Data Acquisition and Seabed Sampling for Basin Modelling, Labrador Offshore to the Jeanne d'Arc Basin (2015 to 2024) – Environmental Assessment

Aivek Stantec Limited Partnership

Prepared for:
MG3 (Survey) UK Limited

Prepared by:
Aivek Stantec Limited Partnership
141 Kelsey Drive
St. John's, NL A1B 0L2
Tel: (709) 576-1458
Fax: (709) 576-2126

File No: 121413515

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Table of Contents

LIST OF APPENDICIES

LIST OF TABLES

LIST OF FIGURES

Executive Summary

This environmental assessment presents information on the proposed geochemical (data acquisition and seabed sampling for basin modelling) program, as proposed by MG3 (Survey) UK Limited, and the results of the environmental assessment. The multi-year program would be conducted between 2015 and 2024 in a Study Area within the Labrador Offshore Area and the northern Grand Banks/Orphan Basin/Flemish Pass/Cap area. A description of the proposed program and the existing physical and biological environments is included. Valued Ecosystem Components (VECs) were identified as per the Scoping Document to focus the environmental effects analysis. The VECs selected for this assessment were:

- Species at Risk;
- Marine Fish and Shellfish;
- Fisheries and Other Ocean Users;
- Marine and/or Migratory Birds;
- Marine Mammals and Sea Turtles; and
- Sensitive Areas

This environmental assessment includes consideration of the environmental effects of the program on each of the VECs, including the potential effects of each of the planned activities and potential unplanned (i.e. accidental) events. Mitigation measures that are technically and economically feasible have been incorporated into the program design and planning.

The residual adverse environmental effects of the proposed geochemical program are predicted to be not significant.

Abbreviations

C-NLOPB	Canada-Newfoundland and Labrador Offshore Petroleum Board
COSEWIC	Committee on the Status of Endangered Wildlife in Canada
DFO	Fisheries and Oceans Canada
EBSA	Ecologically and Biologically Sensitive Area
FFAW-Unifor	Fish, Food and Allied Workers-Unifor
IBA	Important Bird Area
MBES	multibeam echosounder
MMO	Marine Mammal Observer
NAFO	Northwest Atlantic Fisheries Organization
SARA	*Species at Risk Act*
SBP	sub-bottom profiler
VEC	Valued Environmental Component
The Zone	Encompasses 48,690 km² of ocean along the Labrador Shelf established under the Labrador Inuit Land Claims Agreement (2005) (refer to Figure 2-1).

1.0 INTRODUCTION

1.1 Overview

MG3 (Survey) UK Limited (MG3) is proposing to conduct a geochemical and seabed sampling survey (the Project) to identify areas that may have the potential to contain oil-bearing basins. The Project is a multi-year program (2015 to 2024) to be conducted within the Labrador Offshore Area and the northern Grand Banks/Orphan Basin/Flemish Pass/Cap area and includes the following non-invasive research activities: detection of natural seabed seeps; high-resolution bathymetry; collection of shallow cores; and heat flow measurements. While the overall environmental assessment is aimed at a 10-year temporal scale, MG3 recognizes the sensitivity to this time line in the areas covered by the Nunatsiavut Government (predominantly Areas A and B on Figure 2-1), and will therefore agree to a review of the environmental assessment (and additional consultations) after 2017.

1.2 Project Proponent

MG3 is a specialist, independent geoscience survey company operating in both the offshore and coastal environment, providing worldwide marine geochemical, geophysical and geotechnical services.

1.3 Regulatory Context

Activities proposed for this Project can be summarized as sampling the sea surface to detect and capture natural oil seeps, collecting high-resolution bathymetry, collecting shallow seabed cores and conducting seabed heat flow measurements. According to the *Geophysical, Geological, Environmental and Geotechnical Program Guidelines* (Canada-Newfoundland and Labrador Offshore Petroleum Board (C-NLOPB 2012)), an environmental assessment must be conducted on any proposed technical programs in the Newfoundland and Labrador Offshore Area. The Project will require authorizations pursuant to section 138 (1)(b) of the *Canada-Newfoundland Atlantic Accord Implementation Act* and Section 134(1)(b) of the *Canada-Newfoundland and Labrador Atlantic Accord Implementation Newfoundland and Labrador Act*. The limited nature of the proposed activities would suggest the requirement for a C-NLOPB review under the Accord legislation only. That is, based on the activities as described, an environmental assessment pursuant to the *Canadian Environmental Assessment Act 2012* is not required. This environmental assessment has been prepared in accordance with the Scoping Document issued by the C-NLOPB (C-NLOPB 2015).

1.4 Project Rationale

The onshore and offshore basins of Newfoundland and Labrador are vast and largely underexplored, and the modern technologies now available in onshore and offshore research could help identify new prospective oil and gas basin areas.

1.5 Document Organization

The environmental assessment is organized as follows:

- Section 1 introduces the Project, proponent, regulatory context and rationale for the Project.
- Section 2 provides a description of the components of the Project.
- Section 3 describes the existing physical and biological environments
- Section 4 describes the consultation conducted with stakeholders.
- Section 5 describes the valued environmental components (VECs), Project-VEC interactions, and the methods used to conduct the environmental effects analyses.
- Section 6 describes the results of the environmental effects assessment.
- Section 7 provides a list of references used in the preparation of the environmental assessment.

2.0 PROJECT DESCRIPTION

2.1 Objectives

MG3 is proposing to conduct exploration activities in the Newfoundland and Labrador offshore area, from the tip of Labrador to the northern Grand Banks/Orphan Basin/Flemish Pass/Cap area, to identify those areas that have the potential to contain oil-bearing structures/basins. The Project is a multi-year program that includes the following non-invasive research activities:

- collecting high-resolution bathymetry using a multibeam echosounder (MBES);
- sampling of natural seabed seeps;
- collection of shallow seabed cores;
- conducting seabed heat flow measurements; and
- sub-bottom profiler (SBP; used when needed).

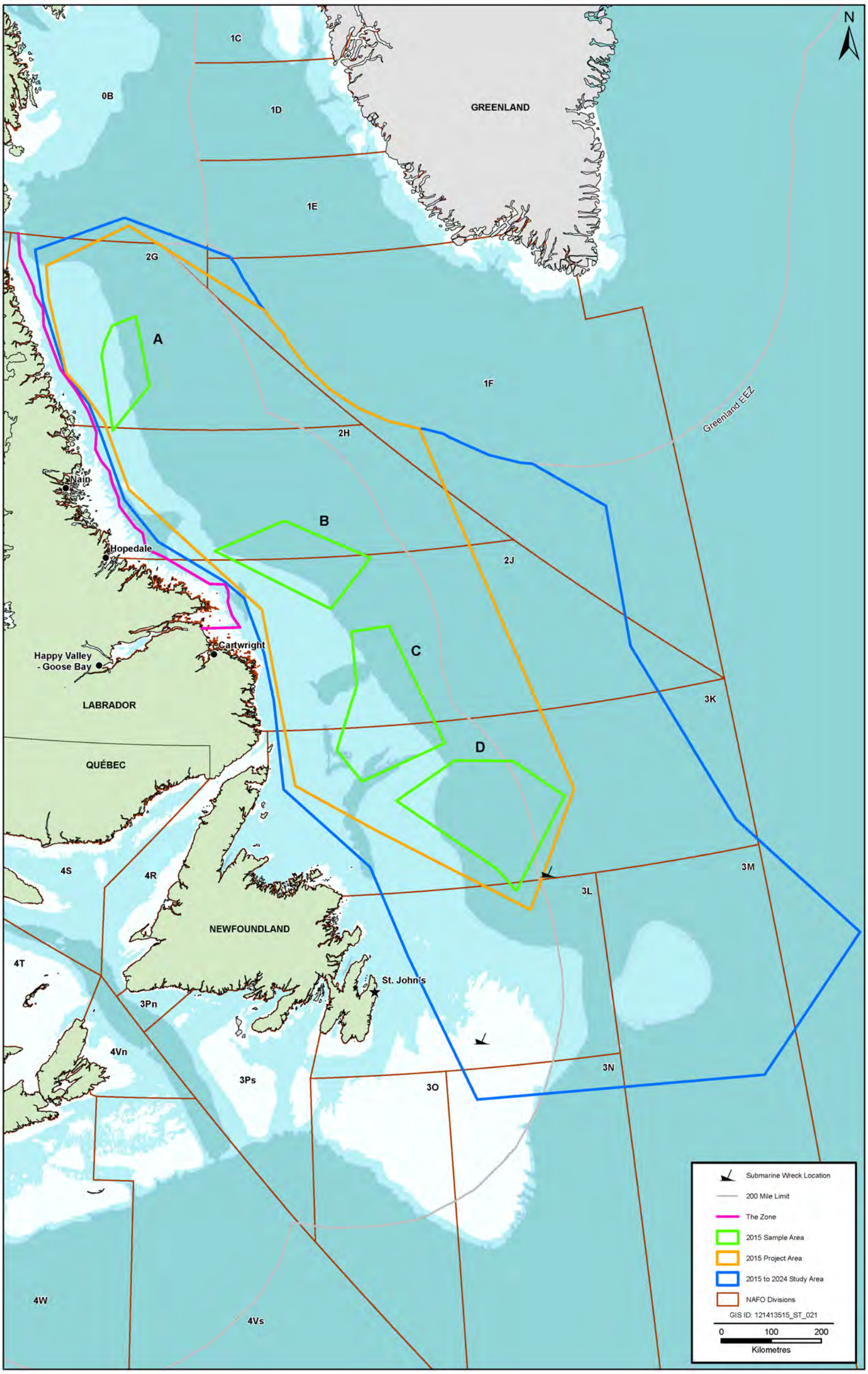
2.2 Project Area

The Project is a multi-year program (2015 to 2024) to be conducted within the 2015 to 2024 Study Area/2015 Project Area illustrated in Figure 2-1. Corner coordinates are provided in Tables 2.1 (2015 to 2024 Study Area), Table 2.2 (2015 Project Area) and Table 2.3 (2015 Sampling Areas) in both UTM and latitude / longitude format.

2.3 Project Scope

The Project is comprised of the following components: sampling for natural oil seeps; conducting MBES; shallow seabed coring; and heat flow measurements of the seabed using a thermal probe. Not all datasets will be acquired every year. MG3 is proposing to collect the following data in 2015:

- conducting MBES at all locations to identify live seeps;
- sampling of potential natural seabed seeps (by collecting water samples);
- collection of shallow seabed cores using a gravity core method at up to 200 locations in 2015;
- conducting seabed heat flow measurements using a thermal probe for the same 200 locations in 2015; and
- SBP (used when needed).



Note: "The Zone" refers to the tidal waters of the Labrador Inuit Settlement Area.
While the overall environmental assessment is aimed at a 10-year temporal scale, MG3 recognizes the sensitivity to this time line in the areas covered by the Nunatsiavut Government (predominantly Areas A and B), and therefore agree to a review of the environmental assessment (and additional consultations) after 2017.

Figure 2-1 2015 to 2024 Study Area and 2015 Project Area

Table 2.1 2015 to 2024 Study Area Corner Coordinates (NAD 83, Zone 22)

Easting	Northing	Long_DD	Lat_DD	Long_DMS	Lat_DMS
206141.099	6749483.809	-56.399	60.772	-56° 23' 55.508"	60° 46' 19.088"
217865.582	6730409.026	-56.157	60.610	-56° 9' 25.031"	60° 36' 35.564"
229318.752	6701366.855	-55.909	60.358	-55° 54' 32.501"	60° 21' 28.717"
236425.262	6689795.002	-55.766	60.259	-55° 45' 55.938"	60° 15' 32.830"
239824.651	6681168.404	-55.693	60.184	-55° 41' 35.695"	60° 11' 2.795"
249590.606	6665258.442	-55.498	60.048	-55° 29' 53.612"	60° 2' 52.094"
253138.978	6656247.650	-55.424	59.969	-55° 25' 26.040"	59° 58' 9.427"
286921.164	6601155.084	-54.764	59.495	-54° 45' 51.142"	59° 29' 40.337"
297499.251	6589213.343	-54.566	59.393	-54° 33' 59.296"	59° 23' 33.899"
304261.170	6571999.208	-54.432	59.242	-54° 25' 55.302"	59° 14' 29.900"
337981.524	6516886.244	-53.801	58.762	-53° 48' 4.414"	58° 45' 41.511"
380747.898	6468476.258	-53.037	58.341	-53° 2' 13.481"	58° 20' 27.462"
381802.830	6467636.361	-53.019	58.334	-53° 1' 7.106"	58° 20' 1.350"
383108.751	6466156.810	-52.996	58.321	-52° 59' 44.175"	58° 19' 14.798"
433617.933	6425903.332	-52.122	57.970	-52° 7' 19.664"	57° 58' 11.419"
435170.061	6425059.110	-52.096	57.962	-52° 5' 44.397"	57° 57' 44.950"
435196.308	6425038.172	-52.095	57.962	-52° 5' 42.780"	57° 57' 44.286"
491920.714	6394148.137	-51.136	57.689	-51° 8' 7.847"	57° 41' 22.135"
553151.190	6373548.124	-50.113	57.501	-50° 6' 47.073"	57° 30' 5.023"
562128.720	6372190.485	-49.964	57.488	-49° 57' 49.108"	57° 29' 17.017"
599303.458	6359643.401	-49.349	57.369	-49° 20' 55.884"	57° 22' 7.616"
599701.698	6359582.892	-49.342	57.368	-49° 20' 32.146"	57° 22' 5.347"
608070.864	6352868.757	-49.206	57.306	-49° 12' 22.051"	57° 18' 21.457"
627412.762	6342269.634	-48.891	57.206	-48° 53' 26.676"	57° 12' 20.971"
630115.455	6340099.322	-48.847	57.186	-48° 50' 49.817"	57° 11' 8.101"
686758.319	6309001.153	-47.934	56.887	-47° 56' 3.734"	56° 53' 13.436"
747941.009	6288172.560	-46.953	56.672	-46° 57' 9.868"	56° 40' 18.404"
770570.078	6284656.177	-46.588	56.628	-46° 35' 17.633"	56° 37' 39.897"
908718.951	6188064.282	-44.498	55.666	-44° 29' 51.029"	55° 39' 56.679"
933541.094	5906746.664	-44.516	53.133	-44° 30' 57.713"	53° 7' 59.411"
1113915.331	5547652.998	-42.470	49.766	-42° 28' 11.100"	49° 45' 58.624"
1340624.235	5306050.809	-39.861	47.364	-39° 51' 39.680"	47° 21' 48.920"
1130463.426	5039626.476	-42.969	45.227	-42° 58' 7.483"	45° 13' 36.791"
557899.333	5033007.238	-50.260	45.448	-50° 15' 34.503"	45° 26' 53.485"

Easting	Northing	Long_DD	Lat_DD	Long_DMS	Lat_DMS
442062.667	5327563.332	-51.778	48.099	-51° 46' 41.429"	48° 5' 55.322"
380834.715	5511247.189	-52.654	49.742	-52° 39' 14.263"	49° 44' 30.834"
221006.619	5679924.336	-54.994	51.202	-54° 59' 38.707"	51° 12' 8.871"
216033.234	5859463.553	-55.214	52.810	-55° 12' 50.020"	52° 48' 36.108"
204097.109	5955947.231	-55.480	53.668	-55° 28' 48.078"	53° 40' 5.943"
173983.525	6067263.187	-56.054	54.647	-56° 3' 15.970"	54° 38' 49.554"
137577.716	6103668.996	-56.661	54.948	-56° 39' 41.195"	54° 56' 52.350"
11812.192	6194683.520	-58.767	55.652	-58° 45' 59.725"	55° 39' 5.508"
-47760.950	6284043.234	-59.884	56.382	-59° 53' 3.309"	56° 22' 54.134"
-84166.760	6423047.233	-60.786	57.569	-60° 47' 10.603"	57° 34' 10.007"
-102369.664	6482620.376	-61.236	58.072	-61° 14' 8.139"	58° 4' 20.442"
-143739.902	6545503.138	-62.099	58.569	-62° 5' 55.365"	58° 34' 7.839"
-175181.283	6694435.994	-63.088	59.830	-63° 5' 17.123"	59° 49' 49.133"
-181008.009	6799317.067	-63.542	60.741	-63° 32' 32.663"	60° 44' 26.398"
3538.145	6846678.470	-60.329	61.433	-60° 19' 43.333"	61° 26' 0.395"
DD = Decimal Degrees; DMS = Degrees, Minutes, Seconds					

Table 2.2 2015 Project Area Corner Coordinates (NAD 83, Zone 22)

Easting	Northing	Long_DD	Lat_DD	Long_DMS	Lat_DMS
265573.350	6635969.463	-55.17888513	59.79495559	-55° 10' 43.986"	59° 47' 41.840"
286921.164	6601155.084	-54.76420616	59.49453818	-54° 45' 51.142"	59° 29' 40.337"
297499.251	6589213.343	-54.56647122	59.39274975	-54° 33' 59.296"	59° 23' 33.899"
304261.170	6571999.208	-54.43202826	59.24163902	-54° 25' 55.302"	59° 14' 29.900"
337981.524	6516886.244	-53.80122623	58.76153084	-53° 48' 4.414"	58° 45' 41.511"
380747.898	6468476.258	-53.03707819	58.34096174	-53° 2' 13.481"	58° 20' 27.462"
381802.830	6467636.361	-53.01864052	58.33370824	-53° 1' 7.106"	58° 20' 1.350"
383108.751	6466156.81	-52.99560409	58.32077729	-52° 59' 44.175"	58° 19' 14.798"
433617.933	6425903.332	-52.12212902	57.96983873	-52° 7' 19.664"	57° 58' 11.419"
435170.061	6425059.11	-52.09566594	57.96248599	-52° 5' 44.397"	57° 57' 44.950"
435196.308	6425038.172	-52.09521671	57.96230178	-52° 5' 42.780"	57° 57' 44.286"
491920.714	6394148.137	-51.13551303	57.68948185	-51° 8' 7.847"	57° 41' 22.135"
551730.991	6374025.927	-50.13667012	57.50585114	-50° 8' 12.012"	57° 30' 21.064"
798519.869	5634067.506	-46.76483436	50.78136964	-46° 45' 53.404"	50° 46' 52.931"
692686.324	5401233.707	-48.37939699	48.73430481	-48° 22' 45.829"	48° 44' 3.497"

Easting	Northing	Long_DD	Lat_DD	Long_DMS	Lat_DMS
394330.000	5586102.011	-52.4874062	50.41743578	-52° 29' 14.662"	50° 25' 2.769"
244643.030	5685109.98	-54.66017359	51.26005096	-54° 39' 36.625"	51° 15' 36.183"
207850.043	6041330.489	-55.5055792	54.43550763	-55° 30' 20.085"	54° 26' 7.827"
-37364.898	6304494.904	-59.75992345	56.57521368	-59° 45' 35.724"	56° 34' 30.769"
-74352.059	6443526.11	-60.67314831	57.76334031	-60° 40' 23.334"	57° 45' 48.025"
-111676.073	6508560.377	-61.45857754	58.28878509	-61° 27' 30.879"	58° 17' 19.626"
-141102.672	6546309.65	-62.05648672	58.57983614	-62° 3' 23.352"	58° 34' 47.410"
-163020.318	6701599.158	-62.89864014	59.91285742	-62° 53' 55.104"	59° 54' 46.287"
-161919.552	6765163.518	-63.08589086	60.47292356	-63° 5' 9.207"	60° 28' 22.525"
10059.959	6829986.564	-60.16428132	61.29379742	-60° 9' 51.413"	61° 17' 37.671"
DD = Decimal Degrees; DMS = Degrees, Minutes, Seconds					

Table 2.3 2015 Sampling Area Corner Coordinates (NAD 83, Zone 21N)

Sample Area	Easting	Northing	Latitude	Longitude
A	297610	6600114	59° 29' 25.818"	-60° 34' 29.379"
	344905	6618981	59° 40' 47.597"	-59° 45' 16.369"
	372057	6479678	58° 26' 20.588"	-59° 11' 29.909"
	298702	6390869	57° 36' 54.621"	-60° 22' 13.026"
	276458	6541263	58° 57' 9.009"	-60° 53' 13.054"
	283275	6568359	59° 11' 55.712"	-60° 47' 43.687"
	297610	6600114	59° 29' 25.818"	-60° 34' 29.379"
B	502580	6150014	55° 29' 46.414"	-56° 57' 32.994"
	641176	6210410	56° 1' 5.224"	-54° 44' 6.390"
	813367	6136396	55° 16' 26.758"	-52° 3' 55.481"
	734683	6034264	54° 24' 6.842"	-53° 23' 2.676"
	502580	6150014	55° 29' 46.414"	-56° 57' 32.994"
C	775796	5988931	53° 58' 29.927"	-52° 47' 38.066"
	850568	6000603	54° 2' 3.124"	-51° 38' 42.191"
	961992	5766511	51° 51' 26.883"	-50° 17' 16.828"
	796723	5690409	51° 17' 15.212"	-52° 44' 38.887"
	746439	5752685	51° 52' 13.494"	-53° 25' 12.028"
	786247	5880861	53° 0' 2.334"	-52° 44' 0.721"
	775796	5988931	53° 58' 29.927"	-52° 47' 38.066"

Sample Area	Easting	Northing	Latitude	Longitude
D	982124	5732236	51° 32' 4.464"	-50° 2' 42.359"
	1098091	5731132	51° 24' 51.429"	-48° 23' 32.679"
	1201956	5661043	50° 40' 30.636"	-47° 3' 19.751"
	1105206	5471751	49° 5' 58.590"	-48° 42' 17.699"
	1066322	5515366	49° 31' 30.906"	-49° 10' 14.826"
	865536	5651612	50° 54' 0.640"	-51° 48' 1.324"
	982124	5732236	51° 32' 4.464"	-50° 2' 42.359"

2.3.1 Multibeam Echosounder

A 44 kHz MBES will be used to collect data providing high-resolution bathymetry in depths of 10 to 5,000 m. The high-resolution data allow differentiation between pockmarks and iceberg plough marks on the seafloor. In addition, the resolution of the MBES data permits the identification of additional smaller pockmarks that cannot be resolved with existing seismic data. The MBES will be used to identify active seeps and will be collected in areas where active oil slicks are present on the ocean surface.

2.3.2 Detection of Natural Seeps

Natural seeps accounted for 160,000 tonnes of the 260,000 tonnes of petroleum released into the marine environment in North America from 1990 to 1999 (National Academy of Sciences 2002). MG3 is proposing to conduct a sampling program to identify areas of potential natural seabed seeps.

Samples to detect the presence of oil from natural seabed seeps will be collected with an AGI (GORE) sampling kit. The sampler is hydrophobic (i.e., repels water) and can collect hydrocarbons from very thin oil layers in the water. The deployment/retrieval mechanism is basically fishing line (folding casting device, weighted bobbers and fishing line and hardware); the sampling containers are deployed by casting them out from the vessel. Laboratory analysis (by thermal desorption/gas chromatography/mass spectrometry) can detect approximately 100 compounds from C_6 to C_{35}, including key biomarkers (AGI 2013).

As MG3 is proposing to collect samples along a pre-identified sampling design at specific slick locations identified by satellite, it is proposed that the sampler will be cast from the bow of the vessel, allowing the sampler to ride the bow wave of the vessel for five minutes as the vessel maintains a speed of 3.7 to 5.6 km/h (2 to 3 knots).

2.3.3 Shallow Core Collection

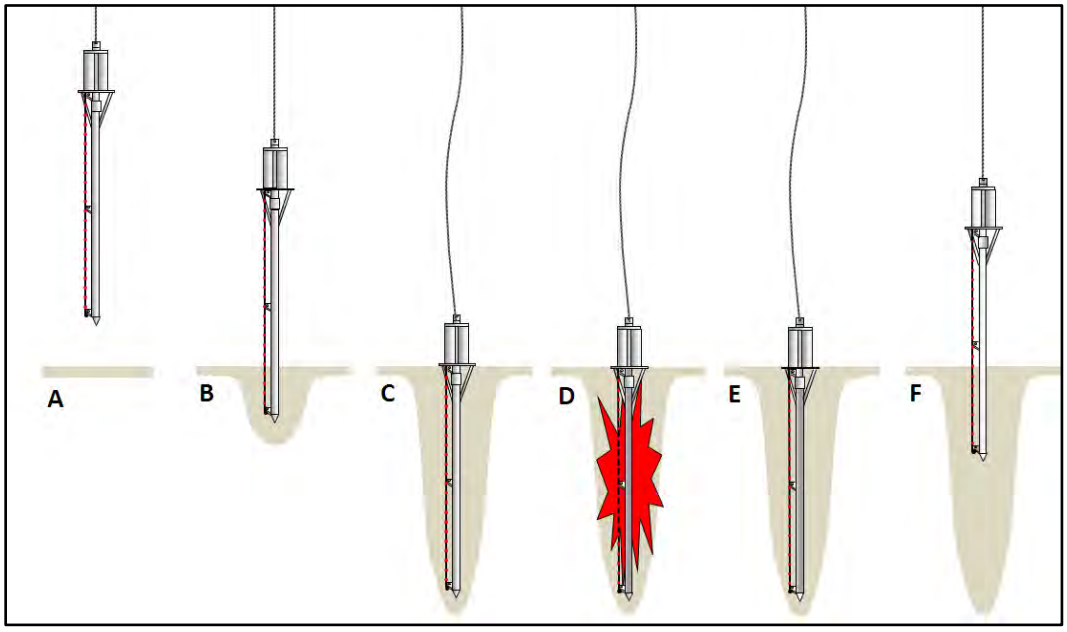
Substrate cores will be collected to a depth of 6 m using a gravity corer (refer to Figure 2-2 for a picture of the proposed gravity coring system). The gravity corer will be lowered to within 50 m of the substrate. Once positioned, the corer will be triggered to release and penetrate into the substrate. Gravity core samples will be collected at up to 200 locations in 2015, with potential for additional sampling in subsequent years.

Figure 2-2 Gravity Coring System

2.3.4 Heat Flow Measurements

The temperature of the substrate can give an indication of the potential for hydrocarbons beneath the surface, and can aid in maturity calculation for oil and gas exploration. Heat flow measurements will be taken using a FIELAX HeatFlowProbe thermal probe. Heat flow measurements will be collected at up to 200 locations in 2015, with potential for additional sampling in subsequent years.

Fine, soft sediments (e.g., clays and silts) are required to achieve good penetration by the heat-flow probes. Prior to releasing the gravity corer to sample the substrate, an MBES and sub-bottom profiler will be used to determine if any subsurface hazards are present in the sampling area.



A: Heat flow probe lowering to the seabed. B: Penetrating into seabed. C: Recording temperatures of thermal decay of frictional heat (approx. 20 minutes). D: Artificial heat pulse. E: Recording temperatures of thermal decay of heat pulse (approx. 20 minutes). F: Retrieval to surface.

Figure 2-3 Principle of a Heat Flow Measurement

2.3.5 Sub-bottom Profiler

The SBP proposed for the Project is a hull mounted pinger array. The array consists of nine transducers operating at a frequency range of between 3 and 12kHz.

2.4 Vessel

As the geochemical data acquisition program is designed to collect information to be used in a basin model, accurate positioning data are key. The data will be collected using a vessel with dynamic positioning capabilities. The vessel will also be required to be able to deploy and retrieve the various sampling equipment proposed as part of the geochemical data acquisition program. Given the 2015 Project Area (Figure 2-1), the vessel will also be required to work in the harsh conditions of the Labrador offshore area.

MG3 will use a certified vessel capable of working in Labrador Sea conditions. The selected vessel will have equipment and protocols and procedures in place for prevention of air pollution and marine pollution by oil, sewage and garbage in accordance with the *Canadian Shipping Act* and international standards and certification authorities. At no time will a survey vessel enter or attempt to conduct any survey work in restricted or protected areas.

2.5 Project Schedule

The 2015 program focuses on the Labrador offshore area, specifically the Hopedale Basin, Saglek Basin, St. Anthony Basin and Orphan Basin. MG3 are proposing to conduct the natural seabed seep sample collection, heat probe and gravity core sample collection components of the research program in August/September of 2015. Data collection will occur over a 24-hour period. The program is anticipated to require 21 days to conduct all sample collection; MG3 has scheduled a four-week period to conclude the program, allowing for weather delays. Future programs (2016 to 2024) will be conducted during the ice-free season.

2.6 Health, Safety and the Environment

MG3 recognizes its operational activities have the potential to impact on the environment and is committed to:

- adopting an environmental vision that makes environmental protection and business value compatible;
- complying with all applicable environmental legislation and other applicable requirements;
- preventing pollution and minimizing the extend of environmental damage occurring as a result of our operations and activities; and,
- continuously improving our environmental performance.

MG3 will ensure the survey vessel has equipment and protocols and procedures in place for prevention of pollution by oil, sewage and garbage in accordance with the *Canadian Shipping Act* and international standards and certification authorities. Solid wastes, recyclables, hazardous materials and non-biodegradable materials will be stored and returned to shore for proper handling and disposal. At no time will a survey vessel enter or attempt to conduct any survey work in restricted or protected areas.

Transport Canada will conduct a safety inspection of the vessel in accordance with requirements of the C-NLOPB. MG3 will have a representative on board the vessel to accompany Transport Canada during their inspection.

MG3 recognizes the importance of health and safety and have developed a corporate Occupational Health and Safety System (OHSAS). The OHSAS integrates the internationally recognized requirements of ISO 18001:2007 into the company's Total Quality Management System that is accredited by DNV.

2.7 Key Mitigation Measures

The scope of work is limited and entails deploying and retrieving a seep sampling kit, collecting MBES (and SBP where necessary) bathymetry and lowering and raising a core sampler. The primary interaction with the environment will be the operation of the vessel and the collection of sediment samples. The following mitigation measures will be applied to this Project:

- MG3 will contract a vessel that has equipment and protocols and procedures in place for prevention of pollution by oil, sewage and associated waste materials in accordance with the *Canadian Shipping Act* and international standards and certification authorities.
- At no time will a survey vessel enter or attempt to conduct any survey work in restricted or protected areas, including the Nunatsiavut Zone ('The Zone'), established under the Labrador Inuit Land Claims Agreement (2005)
- The program (collecting cores) is non-intrusive and its duration is short (approximately 21 days). The hull-mounted SBP and MBES will only be used in targeted locations (i.e., will not sweep large swaths of the seabed).
- There will be a Marine Mammal Observer (MMO)/bird observer on board the research vessel.
- A beneficiary of the Nunatsiavut Government will be on board the vessel as the MMO and bird observer. Bird observations will be made in transit (and during coring operations) and marine mammal observations will be made during operations. The bird and marine mammal observations will be made for data collection only.
- There will be a Fisheries Liaison Officer on board the research vessel.
- The dates of the 2015 Torngat Joint Fisheries Board-Fisheries and Oceans Canada (DFO) Collaborative Post Season Trap Survey will be determined from consultations with Nunatsiavut Government. The 2014 survey was conducted in the last week of August. Although none of the specific coring locations overlap with the survey locations, the FLOs on board the vessel will establish communications to prevent any potential disruption to the survey.
- MG3 will conduct ongoing consultation with One Ocean and the Fish, Food and Allied Workers-Unifor (FFAW-Unifor) Petroleum Industry Liaison on the location and timing of their members who fish in the area and will avoid areas during times of heavy fixed gear use.
- MG3 will time the sampling of the identified areas in a sequence that creates the least disruption to local fishers based on consultation with the FFAW-Unifor Petroleum Industry Liaison.
- The research vessel will maintain a minimum distance of 2 km from active seabird colonies.
- Data collection will occur over a 24-hour period; therefore, lighting is required at night for safety purposes. As there is potential for marine and migratory birds to be attracted to the vessel at night, the vessel crew will conduct routine checks for stranded birds and release of stranded birds per the protocol of Williams and Chardine (1999). The 2015 program will be conducted from mid-August to mid-September. MG3 will implement the suggested beneficial management practices that do not unduly impede the safe execution of the coring program.
- A Live Seabird Salvage permit will be acquired from the Canadian Wildlife Service prior to operations.
- MG3 will contact DFO prior to start of the Project to determine where DFO research vessels are conducting surveys and will revise the sampling location order to avoid conflict with DFO research vessels.
- MG3 will contact the Department of National Defence prior to start of the Project to determine where naval exercises are being conducted and will revise the sampling location order if necessary to avoid interaction with naval vessels.

3.0 EXISTING ENVIRONMENT

Given the non-intrusive nature of the Project, Project-environment interactions are anticipated to be few. If Project-environment interactions occur, the components of the environment most likely to be potentially affected by the Project are fish habitat (sediment) and commercial fisheries (vessel conflict). The 2015 to 2024 Study Area is used for the purpose of describing the existing environment.

3.1 Physical Environment

The 2015 survey will be conducted both along the Labrador Shelf and in deeper waters of the Labrador Sea, with the 2015 to 2024 Study Area extending to the northern Grand Banks/Orphan Basin/Flemish Pass/Cap area. Water depths range from less than 70 m within 2 km of the Labrador coast (into which the Project does not extend) to 3,500 m in the offshore portion of the 2015 to 2024 Study Area.

3.1.1 Metocean Conditions

Water temperatures on the Labrador Shelf and offshore range from -2°C to 0°C, with warmer temperatures in the southern extent of the 2015 to 2024 Study Area (0°C to 15°C) (C-NLOPB 2010, 2011a, 2011b). Grand Banks sea-surface temperatures were at record highs in September 2013 and sea ice volume decreased on the Newfoundland and Labrador Shelf (2J3KLM) to the fourth lowest value since 1980 (DFO 2014a).

Pack ice can occur from November to July in the Labrador portion of the 2015 to 2024 Study Area, extending down to the southern portion of the 2015 to 2024 Study Area in February. Sea ice and icebergs are also present, with icebergs occurring from July to October in the Labrador Shelf Area and the majority along the east coast occurring from March to June or July (C-NLOPB 2010, 2011a, 2011b). The Labrador Shelf ice concentration was below normal in January and March of 2013 and higher than normal for the northwestern part of Labrador Shelf. The winter ice extent decreased on the Labrador Shelf due to a warming trend since 2012 in the 1,000 to 1,500 m layer of the central Labrador Sea (Yashayaev et al. 2014).

Air temperatures range from -15°C to 12°C. Wind speeds are highest in the fall and winter and decline in spring and fall. Waves are also at their highest in the fall and winter. The average number of foggy days is highest from May to August (C-NLOPB 2010, 2011a, 2011b). Record warm conditions were reported in 2011. While temperatures have decreased in the past two years, most environmental indices show a continuation of a warmer than normal trend throughout the Newfoundland and Labrador Shelf (Colbourne et al. 2014).

3.1.2 Acoustic Environment

Oceanic water is an excellent medium for conducting sound. The National Research Council (2003) groups anthropogenic sound sources in the marine environment into six categories: shipping; seismic surveying; sonars; explosions; industrial activity; and miscellaneous. Ambient sound is highly variable on oceanic continental shelves and can be comprised of wind, thermal sound, precipitation, vessel traffic and biological sources. There is a lack of noise measurement and modelling in the Labrador Shelf and offshore area. Vessel traffic is a major contributor to ambient noise and dominates in the 20 to 300 Hz frequency range, with distant fishing vessels peaking at 300 Hz (Richardson et al. 1995, in Husky Energy 2010; Section 3.3.3). Wind, large surface waves and precipitation produce noise is in the range of approximately 100 Hz to 50 kHz, 1 to 20 Hz and above 500 Hz, respectively (Wentz 1962, in Husky Energy 2010, Section 3.3.3). Marine mammals also contribute to the ambient noise, producing noise in the range of 0.01 (blue and fin whales) to 150 (harbour porpoise) kHz (Husky Energy 2010; Section 3.3.3; Table 3-1).

3.2 Species at Risk

A number of species at risk (as listed under the *Species at Risk Act* (SARA) or assessed as at risk by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC)) have the potential to occur throughout the 2015 to 2024 Study Area (Figure 2-1), either as sporadic visitors or regular inhabitants. These include the following species listed on SARA Schedule 1 as of May 8, 2015, which provides them legal protection:

- blue whale (Endangered);
- North Atlantic right whale (Endangered);
- leatherback sea turtle (Endangered);
- Ivory Gull (Endangered);
- white shark (Endangered);
- northern wolffish (Threatened);
- spotted wolffish (Threatened);
- Atlantic wolffish (Special Concern);
- fin whale - Atlantic population (Special Concern);
- Sowerby's beaked whale (Special Concern); and
- polar bear (Special Concern).

Barrow's Goldeneye (Special Concern) and Harlequin Duck (Special Concern) are two primarily coastal species that could occur in the 2015 to 2024 Study Area. The last authenticated record of Eskimo Curlew (Endangered), a shorebird, was made in 1963 (COSEWIC 2009); it is possible that this species is extinct (COSEWIC 2010).

Species assessed as at risk by COSEWIC (but are not listed on SARA Schedule 1) as of May 8, 2015, that could occur in the 2015 to 2024 Study Area include:

- American eel (Endangered);
- Atlantic cod - Newfoundland and Labrador population (Endangered);
- Atlantic salmon (various populations) (Endangered, Threatened, Special Concern);
- porbeagle shark (Endangered);
- roundnose grenadier (Endangered);
- smooth skate - Funk Island population (Endangered) (note Hopedale Channel and Nose of the Grand Banks populations have been assessed by COSEWIC as Data Deficient; there is also a Flemish Cap population that is outside Canadian jurisdiction, but within the 2015 to 2024 Study Area);
- winter skate (Eastern Scotian Shelf – Newfoundland population) (Endangered)
- beluga whale (various populations) (Endangered, Threatened, Special Concern);
- loggerhead sea turtle (Endangered);
- Acadian redfish (Threatened);
- American plaice - Newfoundland and Labrador population (Threatened);
- cusk (Threatened);
- deepwater redfish (Threatened);
- shortfin mako shark (Threatened);
- Atlantic bluefin tuna (Grand Banks of Newfoundland only) (Special Concern);
- basking shark - Atlantic population (Special Concern);
- blue shark - Atlantic population (Special Concern);
- harbour porpoise (Special Concern);
- roughhead grenadier (Special Concern);
- spiny dogfish (Special Concern);
- thorny skate (Special Concern);
- bowhead whale (Eastern Canada – West Greenland population) (Special Concern);
- killer whale (Special Concern); and
- northern bottlenose whale (Davis Strait-Baffin Bay-Labrador Sea population) (Special Concern).

There is no designated critical habitat, as defined under SARA, in the 2015 to 2024 Study Area.

Harlequin Duck and Barrow's Goldeneye will be inland on rivers during the proposed timing of the coring program, outside the 2015 to 2024 Study Area, and therefore there will be no interaction or effect.

Activities associated with the coring program are not expected to occur near any known nesting colonies, and will therefore not affect nesting colonies. Disturbance of small feeding concentrations of marine birds that may occur in the Study Area is possible. It is expected that bird behaviour would likely return to normal shortly after the completion of these activities (if disturbed at all).

Offshore Labrador is a known wintering area for the Ivory Gull in the pack ice and marine waters between Greenland and Newfoundland and Labrador (Environment Canada 2014). The identified critical habitat necessary for Ivory Gull survival (39 breeding colonies in Nunavut) (Environment Canada 2014) is not within the 2015 to 2024 Study Area. Additional critical habitat will be identified in an action plan, scheduled for release in 2018. The Ivory Gull is usually associated with pack ice and may be found in the 2015 to 2024 Study Area during winter months. The Project will only be conducted during ice-free months (July to end-October 2015 to 2024).

3.3 Marine Fish and Shellfish

3.3.1 Fish Habitat

The Labrador Sea is a highly productive ecosystem, with a spring phytoplankton bloom that starts in March and peaks in the spring, followed by a zooplankton bloom; there is another phytoplankton bloom that peaks in the fall (C-NLOPB 2010). Phytoplankton blooms generally occur earlier on the shelves than those in the central basin; and the chlorophyll-a biomass has tended to decline (averaged over the year), despite an increase in the magnitude of the spring blooms (Yashayaev et al. 2014). Benthic polychaete assemblages are influenced by topographical features on the ocean floor, while bivalve assemblages are distributed at approximately 5 to 25 m water depth; other types of assemblages, such as barnacles, sea urchins and suspension feeders, also have distinct substrate requirements (C-NLOPB 2010).

3.3.2 Fish and Shellfish

Northern shrimp, snow crab and Greenland halibut are the most important commercial fish species occurring within the 2015 to 2024 Study Area, accounting for up to 95 percent of the annual harvest in recent years. Other fish and shellfish species include redfish (species at risk), Atlantic salmon (species at risk), Arctic char, sand lance, capelin, herring, Arctic, cod, rock cod, Atlantic cod (species at risk), witch flounder, winter flounder, yellowtail flounder, American plaice (species at risk), lumpfish, Atlantic mackerel, white hake, angler fish, haddock, cusk (species at risk), grenadier (species at risk), American eel (species at risk), thorny skate (species at risk), smooth skate (Funk Island population species at risk), wolffish(species at risk), spiny dogfish (species at risk), black dogfish, and porbeagle shark (species at risk) (Husky Energy 2010; LGL 2011; RSP 2011).

Northern, or pink, shrimp occur from the Gulf of Maine in the south to the Davis Strait in the north. Females typically produce 2,400 eggs in summer (2,400 on average) (Haynes and Wigley 1969, in Husky Energy 2010 (Section 5.2.4.3)), which are attached to the female until the migration to shallow coastal waters to spawn the following spring (Ollerhead et al. 2004, in Husky Energy 2010 (Section 5.2.4.3)). Northern shrimp grow by moulting their shells. Shrimp undergo a vertical migration during the day from the seabed into the water column to feed on small pelagic crustaceans. Predators of northern shrimp include Greenland halibut, cod (DFO 2006, in Husky

Energy 2010 (Section 5.2.4.3)), Atlantic halibut, skate, wolffish and harp seal (DFO 2000, in Husky Energy 2010 (Section 5.2.4.3)).

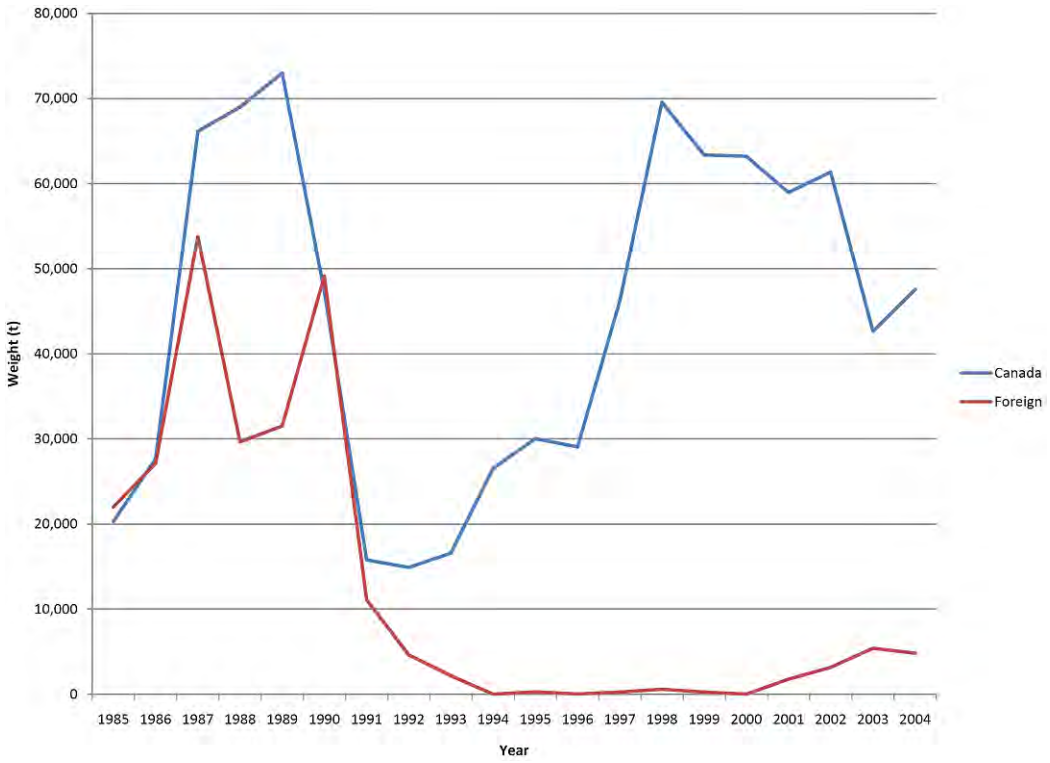
Snow crab occur over a broad range of depths from the Gulf of Maine to Greenland. Females lay between 20,000 to 150,000 eggs and carry the eggs for approximately two years. The eggs then remain in the water column for up to eight months before settling to the seabed (DFO 2002, in Husky Energy 2010; Fisheries Resources Conservation Council 2005, in Husky Energy 2010), where they undergo a series of moults as they increase in size. Commercial-size crabs commonly occur at depths of 70 to 280 m (Elner 1985, in Husky Energy 2010 (Section 5.2.4.2)). Snow crab feed on fish, clams, benthic worms, brittle stars, shrimps and crustaceans, including smaller snow crabs. Predators include various groundfish and seals (DFO 2002, in Husky Energy 2010 (Section 5.2.4.2)). An assessment by Mullowney et al. (2015) found that the snow crab resource has become increasingly concentrated into Divisions 3LNO in recent years, and while the exploitable biomass has changed little since the mid-2000s, recruitment has recently declined. That decline is expected to continue in the short-term and the warm oceanographic regime is expected to have an unfavourable effect on long-term recruitment prospects in all divisions (DFO 2013a; Mullowney et al. 2015).

Greenland halibut (turbot) is a deep-water flatfish that extends from the Scotian Shelf to Greenland over a wide range of depths (90 to 1,600 m), with larger individuals occurring in deeper waters. The spawning grounds of Greenland halibut are believed to be located southwest of Iceland and extend to south of the Flemish Pass off Newfoundland (Junquera and Zamarro 1994, in Husky Energy 2010 (Section 5.2.5.2)). While maturing, Greenland halibut are thought to move to deep water and migrate north to the spawning area, suggesting a continuous stock throughout the range (Bowering 1982, in Husky Energy 2010 (Section 5.2.4.2)). Greenland halibut in the Northwest Atlantic are thought to be a relatively homogenous genetic stock; however, there is some evidence that genetic mixing does occur.

3.4 Fisheries and Other Users

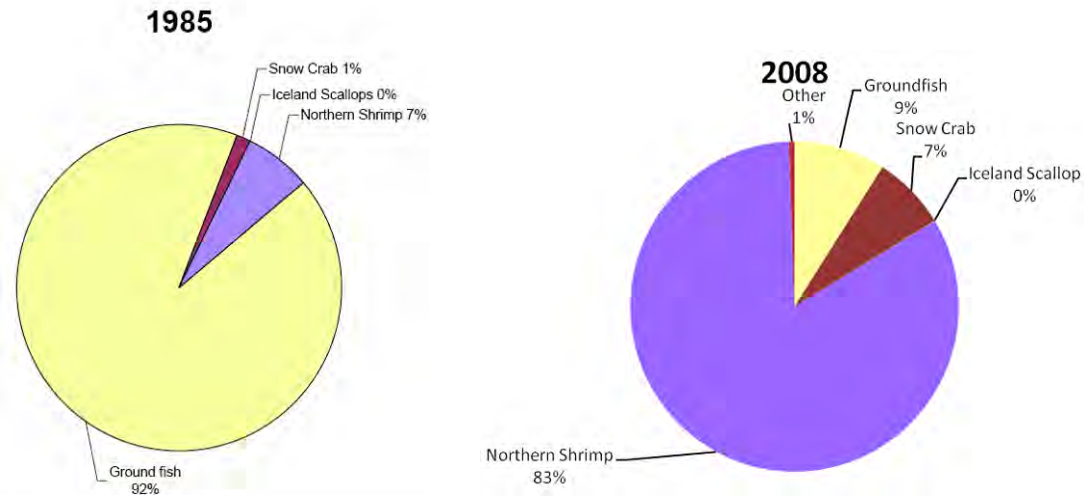
3.4.1 Fisheries

Groundfish catches in Northwest Atlantic Fisheries Organization (NAFO) Area 2 (refer to Figure 2-1) were large in the 1970s and 1980s; however, the fishery was considerably curtailed at the time of the moratorium in the early 1990s (Figure 3-1). In 1985, groundfish landings dominated the NAFO Area 2 harvest, comprising 92 percent of the fishery. Since then, the groundfish fishery in NAFO Area 2 has been considerably reduced while the crustacean (particularly northern shrimp) fisheries have increased in their importance (Husky Energy (2010) Section 5.5.2) (Figure 3-2). The same was seen in NAFO Areas 3KLM, with groundfish harvest between 1990 to 2009 reflecting the onset of the moratorium, and the shrimp and snow crab harvest (LGL (2011) Section 4.3.2, Figures 4.4 and 4.5). There have been minimal foreign fisheries in NAFO Area 2GHJ since the onset of the moratorium (see Figure 3-1). There is minimal foreign fishery in 3K, approximately half the catch in 3L is foreign and almost all of the catch in 3M is foreign (LGL (2011), Section 4.3.1.3, Table 4-5).



Source: Husky (2010) Section 5.5.2

Figure 3-1 Northwest Atlantic Fisheries Organization 2GHJ Harvest, 1985 to 2004, Foreign and Domestic



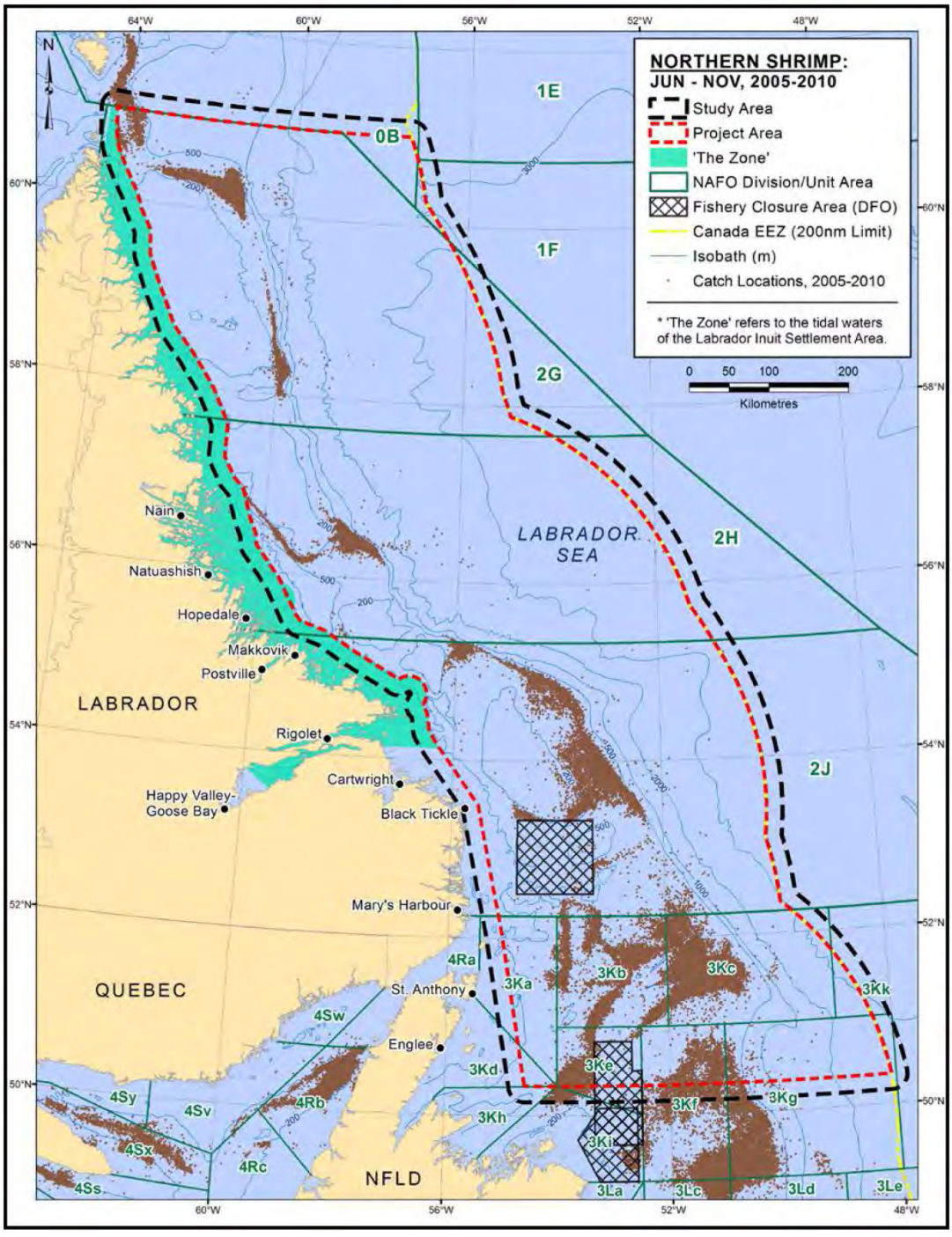
Source: Husky (2010) Section 5.5.2

Figure 3-2 Northwest Atlantic Fisheries Organization Area 2 Composition of Harvest, 1985 and 2008

Fisheries in the 2015 to 2024 Study Area are focused primarily on northern shrimp, which accounts for approximately 85 percent of the harvest in NAFO 2GHJ (Husky Energy 2010), and approximately 60 percent of the harvest in 3KLMN and 2J (RPS Energy 2012). Shrimp spawn in the late summer and fall and are harvested using mobile gear (trawl). Snow crab mate in late winter and spring and are an important component in 3KLMN and 2J; they are harvested using fixed gear (crab pots). Greenland halibut is the other species most often harvested in the 2015 to 2024 Study Area and spawn during December to April; they are harvested using both fixed gear (gillnets and longlines) and mobile gear (otter trawls). These three species account for approximately 95 percent of the harvested fish in the 2015 to 2024 Study Area (C-NLOPB 2010, 2011; Husky Energy 2010).

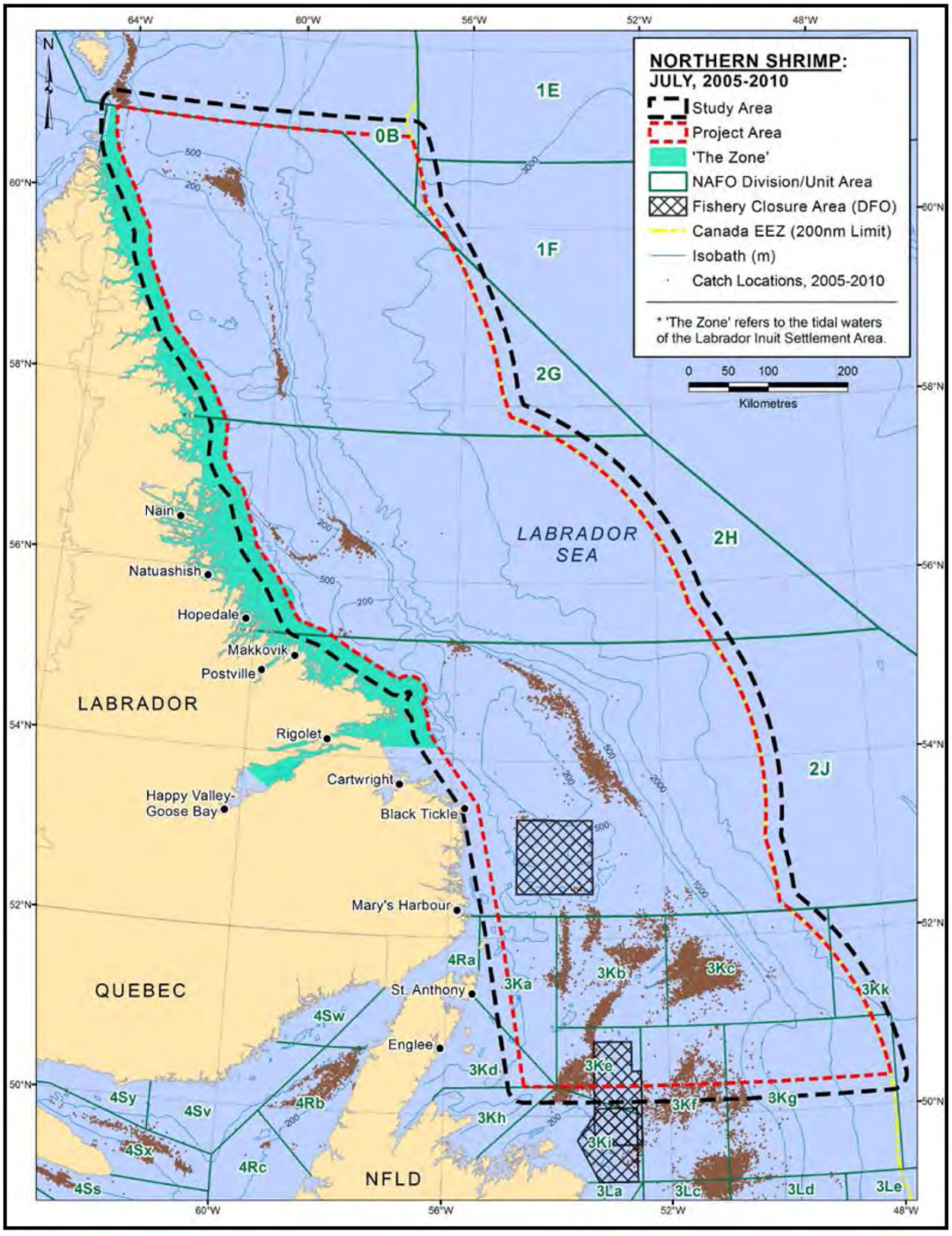
The domestic harvesting locations offshore Labrador (LGL Limited and GX Technology Canada Ltd. 2013; Section 4.3.2.2)) for shrimp (2005 to 2010 combined) from June to November and in July (proposed survey period for this sampling program) are illustrated in Figures 3-3 and 3-4, respectively. The domestic harvesting locations for snow crab (2005 to 2010 combined) from June to November are illustrated in Figure 3-5. The domestic harvesting locations for Greenland halibut (2005 to 2010 combined) for June to November are illustrated in Figure 3-6. The information illustrated in these figures covers the majority of the 2015 Project Area.

Figures illustrating the percent weight and percent value of shrimp, snow crab and Greenland halibut harvested in 2013 are provided in Appendix A (Figures A.1 to A.6). DFO Ottawa Statistical Division has a policy that prohibits the wholesale release of fisheries data in order to maintain privacy of individuals that could potentially be identified through detailed microdata. Spatial data are released at an aggregated 1/10th degree cell level only. No absolute values of weight and value are provided; the actual weight and value of a catch within each box are provided as a range. Therefore, the figures illustrate an average percentage of the weight/value percentage data provided by DFO. The weight/value percent for a specific cell has been summed and divided by the number of months that specific cell was fished (i.e., when the cell was fished, x% of species A was caught in the boundaries).



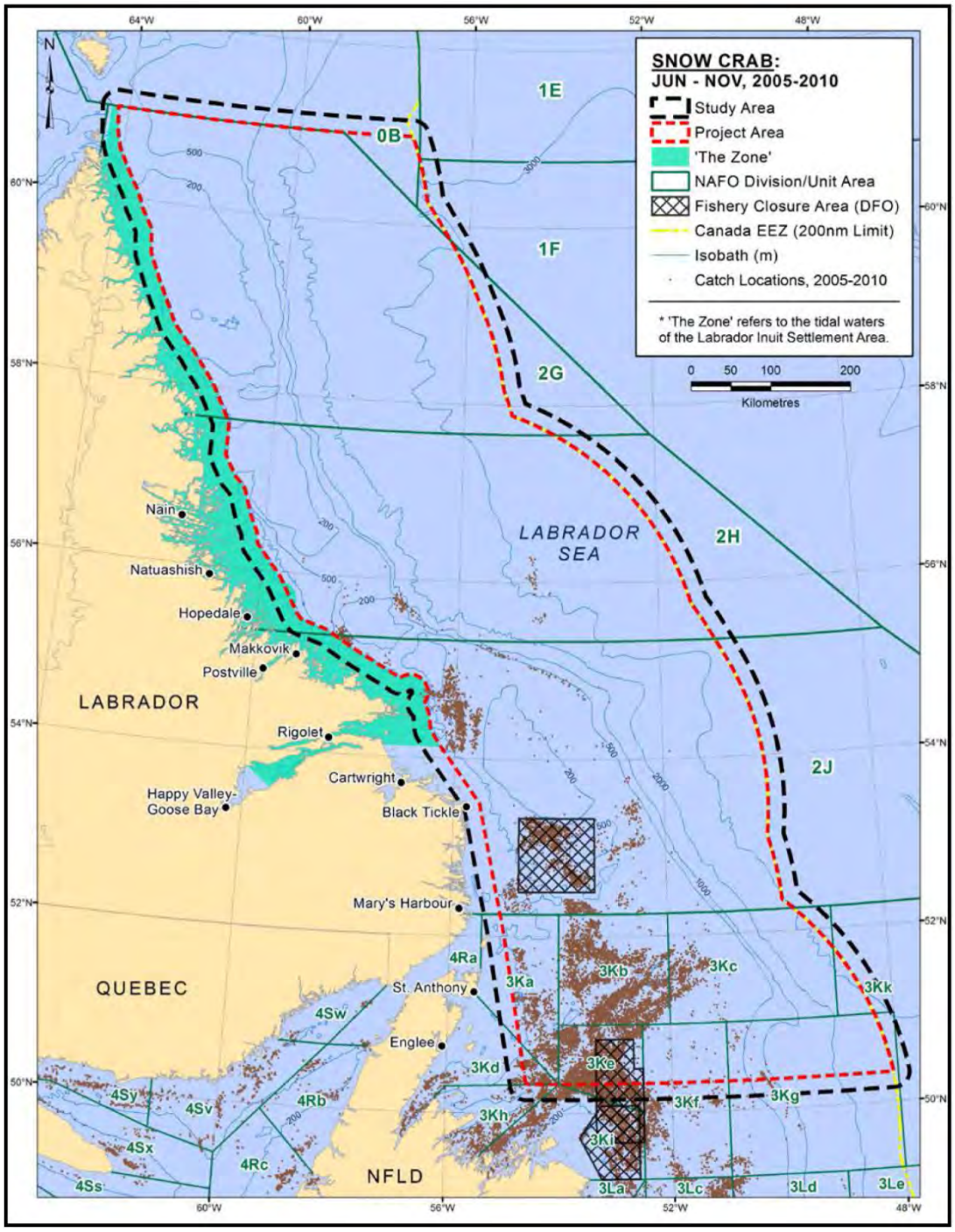
Source: LGL Limited and GX Technology Canada Ltd. 2013 (Figure 4-24, page 77)

Figure 3-3 Domestic Harvesting Locations for Northern Shrimp (2005 to 2010 combined) from June to November



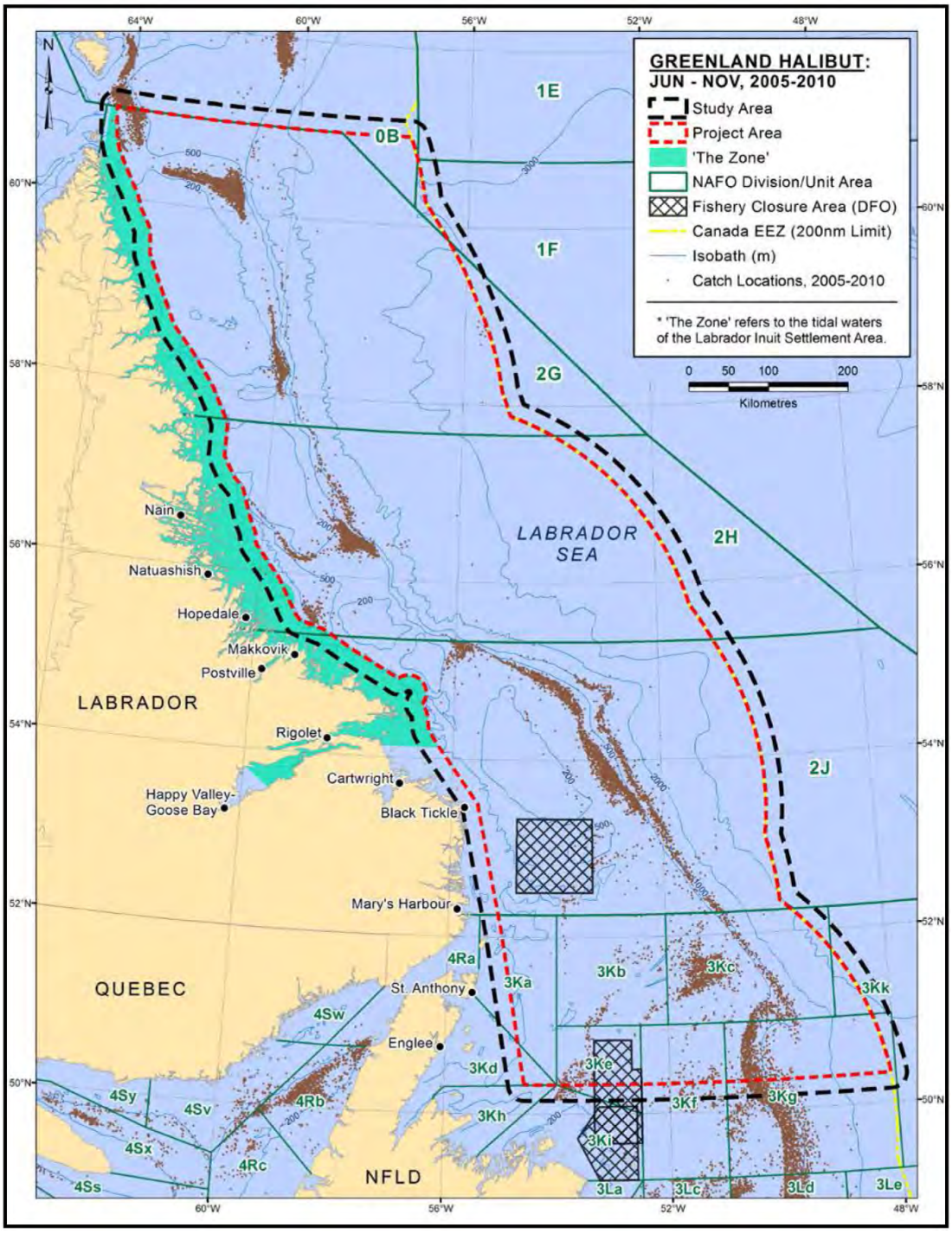
Source: LGL Limited and GX Technology Canada Ltd. 2013 (Figure 4-28, page 80)

Figure 3-4 Domestic Harvesting Locations for Northern Shrimp (2005 to 2010 combined) in July



Source: LGL Limited and GX Technology Canada Ltd. 2013 (Figure 4-34, page 86)

Figure 3-5 Domestic Harvesting Locations for Snow Crab (2005 to 2010 combined) from June to November



Source: LGL Limited and GX Technology Canada Ltd. 2013 (Figure 4.37, page 88)

Figure 3-6 Domestic Harvesting Locations for Greenland Halibut (2005 to 2010 combined) from June to November

3.4.2 Other Users

The southern portion of the 2015 to 2024 Study Area includes the Orphan Basin, Flemish Pass/Cap and the northern Grand Banks. Ongoing oil and gas activities in these areas include exploration drilling, production platforms and seismic surveys.

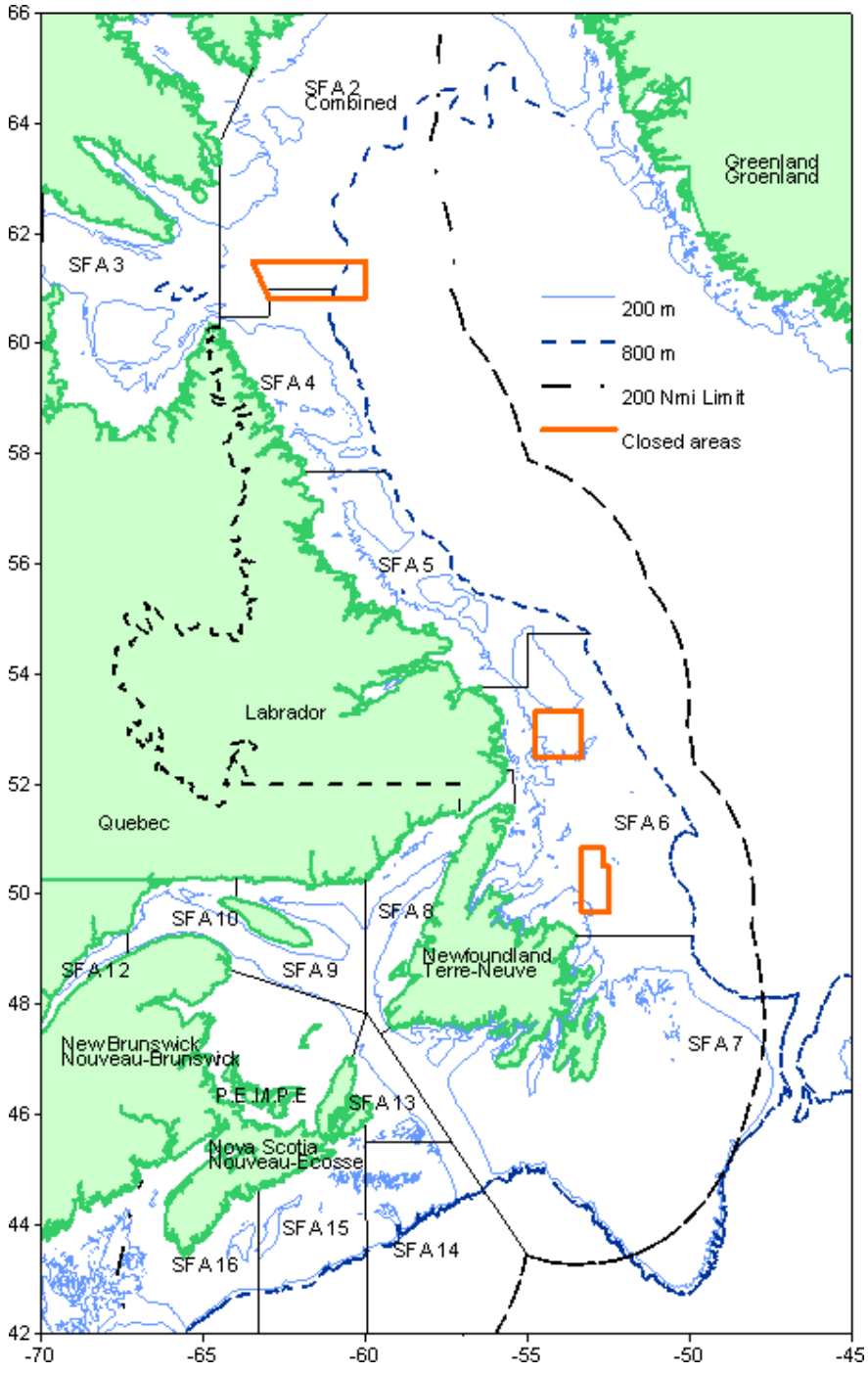
"The Zone" (refer to Figure 2-1) encompasses 48,690 km² of ocean established under the Labrador Inuit Land Claims Agreement (2005). Labrador Inuit have the right to harvest fish and marine mammals for Inuit food, social and ceremonial purposes within "The Zone" (Husky (2010) Section 5.5.9). Traditional fish species include Atlantic cod, Arctic char, rock cod, salmon and other fish species such as herring, capelin, smelt, flounder, turbot, halibut, whitefish, redfish and sculpin (Alton Mackey and Orr 1987 and Brice-Bennett 1977, in Husky (2010) Section 5.5.9).

Shrimp Fishing Areas (SFAs) are illustrated in Figure 3-7. The Northern Shrimp Research Foundation, in conjunction with DFO, conducts an annual summer survey from July 15 to the first week of October in Shrimp Fishing Area 4 (NAFO Division 2G) (Orr and Sullivan 2013) (Figure 3-8). As of February 2013, analysis of data collected from SFA 4, as well as data acquired during the DFO multispecies surveys in SFA 5 (Hopedale and Cartwright Channels) and 6 (NAFO Division 3K + Hawke Channel) indicated that the current status of northern shrimp remains positive in the northern part of the survey area (SFAs 4 and 5) and there is concern for the current status in the south (SFA 6) (Orr and Sullivan 2013). The resource increased in SFA 4, decreased from a peak in 2006 to near 1996 levels in SFA 6 and remained near average in SFA 5 (DFO 2013b).

Crab Management Areas are illustrated in Figure 3-9. The DFO-Industry Post-Season Crab Survey is conducted annually (usually starting in September) from set stations (Figure 3-10) and extends from 3O north to 2J. The locations and timelines for the 2015 survey will be the same as previous years (D. Power, pers. comm.). Catch distribution (mean numbers/trap) for 2011 to 2013 for large and small mesh traps are illustrated in Figures 3.11 and 3.12, respectively.

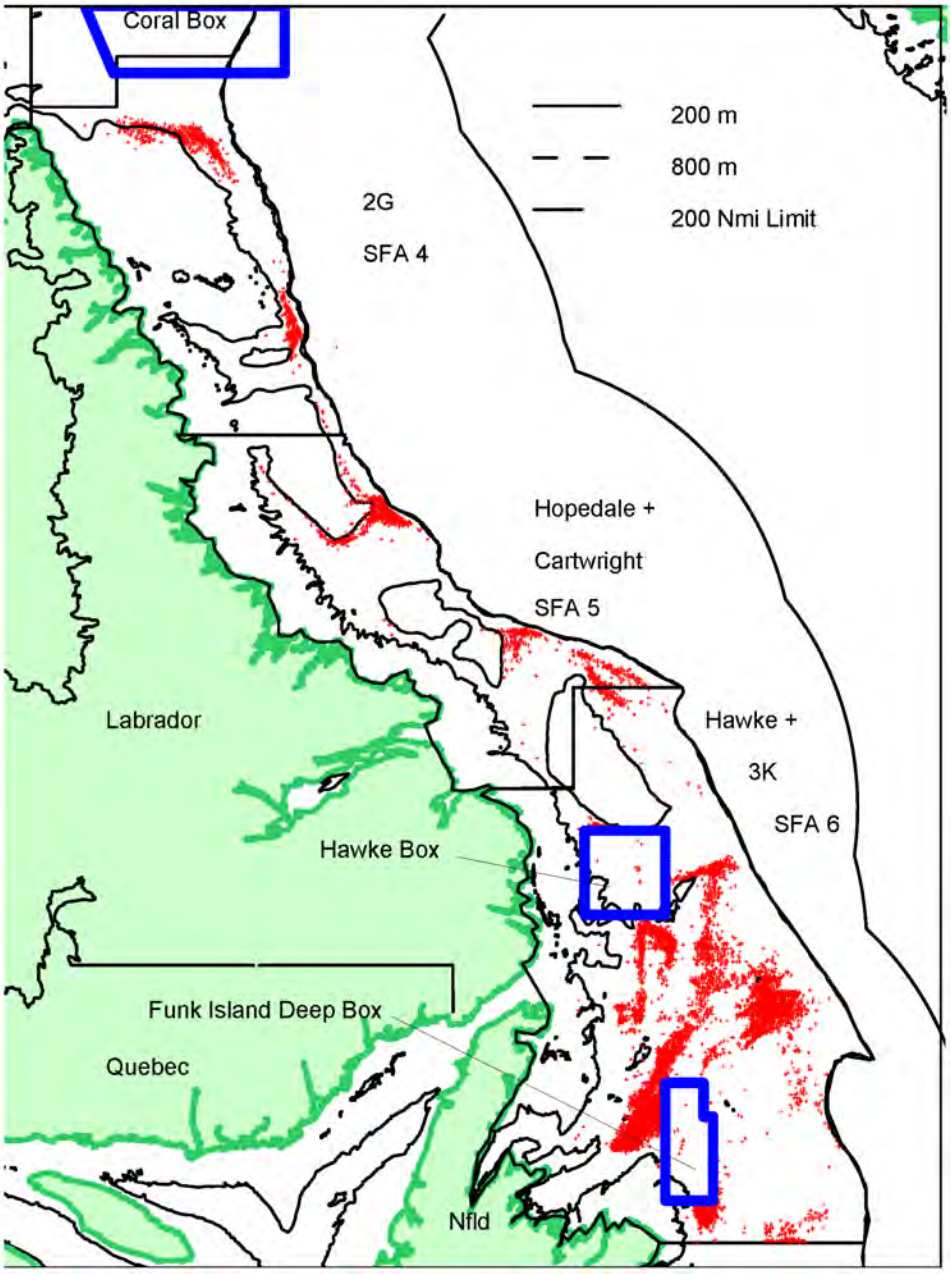
Legal size crab in NAFO Area 2J were predominantly new shell in 2007, older shell in 2008, virtually no old shell in 2009 and average levels of old shell from 2010 to 2012. Legal crab size has shown an annual increase since 2009 to 2012 (Stansbury et al. 2014).

Legal size crab in inshore NAFO Area 3K were equal in new and old shell crab until 2009, when there was a reduction in old shell crab. Current surveys indicate that old shelled crab is at a new high. Legal crab size is declining in offshore NAFO Area 3K. Catch rates for both sub-legal and legal size crab has fluctuated in NAFO Area 3K inshore and offshore (Stansbury et al. 2014).



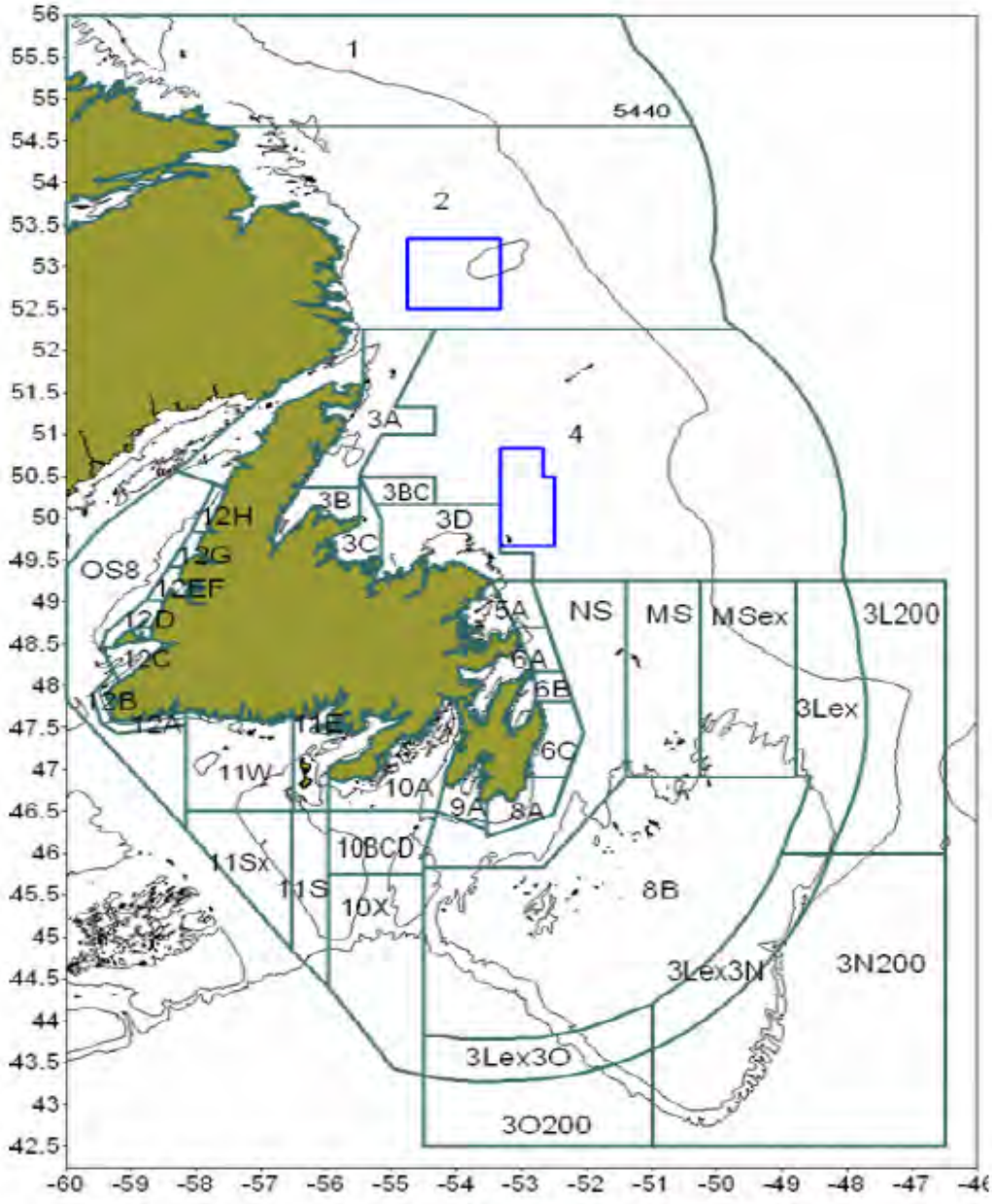
Source: DFO 2013c
NOTE: The orange boxes indicate the large voluntary coral box and Hawke Channel and Funk Island Deep closed areas.

Figure 3-7 Shrimp Fishing Areas



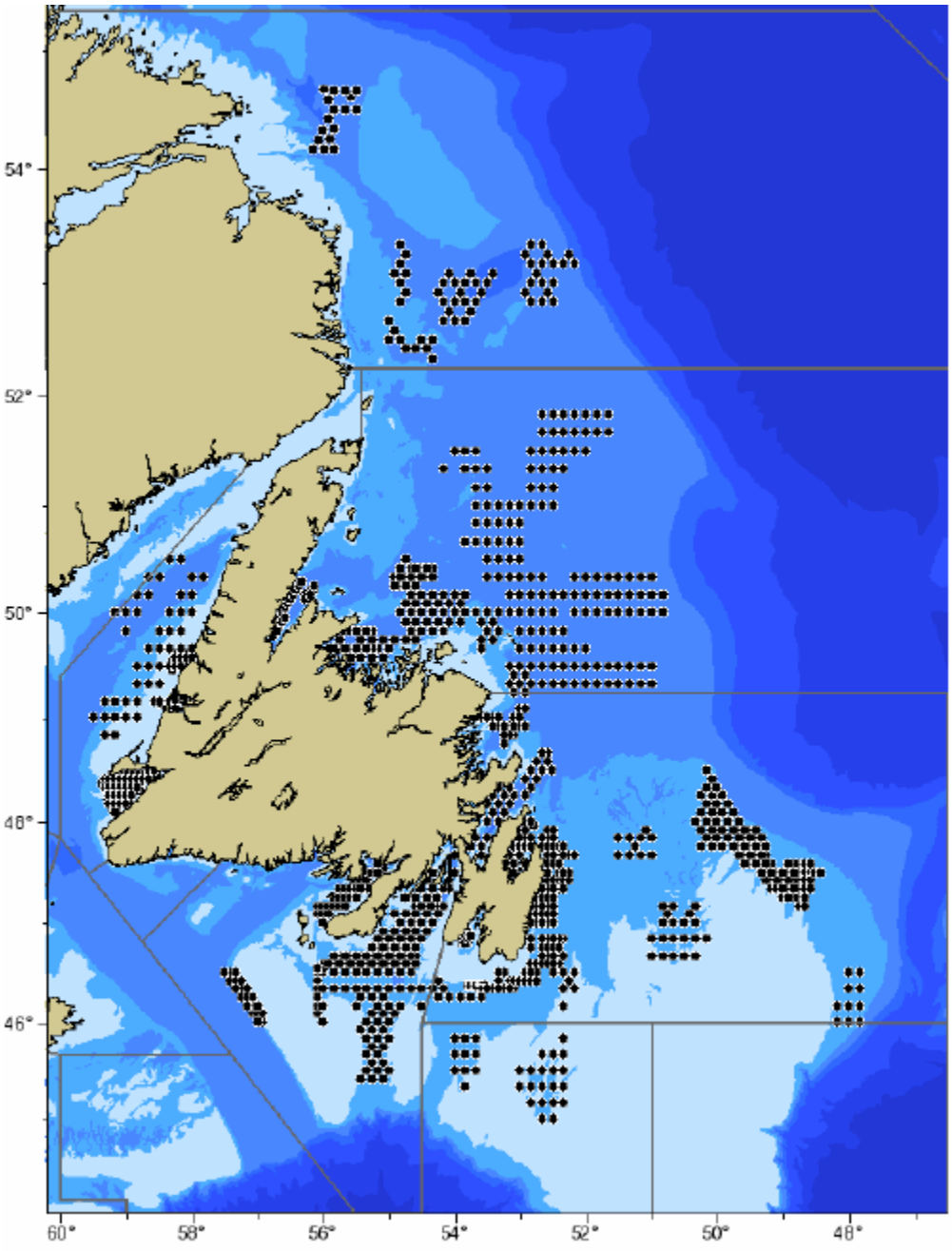
Source: Orr and Sullivan 2013
NOTE: The red crosses indicate large and small vessel fishing positions during 2012-2013. The Blue boxes indicate the large voluntary coral box and Hawke Channel and Funk Island Deep closed areas.

Figure 3-8 Northern Shrimp Research Foundation 2012/2013 Fishing Locations



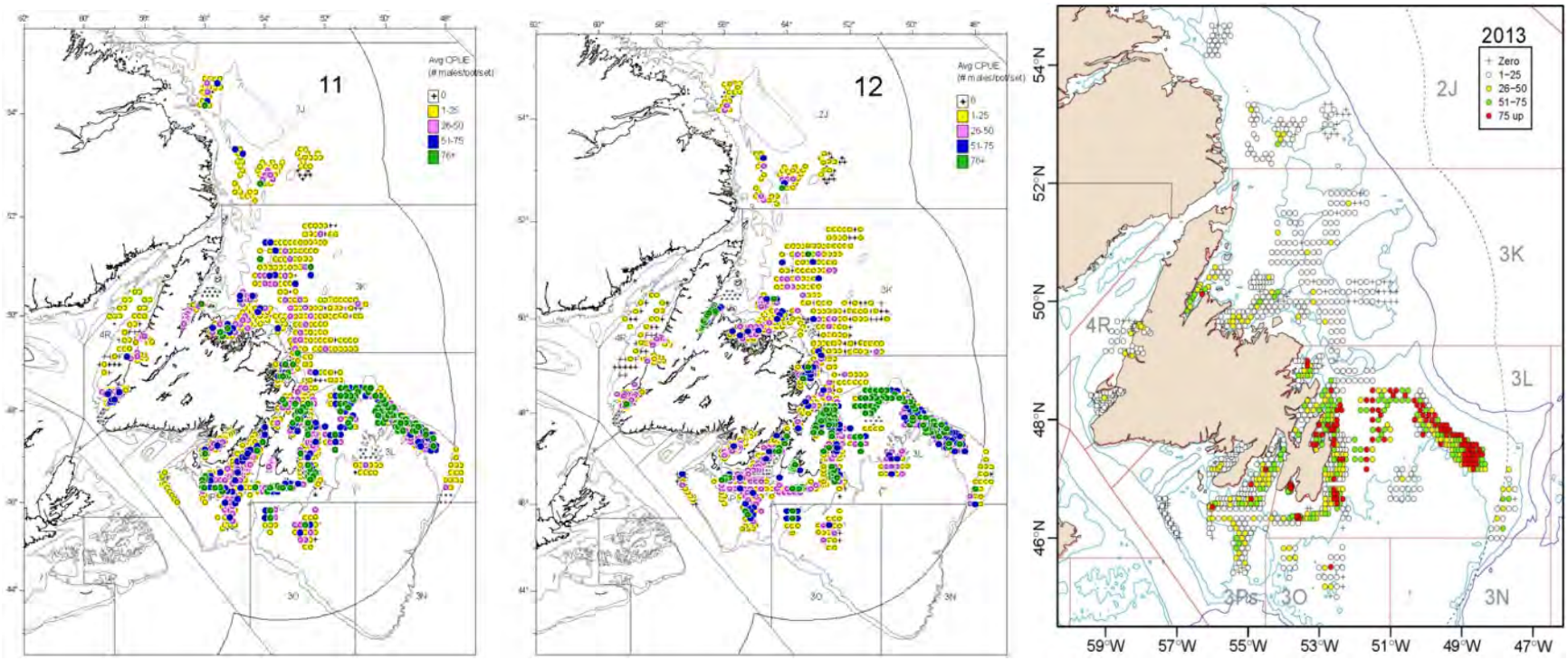
Source: Stansbury et al. 2014
NOTE; The Blue boxes indicate Hawke Channel and Funk Island Deep closed areas (trawling and gill-netting closures).

Figure 3-9 Crab Management Areas



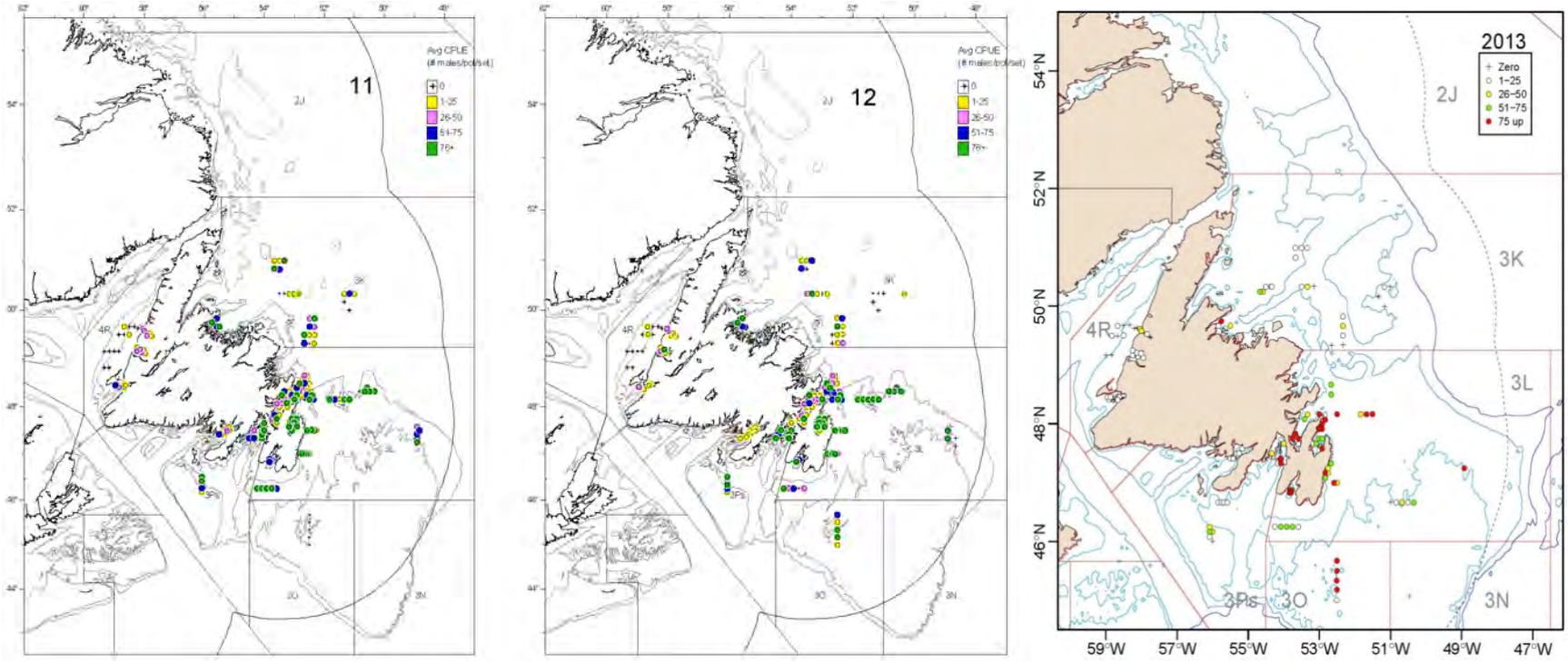
Stansbury et al. 2014

Figure 3-10 Stations for DFO-Industry Post-Season Crab Survey



Source: Stansbury et al. 2014

Figure 3-11 Catch Distribution of Snow Crab (mean numbers/trap) for 2011-2013 for Large Mesh Traps



Source: Stansbury et al. 2014

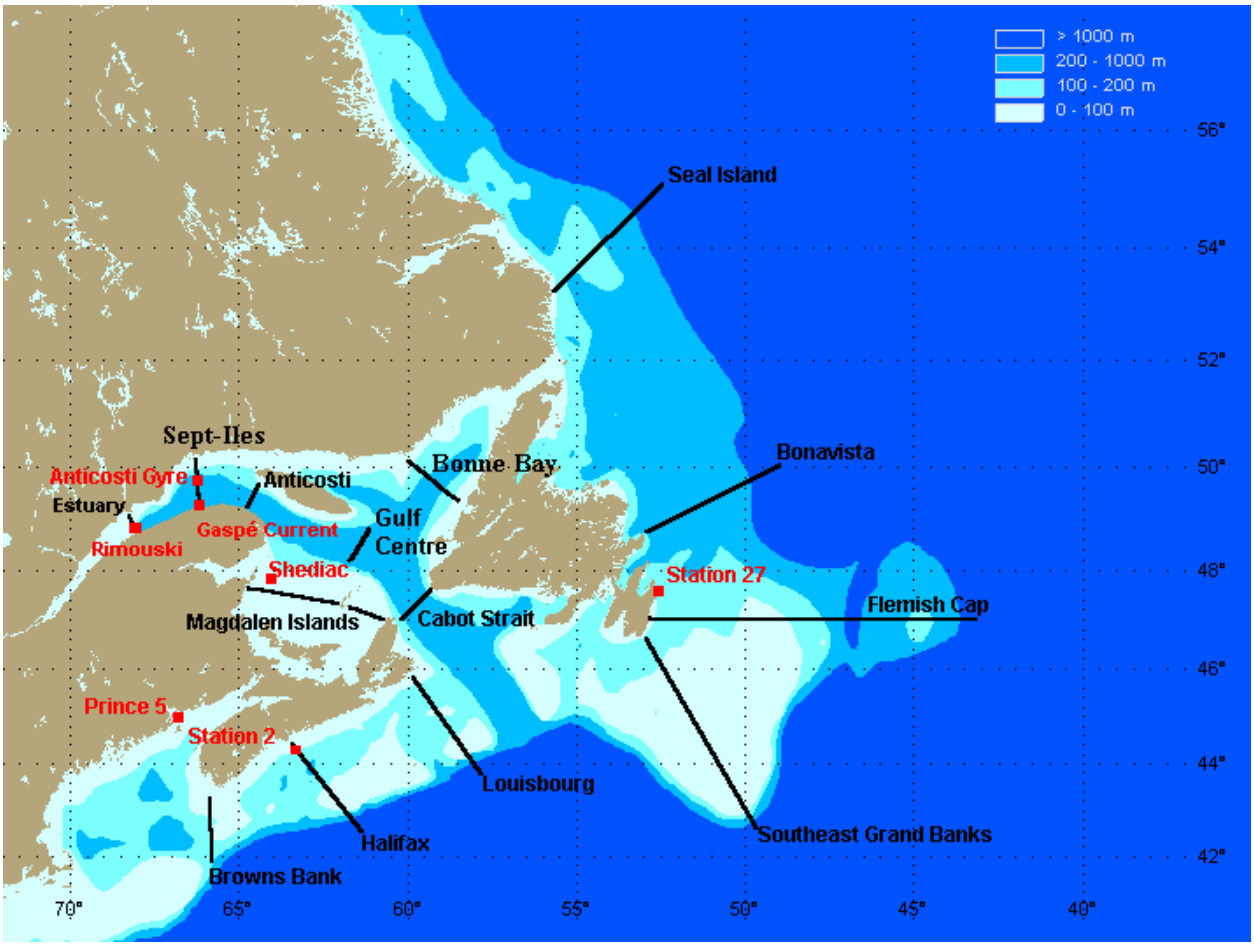
Figure 3-12 Catch Distribution of Snow Crab (mean numbers/trap) for 2011-2013 for Small Mesh Traps

Legal size crab in inshore NAFO Area 3L were equal in new and old shell crab; current surveys indicate that old shelled crab numbers are at a new high. Legal crab size is increasing in offshore NAFO Area 3L. Catch rates for legal sized crab in NAFO Area 3L have increased from 2007 to 2012 in the offshore and remain steady in the inshore. Catch rates of sub-legal size in NAFO Area 3L have declined since 2010 in the offshore (Stansbury et al. 2014).

DFO spring surveys are scheduled from the *Research Vessel* (RV) *Needer* for NAFO Areas 3O and 3N in the latter half of May 2015 and 3L and 3N for the first half of June 2015. The Newfoundland and Labrador Spring Atlantic Zone Monitoring Program survey was conducted from the *RV Teleost* in NAFO Areas 3P and 3KLMNO in April 2015 (Figure 3-13). The *RV Teleost* will also conduct a comparative redfish survey from the end of April and first week of May 2015 and a capelin survey mid- to late May 2015. Fall surveys are scheduled from the *RV Needler* for NAFO Areas 30 and 3N (end September to October 2015), 3N and 3L (latter half of October 2015), 3L (end October to mid-November 2015) and 3K and 3L (latter half of November 2015) and from the *RV Teleost* for NAFO Areas 2H (first half of October 2015), 2H and 2J (second half of October 2015), 2J + 3K (end September to mid-November 2015), 3K (latter half of November 2015) and 3K + 3L Deep (end of November to mid-December 2015) (G. Sheppard, pers. comm.).

The 2014 Torngat Joint Fisheries Board-DFO Collaborative Post Season Trap Survey was scheduled for the last week of August (see Figure 3-14); it is assumed that the 2015 survey will also be conducted in the same area within the same timeframe.

Other potential marine vessels in the 2015 to 2024 Study Area are cruise ships and the Department of National Defence. Cruise ships run primarily south to north and return (C-NLOPB 2011a). The Department of National Defence has advised that they will likely be operating in the vicinity of the 2015 to 2024 Study Area in a non-interference manner during the Project timeframe (C. Griffin, pers. comm., in Aivek Stantec 2014). MG3 will contact the Department of National Defence prior to the start of the Project to determine if there are any naval exercises scheduled during the Project's scheduled operation and ensure de-confliction with possible Allied submarine activities. The Department of National Defence has also identified two wrecks with potential unexploded ordnance in the 2015 to 2024 Study Area (these are outside the 2015 Project Area). MG3 will mark and immediately report any unidentified unexploded ordnance to the Canadian Coast Guard if any is found during the program. The MG3 Project Manager, who would be based in MG3's UK office, would serve as a Point Of Contact for MARLANT queries and concerns. A Notice to Mariners will be issued for all underwater activities and any significant surface ventures, such as use of flares, buoys, and unconventional night lighting. A Notice to Airmen will be issued for all activities that could affect air safety, such as use of balloons, unmanned aerial vehicles or tethered airborne devices.



Source: DFO 2014b

Figure 3-13 Map of the Atlantic Zone Monitoring Program Stations and Sections

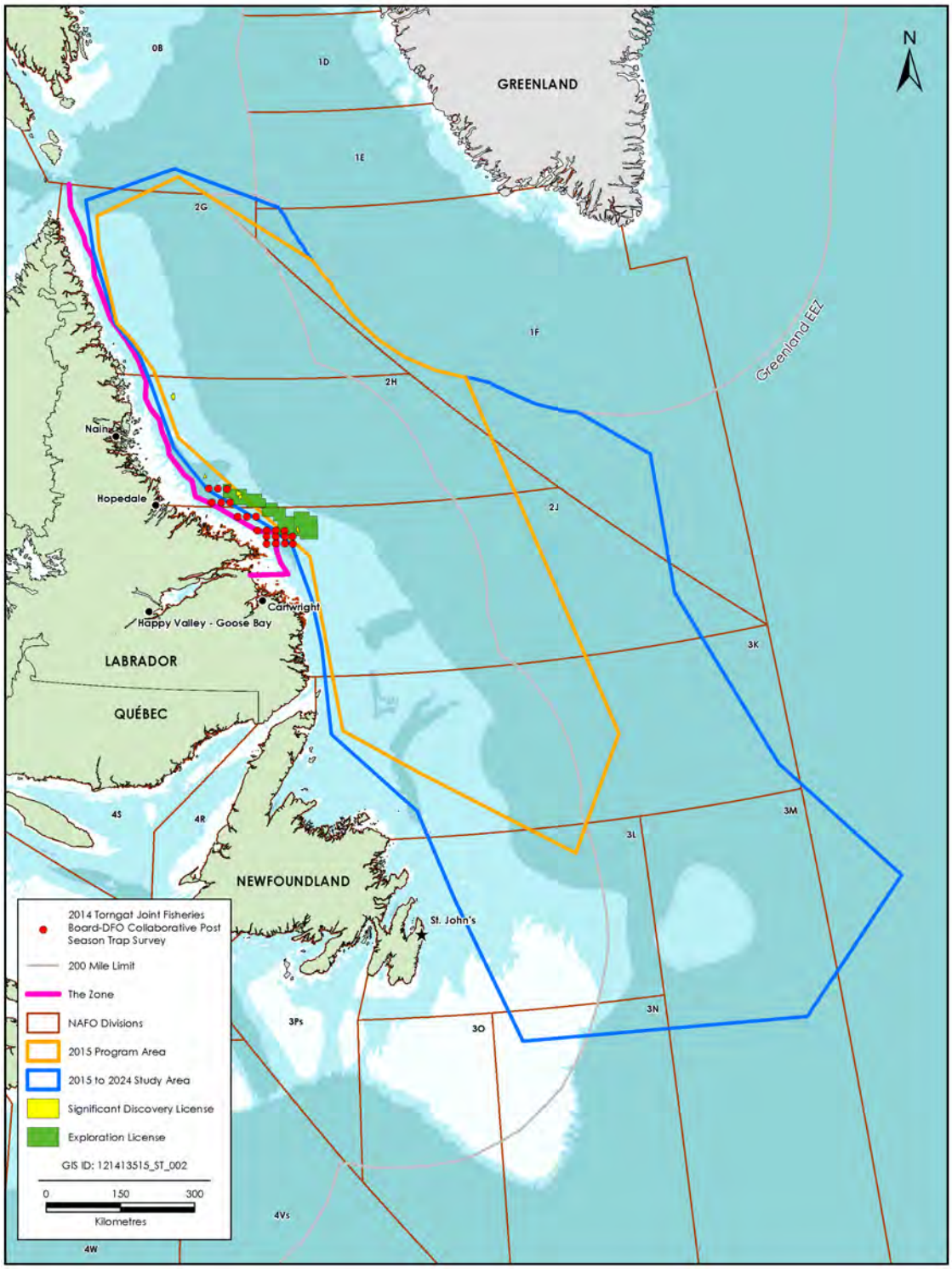


Figure 3-14 2014 Torngat Joint Fisheries Board-DFO Collaborative Post Season Trap Survey Locations

3.5 Marine Mammals and Sea Turtles

Marine mammals (including baleen and toothed whales and seals) are common in the 2015 to 2024 Study Area, especially in the summer, and polar bears are found in the northern portion of the 2015 to 2024 Study Area. A number of these species (including polar bear) are considered to be at risk species by either SARA and/or COSEWIC (refer to Section 3.2). Species not at risk include the sei whale, humpback whale, minke whale, sperm whale, long-finned pilot whale, Atlantic white-sided dolphin, white beaked dolphin, striped dolphin, common bottlenose dolphin, short-beaked common dolphin, harp seal, ringed seal, bearded seal, harbour seal, grey seal, and hooded seal.

The Kemp ridley's sea turtle is the only not at risk sea turtle in the 2015 to 2024 Study Area, although it is not common (C-NLOPB 2010, 2011a, 2011b).

3.6 Marine and Migratory Birds

The coast of Labrador is used by many marine birds for breeding, overwintering, migration or moulting stopover, including sea ducks, shorebirds and seabirds. The 2015 to 2024 Study Area is used by approximately 30 bird species. The Hawke Channel, edge of the Labrador Shelf and Funk Island have high densities during the breeding season, with many birds sharing breeding space. In the southern portion of the 2015 to 2024 Study Area, the Flemish Pass, Orphan Basin and Sackville Spur have been identified as important areas to different bird species/groups. Various species nest along the Labrador coast, including the various coastal islands (e.g., Atlantic Puffin, Common and Thick-billed Murre, Guillemot and Razorbill). A number of species overwinter in the Labrador Sea (e.g., Common and Thick-billed Murre). Other species breed in one location (such as the 2015 to 2024 Study Area) and overwinter in other locations (e.g., Leach's Storm-Petrel). Species also use the 2015 to 2024 Study Area as a migration route between southern wintering areas and northern breeding grounds (e.g., jaegers). The southern portion of the 2015 to 2024 Study Area is important to Black-legged Kittiwake, Northern Fulmar, Leach's Storm-petrel, shearwaters and gulls (C-NLOPB 2010, 2011a, 2011b).

Ship-based and aerial baseline surveys for seabirds on the Labrador Sea (Tranquilla et al. 2013) were conducted in a study area very similar to (overlapping with) the 2015 Program Area. Northern Fulmar and Dovekie were the most abundant species on the Labrador Shelf identified from ship-based surveys; northern fulmar had an extensive distribution, while Dovekies had a more limited distribution (coastal and on the shelf). Large alcids (web-footed diving birds) identified during ship-based surveys had a widespread distribution, with higher densities closer to shore and on the shelf. Shearwaters were not widely distributed during ship-based observations, occurring primarily on the shelf and shelf edge. Leach's Storm-petrel distribution from ship-based surveys was very sparse, with densities primarily over the Hamilton Bank (Tranquilla et al. 2013). Information has been requested for Environment Canada's Eastern Canadian Seabirds at Sea Data for the area; data is expected the week of June 8, 2015, and will be included in an addendum to the environmental assessment.

During aerial surveys the densest aggregations of aclids were found in the most northerly transects, while the densest aggregations of Northern Fulmar were along the most southerly transect lines. Black-winged Gulls were not abundant during aerial surveys, while White-winged Gulls were found throughout the aerial survey (Tranquilla et al. 2013).

Of the approximately 590,000 pairs of breeding seabirds located at eight Important Bird Areas (IBAs) adjacent to the 2015 to 2024 Study Area, approximately two-thirds reside on Funk Island (LGL 2014). Of those adjacent to the 2014 Program Area, the Gannett Islands off Hamilton Inlet has the largest breeding seabird nesting colony in Labrador (LGL 2014). As there are no IBAs within the 2015 to 2024 Study Area (or 2015 Program Area) (see Figure 3-15), the only potential interaction with seabird colonies is the unlikely event of a diesel spill from vessel distress; it is unlikely these IBAs would be affected by the coring program.

3.7 Sensitive Areas

Sensitive areas (Figure 3-15) include a Marine Protected Area at Torngat Mountains National Park, Gilbert Bay, Gannett Islands Ecological Reserve, IBAs (none of which are inside the 2015 to 2024 Study Area), the Bonavista Cod Box, the Placentia Bay-Grand Banks Large Ocean Management Area, and potential Ecological and Biological Sensitive Areas (EBSA) (Figure 3-16). These EBSAs include (DFO 2013d):

- three coastal areas (Nain Area, Lake Melville, and Gilbert Bay);
- four straddle coastal and offshore areas (Northern Labrador, Hamilton Inlet, Grey Islands and Fogo Shelf); and
- seven offshore areas (Outer Shelf Saglek Bank, Outer Shelf Nain Bank, Hopedale Saddle, Labrador Slope, Labrador Marginal Trough, Notre Dame Channel, and Orphan Spur);

The northern portion of the 2015 to 2024 Study Area has the Coral Protection and Conservation Areas (areas of corals (found in deeper waters (>200 m)), with aggregations found between Makkovik Bank and Belle Island Bank, Saglek Bank and Hatton Basin). The southern portion of the 2015 to 2024 Study Area has 11 areas of important coral and sponge concentrations (note that the 2015 program will not be conducted in these areas) (C-NLOPB 2010, 2011a, 2011b).

Twenty-eight IBAs are located adjacent to the 2015 to 2024 Study Area; fifteen are adjacent to the 2015 Program Area; none are located within the 2015 Program Area or 2015 to 2024 Study Area. IBAs adjacent to the 2015 to 2024 Study Area are illustrated in Figure 3-15. As the only potential for an accidental event (a diesel spill) is from the unlikely event of vessel distress, and given the short duration of the program and that the IBAs are not located within the 2015 Program Area, it is unlikely these IBAs would be affected by the coring program.

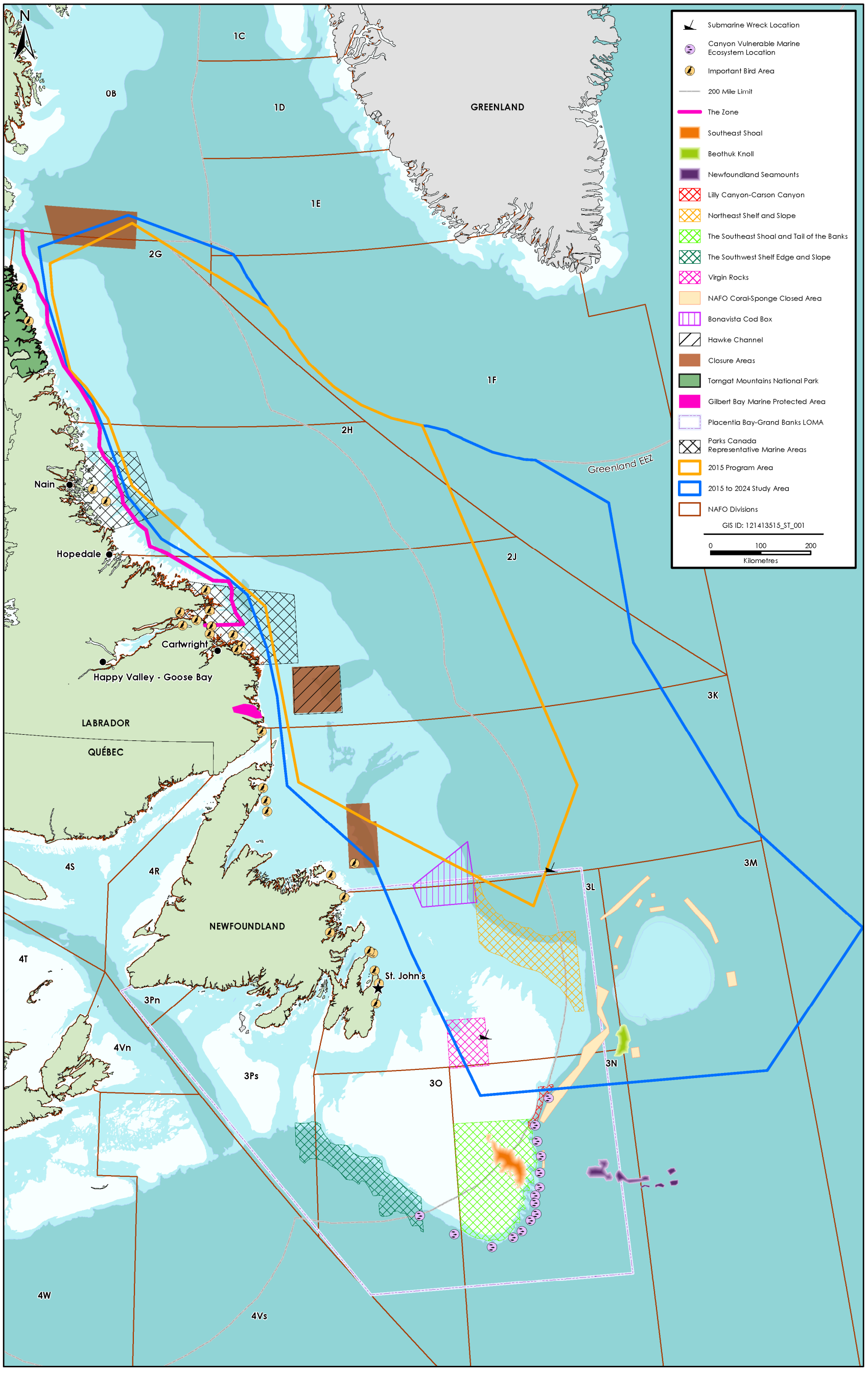
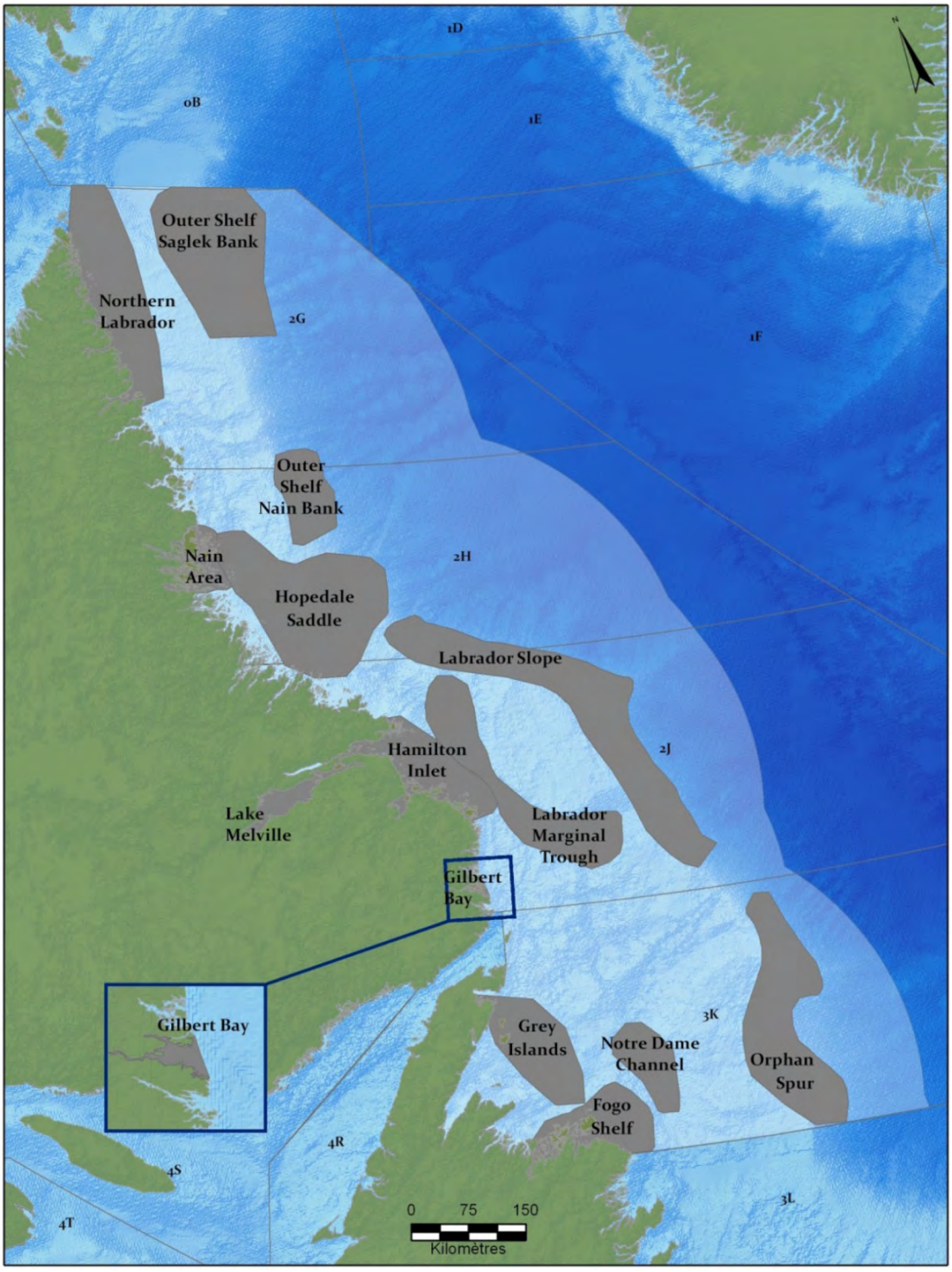


Figure 3-15 Sensitive Areas in the 2015 to 2024 Study Area



Source: DFO 2013d

Figure 3-16 EBSAs Identified and Delineated in the Newfoundland and Labrador Shelves Bioregion Study Area

4.0 STAKEHOLDER CONSULTATION

MG3 has initiated contact with the C-NLOPB, providing a description of the Project to determine the level of environmental assessment that may be required from the C-NLOPB. MG3 will continue to consult with the C-NLOPB during the preparation of the environmental assessment to ensure that all potential issues are addressed by the environmental assessment.

MG3 is meeting with the Nunatsiavut Government on June 8, FFAW-Unifor/One Ocean on June 9 and the C-NLOPB on June 10 to provide information on the Project. And issues arising from the consultations not addressed in this environmental assessment will be addressed in an addendum.

MG3 plans to use a Fisheries Liaison Officer and a MMO/bird observer during the survey.

The Project Description was provided to a representative of the Groundfish Enterprise Allocation Council and the Canadian Association of Prawn Producers; they expressed concerns associated with multi-beam, coring or water collection (B. Chapman, pers. comm.).

5.0 ENVIRONMENTAL ASSESSMENT METHODS

5.1 Valued Environmental Components

The final Scoping Document (C-NLOPB 2015) has defined the following as valued environmental components (VEC) that require assessment of potential environmental effects resulting from the Project:

- Species at Risk (either listed on Schedule 1 of SARA or assessed as at risk by COSEWIC);
- Marine Fish and Shellfish;
- Fisheries and Other Users;
- Marine Mammals and Sea Turtles;
- Marine and Migratory Birds; and
- Sensitive Areas.

Planned activities and accidental events (i.e., unplanned hydrocarbon release) associated with Project activities are assessed in this environmental assessment. In addition, this environmental assessment includes an analysis of cumulative environmental effects.

5.2 Boundaries

Boundaries help focus the scope of the environmental assessment and allow a meaningful analysis of potential environmental effects associated with the Project. The environmental assessment considers the potential effects of the Project within spatial and temporal boundaries that encompass the periods and areas during and within which the Project may potentially interact with, and have an effect on, one or more VECs.

5.2.1 Spatial Boundaries

The 2015 Project Area is shown in Figure 2-1. This is the spatial area within which Project activities will occur in 2015.

The spatial boundary for the 2015 to 2024 program is also shown in Figure 2-1, and is referred to as the 2015 to 2024 Study Area. Given the extent of the 2015 to 2024 Study Area, the Regional Area is equivalent to the 2015 to 2024 Study Area. This is the area that could potentially be affected by Project activities beyond the 2015 Project Area.

5.2.2 Temporal Boundaries

The temporal scope of the 2015 to 2024 program is the ice-free season. While the overall environmental assessment is aimed at a 10-year temporal scale, MG3 recognizes the sensitivity to this time line in the areas covered by the Nunatsiavut Government (predominantly Areas A

and B on Figure 2-1), and will therefore agree to a review of the environmental assessment (and additional consultations) after 2017.

5.3 Project Interactions

The Project consists of:

- sampling of potential natural seabed seeps (casting and retrieving a fishing line with a GORE sampler attached);
- collection of MBES and use of SBP prior to collecting the sample;
- collection of shallow seabed cores using a gravity core; and
- conducting seabed heat flow measurements using a thermal probe.

As this is a seafloor sampling survey, conventional seismic survey methods and equipment, such as a seismic air source array(s) and streamer(s), are not proposed and will not be used. High-resolution bathymetry using MBES will be acquired. The primary interactions of Project operations with the environment are the collection of substrate cores and operation of the vessel. The VECs with the potential to interact with Project operations are Species at Risk, Marine Fish and Shellfish (fish habitat), Fisheries and Other Users, Marine Mammals and Sea Turtles and Marine and Migratory Birds (Table 5.1). An accidental release of diesel fuel due to damage / sinking of the research vessel would also result in an interaction with the environment (see Table 5.1).

Table 5.1 Project-Valued Environmental Component Interaction

Activity	Species at Risk	Fisheries and Other Ocean Users	Marine and Migratory Birds	Marine Mammals and Sea Turtles	Marine Fish and Shellfish (fish habitat)	Sensitive Areas
Operations						
Collection of Surface Oil Samples	-	X	-	-	-	-
Use of MBES and SBP	X	X		X	-	-
Collection of Substrate Cores	-	X	-	-	X	-
Operation of Research Vessel	-	X	X	-	-	-
Accidental Event						
Loss of Diesel Fuel Due to Damage / Sinking of the Research Vessel	X	X	X	-	-	-
Collision with Vessel	X	X	-	X	-	-
Other Projects and Activities						
Fishing Activities	-	-	-	-	-	-
Marine Traffic	-	-	-	-	-	-
Seismic Surveys	-	-	-	-	-	-

5.4 Significance Criteria

Evaluating the significance of predicted residual environmental effects is one of the critical stages in an environmental assessment. Significant environmental effects are those adverse effects that, even with mitigation applied, will cause a change that will alter the status or integrity of a VEC beyond an acceptable level. In this environmental assessment, environmental effects are evaluated as significant or not significant based on definitions of significance that have been developed and used for each VEC (Table 5.2).

Table 5.2 Residual Environmental Effects Significance Criteria by Valued Environmental Component

VEC	Criteria
Species at Risk	A significant adverse residual environmental effect on all species listed in Schedule 1 of SARA as "Extirpated", "Endangered" or "Threatened" is one that results in a non-permitted contravention of any of the prohibitions stated in Sections 32 to 36 of SARA.
Marine Fish and Shellfish Marine Mammals and Sea Turtles Marine and/or Migratory Birds	A significant adverse residual environmental effect is defined as one that affects VEC populations and/or habitat, or a portion thereof, in such a way as to cause a decline or change in abundance and/or distribution of the population over one or more generations. Natural recruitment (reproduction and in-migration from unaffected areas) may not re-establish the population to its original (i.e., pre-Project) level within several generations or avoidance of the area becomes permanent.
Fisheries and Other Users	A significant adverse residual environmental effect is one where the Project results in a net loss of commercial fisheries that is not compensated consistent with C-NLOPB guidelines and past practices and as outlined in the One Ocean Protocol document.
Sensitive Areas	A significant adverse residual environmental effect is one that alters the valued habitat of the identified Sensitive Area physically, chemically or biologically, in quality or extent, to such a degree there is a decline in abundance of key species or species at risk or a change in community structure, beyond which natural recruitment (reproduction and immigration from unaffected areas) would not return the population or community to its former level within several generations.

5.5 Environmental Management

Plans will be developed to avoid or reduce potential effects on the commercial fishery. These plans will include elements such as communications (e.g., notifications on the Fisheries Broadcast and Okalakatiget Society (a regional, native communication service for the people on the North Coast and the Lake Melville region of Labrador) and Notices to Shipping), avoidance of areas during times of heavy fixed gear use and a fishing gear damage compensation program (as per C-NLOPB and CNSOPB 2002), in the event of an oil spill. Other proposed mitigation measures are described in Section 2.7.

A compensation program will be made available by MG3 that is consistent with C-NLOPB guidelines and past practices. This program covers any damage to fishing gear (or vessels) caused by the survey vessel or survey gear, and includes the value of any harvest lost as a direct result of an incident. MG3 will follow procedures for responding to a claim similar to those outlined in the One Ocean Protocol document (these have been successfully employed in the past by other operators). Any and all incidents will be reported to the C-NLOPB, which maintains a 24-hour answering service at 709-682-4426 for this purpose (709-778-1400 during working hours). Reports on contacts with fishing gear will include the exact time and location of initial contact, loss of contact and a description of any identifying markings on the gear.

6.0 ENVIRONMENTAL EFFECTS ASSESSMENT

6.1 Project Activities

The program will collect GORE samples from the surface of the water using a standard fishing rod and line, shallow (penetrating to 6 m in the substrate) seabed cores from the seafloor using a gravity corer with mounted thermal probes and continuous CTD logs through the water column, to just above the seafloor. The collection locations will avoid areas of commercial fishing activity (especially any areas of fixed gear) as identified through consultation with the FFAW-Unifor's Petroleum Industry Liaison. Data collection will avoid coral closure areas and other identified sensitive areas. As the data collection will occur over a 24-hour period, there is potential for marine and migratory birds to be attracted to the vessel at night, potentially resulting in stranding on the vessel. Thus, the magnitude of environmental effects resulting from Project activities is negligible. The frequency of occurrence is once (i.e., one sample is collected at distinct separate locations), with a short duration (i.e., typically two weeks). Given the limited interaction of the Project activities with the VECs, the environmental effects of collecting sediment cores and operating the research vessel on Species at Risk, Commercial Fisheries and Other Users, Marine and Migratory Birds, Marine Mammals and Sea Turtles, Marine Fish and Shellfish, and Sensitive Areas are predicted to be not significant.

A MBES and SBP will be used to delineate the bathymetry at the specific core locations (i.e., will not sweep large swaths of the seabed).

The MBES and SBP are part of the research vessel's infrastructure. The MBES will be used to provide detailed bathymetry and the SBP will be used to refine the sediment core collection areas. The MBES will operate at 30 kHz, and a SBP has a primary high frequency bandwidth of 90 to 115 kHz and a secondary low frequency bandwidth of 2 to 22 kHz; these are within the threshold (less than 228.8 dB measured 1 m from the energy source) stated in the *Geophysical, Geological, Environmental and Geotechnical Program Guidelines* (C-NLOPB 2012). MBES frequencies do not overlap with those used predominantly by baleen whales and pinnipeds. SBP frequencies can overlap with those used by baleen whales and pinnipeds, but masking of communication would be limited due to the discontinuous, short duration of these pulses, which avoids substantial masking. The low frequency spectrum of industrial noise will not overlap with the high frequency echolocation of belugas, dolphins, or pilot whales, for example. SBP pulses are intermittent and predominantly low frequency and are unlikely to mask the echolocation/ communication of toothed whales. Some MBES pulses may be audible to toothed whales, but unlikely to mask communication signals due to the fact they are short and have narrow beam widths (Husky Energy 2010; Section 7.1.3.2).

Sediment cores (6-m deep) will be collected in up to 200 discrete locations. The collection locations will avoid areas of commercial fishing activity (especially any areas of fixed gear) as identified through consultation with the FFAW-Unifor's Petroleum Industry Liaison. Samples will not

be collected within The Zone, nor will the vessel enter The Zone to turn. Data collection will avoid coral closure areas and other identified sensitive areas.

Vessel speed during seep sample collection will typically be 3.7 to 5.6 km/h (2 to 3 knots), and as evidence suggests serious (or lethal) vessel strikes to whales are infrequent at vessel speeds less than 26 km/h (14 knots) and are rare at vessel speeds less than 18.5 km/h (10 knots) (Laist et al. 2001), the potential for the research vessel to strike a marine mammal is minimized.

As the data collection will occur over a 24-hour period, there is potential for marine and migratory birds to be attracted to the vessel at night, potentially resulting in stranding on the vessel. MG3 will implement a program to conduct a routine check for stranded birds on the research vessel and will release stranded birds per the protocol of Williams and Chardine (1999). Dead birds are occasionally found on ships. If more than 10 birds are found dead in the same event, they will be collected as per the Environment Canada (2012) Protocol for Collecting Dead Birds from Platforms (for birds not associated with a pollution event). MG3 will obtain the necessary permit prior to operations.

The magnitude of environmental effects resulting from Project activities is negligible. The frequency of occurrence is one sample collected at distinct separate locations within a short duration (i.e., three to four weeks). Given the limited interaction of the Project activities with the VECs, the environmental effects of the Project on Species at Risk, Fisheries and Other Ocean Users, Marine Fish and Shellfish, Marine and/or Migratory Birds, Marine Mammals and Sea Turtles and Sensitive Areas are predicted to be not significant.

MMOs are a useful mitigation measure to avoid harm to marine mammals within a 500 m safety radius of high area of ensonification during extensive seismic operations when arrays are active over long periods of time. Use of the MBES (and SBP if required) is conducted in the immediate vicinity of each station, with ample time between stations, making any effect on marine mammals unlikely. Together, noise level and length of activity will likely not cause any environmental effects. There will be a MMO on board the vessel to collect data on marine mammal and seabird sightings. However, no further mitigation (i.e., shut down of MBES/SBP if marine mammals are observed within 500 m of the vessel) will be implemented.

6.2 Accidental Events

In the event of an accidental release of hydrocarbons, most spill fluids will consist of light fuel (diesel). The nature of diesel fuel is such that it evaporates from the water surface relatively quickly and does not persist in the environment for any length of time, dispersing naturally within a day or less, even in cold water (National Oceanic and Atmospheric Administration 2006). Small diesel spills will usually evaporate and disperse naturally within a day or less. This is particularly true for typical spills from a fishing vessel (1,900 to 19,000 L (500 to 5,000 gallons)), even in cold water.

Diesel has a low viscosity and is readily dispersed within the water column when winds reach approximately 9 to 13 km/h (5 to 7 knots) or with breaking waves. It is possible for diesel to be dispersed by wave action and may form droplets that are kept in suspension and move with currents. It is unlikely diesel would reach the seabed. Species at risk and other not at risk species would be able to avoid any film that might form. The research vessel will have limited amounts of marine fuel on board that could potentially be spilled to the ocean. The research vessel will have spill response equipment on board. The vessel will have an Emergency Response Plan, including an Oil Spill Response Plan, in the unlikely event of vessel distress. The vessel's Safety, Health and Environment Management System includes spill response, the Table of Contents is provided as Appendix B.

The program involves the collection of cores. The only potential for an accidental event (a diesel spill) is from the unlikely event of vessel distress. Data collection will occur in ice-free season, and therefore no spilled fuel will become trapped in ice. Given the on-board spill response plan and equipment, the adverse residual environmental effect of an accidental spill on Species at Risk, Commercial Fisheries and Other Users, Marine and Migratory Birds, Marine Mammals and Sea Turtles, Marine Fish and Shellfish and Sensitive Areas is predicted to be not significant. The likelihood of a spill is unlikely.

6.3 Cumulative Environmental Effects

The program will be conducted from a single research vessel, with sampling gear limited to the immediate vicinity of the research vessel, and can therefore be considered as essentially another vessel traversing the 2015 Project Area. Compared to existing vessel traffic in the region, the incremental amount of vessel traffic as a result of this Project will be negligible. The Project activities are transitory with limited spatial and temporal overlap with other projects and activities; overlap with other oil and gas exploratory programs or development projects is not anticipated. Therefore, the adverse residual cumulative environmental effect on Species at Risk, Commercial Fisheries and Other Users, Marine and Migratory Birds, Marine Mammals and Sea Turtles, Marine Fish and Shellfish and Sensitive Areas is predicted to be not significant.

6.4 Conclusion

Given the Project consists of deploying and retrieving fishing lines to collect oil samples on the water surface, using MBES and SBP, and lowering and raising a sample corer (with thermal probes) to collect 200 substrate cores, interaction with the environment will be limited and environmental effects will be negligible. The adverse residual environmental effects of this Project are assessed as not significant. Given the limited interaction with the environment (deploying and retrieving fishing lines, collecting high-resolution bathymetry and collecting shallow sediment cores (with thermal probes), follow-up monitoring is not required for this Project. There will be am MMO/bird observer and an FLO on board the research vessel.

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APPENDIX A

Percent Weight and Percent Value (2011 to 2013)
for Northern Shrimp, Snow Crab and Greenland Halibut

(Appendix A is separate PDF File)

APPENDIX B

Vessel Safety, Health and Environment Management System
Table of Contents

INDEX OF CONTENTS PAGE