RPS Energy

UPDATE REPORT

ENVIRONMENTAL IMPACT ASSESSMENT FOR MARINE 2-D SEISMIC REFLECTION SURVEY
LABRADOR SEA AND DAVIS STRAIT

MULTI KLIENT INVEST AS

Prepared for:
Canada-Newfoundland & Labrador Offshore Petroleum Board

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1.0 INTRODUCTION

TGS-NOPEC Geophysical Company ASA (TGS) and Petroleum GeoService (PGS) have entered into a joint venture to conduct a regional marine 2-D (two-dimensional) seismic reflection survey offshore in the Labrador Sea starting in 2011 for a three year seismic program (2011-2013). Multi Klient Invest AS (MKI) is the operator and they are a wholly-owned subsidiary of PGS. The 2011 survey was underway from September 8th to October 25th, 2011.

This document provides a validation of the environmental assessment report (RPS April 2011) and addendum report (RPS June 2011) prepared by RPS for the 2-D seismic reflection survey for MKI. The C-NLOPB requested a validation of the EA predictions relative to the proposed 2012 program. MKI acknowledged in the EA Addendum that the scope of the Project being assessed extends over several years, during which time the regulatory, biophysical, and socio-economic environment may change from that assessed in this report. MKI will periodically review the EA Report, as directed by the C-NLOPB, for current applicability and will work with regulatory authorities to ensure that the EA remains fit for purpose. At the time of application for subsequent program authorizations in the Project Area, MKI will be required to provide information to the C-NLOPB regarding these activities.

1.1 PROPONENT INFORMATION

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1.1 REGULATORY CONTEXT

There has been no change in legislation that pertains to environmental approval of offshore geophysical exploration surveys since June 2011.

2. PROJECT OVERVIEW

The proposed project is a regional survey designed to provide a better understanding of the offshore geology of northern Labrador Shelf, and to use this information to introduce new exploration opportunities to the industry. This information will be used to determine the regional extent of geological formations. This program is being used to develop geological concepts and is not the basis of an exploration drilling program, as the survey line spacing is much too coarse for that purpose.

The proposed survey season is June through November for 2012 and in subsequent years. The 2012 program will be about 40 - 60 days in duration. The exact dates will depend on the location, weather conditions, and vessel availability. Based on previous work in Labrador, weather usually allows productive recording until approximately mid-October. It is expected that work might be able to continue as late in the year as November. The vessel will be at sea and operate continuously (i.e., 24-hour operations) during survey operations. Seismic vessels typically operate on a 5/6 week crew change schedule, which will be maintained for this project. Crew changes will be made via port call. All seismic equipment being used for the project will be the same as the 2011 project (Sercel - G Gun 2, 4135 Cubic Inch Array, PGS GeoStreamer®). The vessel will collect gravity data as was the case in 2011 and the same equipment will be onboard (a CHEKAN AM GraviMeter).

All mitigations will be adhered to. There will be two Marine Mammal Observers, one Inuit Observer, and a Fisheries Liaison Officer onboard for the duration of the program, for each rotation.

The planned 2012 program is illustrated in Figure 1. This represents proposed survey lines in the jurisdiction of the C-NLOPB, totalling 11,459 km, with 29 lines in a survey area of about 541,423 km^2. Infill lines will be acquired in subsequent seasons. No survey lines will enter the waters of the Labrador Inuit Settlement Area (the Zone) as defined pursuant to the Labrador Inuit Land Claims Agreement, or within 12 nautical miles of the coast of Labrador. Time will most likely not allow for the collection of all lines, but approval is necessary of all lines in order to facilitate commercial fisheries concerns, etc. In subsequent years, infill lines will be collected. The layout of the 2012 program is, in general, similar to the layout of the 2011 program, as illustrated in Figure 2, with the range of line spacing being the same, from 20 km to 120 km. The increase in planned total line km from 9,593 in 2011 to 11,459 in 2012 represents a 19.45% increase in planned 2D seismic data acquisition. Although the proposed survey vessel is an ice-class vessel (1A1 Ice C), data will not be acquired in areas of pack ice. The survey data will be acquired such that ice-free areas are surveyed first (i.e., the southern portion of the survey area) then, as the season progresses, the vessel will move north.

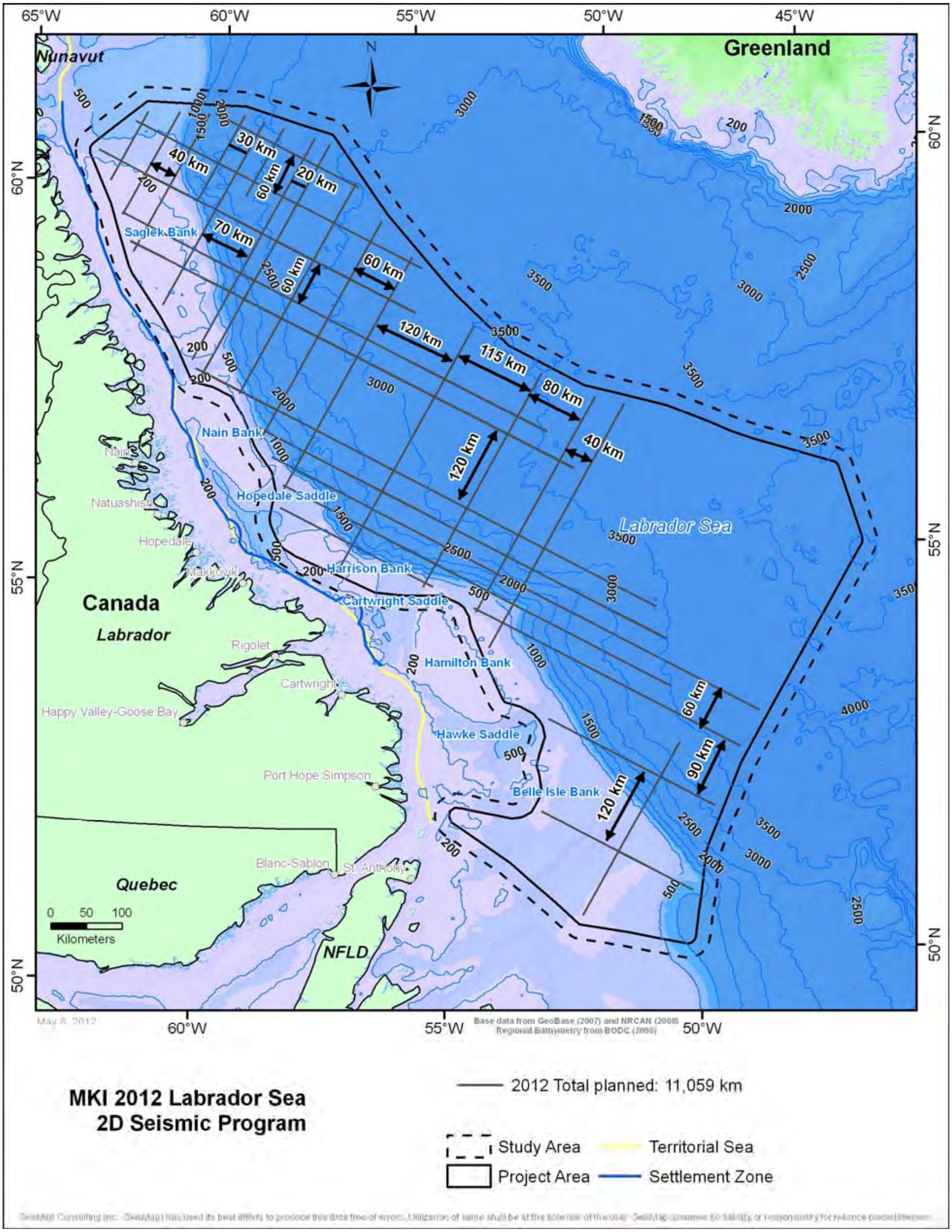

Figure 1. 2012 Planned 2D Seismic Program

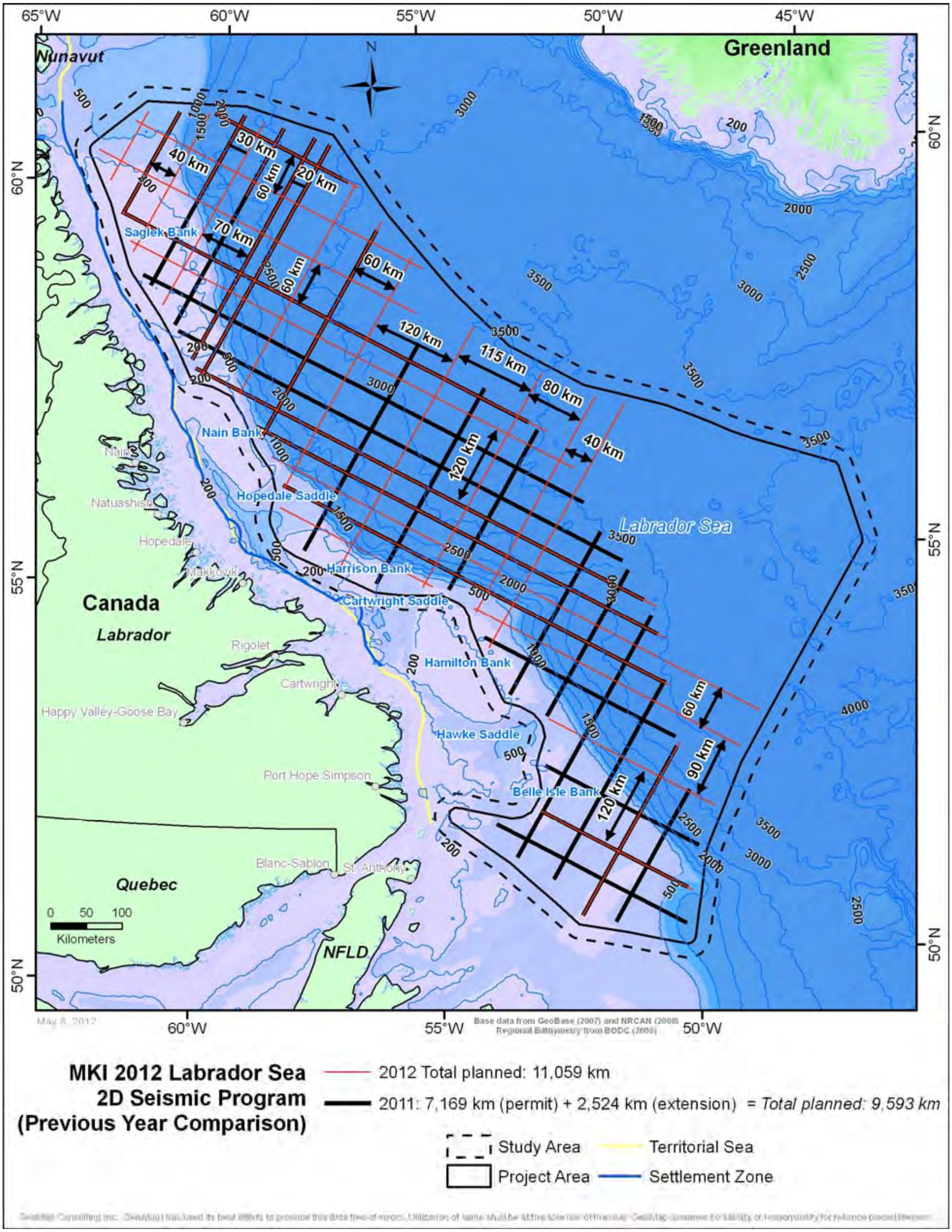

Figure 2. Previous Year Comparison
(Thick red lines indicate coincidence of 2011 and 2012 lines)

2.1 SEISMIC VESSEL

The program will use the same vessel as in 2011, the dedicated seismic research vessel, the M/V Sanco Spirit (Photo 1).

Photo 1. Survey Vessel M/V Sanco Spirit

The vessel will have equipment, systems, and protocols in place for prevention of pollution by oil, sewage, and garbage in accordance with international standards and certification authorities, specifically the Arctic Shipping Pollution Prevention Act (ASPPA) and Arctic Shipping Pollution Prevention Regulations (ASPPR). These regulations require that the survey vessel possess an Arctic Pollution Prevention Certificate. The vessel will be subject to pre-survey audits by the operator in the port of mobilization prior to survey commencement. Transport Canada (TC) will conduct a Safety Inspection of the vessel in accordance with the issuing of the Coasting Trade License to operate in Canada.

The survey vessel will comply with all applicable regulations concerning management of waste and discharges of materials into the marine environment. The vessel has a ballast water management plan. The International Maritime Organization (IMO; http://www.imo.org/) is the United Nations specialized agency with responsibility for the safety of shipping and the prevention of marine pollution by ships. Canada became a member of the IMO in 1948.

2.2 2-D SEISMIC SURVEY TOWED ARRAY

The seismic air guns for the 2012 program are the same as last year: Sercel – G Gun 2. The guns have a working pressure of 2000 psi and the typical array is a single source array made up of 6 sub-arrays. The survey parameters for the program are shown below in Table 1.

Table 1. Sercel – G Gun 2 Seismic Survey Parameters

Effective volume of standard array(s)	4135 cu in
Maximum number of sub-arrays	6
Standard array depth(s)	7 m
Position of depth transducers	Front and tail of sub-array
Working pressure	2000 psi
Type of firing sensors	Pressure activated
Type of firing synchronizer unit	RTS BigShot
Timing resolution	0.1ms ms
Timing accuracy	+/- 1.0ms
Air compressors capacity	Neuman & Esser, 2200 cfm each
Number of air compressors	2

2.3 STREAMER

The vessel will use the same streamer as last year – the PGS GeoStreamer® which is a solid streamer. Solid streamers are less sensitive to weather-related noise than liquid streamers and eliminate the environmental impact of fluid loss from breaks or tears in conventional fluid filled streamers. Technical specification of the streamer system is provided in Table 2.

Table 2. PGS GeoStreamer® Solid Streamer Specification

Skin material	Polyurethane
Outside diameter	62mm cm
Length of each group	12.5m m
Streamer set-up	Typical 1 x 10050m
Manufacture and type of hydrophones	Hydrophones: Teledyne T-2BX or equivalent, Velocity Sensors: PGS confidential (Mark III)
Type of array (e.g., linear, binomial)	Linear
Number of hydrophones per group/distance apart	Hydrophones: 12 per 12.5m, Velocity Sensors: PGS confidential
Coupling between phones and pre-amp	Capacitive
Sensitivity of near and far group at 1/P to recorder	20V/Bar
Bandwidth over which above sensitivities apply	Specified at 100Hz
Availability of shore-side spares if required	Pool system
Manufacturer and type of depth controller and compass	ION DigiCourse 5011

About 30 minutes prior to arriving at the start of a line, the airgun array is slowly brought up to a specified power, a ramp-up procedure referred to as a “soft start”. This procedure is an environmental protection measure to permit marine animals opportunity to temporarily vacate that area if the sound levels are perceived as a disturbance. A soft start approach would occur at the beginning of a new line within the perimeter or at the start of operations anywhere within the program area. This approach is discussed in greater detail below. Vessels towing streamers have reduced manoeuvrability when the equipment is deployed. MKI will include a 10 km vessel turn-around perimeter around the survey area.

2.3.1 Marine Mammal Safety Zone and Ramp-up Procedure

MKI will implement a 500 m safety zone monitoring program for whale species at risk during survey data acquisition. The source will be shut down every time an endangered whale enters the defined safety zone. An environmental observer, trained for marine mammal observations, will watch for marine mammals from the bridge of the seismic vessel throughout the survey. Safety zones for marine mammals are commonly defined by the areas within which specific sound level thresholds are exceeded. These have been quantified by the US National Marine Fisheries Service (NMFS) (NMFS 2000). NMFS policy regarding exposure of marine mammals to high-level sounds is that whales should not be exposed to impulse sounds exceeding 180 dB re 1µPa (rms). These sound levels are the received levels above which, in the view of a panel of bioacoustics specialists convened by NMFS, one cannot be certain that there will be no injurious effects, auditory or otherwise, to marine mammals.

The Statement of Canadian Practice for Mitigation of Seismic Noise in the Marine Environment (DFO 2007) provides guidance to the seismic program, as stipulated in the scoping document. This DFO document aims to formalize and standardize the mitigation measures used in Canada with respect to the conduct of seismic surveys in the marine environment. It is based on a DFO-sponsored peer review by Canadian and international experts. MKI will adhere to the mitigation measures outlined in the Statement of Canadian Practice on the Mitigation of Seismic Noise in the Marine Environment, to the extent reasonably practical.

2.3.2 Logistical Support

Details of logistical operations to support the subject geophysical program will largely depend on seismic acquisition company, season, and weather.

Helicopters
The larger seismic vessels are usually equipped with a helicopter platform and helicopters are often used for crew changes, and can be used in case of medical and other emergencies and re-supply. In some cases, survey contractors may prefer to come to shore for crew changes and re-supply (if required).

Helicopters may or may not be utilized depending on type of helicopter available and the seismic vessel procured. For the duration of the seismic program, it is possible that the fleet of helicopters available out of St John’s will be Sikorsky S-92s only. The implication of this is that many of the seismic vessels currently available on the market are not capable of allowing S-92s to land on their helideck. Super Pumas or equivalent are the only type of helicopter potentially available that are approved for landing on the helidecks of the anticipated seismic vessels.

Shore Base
MKI will use shore facilities in St. John’s, NL. During a short operational program, re-supply may not be needed. No new shore-base facilities will be established as part of this Project.

Support Vessels
The primary functions of support boats are to provide supplies for the seismic vessel and to assist in emergency situations (including oil spills). At least one support vessel will be utilized

for the duration of the proposed seismic survey. In 2011, two vessels were employed to provide support services.

2.4 EMISSIONS AND WASTE DISCHARGES

The vessels and towed array will generate underwater noise. The vessels also generate atmospheric, light, liquid, and solid emissions. Discharges and emissions from this program will be similar to those of any standard marine vessel. These emissions and discharges are described below.

2.4.1 Atmospheric Emissions

Atmospheric emissions will result from vessel and equipment exhaust. These emissions are minor and will be reduced through best management practices and preventative maintenance procedures. These include properly maintaining and routinely inspecting ship equipment, controlling vapour loss from fuel tanks, and avoiding engine idling when not in use. Emissions from ship engines and onboard equipment will comply with the Air Pollution Control Regulations (Newfoundland and Labrador Environmental Protection Act) and the Ambient Air Quality Objectives (Canadian Environmental Protection Act).

2.4.2 Liquid Emissions

Ballast water is stored in dedicated ballast tanks to improve vessel stability. No oil will be present in these tanks or in any discharged ballast/preload water. If oil is suspected to be in the water, it will be tested and, if necessary, treated to ensure that oil concentrations in the discharge do not exceed 15 mg/L as required by the MARPOL 73/78 (International Convention for the Prevention of Pollution from Ships, 1973, and the Protocol of 1978 related thereto), IMO and the Offshore Waste Treatment Guidelines (OWTG) (NEB et al. 2010).

The OWTG were developed specifically for the treatment and control of waste generated by petroleum operations related to exploration and production on Canada’s offshore areas. Bilge water often contains oil and grease that originate in the engine room and machinery spaces. Before discharge, bilge water is treated in accordance with MARPOL 73/78, IMO and OWTG, using an oil/water separator. The extracted water is tested to ensure that the discharges contain no more than 15 mg/L of oil.

2.4.3 Solid Waste

All solid waste will be transferred to shore and disposed of at an approved facility. Any hazardous materials (e.g., oily rags) will be handled separately in hazardous materials containers. Sanitary and food wastes will be macerated to a particle size of 6 mm or less and then discharged as per the OWTG.

2.4.4 Light Emissions

The survey vessel will carry operational, navigation, and warning lights. Working areas will be illuminated with floodlights as required for compliance with occupational health and safety standards and will be fully equipped with emergency lighting. If a helideck is present, it will be floodlit and have omni-directional guidance lights with an average illumination intensity of between 20 and 25 candelas. Hazards in the vicinity of the helideck will also have omni-directional hazard lighting. Lighting will comply with relevant offshore standards/regulations, including TC's Guidelines Respecting Helicopter Facilities on Ships. The Geophysical Contractors will adhere to the Leach's Storm Petrel Program.

2.4.5 Potential Malfunctions and Accidental Events

There are unplanned situations that may be encountered during seismic operations. Potential hazards are addressed during site-specific planning as part of emergency response planning. Procedures are developed by MKI to ensure that such events are managed in a safe and environmentally sound manner. MKI has policies, plans, and procedures to prevent or mitigate effects of malfunctions and accidents. These policies, plans, and procedures will be located on the seismic vessel, and in MKI St. John's (shore office). During seismic surveys, there will be limited amounts of marine fuel and lube oil onboard that could potentially be spilled to the ocean. All of the vessels involved in the survey will use diesel fuel. The fuel capacity of the seismic ship, M/V Sanco Spirit is 1100 m^3. Any accidental spill will be reported to the C-NLOPB immediately.

The contracted vessel is equipped with solid-streamer technology, as this type of streamer is not reliant on flotation fluid to achieve a neutral ballast state, thus eliminating the risk of an accidental spill from a damaged streamer.

Other accidental events could include damage or loss of seismic equipment, entanglement of seismic equipment with fishing gear, and vessel collisions. Best management practices and communications will be used on the survey vessel to avoid equipment loss or damage. Gear will be retrieved from the water if wave heights reach or exceed unacceptable limits. The unacceptable limits are generally prescribed by the Geophysical Contractor in agreement with the Contractor's and Client's HSE policies, and are based on consideration of multiple factors, including but not limited to the geophysical equipment deployed, the weather conditions at the time, and the short and long-term weather forecasts during survey operations. Generally though, unacceptable limits may occur when wave heights reach or exceed 3 to 4 metres height, though unacceptable limits may occur at shorter wave heights depending upon the above-noted considerations. In case of severe weather, the vessel may return to shore until conditions improve.

A trained Fisheries Liaison Observer will be onboard the seismic vessel during the seismic program to liaise with fishers who may have gear deployed in the Project Activity Area, in order to ensure effective and ongoing communication and avoid unnecessary gear conflicts and possible vessel collisions. Entanglement of marine mammals in seismic equipment is not likely since streamers have no tangle gear and marine mammals are expected to avoid the vessel during operations. The trained onboard Marine Mammal Observer will keep watch for marine mammals during the survey program.

3. CONSULTATIONS AND COMMUNITY ENGAGEMENT

MKI is conducting ongoing consultations with fishing representatives and organizations, representatives from users of alternative resource sectors within the Study Area, First Nations, and relevant communities with an interest in the Project. Sikumiut Environmental Management Ltd. (Sikumiut) was engaged by RPS Energy (Canadian Lead Consultancy for the Operator) to carry out a consultation program in support of the Seismic Project to be conducted on the Labrador Offshore Shelf in 2012.

MKI is currently working with Sikumiut to schedule meetings in Cartwright and St. Anthony to meet with Fishers that they were unable to meet with in 2011, as it was to late into the season. Sikumiut is currently dealing with Fishers to set the dates, expected to be late March, early April.

Copies of MMO/FLO reporting from 2011 will be delivered to proponents in the 2012 consultations in the following communities:

- Port Hope Simpson
- Hopedale
- Nain
- Happy Valley Goose Bay
- Rigolet
- Postville
- Makkovik
- North West River

Direct meetings will be/were held with the Fish Food and Allied Workers Union (FFAW) and One Ocean and Newfound Resources Limited. Other fishing organizations (Clearwater, OCI) have not responded to an invitation to discuss the program.

As a result of initial meetings held with Fish Food and Allied Workers Union (FFAW) and One Ocean, the Operations Manager and Shore Manager for the 2012 project will be travelling to Newfoundland to meet with FFAW and One Ocean to explain the logistics of the survey on March 13th, 2012.

PGS is also meeting with Sikumiut on March 14th, 2012 in Newfoundland to continue planning for the training of MMOs in St. John's, NF and Labrador.

Update

PGS and TGS representatives travelled to St. John's, NF on March 26th for scheduled meetings in St. Anthony, Cartwright, and Plum Point. They were unable to continue due to bad weather and cancelled flights. These meetings were re-scheduled for the week of Aprll 23rd.

A letter was sent to Tom Sheldon at NG on March 29th with an attached copy of the Final Environmental Report for the Labrador 2011 Project. Copies of the Final Environmental Report were also sent via email and regular mail to all the Stakeholders in the Labrador 2011 Consultation meetings.

PGS has also confirmed attendance with the C-NLOPB of their intention to attend the Seismic Workshop for further discussion with NG. PGS arranged with Sikimiut Environmental Management the training of four Inuit Observers for participation in this year's program. The trainer travelled from the UK – Ross Compton (RPS Energy) on April 16th. See details below;

Instructor: Ross Compton
Location: St. John's, NL
Date: April 16th, 2012
Host: Sikumiut Environmental Management Ltd.

The following candidates were trained:

Names of Inuit Participants (4): Lester Mitchell (Makkovik), Michael Holwell (Cartwright), Samuel Jacque (Makkovik), Travis Winters (Makkovik)

4. ENVIRONMENTAL SETTINGS

4.1 PHYSICAL SETTING

There have been no significant changes in meteorology, climate, physical oceanography, or ice condition in the Study Area from that reported in the 2011 EA Addendum Report.

4.2 BIOLOGICAL ENVIRONMENT

There are no changes in populations of plankton, marine birds, marine mammals or sea turtles since submission of the June 2011 EA Addendum Report.

4.2.1 Species at Risk

Since the EA Addendum submission in June 2011, Sowerby's beaked whale was added to species listed on Schedule 1 of SARA under the category of special concern (Table 3). This species was previously listed on Schedule 3. An order amending Schedule 1 to the Species at Risk was published in the Gazette on July 6th, 2011.

Table 3. SARA Schedule 1-listed Species Within the Study Area

Common Name	Scientific Name	SARA Risk Category	COSEWIC Status
Marine Mammals			
Blue Whale	*Balaenoptera musculus*	Endangered	Endangered
Fin Whale	*Balaenoptera physalus*	Special Concern	Special Concern
North Atlantic Right Whale	*Eubalaena glacialis*	Endangered	Endangered
Sowerby's Beaked Whale	*Mesoploden bidens*	Special Concern	Special Concern
Reptiles			
Leatherback Sea Turtle	*Dermochelys coriacea*	Endangered	Endangered
Fish			
Atlantic Wolffish	*Anarhichas lupus*	Special Concern	Special Concern
Northern Wolffish	*Anarhichas denticulatus*	Threatened	Threatened
Spotted Wolffish	*Anarhichas minor*	Threatened	Threatened
Birds			
Harlequin Duck	*Histrionicus histrionicus*	Special Concern	Special Concern
Ivory Gull	*Pagophila eburnea*	Endangered	Endangered
Barrow's Goldeneye	*Bucephala islandica*	Special Concern	Special Concern
Eskimo Curlew	*Numenius borealis*	Endangered	Endangered

Sources: Species at Risk website

Under Section 32 of the SARA, killing, capturing, and destruction of critical habitat of extirpated, endangered, and threatened species, listed under Schedule 1, is prohibited. These prohibitions do not apply to those listed as special concern. Recovery strategies are required for endangered, threatened, and extirpated species and management plans are required for special concern species. SARA is administered by Environment Canada, Parks Canada, and DFO.

4.2.1.1 Marine Mammals

Sowerby's Beaked Whale

The text below is from the Order Amending Schedule 1 to the Species at Risk Act P.C. 2011-728 June 23rd, 2011 printed July 6th, 2011.

Sowerby's beaked whales are only found in the North Atlantic, from Cape Cod to Davis Strait in the western Atlantic, and from Norway to Spain in the eastern Atlantic. Their distribution is poorly known, although sightings have typically occurred in off-shore waters. COSEWIC states "Given that Sowerby's beaked whale belongs to a family of whales (Ziphiidae) in which acute exposure to intense sounds (e.g. military sonar, seismic operations) has led to serious injury and mortality, COSEWIC identified acoustic pollution as a potential threat to the species." However, only one event of stranding of beaked whales that might be related to airgun activity has been recorded in 2002 associated with one seismic program. In 2002, two beaked whales were stranded in the Gulf of California at around the time R/V Maurice Ewing was conducting acoustic research in the area, but a causal relationship has not been established. There was confirmed evidence associated with stranding from naval activities. COSEWIC states " Seismic operations are currently widespread and military activities involving the use of mid- and low-frequency sonar likely occur at least occasionally in the habitat of this species off Canada's East Coast." However, there have been no strandings off the East Coast attributed to seismic or naval activities. COSEWIC states "Although there is no direct evidence that such sound sources have affected this species, there is strong evidence for lethal effects on individuals of related species." This is a broad statement based on one event that was not proven. Population-level impacts of this type of mortality are unknown. COSEWIC states "Other potential threats listed in the status report include pollutants, ship strikes, and entanglement in longline gear. While little is known about the species, a listing as special concern will not have a significant impact on commercial fisheries or most other activities."

There is no recovery strategy, recovery plan, or management plan for Sowerby's beaked whale at this time. COSEWIC states that "A "Statement of Practice with Respect to the Mitigation of Seismic Sound in the Marine Environment" will be adapted for this species." This has not occurred. In addition, there have been sightings of the species in the Gully Marine Protected Area, which provides protection to individuals and part of their habitat.

4.2.1.2 Birds

Barrow's Goldeneye

The management plan for the Barrow's Goldeneye (eastern population) listed threats to this species in the following descending order of concern: logging, fish stocking, oil spills, hunting, and sediment contamination (Environment Canada 2011). The distribution range is provided in Figure 3, which shows its overwinter coastal ranges on the east coast of Newfoundland and the moulting areas along the coast of Labrador.

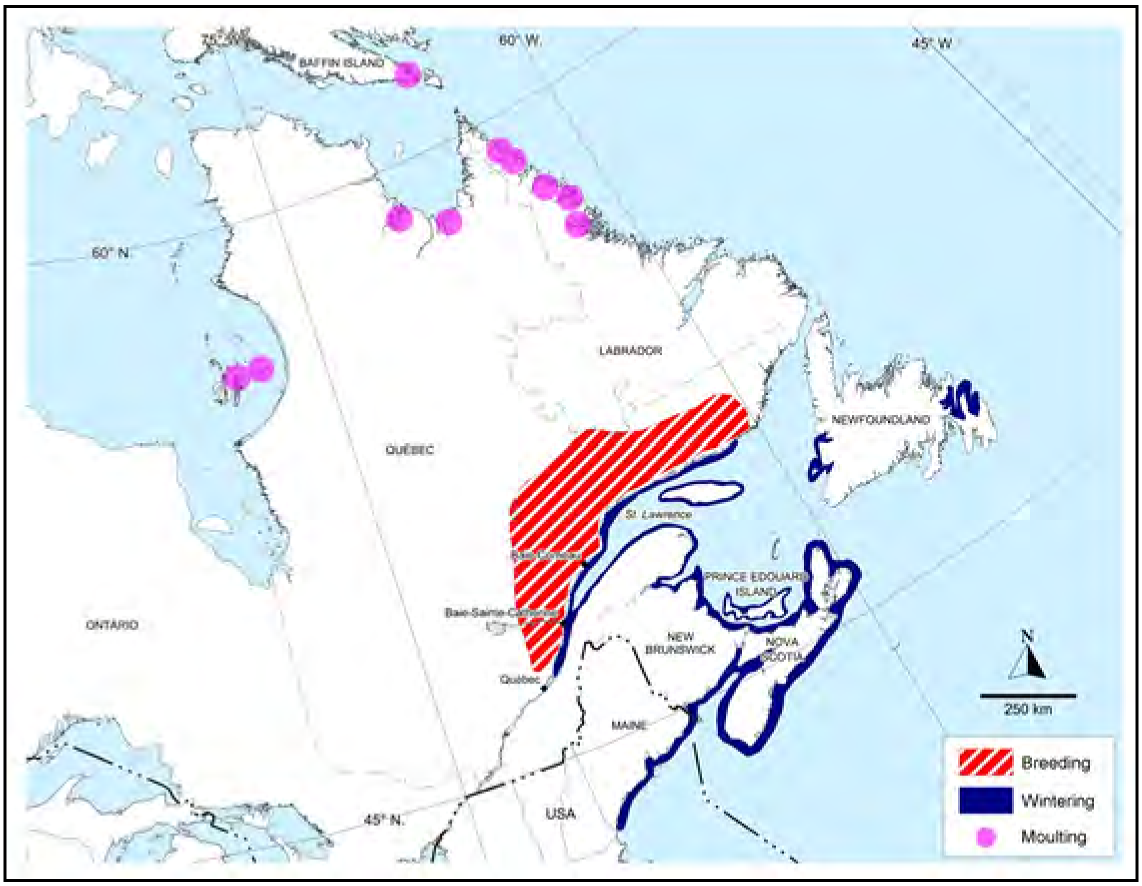

Figure 3. Distribution Range of the Barrow's Goldeneye, Eastern Population

The long-term objective of this management plan is to maintain and, if possible, increase the population size and range of the Barrow's Goldeneye, Eastern population, in Canada. In order to achieve this objective, the size of the population must be maintained for the next ten years at not less than 6800 individuals across the Canadian range of the population.

Eskimo Curlew

These birds use a variety of habitats, both coastal and inland, during autumn migration. They often feed in areas of crowberry, as well as coastal habitats in Labrador, and used ericaceous heath habitat in Alaska, the Northwest Territories, northern Ontario, southern Québec, Newfoundland and Labrador, and the Maritime provinces. There is very little information on the breeding, staging, or migratory habitat necessary for the recovery or survival of the Eskimo Curlew; therefore, identifying critical habitat for the Eskimo Curlew is not possible at the current time. This species presence in the Study Area are only during overflights during migration. No threats from seismic exploration or any vessel presence was identified.

4.2.2 Sensitive Areas

There are no new special areas established in or adjacent to the Study Area since June 2011.

4.3 OCEAN RESOURCES USERS

4.3.1 Commercial Fisheries

This section describes the existing commercial fisheries in the Study Area for MKI's 2-D seismic surveys and provides additional context for the area's foreign commercial fisheries. It also describes economic and logistical aspects of the fisheries.

Datasets. Fisheries within the Study Area are primarily managed by DFO and NAFO, for convention countries. While the domestic commercial fisheries analysis in this section is based primarily on data derived from the DFO Newfoundland and Labrador Region catch and effort datasets, foreign catches landed outside the regions are not included in these.

The 2010 DFO data has been added to the 2005 to 2009 period provided in the 2011 EA Addendum. DFO data for Unit Areas NAFO 2G, 2H, 2J, 3K, 0B, and 1F were used (the Project Area Unit Areas) for the analyses.

4.3.1.1 Study Area Domestic Fisheries

4.3.1.1.1. 2005 to 2010, June to November Study Area Catch Analysis

Table 4 shows the annual domestic landed harvest by species, 2005 to 2010, from within the Study Area from June to November, based on the geo-referenced DFO datasets. As the data show, the domestic harvest in the Study Area has been singly dominated by shrimp throughout this period, in terms of quantity.

Table 4. Average Study Area Harvest (t) by Species, June to November, 2005-2010

2005			
Commercial Species	Landed Weight (t) All NAFO Areas	Landed Weight (t) Study Area	% Landed Weight in Study Area
Pandalus Borealis Shrimp	69121	42338	61
Mackerel	24050	0	0
Capelin	12194	0	0
Queen-Snow Crab	6174	1956	32
Greenland Halibut (Turbot)	5020	3427	68
Pand. Montagui Shrimp	1475	786	53
Herring	784	0	0
Icelandic Scallops	672	0	0
Spider-Toad Crab	648	0	0
Cod	494	0	0
Whelks	382	0	0
Lumpfish Roe	219	0	0
Lobster	135	0	0
Redfish	131	87	66
Roughhead Grenadier	97	60	62
Illex Squid	90	0	0
Sea Urchins	78	0	0
Rock Crab	77	0	0
Winter Flounder	37	0	0
Skate	28	16	56
Eel	12	0	0
Greysole-Witch Flounder	9	4	42
Lumpfish	6	0	0
Arctic Charr	5	0	0
Rock Cod	3	0	0
White Hake	2	2	100
American Plaice	1	0	0
Haddock	1	1	100
Atlantic Halibut	1	0	49
Yellowtail Flounder	1	0	0
Sculpin	0	0	0
Sturgeon	0	0	0
Total	121947	48678	

2006			
Commercial Species	Landed Weight (t) All NAFO Areas	Landed Weight (t) Study Area	% Landed Weight in Study Area
Pandalus Borealis Shrimp	69959	42593	61
Mackerel	19163	123	1
Capelin	14366	0	0
Greenland Halibut (Turbot)	2672	1215	45
Illex Squid	2426	0	0
Queen-Snow Crab	2106	308	15
Pand. Montagui Shrimp	1959	1640	84
Cod	941	3	0
Icelandic Scallops	664	0	0
Spider-Toad Crab	402	0	0
Redfish	254	147	58
Whelks	218	0	0
Herring	209	0	0
Lumpfish Roe	140	0	0
Lobster	99	0	0
Rock Cod	75	0	0
Rock Crab	65	0	0
Roughhead Grenadier	61	44	72
Arctic Charr	39	0	0
Winter Flounder	38	0	0
Skate	25	7	29
Greysole-Witch Flounder	11	3	30
Eel	10	0	0
American Plaice	2	1	41
Atlantic Halibut	2	0	11
Sculpin	0	0	0
Total	115909	46085	

2007			
Commercial Species	Landed Weight (t) All NAFO Areas	Landed Weight (t) Study Area	% Landed Weight in Study Area
Pandalus Borealis Shrimp	80072	56494	71
Capelin	13024	0	0
Queen-Snow Crab	9423	1572	17
Mackerel	8768	0	0
Greenland Halibut (Turbot)	2402	1566	65
Pand. Montagui Shrimp	2060	1886	92
Cod	1037	0	0
Herring	377	0	0
Spider-Toad Crab	312	0	0
Whelks	148	0	0
Lumpfish Roe	131	0	0
Illex Squid	117	0	0
Lobster	110	0	0
Winter Flounder	83	0	0
Rock Crab	53	0	0
Icelandic Scallops	40	0	0
Roughhead Grenadier	32	22	68
Arctic Charr	29	0	0
Sea Raven	24	0	0
Redfish	20	7	33
Sculpin	19	0	0
Eel	13	0	0
Skate	6	2	40
American Plaice	2	0	0
Greysole-Witch Flounder	2	2	94
Total	118305	61552	

2008			
Commercial Species	Landed Weight (t) All NAFO Areas	Landed Weight (t) Study Area	% Landed Weight in Study Area
Pandalus Borealis Shrimp	70650	47669	67
Capelin	13043	0	0
Mackerel	9125	0	0
Queen-Snow Crab	7332	1141	16
Greenland Halibut (Turbot)	3674	1185	32
Cod	1464	0	0
Pand. Montagui Shrimp	1021	868	85
Herring	310	0	0
Spider-Toad Crab	263	0	0
Illex Squid	237	0	0
Whelks	158	0	0
Lumpfish Roe	125	0	0
Lobster	65	0	0
Winter Flounder	54	0	0
Rock Crab	43	0	0
Lumpfish	32	0	0
Arctic Charr	18	0	0
Icelandic Scallops	17	0	2
Redfish	11	6	48
Eel	10	0	0
Roughhead Grenadier	5	2	47
Skate	3	1	15
Greysole-Witch Flounder	0	0	43
Total	107660	50872	

2009			
Commercial Species	Landed Weight (t) All NAFO Areas	Landed Weight (t) Study Area	% Landed Weight in Study Area
Pandalus Borealis Shrimp	45631	31912	70
Queen-Snow Crab	15468	5599	36
Capelin	9823	0	0
Mackerel	6898	3	0
Greenland Halibut (Turbot)	6862	3187	46
Cod	1147	0	0
Pand. Montagui Shrimp	688	636	93
Herring	424	0	0
Illex Squid	398	0	0
Whelks	149	0	0
Spider-Toad Crab	140	0	0
Lobster	71	0	0
Lumpfish Roe	46	0	0
Rock Crab	45	0	0
Winter Flounder	42	0	0
Greysole-Witch Flounder	37	5	14
Redfish	28	12	44
Icelandic Scallops	17	0	2
Arctic Charr	15	0	0
Eel	9	0	0
American Plaice	7	2	32
Roughhead Grenadier	7	1	9
Skate	6	0	8
Total	87956	41359	

2010			
Commercial Species	Landed Weight (t) All NAFO Areas	Landed Weight (t) Study Area	% Landed Weight in Study Area
Pandalus Borealis Shrimp	98648	83690	85%
Queen-Snow Crab	14558	5384	37%
Mackerel	12953	0	0%
Turbot-Greenland Flounder	5221	4288	82%
Capelin	3544	0	0%
Greenland Halibut (Turbot)	2983	4	0%
Pand. Montagui Shrimp	1863	1788	96%
Cod	1136	0	0%
Herring	601	0	0%
Whelks	162	0	0%
Greysole-Witch Flounder	126	74	59%
Spider-Toad Crab	111	0	0%
Lobster	96	0	0%
Lumpfish Roe	79	0	0%
Rock Crab	69	0	0%
Illex Squid	66	0	0%
Redfish	61	39	63%
Billfish	59	0	0%
Roughhead Grenadier	30	13	43%
Winter Flounder	23	0	0%
American Plaice	22	4	19%
Icelandic Scallops	16	0	0%
Sea Urchins	16	0	0%
Sculpin	12	0	0%
Arctic Charr	11	0	0%
Eel	8	0	0%
Skate	4	0	10%
Atlantic Halibut	0	0	0%
Total	143037	95286	

Figure 4 indicates the changes in the total catch recorded annually within the Study Area for the 2005 to 2010 period. As the graph in Figure 4 indicates, the total quantity of the harvest fluctuates, mainly the result of increasing shrimp catches in the Study Area, with a considerable decline after 2007. However, significant reductions in shrimp quotas after 2010 are expected to result and continue this general trend due to declines in significant biomass in SFA 6 and 5 of 50% and up to 15 to 40%, respectively (DFO 2010).

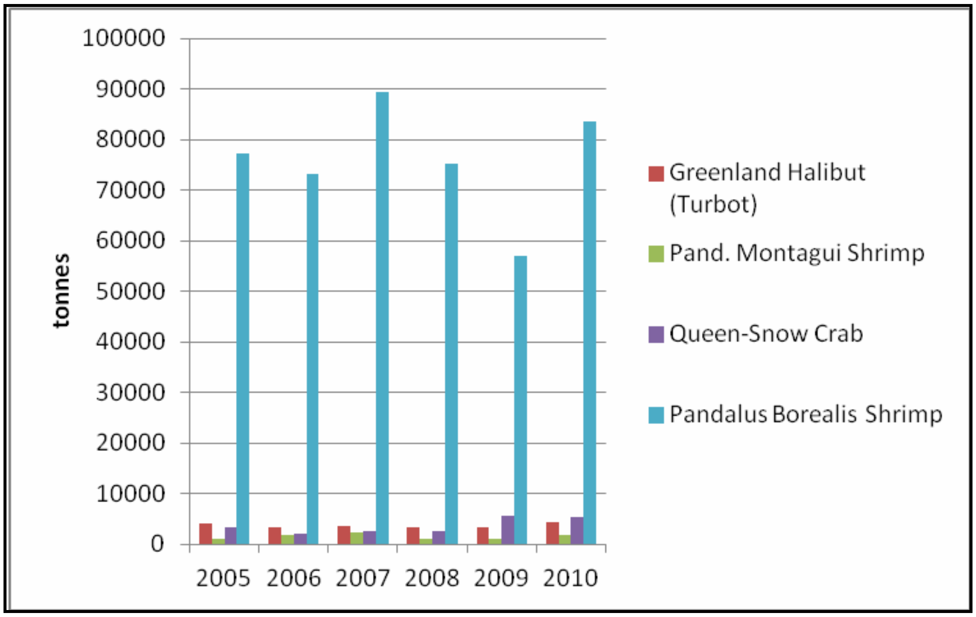

Figure 4. Annual Harvest of Main Species Within the Study Area, 2005 to 2010

4.3.1.2 Harvesting Locations

Figure 5 shows DFO dataset geo-referenced fishing locations in relation to the Study Area for the period June to November, for 2005 to 2010. As Figure 5 illustrates, most of the domestic fish harvesting in the general area is concentrated inside the 1,000 m contours of the Labrador Shelf, and along the edges of the banks. Figure 6 to Figure 8 show harvesting locations for groundfish, pelagic fish, and shellfish.

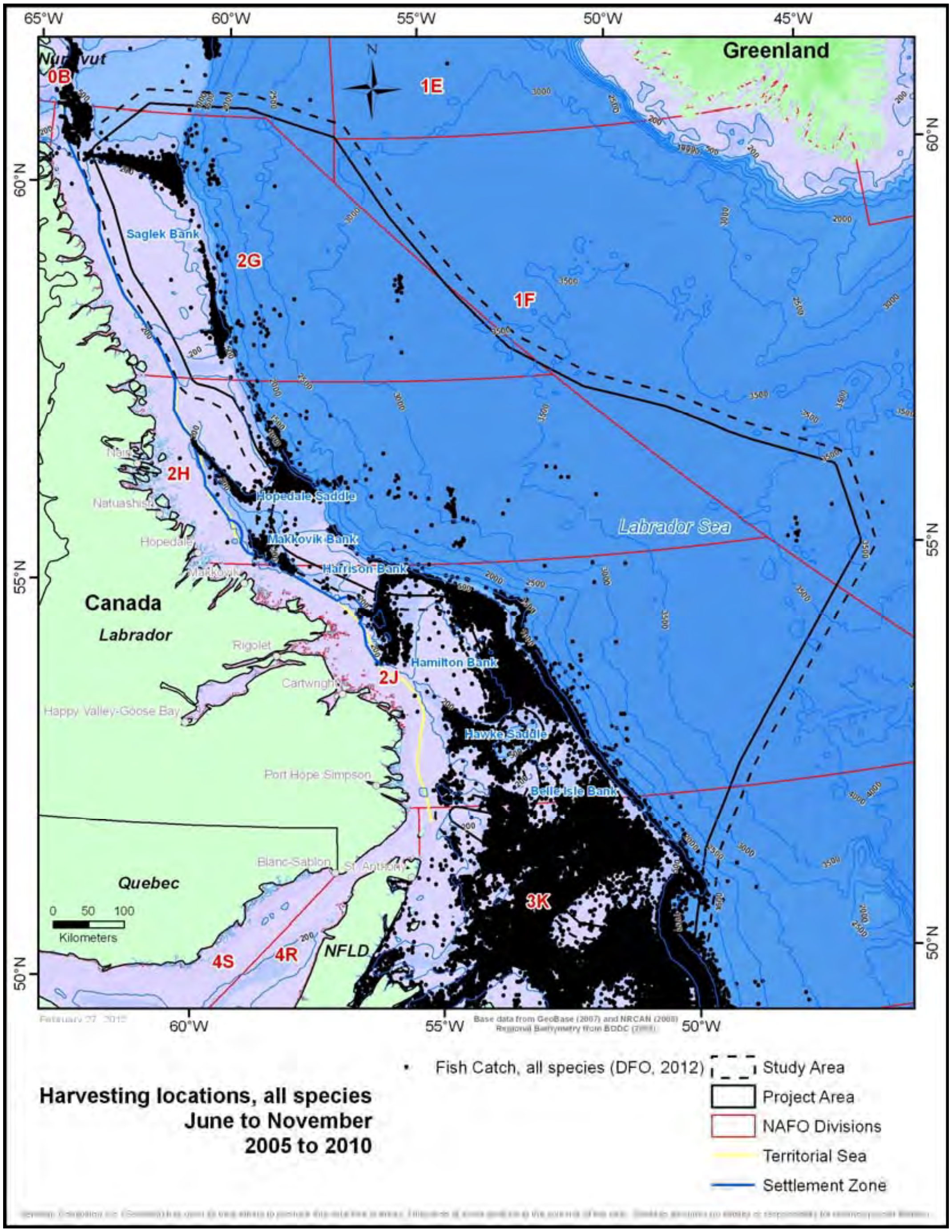

Figure 5. All Species Harvesting Locations June to November, 2005 to 2010

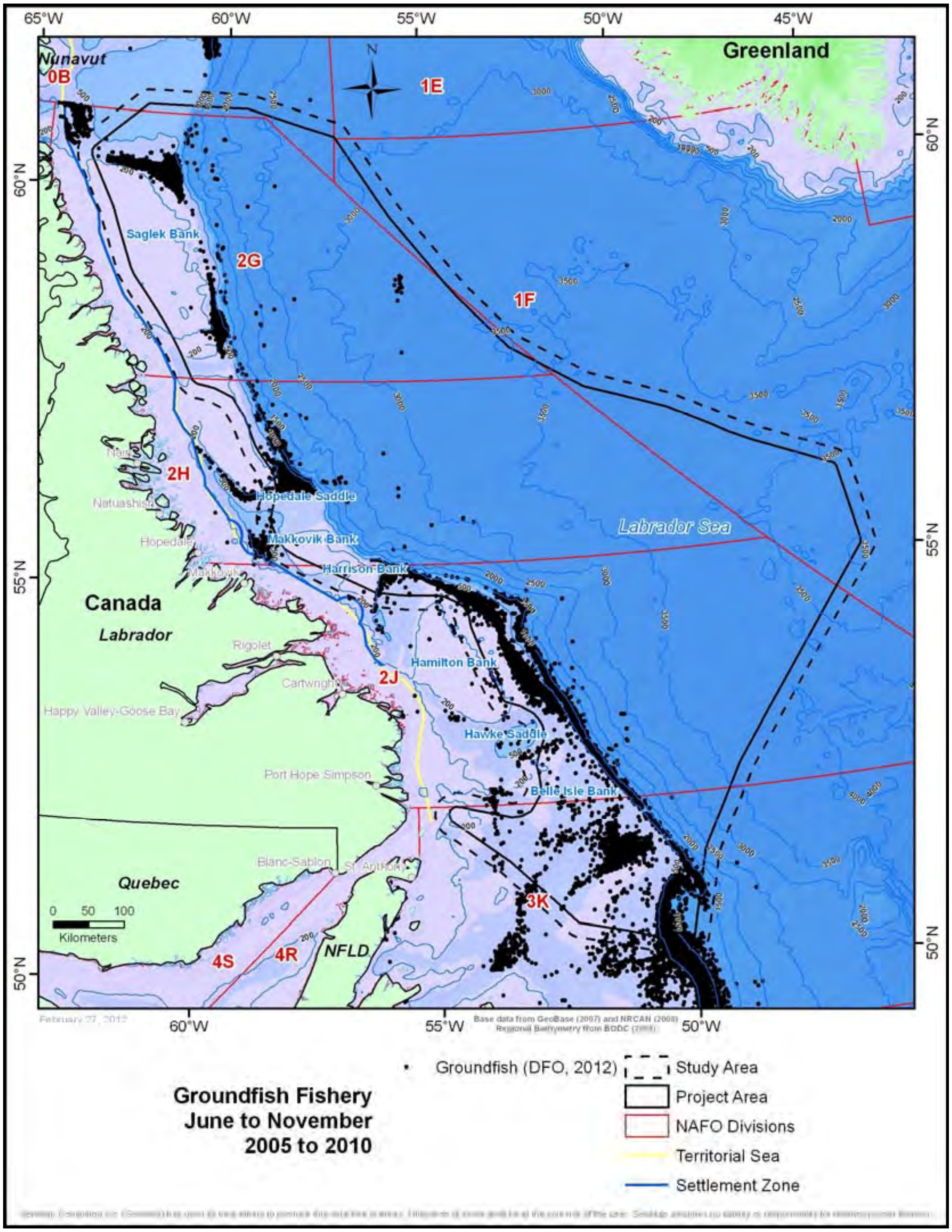

Figure 6. Harvesting Locations, Groundfish Fishery, June to November, 2005-2010

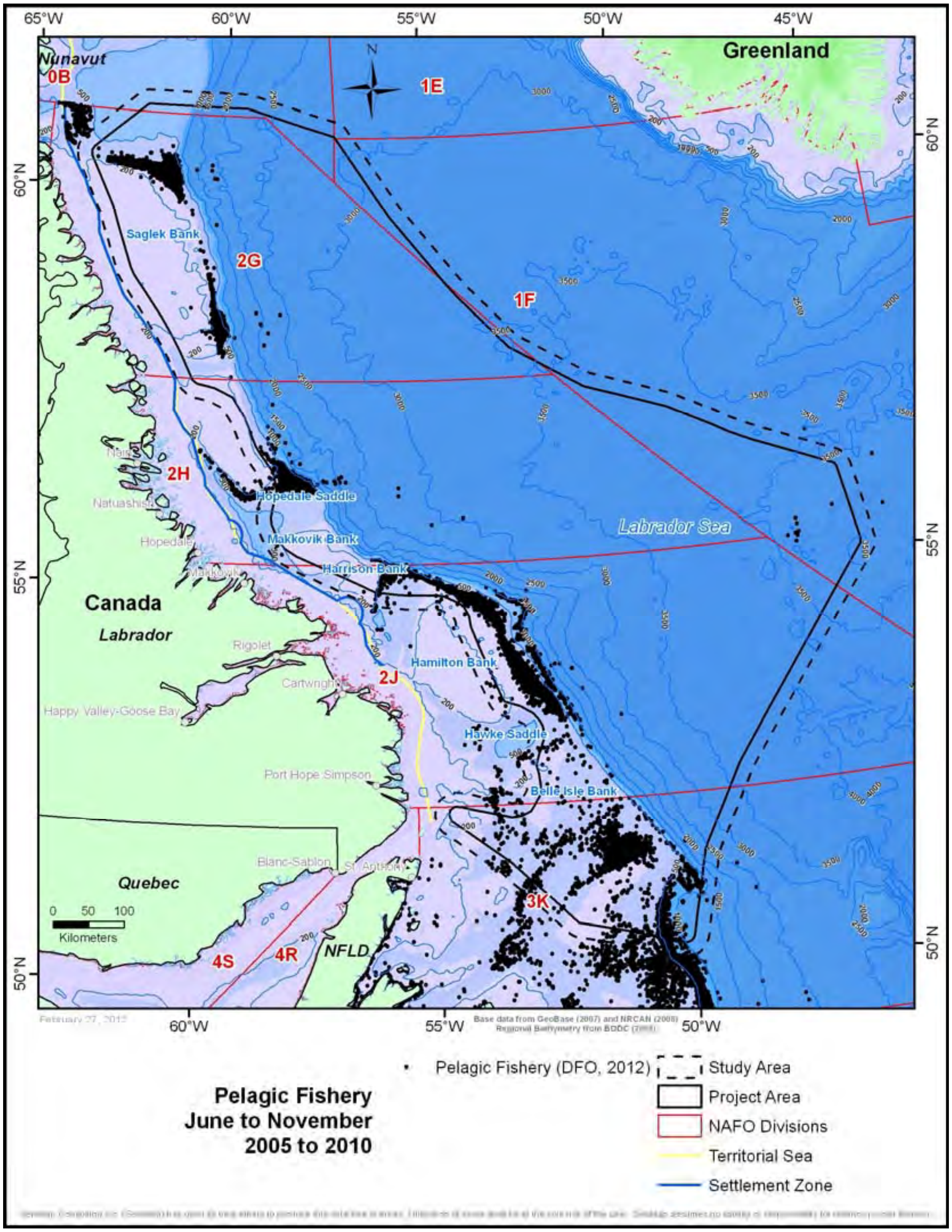

Figure 7. Harvesting Locations, Pelagic Fishery June to November, 2005-2010

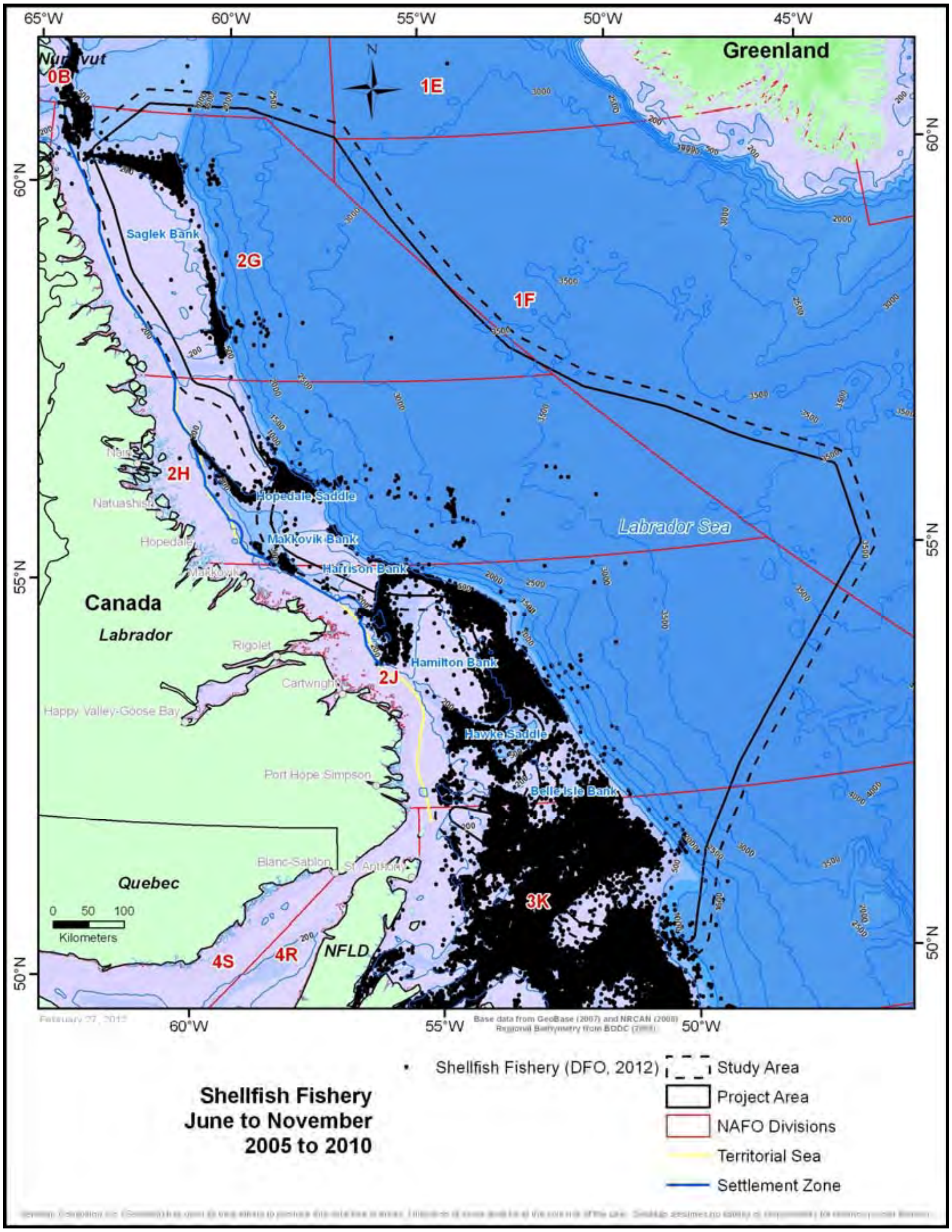

Figure 8. Harvesting Locations, Shellfish Fishery June to November, 2005-2010

4.3.1.3 Key Fisheries

4.3.1.3.1. Northern Shrimp (Pandalus borealis)

The following maps show the monthly reported domestic harvesting locations for key species for June to November 2005 to 2010 (Figure 9 to Figure 14). Northern shrimp is the most significant species harvested within the Study Area in terms of quantity and value of harvest, accounting for 86% to 93% of the total harvest of all species between June and November from 2005 to

2010. The Study Area overlaps with parts of Shrimp Fishing Area (SFA) 4, 5, and 6 and is managed by Canada's DFO. Figure 9 to Figure 14 show harvesting locations for shrimp.

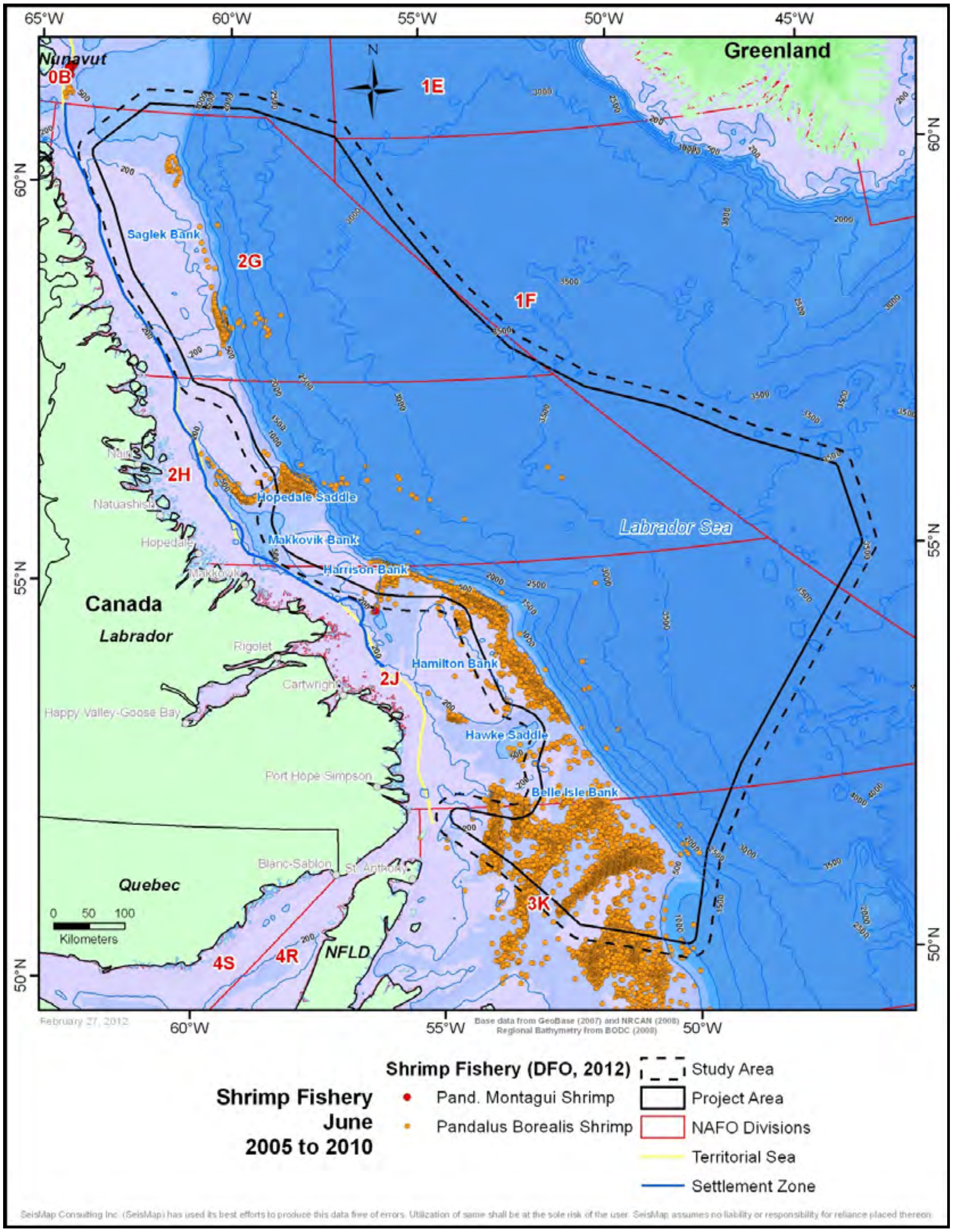

Figure 9. Harvest Locations, Shrimp, 2005-2010, June

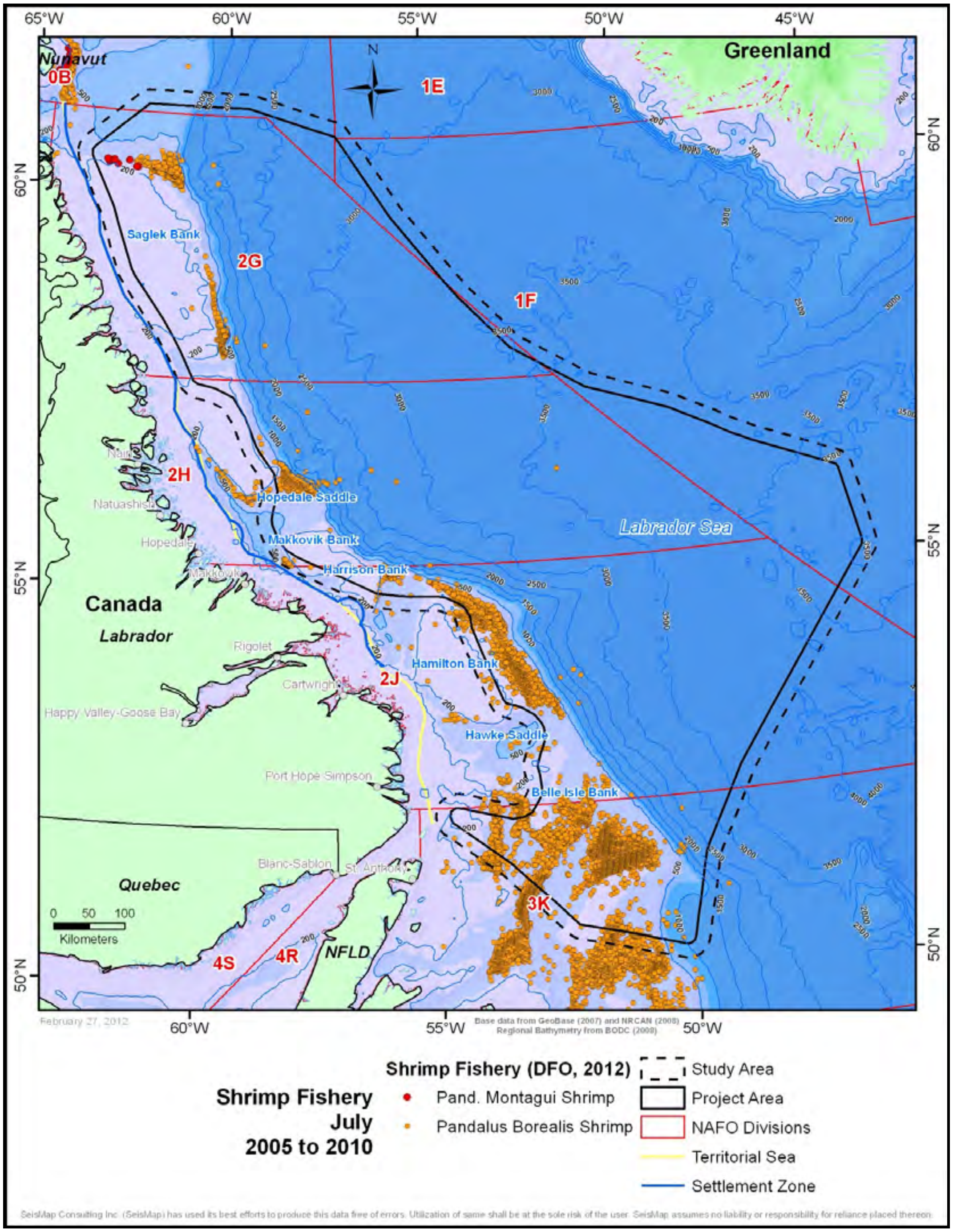

Figure 10. Harvest Locations, Shrimp, 2005-2010, July

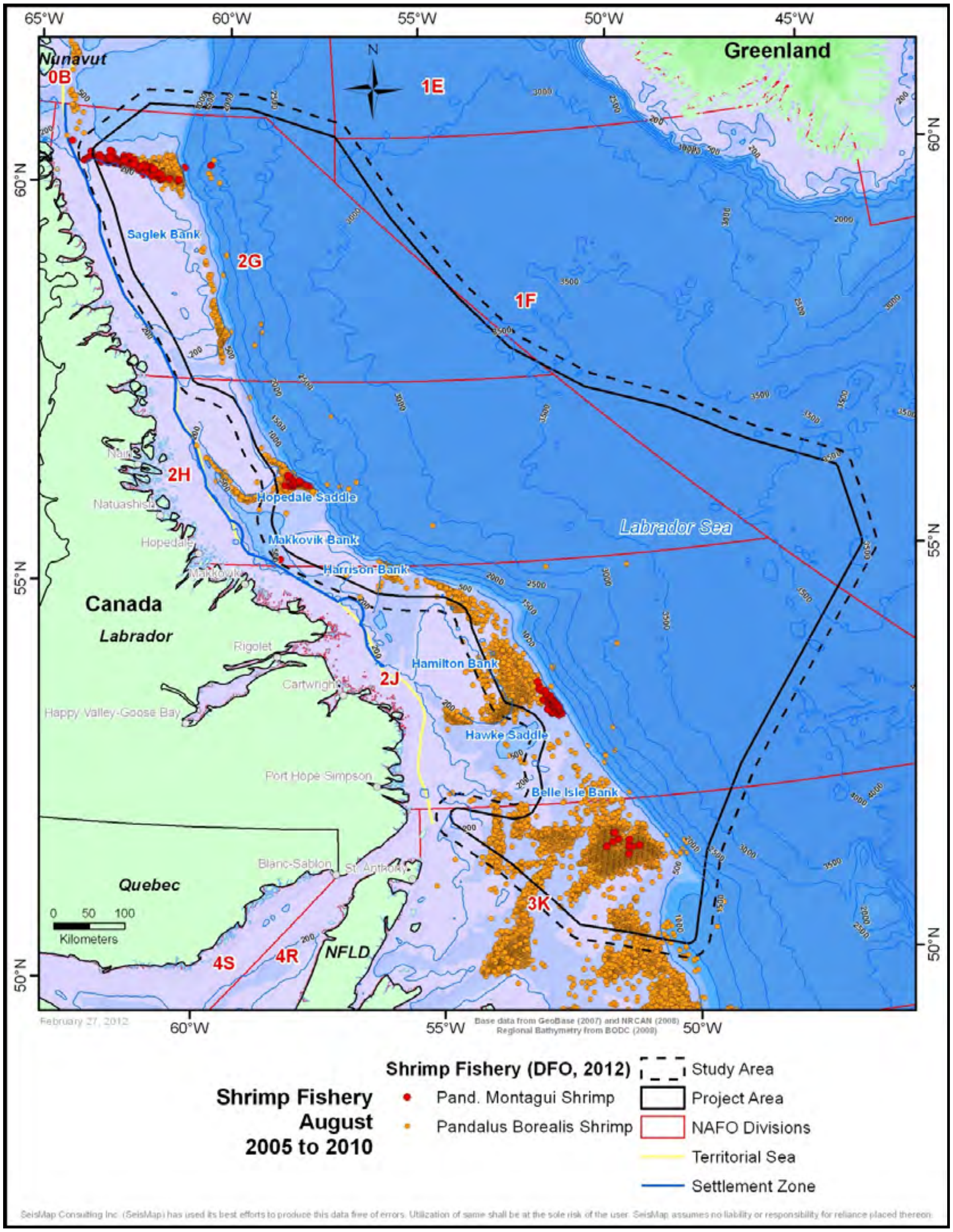

Figure 11. Harvest Locations, Shrimp, 2005-2010, August

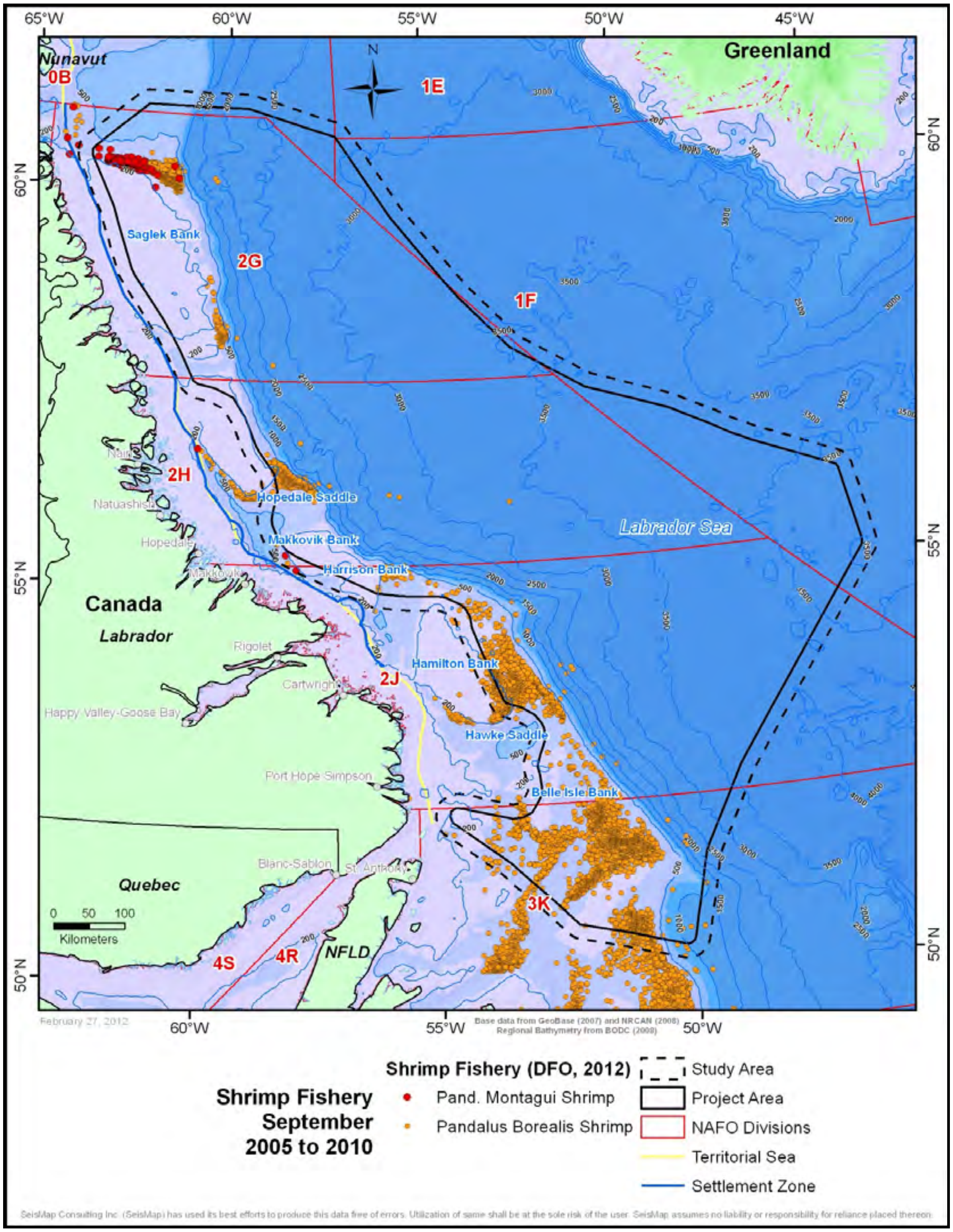

Figure 12. Harvest Locations, Shrimp, 2005-2010, September

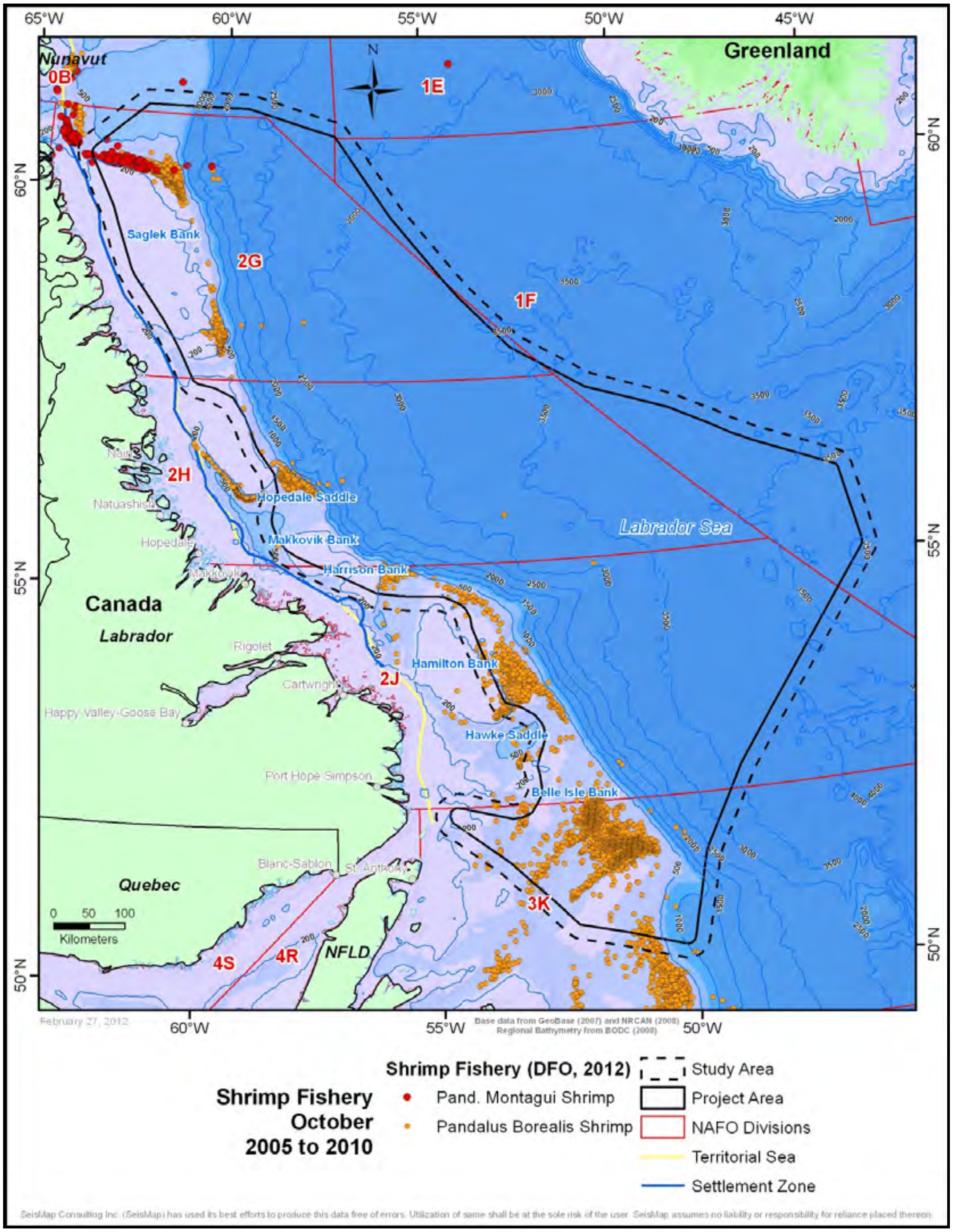

Figure 13. Harvest Locations, Shrimp, 2005-2010, October

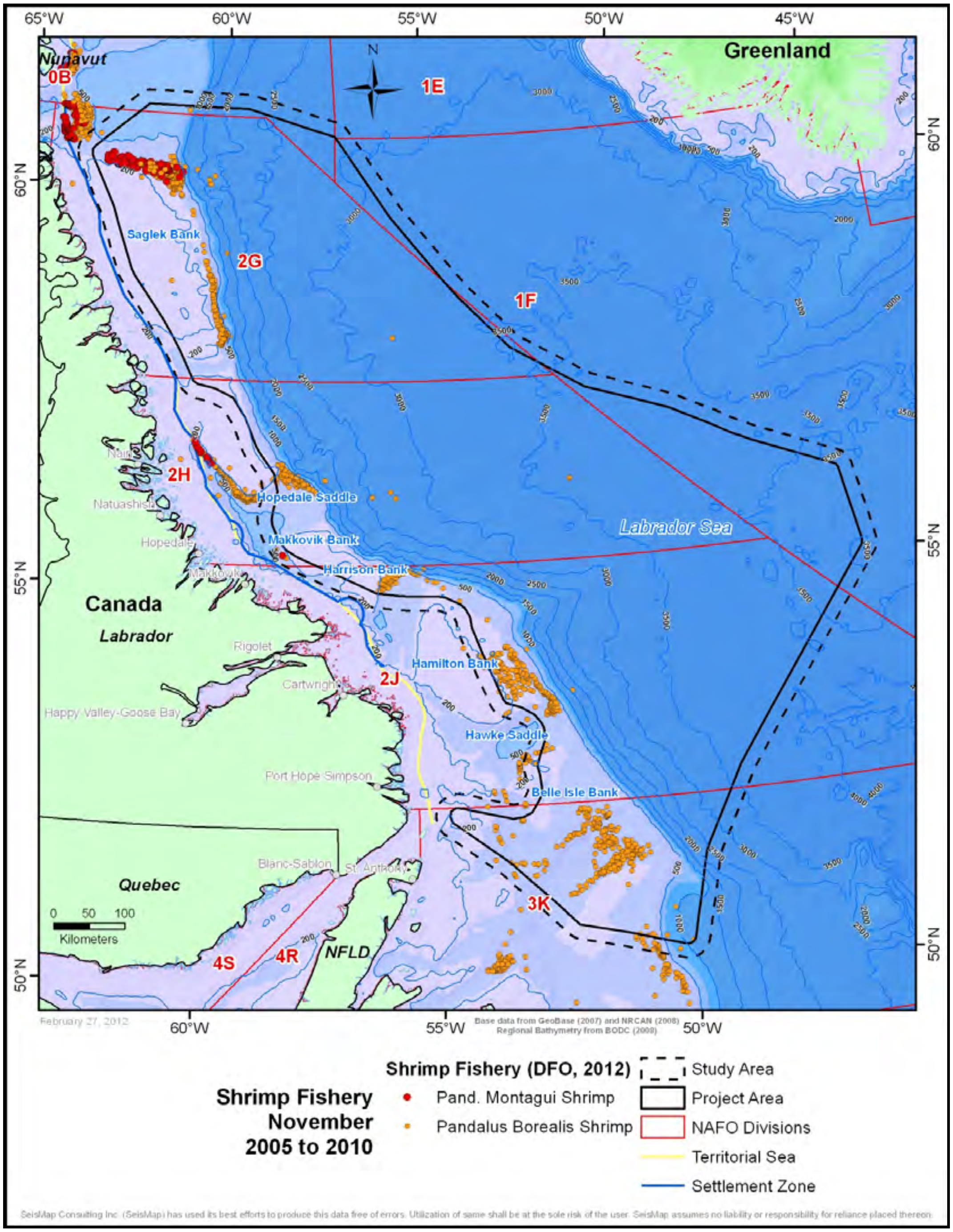

Figure 14. Harvest Locations, Shrimp, 2005-2010, November

As of June 16th, 2011, the 2011 quota for SFA 4 was 4,700 t, 11,320 t for SFA 5 and 52,387 t for SFA 6. The SFA 6 quota, which was 85,725 t in 2009/10 (DFO 2010/018) was reduced to 52,387 t for 2010/11.

Figure 15 shows the northern shrimp harvest by month from the Study Area, for the period of 2005 to 2010.

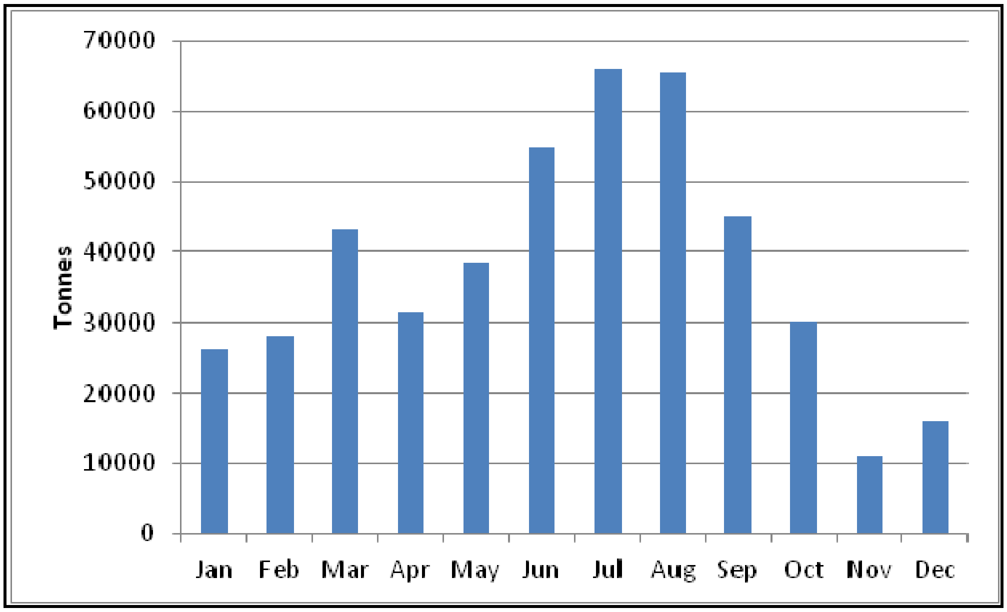

Figure 15. Annual Shrimp Harvest Within the Study Area, by Month, 2005-2010

4.3.1.3.2. Snow Crab (Chionoecetes opilio)

Snow crab is of high importance in the Study Area's fisheries, averaging 7,504.4 tonnes from April to August and accounting for about 50% of the total harvest. Figure 16 shows the annual snow crab quantity of harvest from the Study Area for 2005 to 2010. The season is defined each year but typically runs in 2J north from June 15th to August 30th and in 2J south from May 1st to July 15th, and in 3K from April to end of June. Because the fishery uses fixed gear (crab pots), the fishery poses a potential for seismic / fishing gear conflicts in those areas where the two marine activities might overlap. The Study Area overlaps with portions of crab fishing areas in 2H, 2J, and 3K.

The most recent DFO snow crab science advisory report (DFO 2010/020) notes that "landings in Div. 2H declined by 53% from 190 t in 2007 to 90 t in 2009, the effect of removal in 2010 in unknown. In Div 2J landings increased by 60% from 2005-2008 and unchanged in 2009 but effort increased by 27%. In Div 3K offshore, landings decreased to 6,000 t in 2005, but doubled to 13,000 t in 2009. Landings returned to pre-2005 levels."

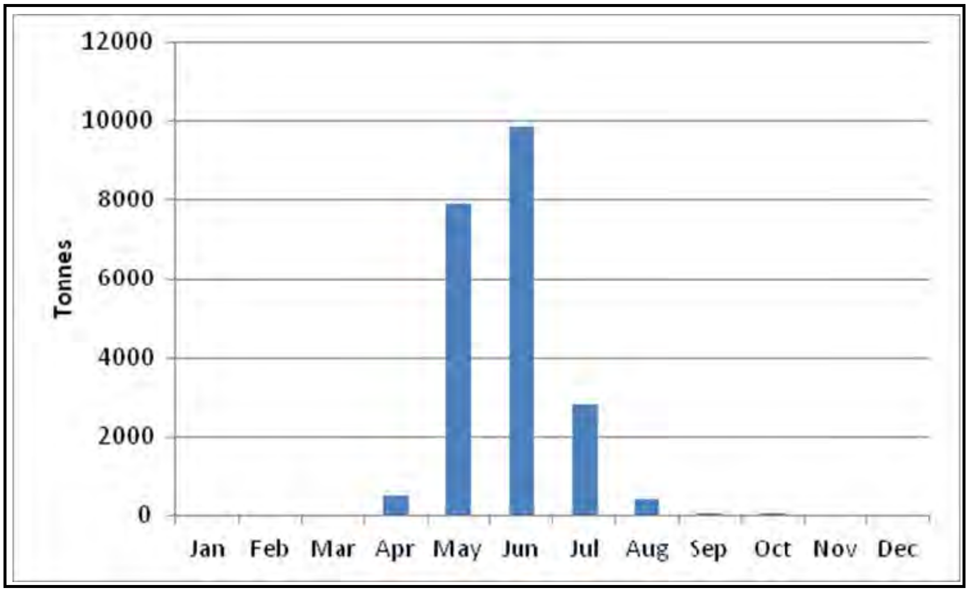

Figure 16. Annual Snow Crab Harvest in the Study Area, by Month, 2005 to 2010

Figure 17 to Figure 22 show the harvesting locations for the species (June to November, 2005 to 2010) in relation to the Study Area. The 2011 quotas for 2J (includes 2H) was 2197 t, and 12053 t for Div 3K.

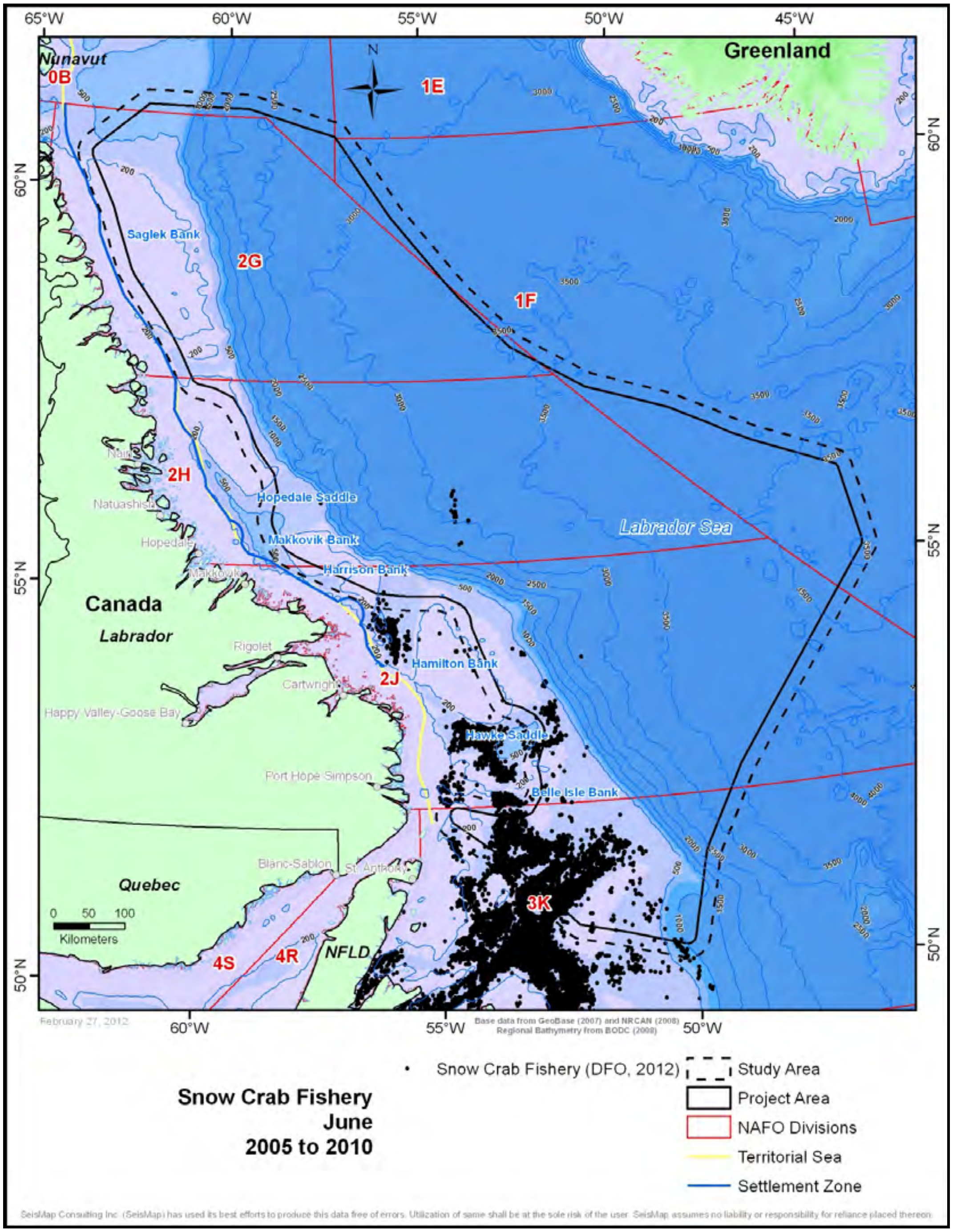

Figure 17. Harvest Locations, Snow Crab, 2005-2010, June

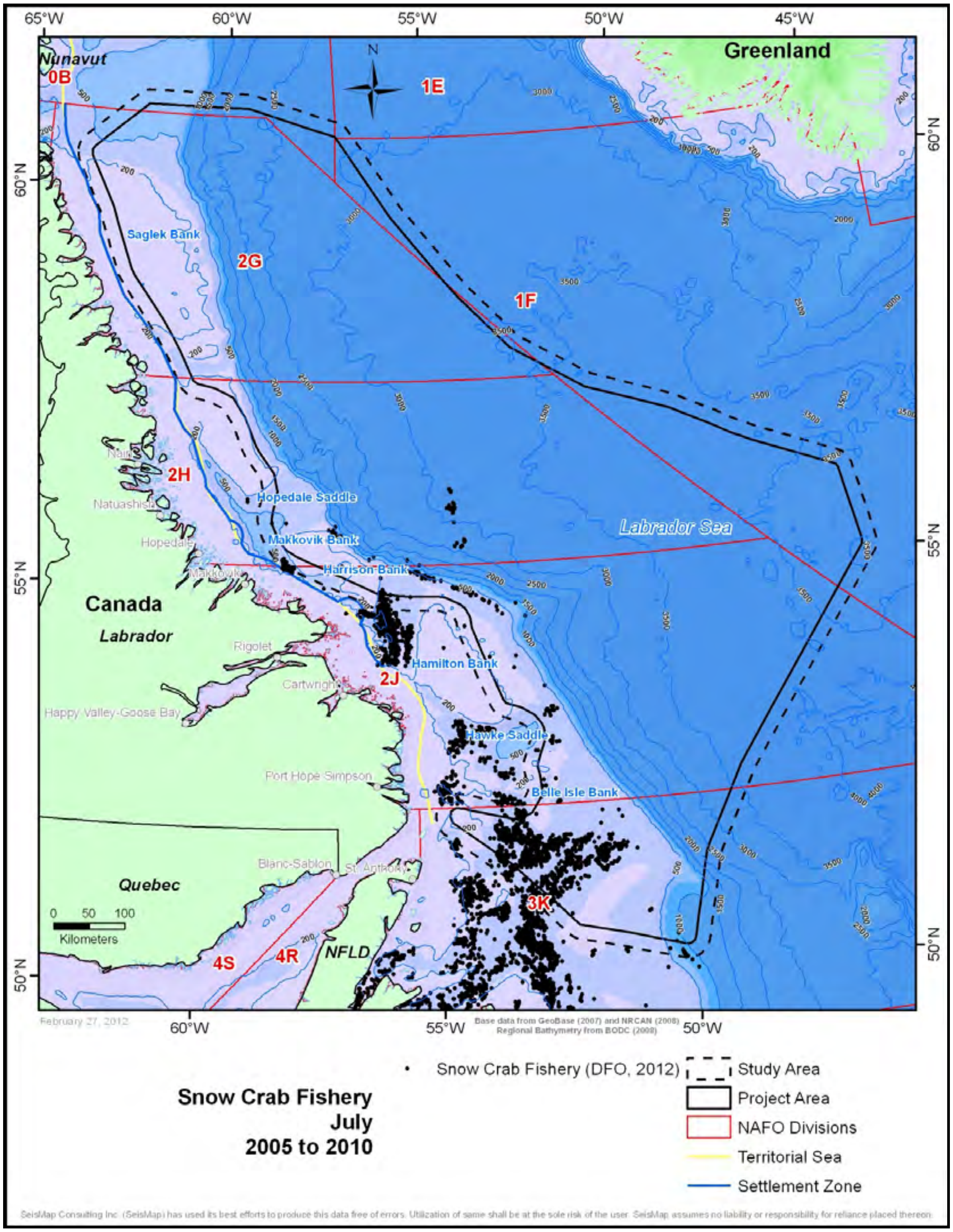

Figure 18. Harvest Locations, Snow Crab, 2005-2010, July

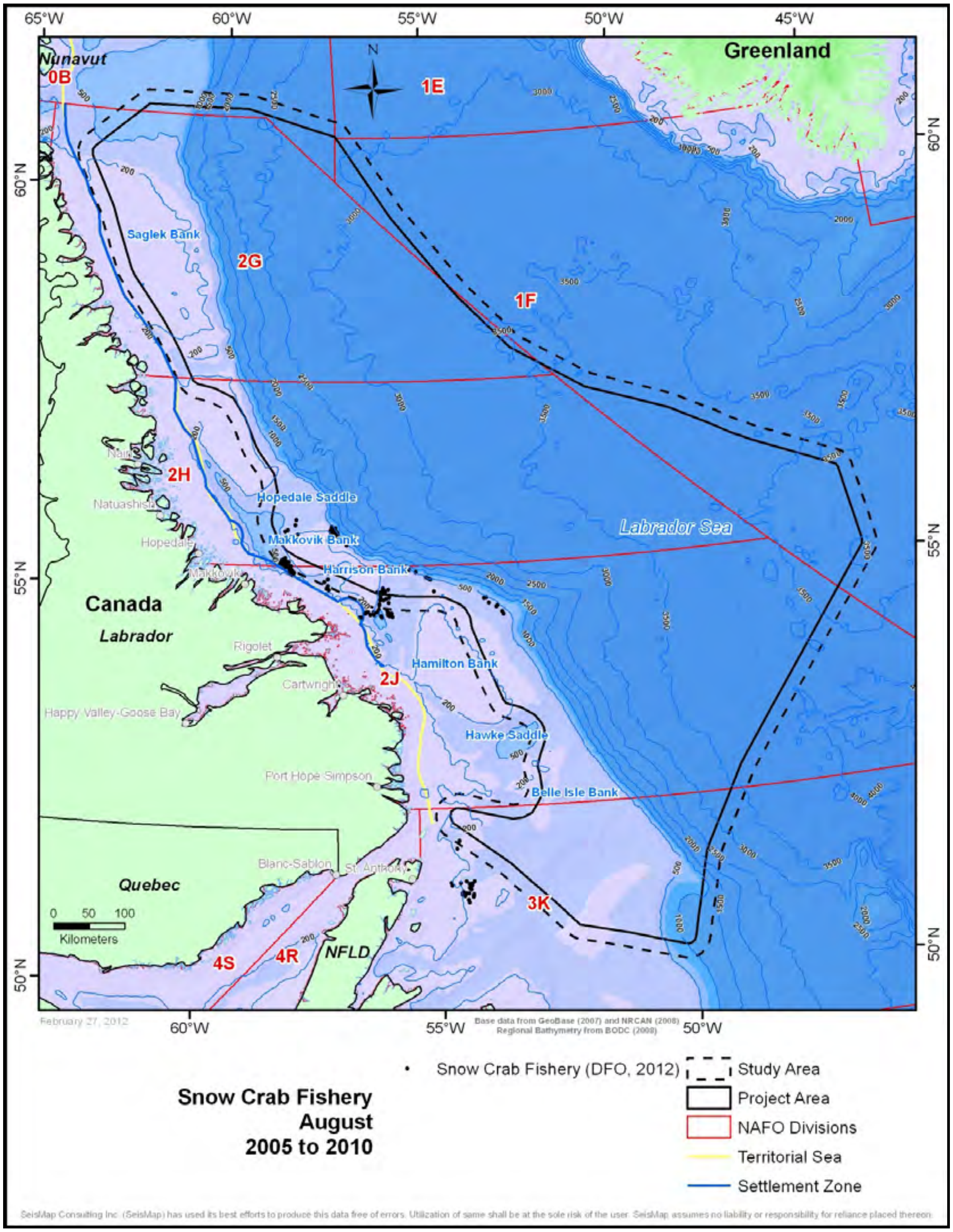

Figure 19. Harvest Locations, Snow Crab, 2005-2010, August

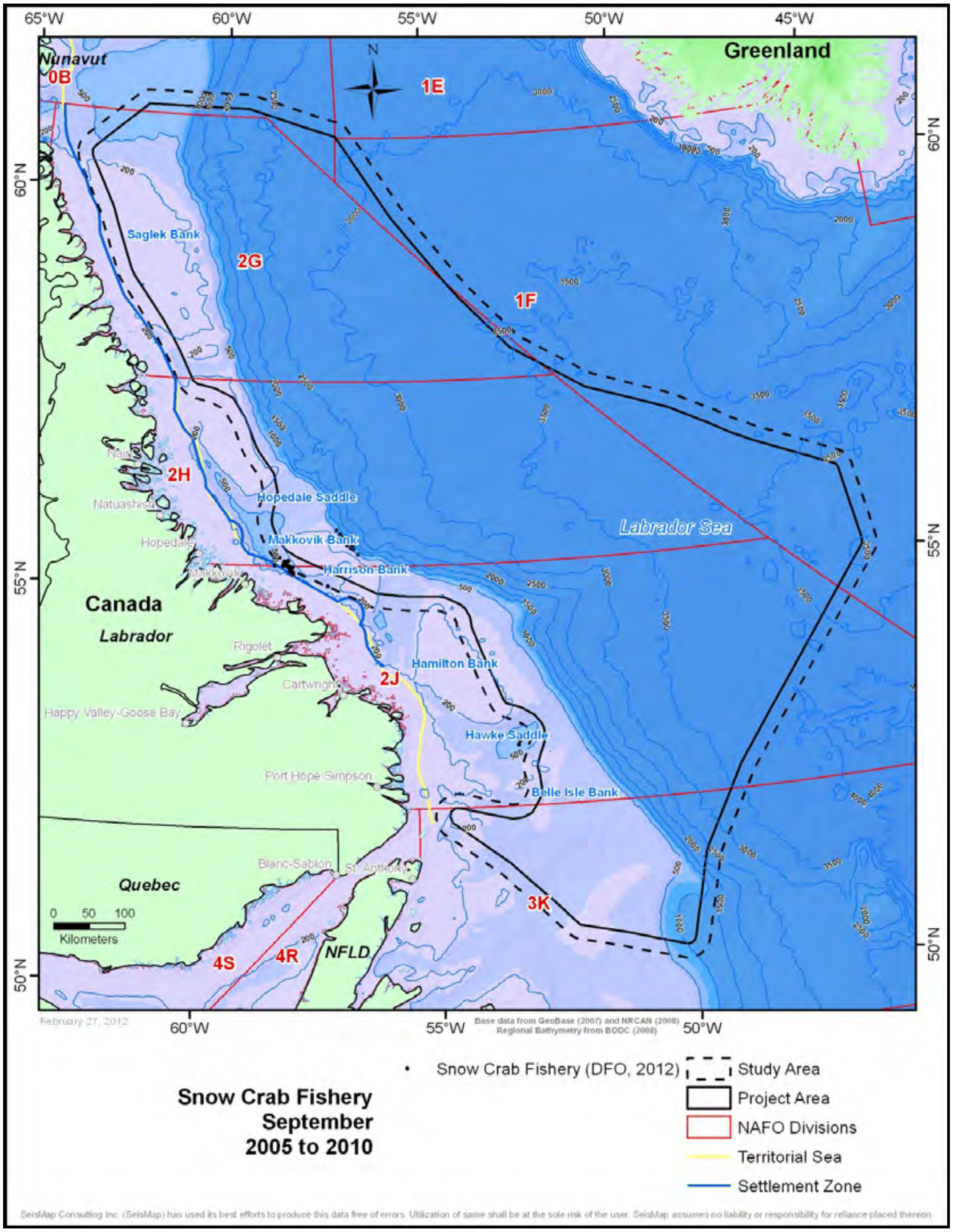

Figure 20. Harvest Locations, Snow Crab, 2005-2010, September

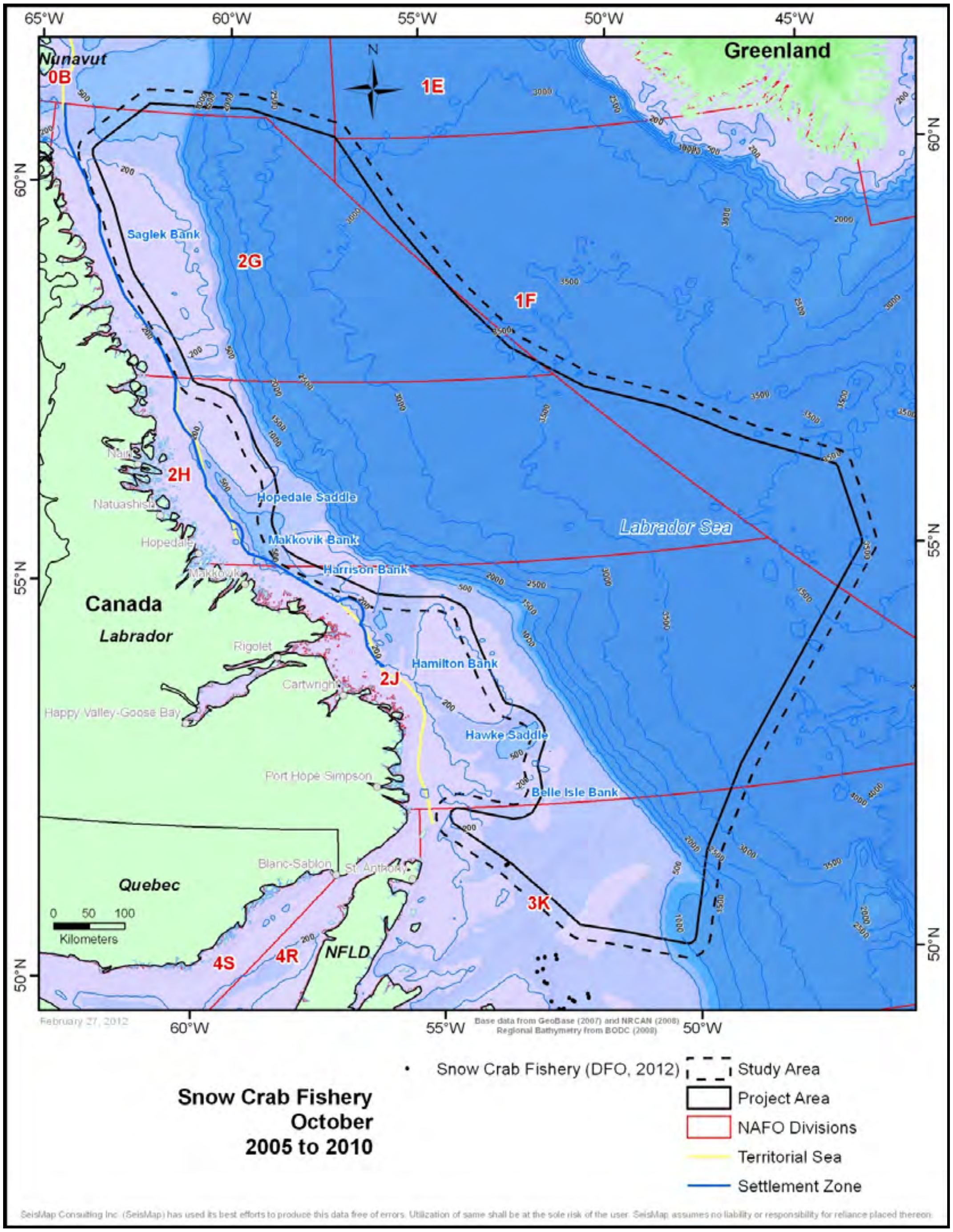

Figure 21. Harvest Locations, Snow Crab, 2005-2010, October

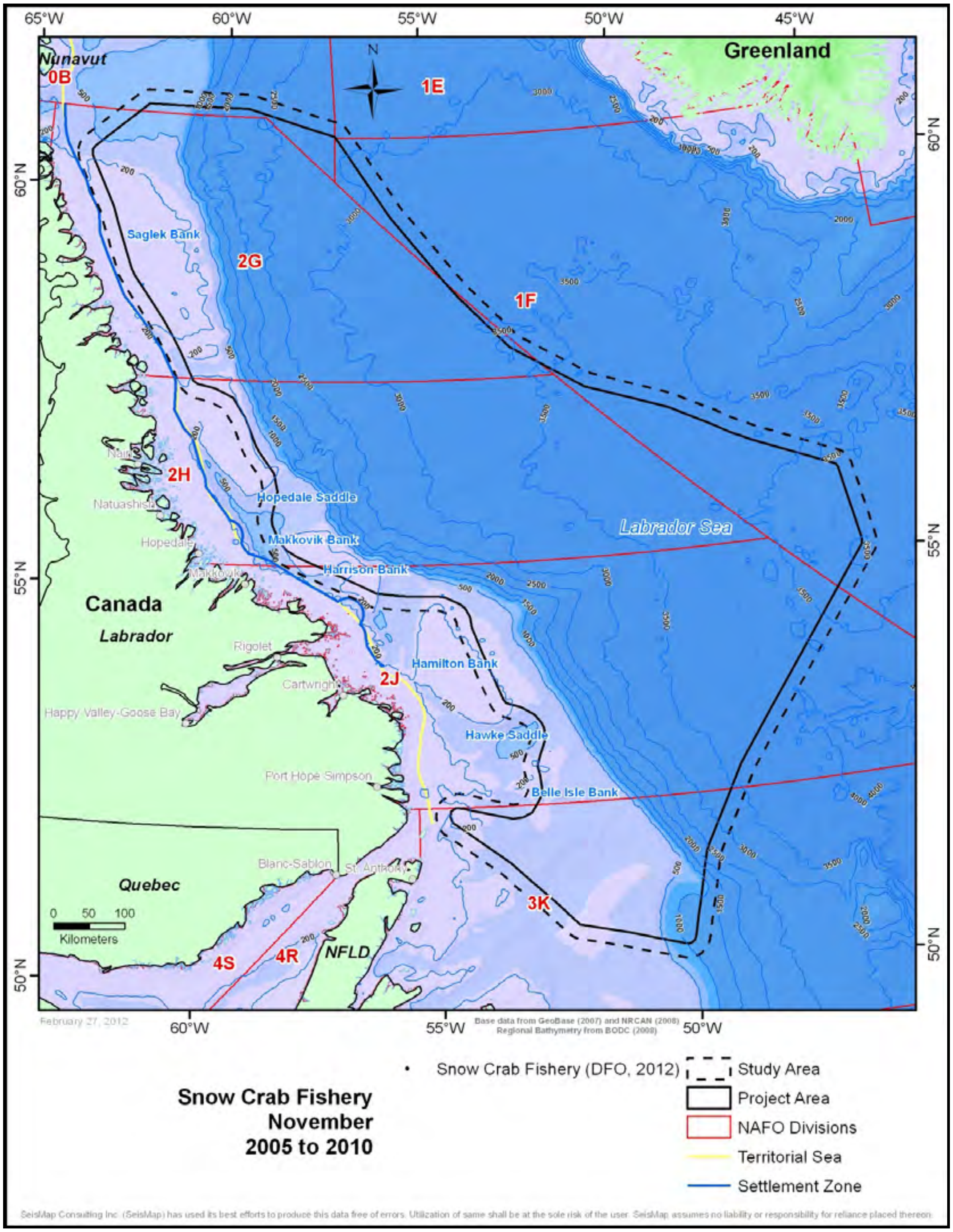

Figure 22. Harvest Locations, Snow Crab, 2005-2010, November

4.3.1.3.3. Greenland Halibut / Turbot (*Reinhardtius hippoglossoides*)

Greenland halibut (turbot) represents about 0.1% of the Study Area catch by quantity and value. Most (about 99%) of this harvest in the Study Area is taken using fixed gear gillnets. This fishery occurs year round, with most of the catch taken in June and July (Figure 23). For 2011, the quota was 0t in OB, but there is a catch of 2122 t, 0t for 2J, but a catch of 26 t and quota of 2,365 t for 3K.

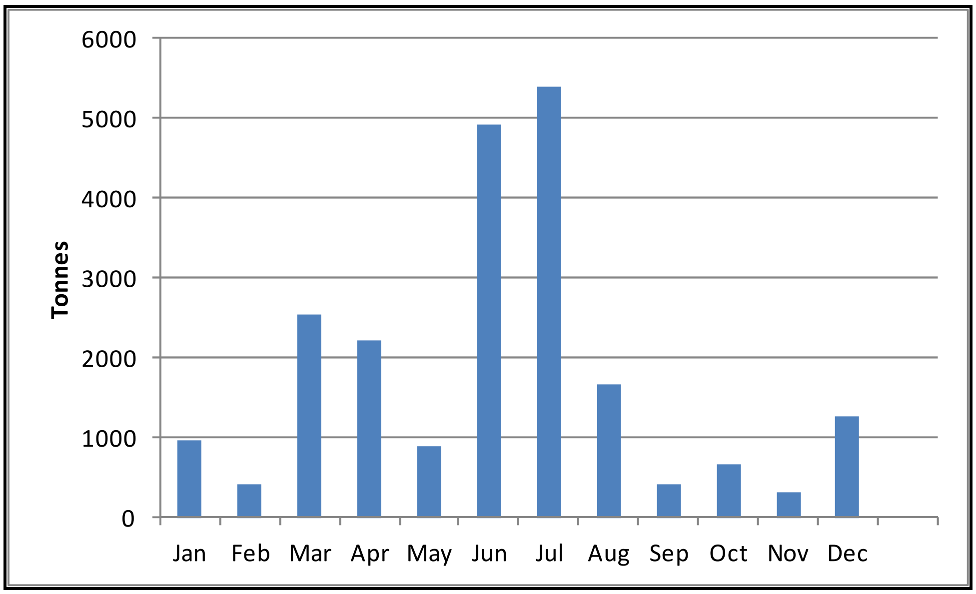

Figure 23. Annual Harvest of Greenland Halibut (Turbot) Within the Study Area, by Month, 2005-2010

Figure 24 to Figure 29 indicate that the Study Area June to November domestic harvest of turbot, in 2005 to 2010.

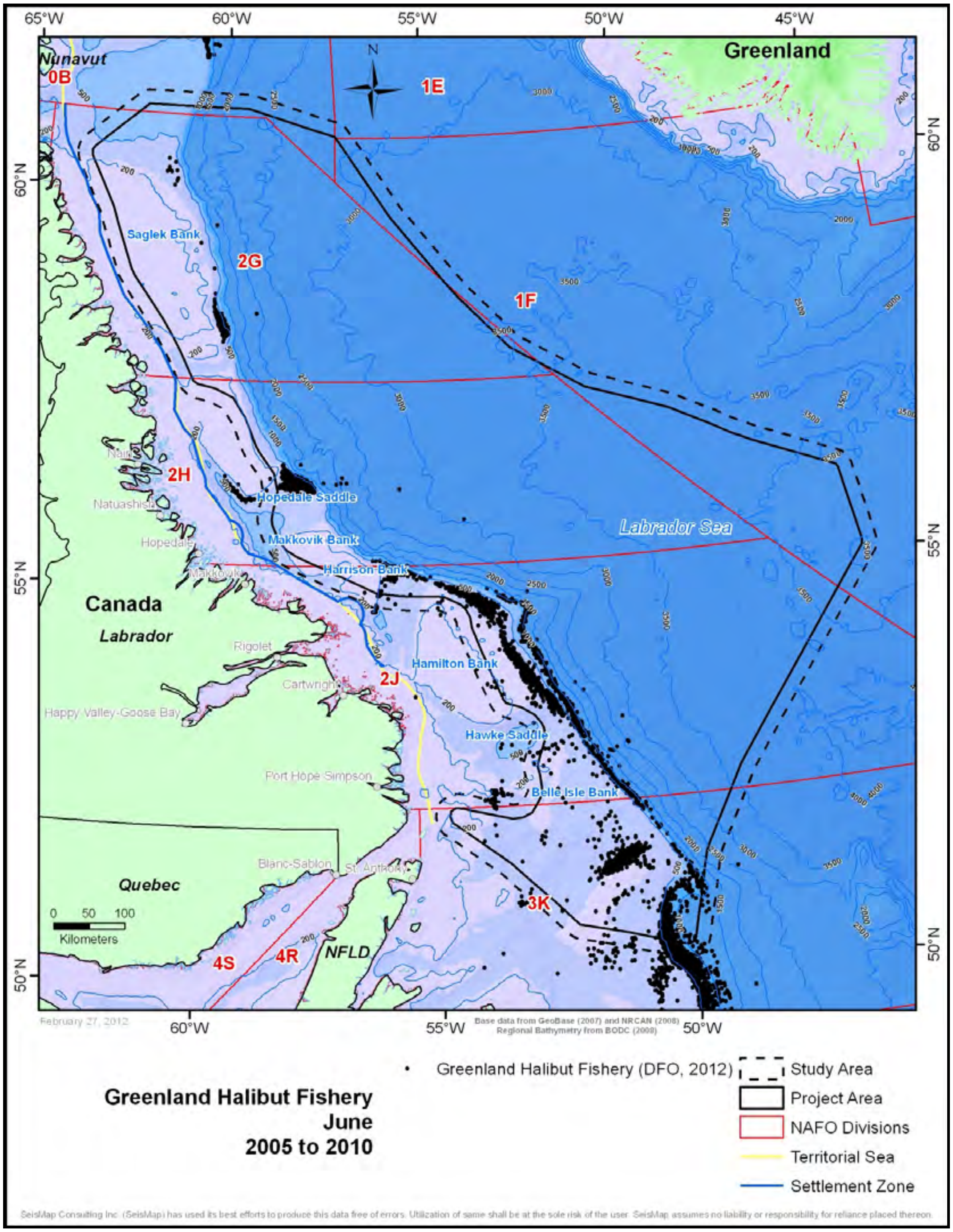

Figure 24. Harvest Locations, Greenland Halibut, 2005-2010, June

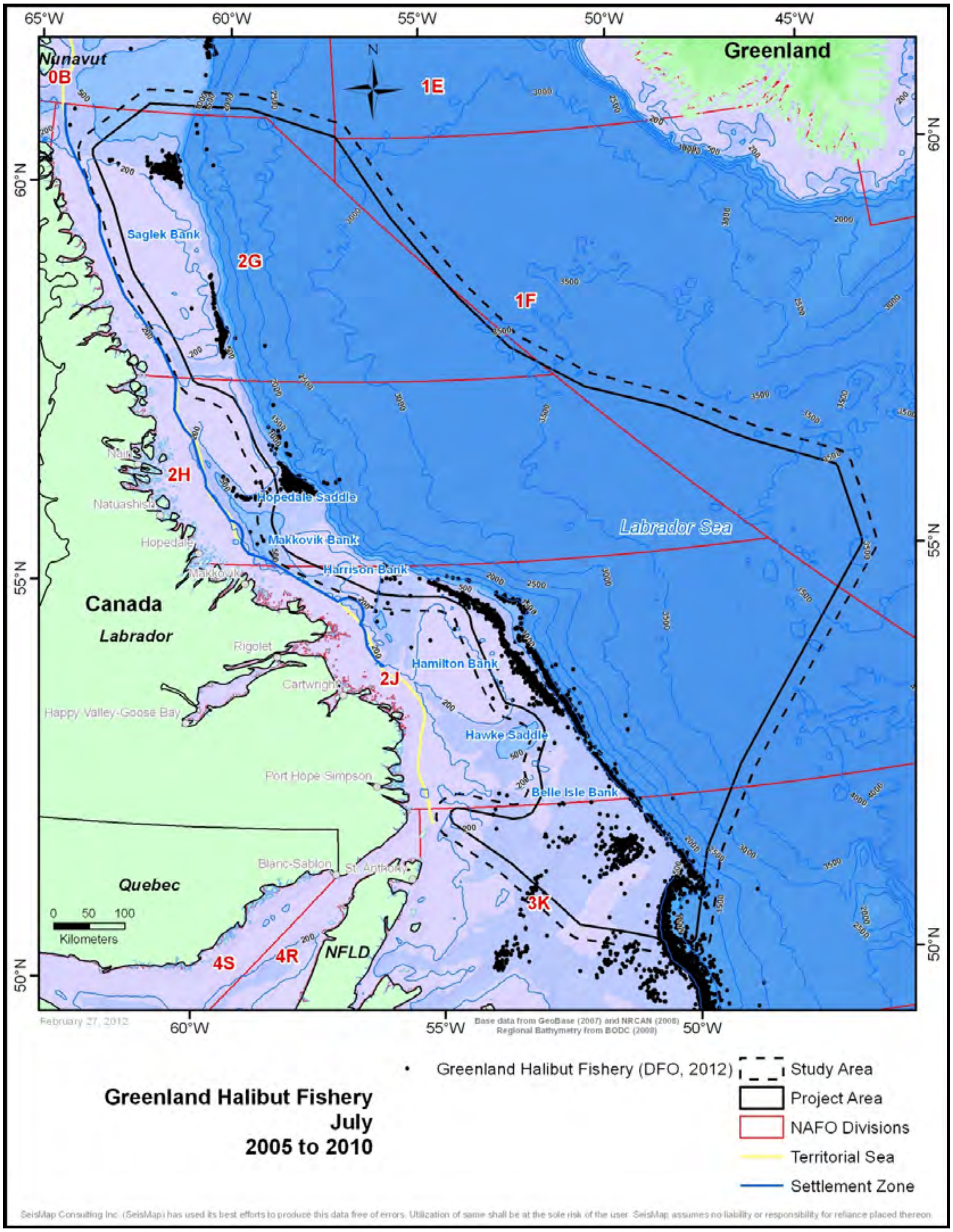

Figure 25. Harvest Locations, Greenland Halibut, 2005-2010, July

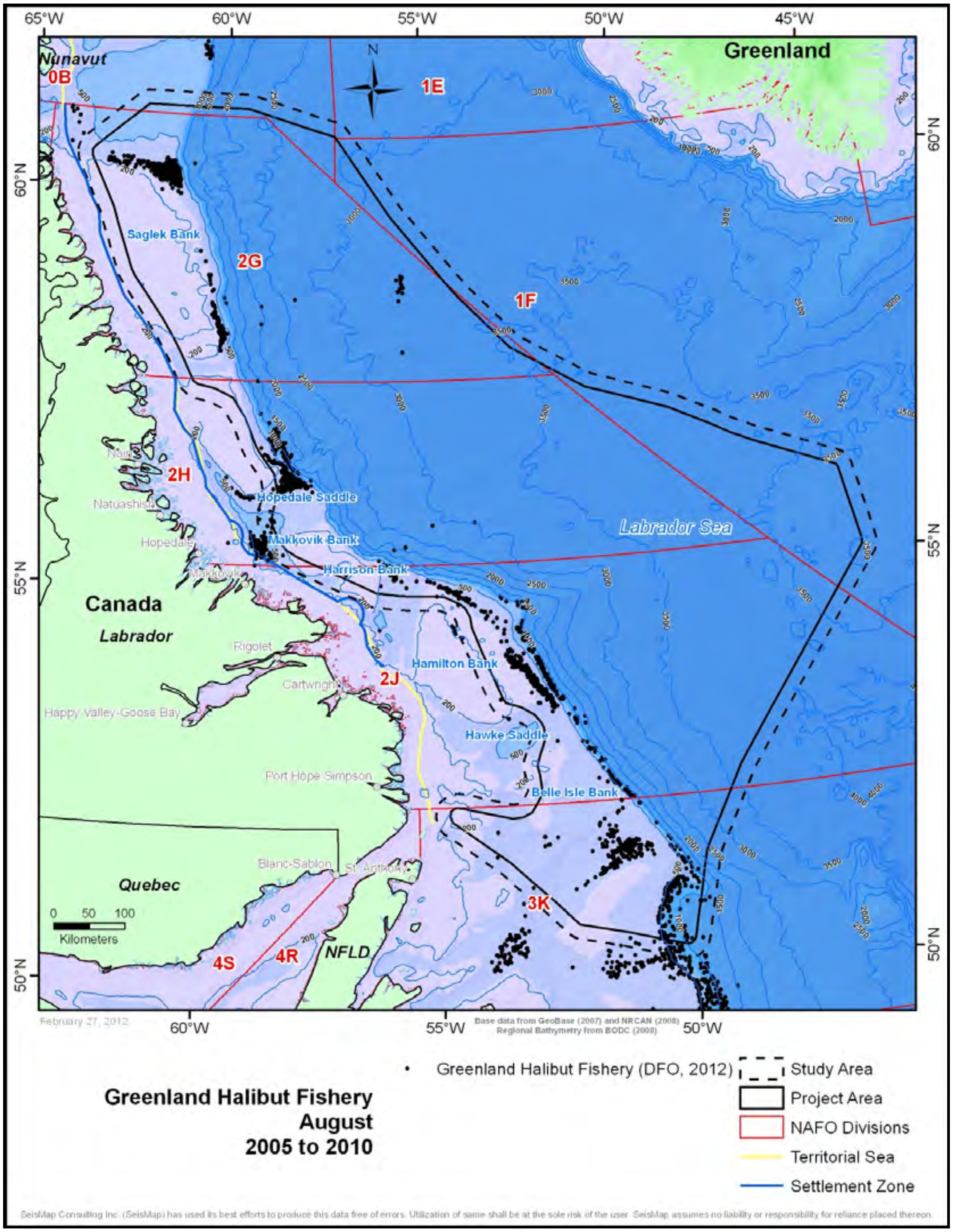

Figure 26. Harvest Locations, Greenland Halibut, 2005-2010, August

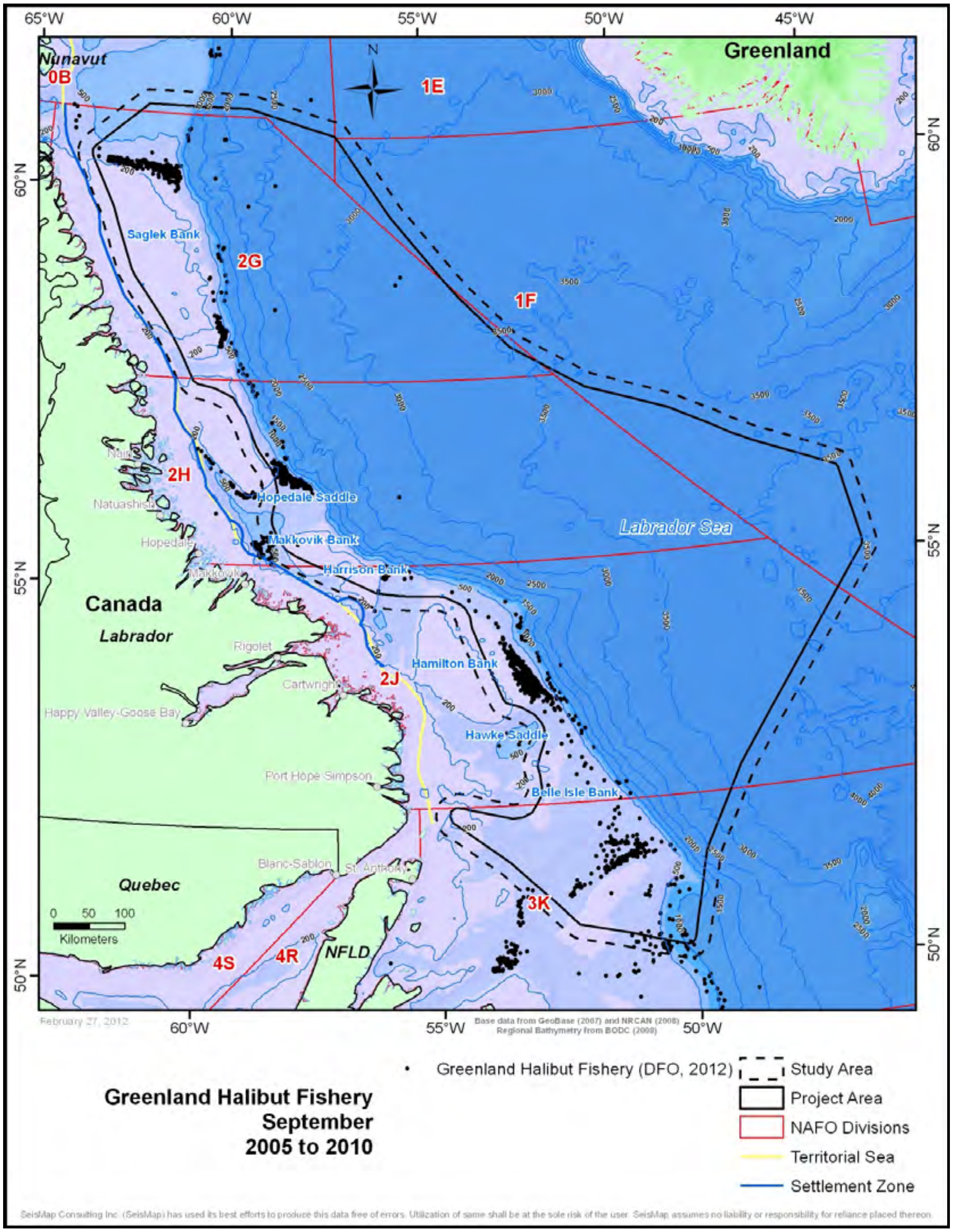

Figure 27. Harvest Locations, Greenland Halibut, 2005-2010, September

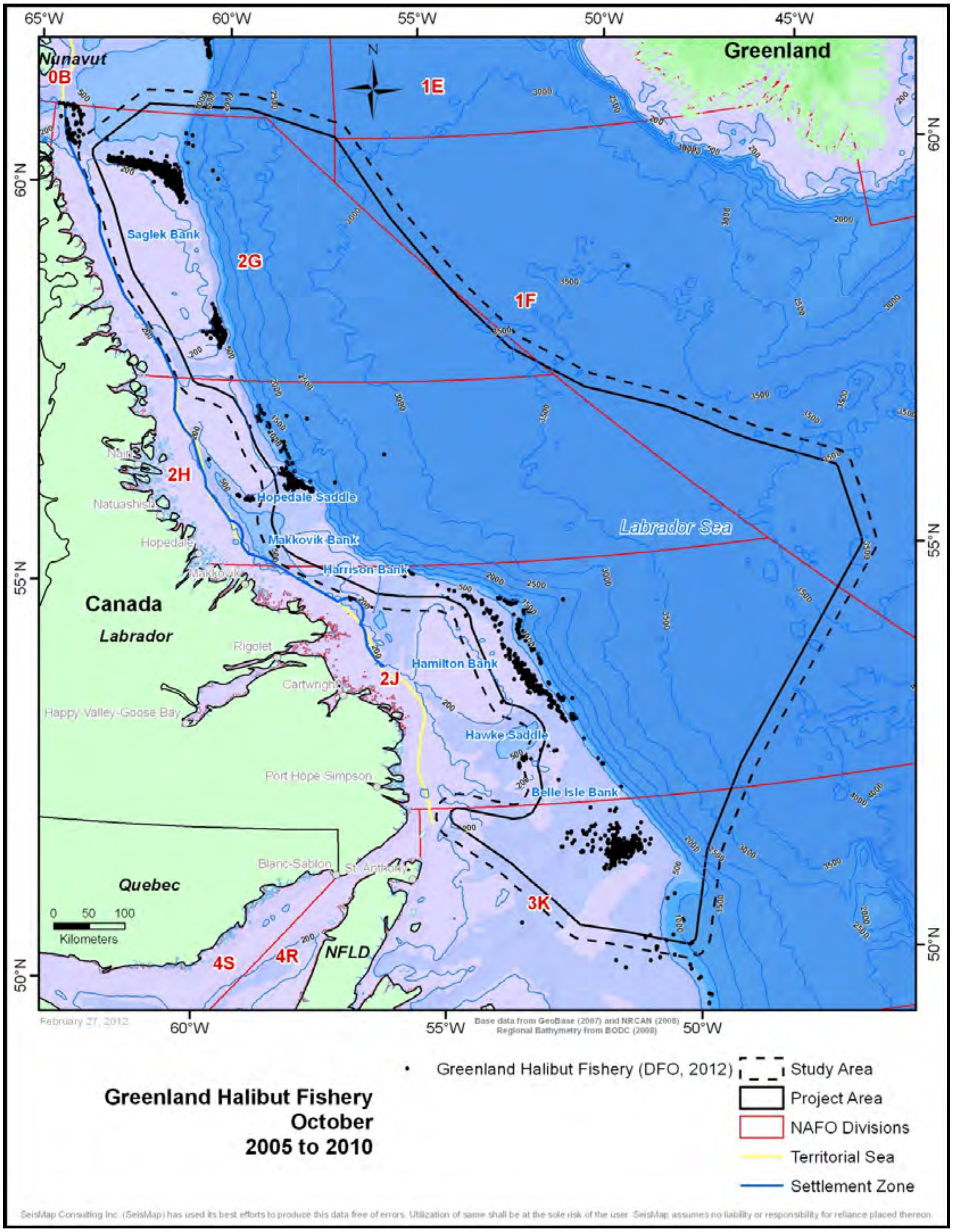

Figure 28. Harvest Locations, Greenland Halibut, 2005-2010, October

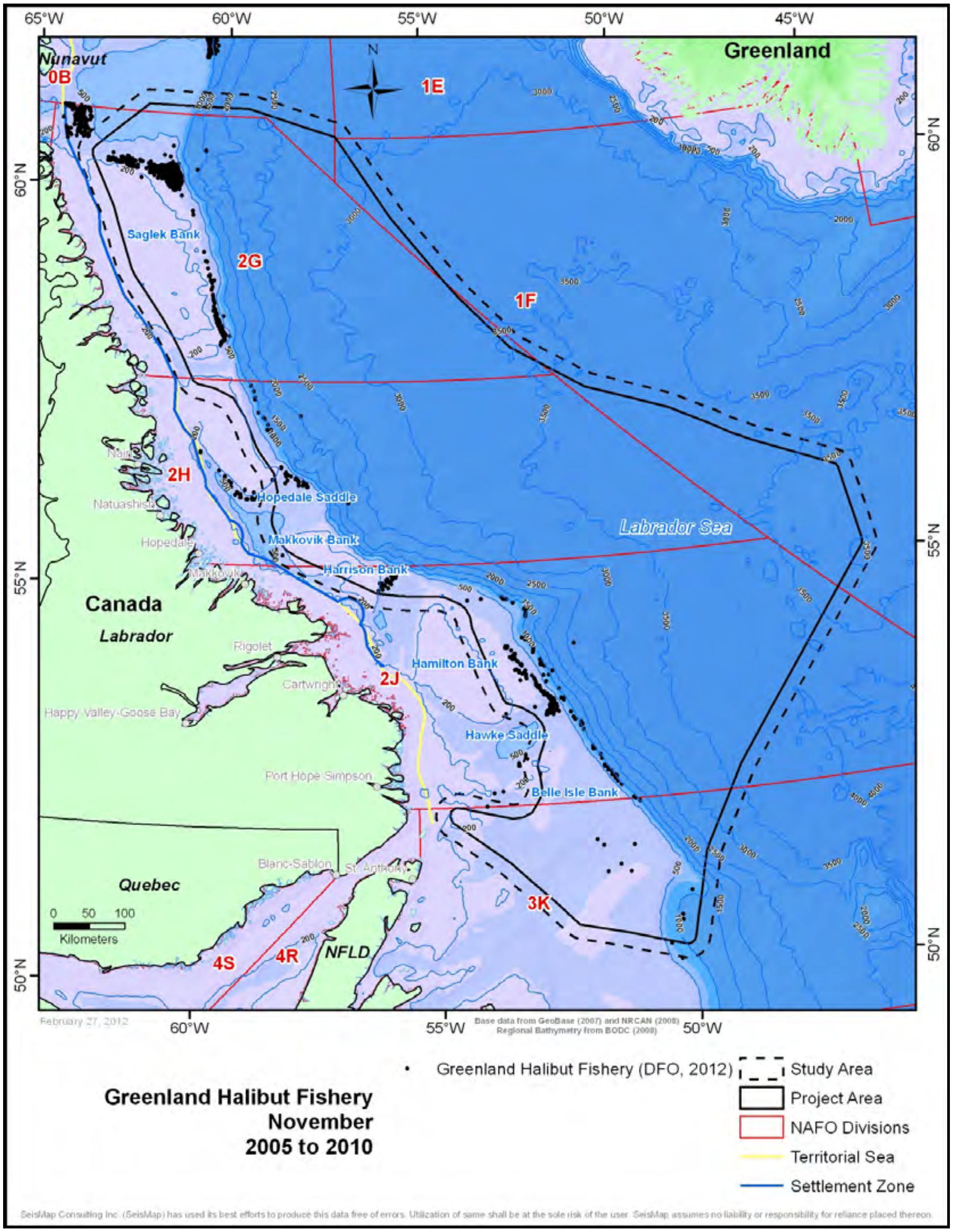

Figure 29. Harvest Locations, Greenland Halibut, 2005-2010, November

5. EFFECTS ASSESSMENT OF PROJECT ACTIVITIES

The potential effects of the MKI seismic survey was assessed in the EA Addendum Report, which concluded that the vessel presence, noise emissions, and accidental events associated with the proposed seismic surveys are not predicted to result in significant adverse environmental effects on fish and shellfish, marine and migratory birds, marine mammals, sea turtles, species-at-risk, sensitive areas, or fisheries in the Labrador Shelf Study Area following mitigation (Table 5). Ecological processes will not be disturbed outside natural variability, and ecosystem structure and function will not be critically affected. All effects are reversible, of limited duration, magnitude, and geographic extent.

Table 5. VEC-Specific Mitigative Measures and Follow-Up

VEC	Mitigation Measures	Follow up and Monitoring
Marine and Migratory Birds	• Compliance with PGS vessel WMP, *Canada Shipping Act,* OWTG and MARPOL for all discharges. • A fuel transfer plan will be developed and implemented. • Any handling of stranded birds will follow CWS and industry protocols. • A dedicated Environmental Observer will be on board the seismic vessel to record marine birds. • Vessel compliant with audit prior to survey. • Avoidance of bird colonies.	• Sightings data for seabirds, will be summarized in a monitoring report which will be submitted to C-NLOPB, and CWS. • Records of bird strandings will be provided to the C-NLOPB, and CWS for distribution to interested parties.
Marine Fish and Shellfish	• Adherence to the *Statement of Canadian Practice on the Mitigation of Seismic Noise in the Marine Environment,* to the extent reasonably practical. • To minimize sudden changes in noise levels, a 20 to 40 minute ramp up procedure will be implemented.	• No follow up or monitoring required for routine activities
Marine Mammals and Turtles	• Before start of the operations, a meeting will be held with MKI representatives and TGS seismic company representatives to review sail lines, scheduling, anticipated fishing vessels and gear types, mitigating measures, expectations of all parties and Emergency Response Plans. • An Environmental Observer will be onboard the vessel throughout the duration of the survey and will record sightings of marine mammals on a daily basis as per protocol. • A 20 to 40 minute ramp-up procedure will be undertaken for seismic surveys. • Ramping up will be delayed if a marine mammal is observed in the 500 m safety zone. • Air sources will be shut down or reduced to a smaller air source while the vessel is doing	• A trained Environmental Observer will record marine mammal and turtle observations. • All spills will be reported.

VEC	Mitigation Measures	Follow up and Monitoring
	turns between survey lines. • The Environmental Observer will ensure the delay or shut down of seismic operations if SARA-listed Schedule 1 mammals or turtles are present within 500 m. • Collision avoidance practices, including constant speed and course maintained by seismic and support vessels. • Vessels will maintain a steady course and speed, and use existing travel routes, where possible. MARPOL standard procedures.	
Species at Risk	• Adherence to the *Statement of Canadian Practice on the Mitigation of Seismic Noise in the Marine Environment* to the extent reasonably practical. • Same as above for marine birds, marine turtles and marine mammals	• A trained Environmental Observer will record marine mammal, sea turtles and seabird observations. • All spills will be reported.
Sensitive Areas	• Vessel compliant with audit prior to survey. • Maintenance of streamer equipment and responsible management of such equipment. • Compliance with OWTG (NEB *et al.* 2002) for all discharges. • Avoidance of bird colonies by vessel.	• No follow up or monitoring required for routine activities • All spills will be reported.
Commercial Fisheries	• A Notice to Shipping and notification on the CBC Fisheries Broadcast on the location and scheduling of seismic activities will be issued. • Communication mechanisms will be developed with the fishing industry and DFO research surveys. • The Fisheries Liaison Observer on the vessel will monitor fishing activity in the vicinity of the seismic vessel and serve as a liaison between the fishing vessels and the seismic vessel; • Arrange for a Single Point of Contact • MKI will comply with C-NLOPB compensation guidelines.	• No follow up or monitoring required for routine activities

An environmental observation report was submitted to the C-NLOPB under separate cover that describes the marine mammal observation, seabird observations, and fisheries liaison officer communications with commercial vessels. Mitigation actions and compliance are described in that report. In summary, there were no observed significant effects imposed on any VECs, no compensation claims made for gear damage or loss, and no spills were reported.

Discussions with the fish harvesters and FFAW for another proposed seismic program revealed an unexplained significant decrease in shrimp landings in 2010 in SFA 7 with no evidence of recovery, as expected. At this time, fish harvesters are not attributing this observation on two seismic surveys by Western Geco in the Orphan Basin area. FFAW is considering conducting research on the effects of seismic on shrimp and snow crab in the near future. Shrimp harvesting company Newfound Resource Limited also commented in a decrease in shrimp catch following the MKI 2011 survey. Catch data are not available for 2011 to review this observation. However, historically the Labrador Sea has been subject to seismic exploration over large areas similar to MKI's program, and that warrants examination against shrimp landings. The EA Addendum Report examined commercial harvesting landings between 2005 to 2009. Data for 2010 have been included for this validation report. Seismic exploration surveys in that period are provided in Table 6. All the seismic surveys have taken place between the months of June to July and October in that 2005 to 2010 window.

Table 6. Geoscientific Exploration Programs - Labrador Sea

Year	Program	Location	Survey Dates	Operator
2010	2-D	Hopedale Basin	July 23-Oct 1	Husky
2009	none			
2008	2-D	Labrador Shelf	July 26-Oct 16	GSI
2007	2-D	Labrador Shelf	June 30-Oct 24	GSI
2006	2-D	Labrador Shelf	June 17-Oct 18	GSI
2005	2-D	Labrador Shelf	June 29-Oct 6	GSI

The shrimp fishery is open year round (April 1 to March 30) in this Labrador Sea region. Two species of shrimp are harvested in the Labrador Sea; the northern shrimp (Pandulus borealis) are by far the dominant catch within shrimp fishing areas (SFA) 4, 5 and 6. These SFAs corresponds to NAFO units 2G, 2H and 2J/3K, respectively. The overall total allowable catch (TAC) quotas and landings by weight for all areas combined are provided in Table 7.

Table 7. Annual TAC Quotas and Landings (tonnes) of Shrimp in the Study Area, 2005-2010

2005	2006	2007	2008	2009	2010
112 148	109 955	111 551	120 344	120 345	96 252

The decrease in overall TAC in 2010 is attributed to the reduction from 85 725 t down to 61 632 t in SFA6 in the 2010/11 management period due to operational and market conditions. The TAC was not taken in 2008 or 2009 (DFO 2011). The TAC quotas have remained relatively consistent with minor increases over this 2005 to 2010 period.

Between 2005 and 2010, a range of 56 910 to 89 426 tonnes of shrimp (both species combined) were caught in the MKI Study Area (Figure 30).

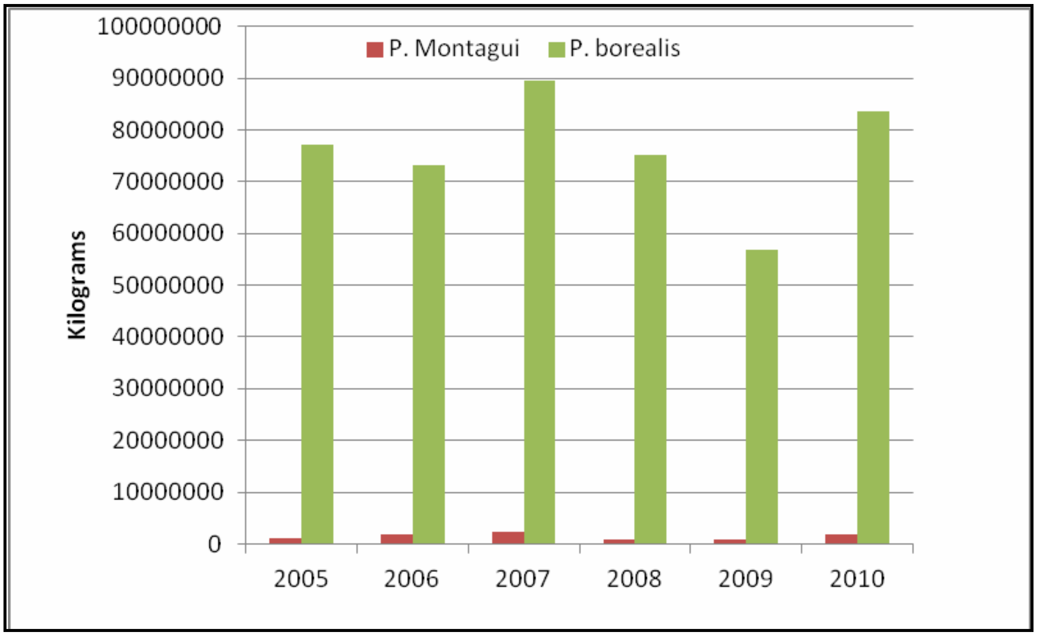

Figure 30. Annual Landings (kg) of Shrimp in MKI Study Area, 2005-2010

Figure 31 shows the shrimp harvesting pattern by month, between 2005 and 2010. Harvesting peaks in June to August each year.

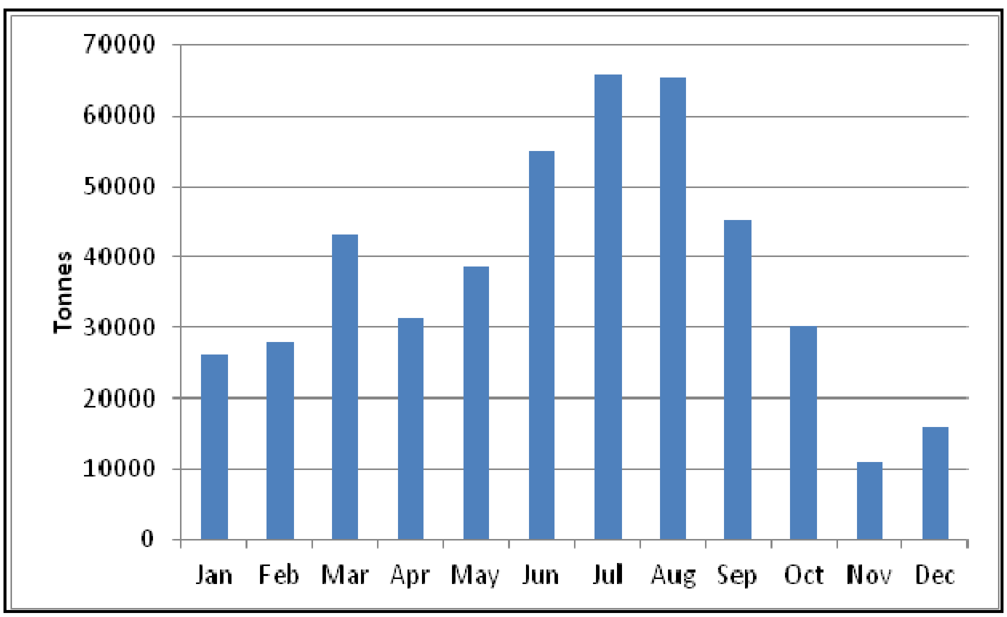

Figure 31. Monthly Northern Shrimp Harvesting From 2005 to 2010

The MKI Study Area encompasses the GSI and Husky seismic exploration survey areas, which have occurred in that period prior to MKI's 2011 survey. Figure 32 shows the landings (kg) within the MKI Study Area for the period when no seismic survey was underway by GSI or Husky. The 2008 and 2009 decreased landings are clear, followed by an increase in 2010.

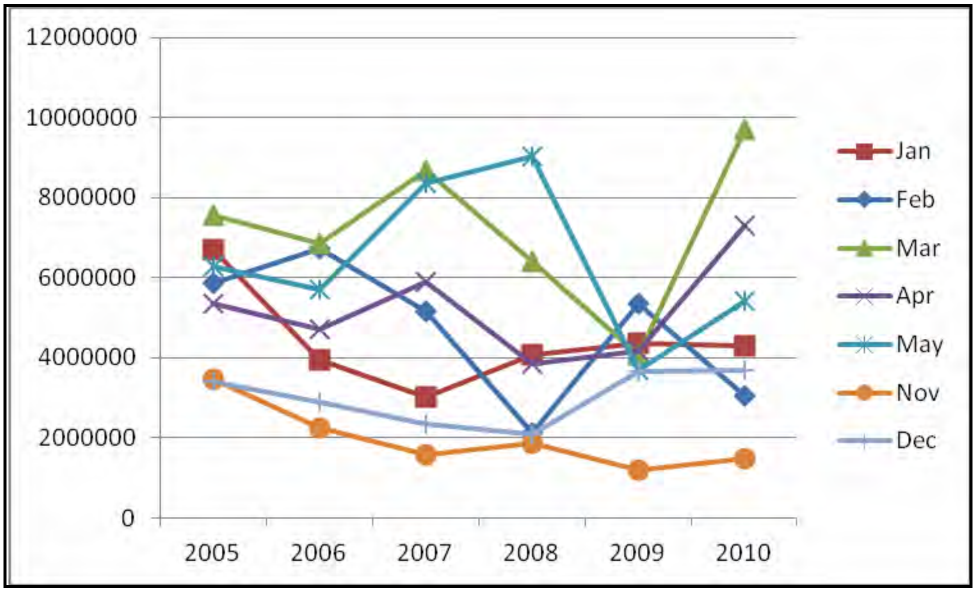

Figure 32. Landings (kg) of Shrimp During Months With No Seismic Surveys, 2005-2010

Of interest, is the drop in shrimp landings in 2009 when no seismic surveys were operating that year in the Labrador Sea. Figure 33 shows the landings in the MKI Study Area for the months when seismic surveys by GSI and Husky were underway. In keeping with the harvesting effort in Figure 31, the increased landings in June to August is evident.

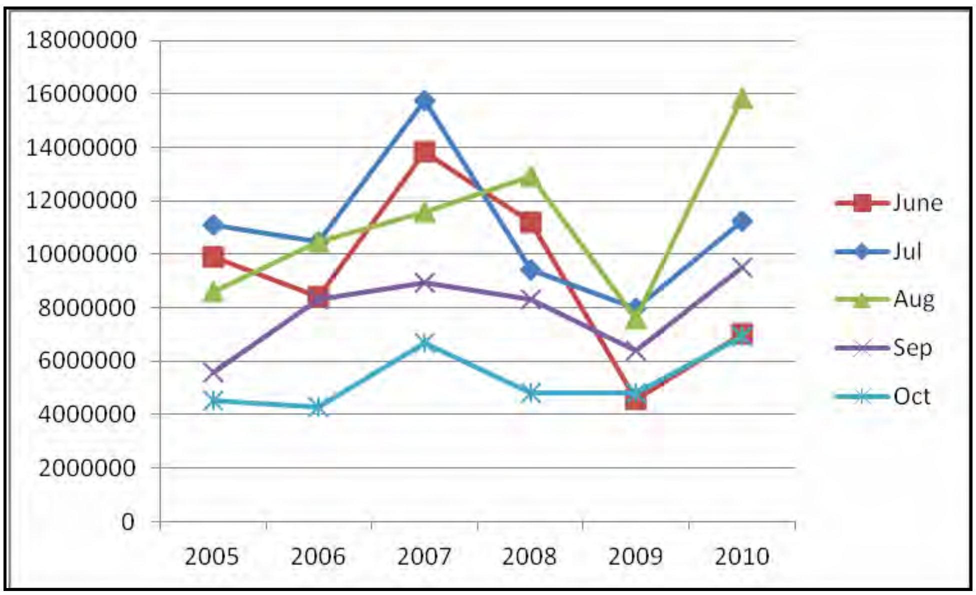

Figure 33. Landings (kg) of Shrimp During Months with Seismic Surveys, 2005-2010

It appears that there is no evidence in the 2005 to 2010 catch data to suggest that seismic surveys were detrimental to shrimp harvesting. Fluctuations in harvest are a result of a more dominant influence whether it be environmental or harvesting pressure or a combination of factors. Therefore, the effects assessment remains consistent as predicted in the EA report.

In conclusion, the residual effects summaries of the EA and addendum reports remain valid. A commitment has been made for avoidance of heavily fished areas and scheduling of surveys to reduce interference with DFO research vessels. A scout vessel will accompany the seismic survey vessel to provide advance warning of fishing activities in the area.

6. REFERENCES

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