transportation within the Study Area is discussed in the Labrador Shelf Strategic Environmental Assessment (SEA) (Section 5.8.1 of C-NLOPB 2008). Vessel traffic relative to the MKI Project Area was also described in subsection 6.5.1.2 of the 2019 EA Update (LGL 2019b).

Accurate assessments of regional marine traffic have been facilitated by the ubiquitous use of AIS transponders by vessels and technological advances in data storage, processing capabilities and online commercial service providers over the past decade. Figures 6.1 and 6.2 show cumulative marine traffic density that transited through the Project Area for calendar years 2016 and 2017, respectively. Source data to generate maritime routes for all vessel traffic was obtained from marine AIS tracking information archived and processed by marinetraffic.com (Marine Traffic 2020). Publicly available density maps are color-coded to indicate concentrated maritime activity/traffic routes. Online visualizations are dynamic and based on unique vessel transits through a variable grid-cell size based on chosen zoom-level of a worldwide interactive map. Figures 6.1 and 6.2 are presented with similar scale for ease of comparison; vessel routes ranging from 1 to >800 per 23 km^2 grid-cell.

Within the MKI Labrador offshore Project Area, marine traffic density is concentrated in the southwestern corner at the confluence of marine routes between the Strait of Belle Isle and the eastern coastline of the Great Northern Peninsula of Newfoundland. Localized concentrations (orange/red clusters; >40 vessel routes per 23 km^2 grid-cell) adhere strongly to commercial catch (0.1 x 0.1 decimal degree) grid data for both 2016 and 2017. Specifically, northern shrimp catch effort at depths between 200 and 500 m in the northern half (i.e., NAFO divisions 2H, 2G, 2G/0B) and southwest corner (2J) of the Project Area; Greenland halibut fishery along the Labrador Shelf (2J); and snow crab fishery locations at the southwestern extent of the Project Area (2J). Overall, shipping traffic levels through the Project Area are considered low, particularly in areas distant from coastal shipping routes. Shipping data from 2016 and 2017 confirm the conclusions made in the Labrador SEA (C-NLOPB 2008). Behavioural responses to periodic ship transits by marine mammals are expected to be short-term and localized. MKI (as well as other seismic operators) take steps to avoid close approach to other vessels. As such, while some animals may receive sound from a seismic program(s) and other vessels offshore Labrador, the current prediction is that no significant residual cumulative effects will result from exposure to underwater sound.

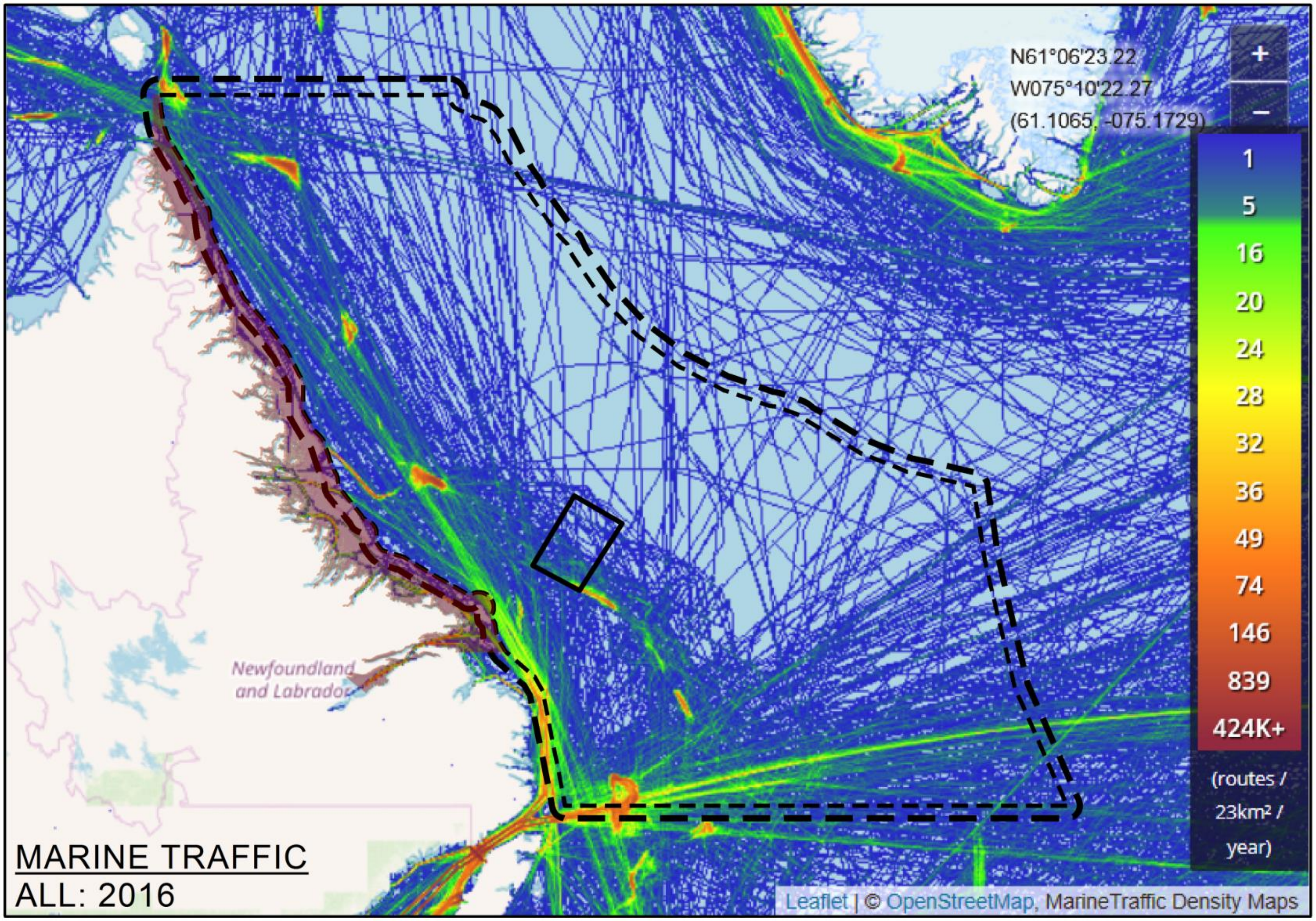


Figure 6.1. Marine shipping traffic density (routes per 23 km^2 grid cell) in 2016 in the MKI Project and Study Areas (depicted with small and large dashed lines, respectively) and the Torngat survey area.

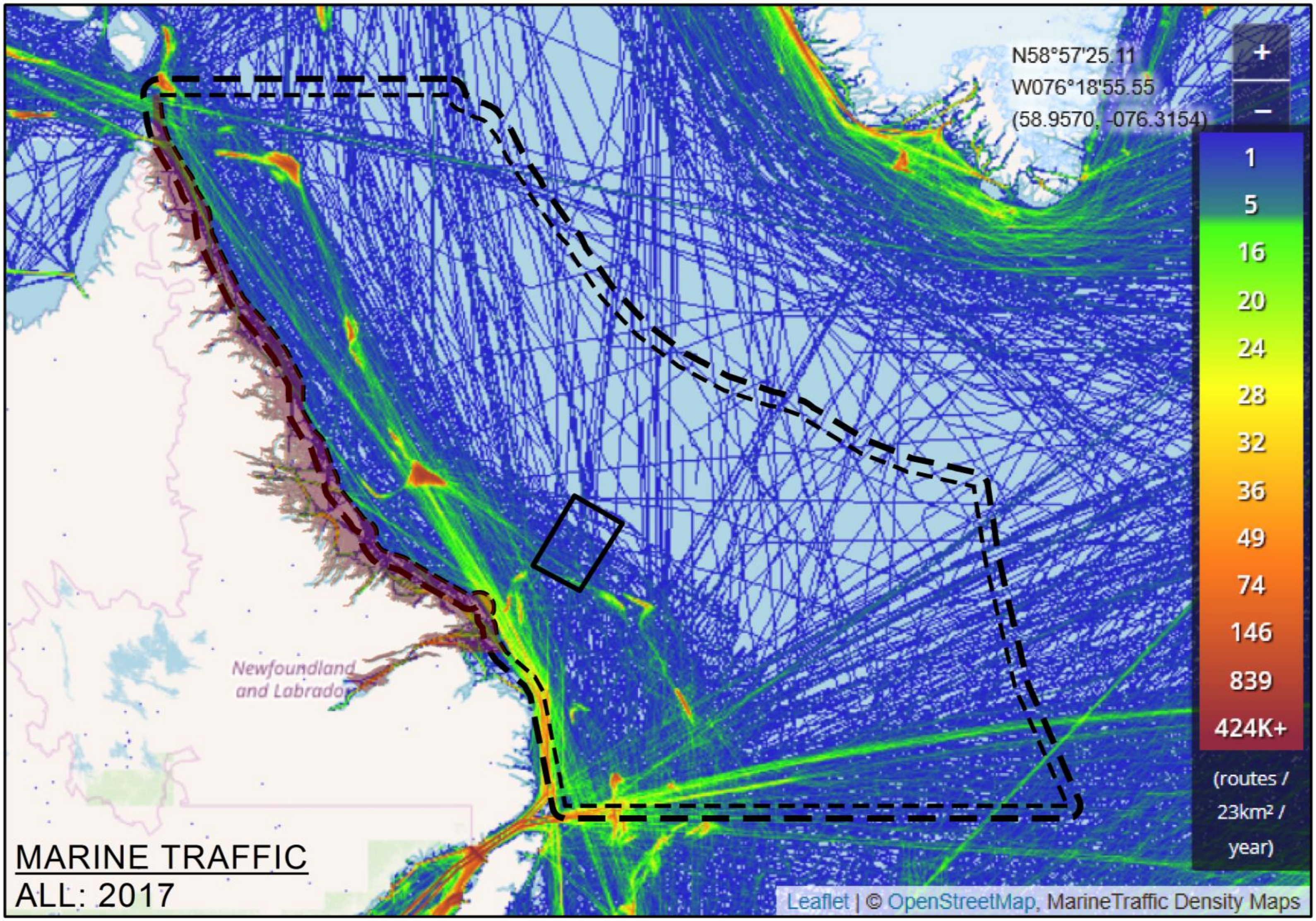


Figure 6.2. Marine shipping traffic density (routes per 23 km^2 grid cell) in 2017 in the MKI Project and Study Areas (depicted with small and large dashed lines, respectively) and the Torngat survey area.

6.5.1.3 Oil and Gas Activities

In 2020, MKI is planning to simultaneously conduct two 3D seismic surveys offshore Newfoundland and Labrador during the mid-May to August period (Figure 6.3). The timing of the planned MKI surveys is shown in Table 6.2 including those planned for offshore of the island of Newfoundland. Note that it is uncertain at this stage if the East Tableland 3D survey area and Central Ridge 3D survey area will be surveyed in 2020. If surveying does occur there, it will be conducted with either the *Ramform Atlas* or *Ramform Titan*. In 2020, when seismic surveying is conducted by the *Ramform Atlas* offshore Labrador (in the Torngat 3D survey area), the *Ramform Titan* will be conducting a seismic survey in the South Bank 3D survey (from mid-July to early August) and then in the Jeanne d'Arc HD3D survey area (during last three weeks of August); these survey areas are about 1400 km and 920 km from the Torngat 3D survey area, respectively. Based on a review of the C-NLOPB website, there are currently no indications that other seismic surveys will occur in 2020. If other seismic surveys do occur offshore Labrador (or offshore Newfoundland) MKI commits to communicating closely with these seismic operator(s) to ensure appropriate spatial separation between surveys as required.

As discussed in the original EA, in addition to seismic survey activity, there are four existing offshore production developments (Hibernia, Terra Nova, White Rose, and Hebron) on the northeastern Grand Banks. The existing developments fall inside of the boundaries of MKI's Jeanne d'Arc HD3D survey area. Underwater sound generated from production installations and attending support vessels have lower source levels and are continuous in nature versus those produced during seismic surveys. MKI will avoid close approach to production developments and any exploratory drilling activities which may occur in its planned survey areas for offshore Newfoundland unless appropriate simultaneous operations (SIMOPS) plans are in place. MKI commits to communicating closely with production and exploratory drilling operators to ensure appropriate spatial separation of activities.

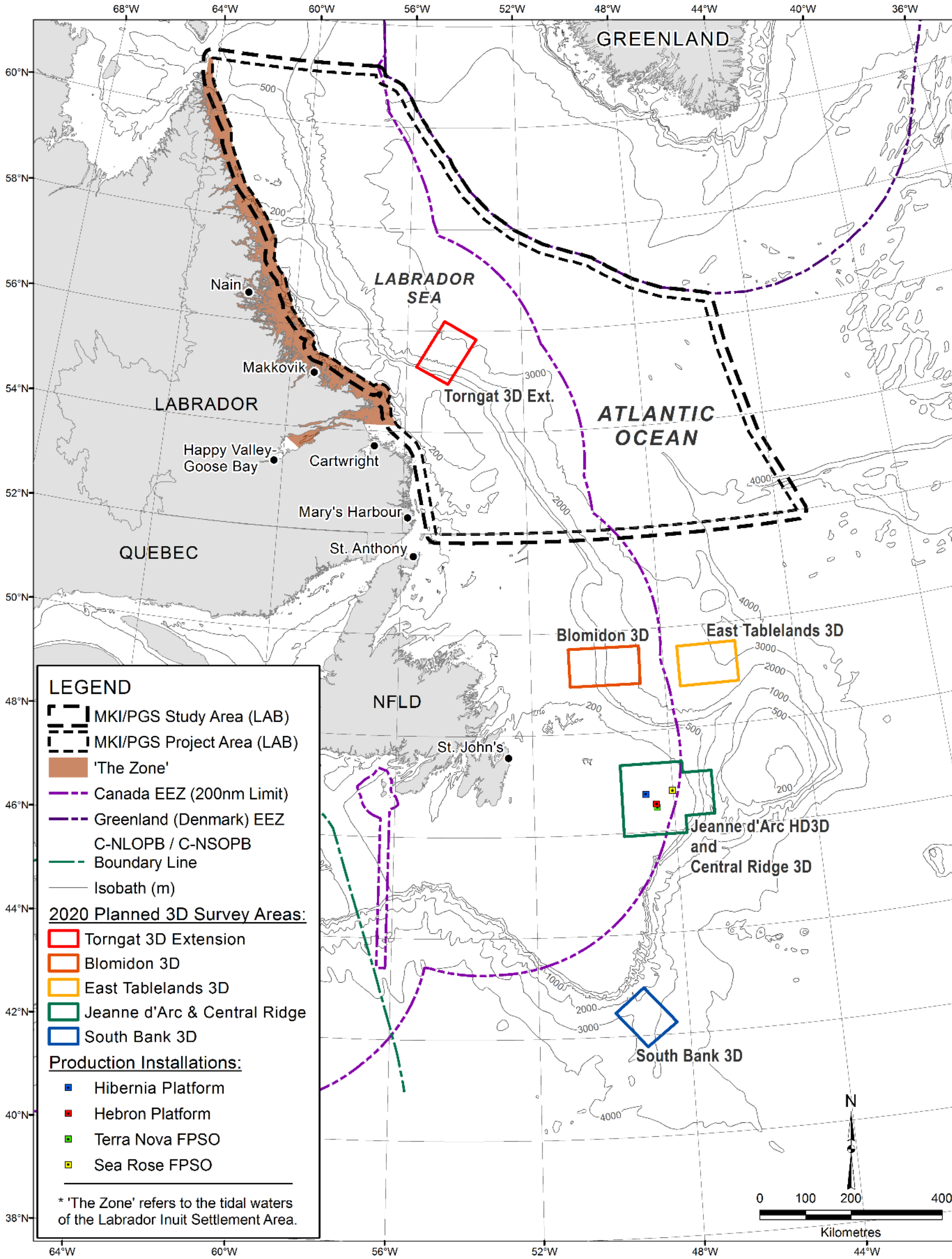


Figure 6.3. Locations of MKI's planned 3D seismic survey areas in 2020. Also shown are the production installations on the Grand Banks.

Table 6.2. Timing of MKI's planned 3D seismic surveys in 2020.

	May (week)		June (week)				July (week)				Aug (week)			
3D Survey Area	3	4	1	2	3	4	1	2	3	4	1	2	3	4
Blomiden 3D														
Jeanne d'Arc HD3D/Central Ridge 3D														
South Bank 3D														
Torngat 3D														

6.5.1.4 Consideration of Combined Activities

The primary concern associated with seismic surveys in combination with other projects or activities in the Study Area is the effects of underwater sound on VECs. As discussed in §5.7 and §5.8 of LGL (2018), the cumulative effects of airgun sound from simultaneous seismic surveys 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 these predictions, particularly including the effects of masking and disturbance on marine mammals, and the effects of disturbance on marine invertebrates and fishes from sound produced during multiple seismic surveys. Note that possible disturbance effects on marine invertebrates and fishes might not only impact key life history components but also commercial fisheries and science surveys. However, disturbance effects on fisheries are more readily mitigated primarily through communication and temporal and spatial avoidance of seismic surveys from fishing activity. The uncertainties with the effects of underwater sound increase with the number of seismic surveys and additional sources of underwater sound in the area (e.g., commercial shipping, fishing vessels, oil developments, and exploratory drilling). Sound from vessels and sound associated with offshore production and drilling are generally continuous (vs. pulsed sound from airguns) and at much lower sound levels. There is little potential for hearing impairment or physical effects on VECs associated with underwater sound from vessels and offshore oil production. Any avoidance of vessels and offshore oil developments by VECs, including species at risk, is likely to be localized and temporary (e.g., see §5.7 of the EA; LGL 2018).

As discussed in the EA for this Project, 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 seismic programs will use mitigation measures such as ramp-ups, delayed startups, and shut-downs of the airgun arrays as well as spatial separation between concurrent seismic surveys (in 2020, a minimum separation distance of about 900 km between MKI survey areas offshore Labrador and Newfoundland). Seismic programs and other ocean users (commercial shipping, fishing as well as oil developments) will have to maintain an appropriate separation distance for safe operations. Marine mammal response (including species at risk) to commercial shipping noise is expected to be localized and temporary especially for vessels maintaining a constant course and speed, which is typical for transiting commercial vessels. Marine invertebrate and fish response to commercial shipping noise is also expected to be localized and temporary, especially given the much lower sound levels associated with commercial shipping. Thus, it seems likely that while some animals may receive sound from MKI seismic programs and other vessels in the Study Area, the current prediction is that no significant residual effects will result from exposure to underwater sound. The level of confidence associated with this prediction is rated as low to medium given the scientific data gaps.

7.0 Concluding Statement

The 3D seismic survey activities proposed by MKI for 2020 have been reviewed and determined to be within the scope of the EA (LGL 2018) and its Addendum (LGL 2019a). The original EA assessed the potential effects of three 3D surveys and one 2D survey occurring simultaneously in a given year (i.e., during May–November 2018–2023). However, the 2020 seismic program includes one 3D survey.

The environmental effects predicted in the EA and its associated Addendum remain valid. MKI reaffirms its commitment to implement the mitigation measures proposed in these assessment documents.

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Personal Communications:

Ball, D.	Resource Management, DFO. 17 March 2020.
Hosein, J.	Chief, Statistical Services, DFO. 16 March 2020.
Keel, R.J.	Manager of Aquaculture Licensing and Administration, Department of Fisheries and Land Resources, Government of Newfoundland and Labrador. 20 March 2020.
Mello, L.	Stock Assessment Biologist, Marine Fish Species at Risk and Fisheries Sampling, Northwest Atlantic Fisheries Centre, DFO. 17 March 2020.
Pierce, C.	Ecosystem Geomatics Technician, Protected Areas Establishment Branch, Parks Canada. 18 March 2020.
Pye, B.	Environmental Sciences, Science Branch, DFO. 17 March 2020.
Wilhelm, S.	Wildlife Biologist, ECCC-CWS. 30 March 2020.

List of Appendices

Appendix A – MKI Newsletter Distributed to Consultees

Appendix B – List of Consultees Contacted by MKI

Appendix A – MKI Newsletter Distributed to Consultees

Multiklient Invest AS | **Seismic Programs Offshore Labrador 2020 Update**

Resumption of the Program in 2020

This news update is to inform stakeholders and other interested parties of the continuation of MKI's current seismic program, started in 2012, in waters offshore Newfoundland and Labrador. 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 Ramform Atlas will be acquiring data between July and September 2020.

Figure 1: Ramform Atlas is seismic vessel expected to work in Labrador during the 2020 season

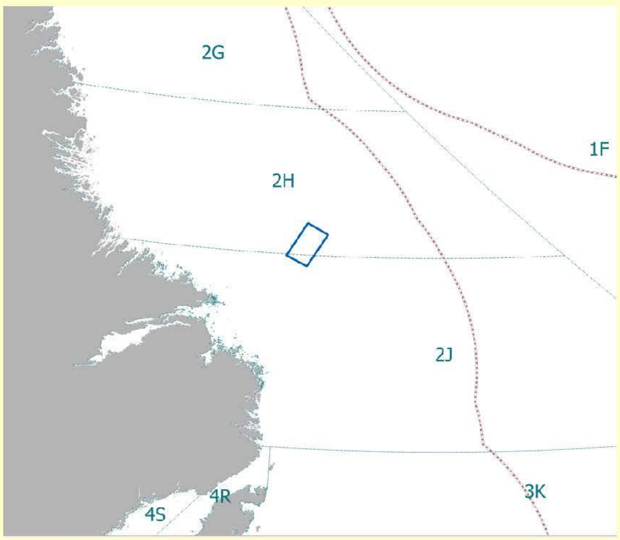

Figure 2: Labrador 2020 3D survey

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 Multiklient Invest AS Labrador Offshore Seismic Program 2018-2023 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 *"Multiklient Invest AS Labrador Offshore Seismic Program 2018-2023"* 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 with fishing

Contact Information

If you have any inquiries regarding the Labrador Offshore Seismic Program (2018-2023) 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

PGS

Appendix B – List of Consultees Contacted by MKI

Organization or Group Name	Email Address	Contact Name
Labrador Southeast Coastal Action Program	lscap@nf.aibn.com	Rex Turnbull
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
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
Forteau		
Forteau Community Council	forteautowncouncil@hotmail.com	Lauralee James
Happy Valley Goose Bay		
Town of Happy Valley-Goose Bay	bpomeroy@townhvgb.com ldysonedmunds@townhvgb.com	Bert Pomeroy, Deputy Mayor and Chair, Development and Planning Committee; Lori Dyson, Councillor and Chair, Economic Development and Public Engagement Committee
Newfoundland and Labrador Department of Innovation, Business, and Rural Development	bernarddavis@gov.nl.ca	Hon. Bernard Davis
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	jamie.snook@torngatsecretariat.ca	Jamie Snook, Executive Director
Nunatsiavut Government Department of Lands and Natural Resources	Carl.mclean@nunatisiavut.com	Carl Mclean
Nunatsiavut Government Non-Renewable Resources	claude_sheppard@nunatsiavut.com	Claude Sheppard, Director of Non-renewable resources
Nunatsiavut Government Department of Education and Economic Development	Gary.mitchell@nunatsiavut.com	Gary Mitchell
Labrador Friendship Centre	Jhefler-elson@lfchvgb.ca	Jennifer Hefler-Elson
Hopedale		
Hopedale Inuit Community Government	Wayne.piercy@nunatsiavut.com	Wayne Piercy

Organization or Group Name	Email Address	Contact Name
	L'Anse au Clair	
L'Anse au Clair Community	townoflanseauclair@hotmail.com	
	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
	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
	Makkovik	
Makkovik Inuit Community Government	barry.andersen@nunatsiavut.com	Barry Andersen
	Mud Lake	
Mud Lake Community	jholwell@nunatukavutcouncil.ca	James W. Howell, VP and Councillor
	Nain	
Nain Inuit Community Government	tony.andersen@nunatsiavut.com	Tony Andersen
Fishers' Committee	jangnatok@hotmail.com	Joey Angnatok
	Natuashish	
Mushuau Innu Band Council	Kanikue@gmail.com	Gregory Rich
Innu Nation	kanikue.rich@innu.ca	Gregory Rich, Grand Chief, Innu Nation
	North West River	
Town of North West River	manager@townofnwr.ca	Arthur Williams
Sivunivut Inuit Community Corporation Inc.	Maxene.Winters.tuttauk@nunatsiavut.com	Maxene Winters, Chairperson
Innu Nation	Preid@innu.ca	Paula Reid
	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
	Port Hope Simpson	
Town of Port Hope Simpson	porthopesimpson@nf.aibn.com	Michelle Clark
	Postville	
Postville Inuit Community Government	melaniepicg@gmail.com	Melanie Gear, Chief Administrative Officer
Nunatsiavut Government Department of Lands and Natural Resources	Glen.sheppard@nunatsiavut.com	Glen Sheppard
	Rigolet	
Rigolet Inuit Community Government	townmanager@rigolet.ca	Sherri Wolfrey
Fishers' Committee	richardrich749@gmail.com	Richard Rich
	Sheshatshiu	
Sheshatshiu Innu First Nation Band Council	jandrew@innu.ca	Jeremy Andrew
Innu Development Ltd. Partnership	madams@innudev.com	Melissa Adams
	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

Organization or Group Name	Email Address	Contact Name
	St. Johns	
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Transport Canada	Clement.murphy@tc.gc.ca	Clement Murphy, Manager, Examinations, and Enforcement
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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	flrminister@gov.nl.ca	Hon. Gerry Byrne, Minister
City of St. Johns	soleary@stjohns.ca	Sheilagh O'Leary, Deputy Mayor
Food, Fish, and Allied Workers	jjoensen@ffaw.net	Johan Joensen, Petroleum 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.	office@carino.ca	John Kearley, CEO
Gulf Shrimp Limited	Dphilpott@quinsea.com	Derrick Philpott, Director
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Nataaqnaq Fisheries	keith@natfish.ca	Keith Coady, Fleet Manager
Newfound Resources Limited	ottar@newfoundresources.com	Ottar Ingvason, Operations Coordinator
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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