WESTERN NEWFOUNDLAND & LABRADOR OFFSHORE AREA
Strategic Environmental Assessment Update

Draft Report

Submitted to:

Canada-Newfoundland and Labrador Offshore Petroleum Board
5th Floor TD Place, 140 Water Street
St. John's, Newfoundland & Labrador
Canada A1C 6H6

Submitted by:

AMEC Environment & Infrastructure
A Division of AMEC Americas Limited
133 Crosbie Road, PO Box 13216
St. John's, Newfoundland & Labrador
Canada A1B 4A5

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1 INTRODUCTION

The Canada-Newfoundland and Labrador Offshore Petroleum Board (C-NLOPB, or the Board) is responsible, on behalf of the Government of Canada and the Government of Newfoundland and Labrador, for petroleum resource management in the Newfoundland and Labrador (NL) Offshore Area.

The *Canada-Newfoundland Atlantic Accord Implementation Act* and the *Canada-Newfoundland and Labrador Atlantic Accord Implementation Newfoundland and Labrador Act* (the Accord Acts), administered by the C-NLOPB, govern all petroleum operations in the NL Offshore Area. The C-NLOPB's mandate is to interpret and apply the provisions of the Accord Acts to all activities of operators in the NL Offshore Area, and to oversee operator compliance with those statutory provisions. In the implementation of its mandate, the role of the C-NLOPB is to facilitate the exploration for and development of the hydrocarbon resources in the NL Offshore Area in a manner that conforms to the statutory provisions for:

- Worker safety;
- Environmental protection and safety;
- Effective management of land tenure;
- Maximum hydrocarbon recovery and value; and
- Canada / Newfoundland and Labrador benefits.

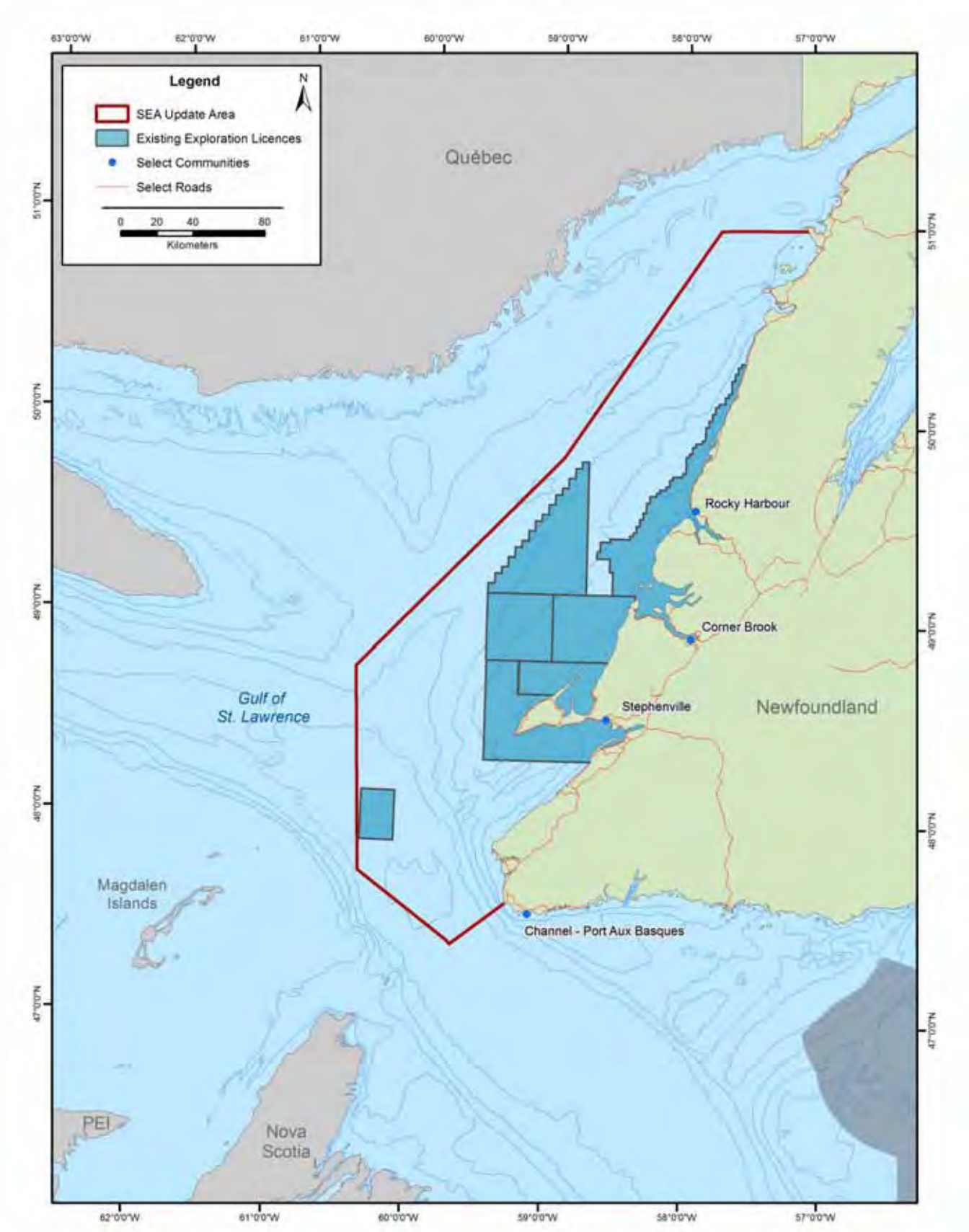
Although the legislation does not prioritize these mandates, worker safety and environmental protection are paramount in all Board decisions.

The Board's regulatory responsibilities include the administration and issuance of specific licences, authorizations and approvals pertaining to offshore petroleum exploration and development activities in the NL Offshore Area. As part of these processes, the C-NLOPB has been undertaking Strategic Environmental Assessments (SEAs) of portions of the NL Offshore Area in which the issuance of exploration licences could be contemplated and which have not previously been subject to substantial levels of environmental assessment (EA). This has included the preparation of an SEA for the Western NL Offshore Area, which was initially completed in 2005 and subsequently amended in 2007 to extend its geographic coverage (LGL Limited 2005, 2007).

The C-NLOPB has also committed to regularly review its SEAs every five years and to update them as required, and in late 2011 commenced a process of updating its SEA for the Western NL Offshore Area (Figure 1.1). As part of this update, the western limits of the area under assessment have also been extended out to the boundary of an ongoing Québec SEA, as described further in a later section.

This SEA Update includes the identification, review and presentation of any new and relevant information on the existing environment in the area that has become available since the initial SEA Reports were completed, as well as an updated analysis (including associated public and stakeholder consultation and Aboriginal engagement) of any key potential environmental issues which may be associated with any future petroleum exploration and/or development activities in the area.

Figure 1.1 The Western Newfoundland and Labrador Offshore Area – SEA Update Area



1.1 Nature, Purpose and Context of the SEA Update

SEA is a relatively broad-based and regional approach to EA that proactively examines the environmental issues that may be associated with a plan, program or policy proposal, and therefore allows for the identification, analysis and incorporation of environmental considerations at the earliest stages of planning and decision-making. Because SEAs are undertaken quite early in the strategic planning process, they typically focus on a general description of the environmental setting and on identifying and attempting to address overall environmental issues, thereby describing potential effects in relatively broad terms. This helps to allow any such issues to be identified and considered early in planning, before project-specific activities are defined and proposed. SEA is not intended as a replacement for project-specific EA processes and associated project planning and regulatory decisions. The objective of SEA is to provide the type and level of information necessary to aid decision-making at the early stages of the planning process, and in doing so, to influence and seek to improve both strategic and subsequent decisions and actions - including whether and how individual projects are later designed, proposed and implemented.

The purpose of this study is to complete and present an update of the SEA for the Western NL Offshore Area (also referred to interchangeably herein as the SEA Update Area). Again, this includes the identification, review and presentation of any new and relevant information on the existing environment in the area that has become available since the initial SEA Reports were completed, as well as an updated analysis of any key environmental issues that may be associated with future petroleum exploration and/or production activities in the region. It also identifies any relevant knowledge and data gaps and makes recommendations for future mitigation and planning. An important and integral component of the SEA Update has been a program of public and stakeholder consultation and Aboriginal engagement.

Information from the SEA Update will assist the C-NLOPB in determining whether further exploration rights should be offered in whole or in part for the Western NL Offshore Area, as well as identifying any general restrictive or mitigative measures that may be considered for application to any future projects and activities. The SEA Update has a key focus on the "exploration phase" of offshore petroleum activity in the region, including potential seismic surveys and drilling programs. To the degree possible and meaningful, however, it also generally considers potential future production activity which may take place in the area should such exploration be successful in identifying commercially significant, and technically and economically viable, hydrocarbon resources.

Any future offshore petroleum activities that may be proposed in the SEA Update Area pursuant to any additional exploration licences will require individual review and approval by the C-NLOPB and possibly other agencies under applicable regulatory processes. The SEA Update will therefore also provide individual operators with an updated overview of the region's existing environmental setting, and help define key environmental issues, interactions and mitigation measures which may require consideration in the early planning phases of individual projects, as well as in their subsequent approval processes.

1.2 Document Organization

This SEA Update Report is organized as follows:

Chapter 1 provides an introduction to SEA, outlines the purpose and context of the SEA Update, and describes the overall organization of the document.

Chapter 2 establishes the scope and purpose of the SEA Update, identifying the particular "strategic decision" that it is intended to inform, defining the spatial and temporal boundaries of the assessment, and identifying the key environmental components and issues upon which the assessment is focussed. This includes a summary of the consultation processes and initiatives that have been undertaken as part of the SEA Update and their key findings. It identifies the Valued Environmental Components (VECs) upon which it is focussed and the rationale for their selection, as well as giving an overview of the approach and methods used to conduct the SEA Update.

Chapter 3 provides an overview of the planning and regulatory processes which apply to offshore oil and gas activity in the NL Offshore Area. This is followed by a general description of offshore petroleum exploration and development activities, as well as an overview of past and potential oil and gas activities within the SEA Update Area.

Chapter 4 provides an updated description of the existing environmental setting of the SEA Update Area, including the relevant components of its physical and biological environments and human activities, based on existing information that has become available since the initial SEA Reports were completed in 2005 and 2007.

Chapter 5 provides the environmental issues, mitigation and planning analysis for each of the VECs under consideration. Each VEC is addressed in a separate section, which includes a discussion of:

- Potential environmental interactions and standard mitigation measures which may be applied to offshore oil and gas activities to avoid or reduce environmental effects;
- Key environmental planning considerations and any additional activity, site or time-specific mitigation measures which may be required or appropriate;
- Potential cumulative environmental effects that may result from future offshore petroleum activities in the region in combination with each other and with other projects and activities, and associated planning implications; and
- The availability and adequacy of existing environmental information, and any relevant data gaps and requirements.

Chapter 6 presents a summary of the key findings and conclusions of the SEA Update.

Chapter 7 provides the references used in the SEA Update, including the literature cited and any personal communications.

Supporting information is provided as *Appendices*.

2 STRATEGIC ENVIRONMENTAL ASSESSMENT UPDATE: SCOPE, FOCUS AND APPROACH

An EA requires an initial scoping exercise to define the components and parameters of the policy, plan, program or project that is being assessed, as well as to establish the study area for the assessment and the primary environmental components and issues to be considered. The scope of an EA should be established early in the process to ensure that the analysis remains focussed, manageable and meaningful.

This Chapter outlines the scope and purpose of the SEA Update, including defining the "strategic decision" that the SEA Update is intended to inform, as well establishing as the spatial and temporal boundaries of the assessment and identifying the environmental components, issues and potential interactions upon which it is focussed. In doing so, it also describes and summarizes the nature and key findings of the consultation processes that have been undertaken as part of the SEA Update.

Based on these initial scoping activities, the Chapter then goes on to identify the VECs upon which the SEA Update is focussed and the rationale for their selection. It concludes with an overview of the approach and methods used to conduct the SEA Update and its associated analyses.

2.1 The SEA Update and the Associated "Strategic Decision"

The C-NLOPB 's responsibilities, pursuant to its associated role, mandate and relevant legislation (Chapters 1 and 3), include the administration and issuance of specific licences, authorizations and approvals pertaining to offshore oil and gas exploration and development projects and activities in the NL Offshore Area. As part of its planning and decision-making regarding the issuance and administration of petroleum exploration (and possibly, development) rights, the C-NLOPB has been undertaking SEAs of portions of the NL Offshore Area. The results of these SEAs then help to inform future exploration licencing decisions and thus, the eventual planning and conduct of any subsequent oil and gas activities in these regions.

This has included the preparation of an SEA for the Western NL Offshore Area (LGL Limited 2005, 2007), the results of which helped to inform subsequent decisions and actions by the C-NLOPB regarding the issuance of exploration licences and other regulatory approvals related to offshore oil and gas activities in that area. As outlined in Chapter 3, there has been oil and gas exploration activity undertaken and proposed in the Western NL Offshore Area pursuant to previous licencing decisions and actions by the C-NLOPB. The C-NLOPB also reviews its SEAs every five years and updates them as required, and in late 2011 commenced a process of updating its SEA for the Western NL Offshore Area. The results of that exercise are outlined in this Report, and will be considered in future licencing decisions regarding petroleum activities in the region.

The specific "strategic decision" that the SEA Update is intended to inform is therefore whether to issue further exploration licences in the Western NL Offshore Area, and if so, to identify any environmental components and issues which should be considered in taking these future decisions and actions.

It should be noted that the SEA Update does not revisit previous licencing or other regulatory decisions or actions regarding offshore oil petroleum activity in the region. It also does not pertain to regulatory or policy decisions in areas that are outside of the jurisdiction of the C-NLOPB, or address overall and generic issues regarding petroleum activities, the potential use of certain technologies or other matters in Newfoundland and Labrador which are not related specifically to offshore licencing decisions the Western NL Offshore Area.

2.2 Spatial and Temporal Boundaries

This SEA Update focuses on describing the environmental setting of the SEA Update Area. The boundaries of this area are as illustrated in Figure 1.1 and were chosen based on historical activity in the area as well as with consideration of relevant administrative boundaries. This area forms the primary focus of this SEA Update, and is in keeping with and encompassing of the study areas for the initial (2005 and 2007) SEA Reports.

As described later in Chapter 3, some offshore exploration activities may be relatively widespread in nature (such as seismic surveys), and often extend beyond the boundaries of individual exploration licences. In addition, it is recognized that ecological and human components and systems rarely correspond to (and indeed, typically extend beyond) such administrative boundaries, due to oceanographic conditions and the often extensive ranges and mobile / migratory nature of some marine species and activities. These marine characteristics and processes can also influence and extend the potential "zones of influence" of any environmental disturbances and effects that may be associated with petroleum activities in the Western NL Offshore Area beyond this boundary.

Therefore, although the SEA Update has a key focus on the Western NL Offshore Area (approximately 36,000 km^2), the area studied is not confined to the SEA Update Area itself. For the purposes of the SEA Update, the area within which the environmental components that could potentially be affected by the potential exploration and production activities, including accidental events, are also considered.

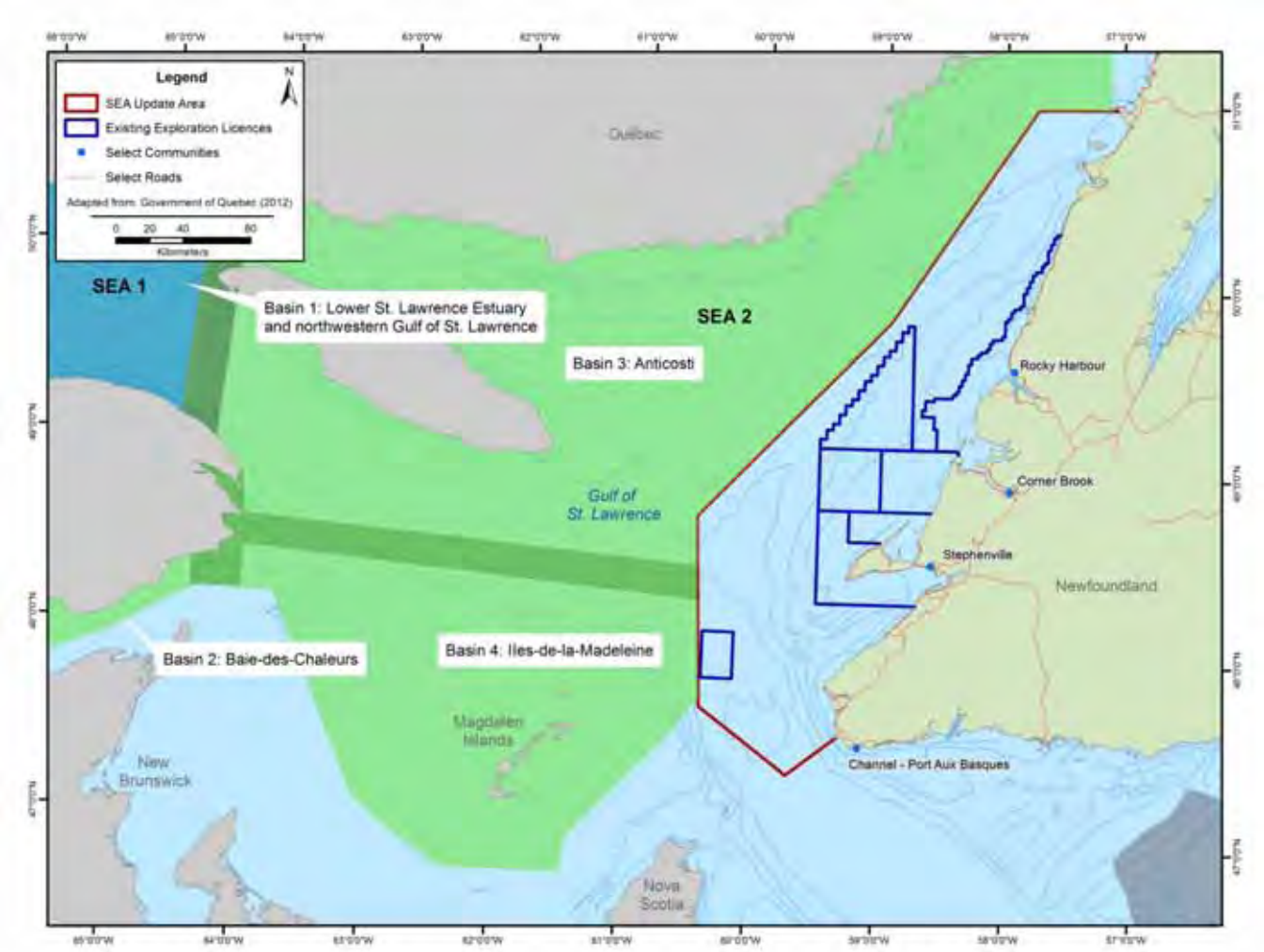
Independently of C-NLOPB's SEA Update for the Western NL Offshore Area, the Government of Québec is also undertaking a program of SEAs for a marine area of approximately 140,000 km^2 that includes portions of the Gulf of St. Lawrence and its maritime estuary. These assessments are being coordinated by the Ministère des Ressources naturelles et de la Faune (MRNF), and include two SEAs involving four separate basins (Figure 2.1):

1) The first SEA covers the maritime estuary and the northwestern parts of Gulf of St. Lawrence, an area located between the north and south shores of the St. Lawrence River and covering nearly 29,000 km^2 of marine territory located east of the Saguenay–St. Lawrence Marine Park to the western tip of Île d'Anticosti. This SEA began in the spring of 2009, and resulted in the Québec Government deciding not to allow oil and gas exploration or extraction in the region (with associated legislation passed in June 2011); and

2) The second SEA covers approximately 111,000 km^2, including the Baie-des-Chaleurs, Anticosti and Magdalen Basins. It commenced in the winter of 2009, and has included recent public consultation activities throughout Québec. This SEA remains in progress.

Although these separate SEAs are being carried out by the Government of Québec within the marine areas off that province, these assessments do cover adjacent portions of the Gulf of St. Lawrence, and the western limits of the SEA Update Area have been extended to the boundary of the ongoing Québec SEA.

Figure 2.1 The SEA Update Area and Other Portions of the Gulf of St. Lawrence Covered in Québec SEAs



In terms of temporal boundaries, the SEA Update has a key focus upon the "exploration phase" of offshore petroleum activity in the Western NL Offshore Area. This includes the land rights issuance and licencing processes that may occur and the various components and activities which may be associated with future geophysical surveys and well drilling programs in the region that may result from such licencing (see Chapter 3). The SEA Update focuses upon an overall time horizon of approximately 10 years, which would generally correspond to the temporal duration of any additional exploration licences that may be issued in the area upon completion of the SEA Update. As has been the C-NLOPB's practice in completing its SEAs over the past decade, this SEA Update will be again reviewed within a five year period to determine whether a further update is required to inform any future licencing decisions and actions beyond that time.

Notwithstanding its primary focus on potential future oil and gas exploration licencing and associated activities, the SEA Update also includes general consideration of possible future petroleum development activities in the Western NL Offshore Area. Whether and how any such production activities occur would obviously depend on the type and quantity of any hydrocarbons found, the location, area, depth and other characteristics of these reserves, and other factors. These and numerous other technical, economic and other considerations will determine the likelihood and feasibility of, and specific characteristics of, any future exploration or development projects and their associated infrastructure and activities. Experience with offshore petroleum discoveries and associated planning, design, regulatory approval and implementation processes and timelines elsewhere in the

NL Offshore Area also suggests that these can take well over a decade to advance to production following a significant commercial discovery. Therefore, while potential future development activities are considered very generally in the SEA Update, these are not and cannot be defined, described or assessed in any degree of detail at this early stage.

2.3 SEA Update: Scoping Document

The planning and preparation of the SEA Update is being guided by a Scoping Document, which outlines the factors to be considered, the scope of those factors, and other guidelines for preparing the SEA Update Report.

A Draft Scoping Document was initially prepared by C-NLOPB staff with the assistance of a Working Group comprised of 17 members representing various federal and provincial government agencies and non-governmental organizations. This draft document was released for public comment in December 2011 for an approximately one month period, during which time 11 submissions were received from interested organizations and individuals.

A Final Scoping Document was eventually prepared and released by the C-NLOPB in February 2012, along with the Board's responses to each of the comments received on the Draft. This document eventually formed the basis for the C-NLOPB's Request for Proposals for the preparation of the SEA Update, and has guided its planning and completion from the onset.

The Scoping Document sets out the key objectives of the SEA Update, which include that it will:

- Provide an overview of the existing environment in the SEA Update Area;
- Generally describe typical offshore oil and gas exploration activities;
- Generally describe typical offshore oil and gas production activities;
- Describe and evaluate potential environmental effects associated with offshore oil and gas exploration activities;
- Consider the potential cumulative effects of typical offshore oil and gas activities with other potential activities;
- Identify knowledge and data gaps;
- Highlight issues that may be of concern;
- Identify areas of interest, or sensitive areas;
- Make recommendations for general mitigative measures that should be employed during petroleum related activities;

- Identify general restrictive or monitoring measures, as appropriate, that may be required for future petroleum activities; and

- Assist the Board in determining whether exploration rights should be issued in whole or in part in the SEA Update Area.

2.4 Consultation Program

An important and integral component of the SEA Update has been a program of public and stakeholder consultation and Aboriginal engagement. The activities that have been carried out to date have been designed and implemented to identify any associated questions or concerns regarding future oil and gas exploration and/or development activities in the Western NL Offshore Area and their potential environmental effects, so that these issues could be considered in the SEA Update and ultimately, in future licencing decisions.

In recognition of the relatively high level of public interest regarding oil and gas activities in the Western NL Offshore Area (and in the Gulf of St. Lawrence in general), the C-NLOPB expanded the nature and scope of these consultation initiatives as compared to those undertaken for other SEAs, both geographically (throughout Atlantic Canada and Québec) and in terms of their approach and methods (involving public consultation sessions and Aboriginal engagement in addition to discussions with identified stakeholders).

The preparation of the SEA Update has therefore included discussions with government departments and agencies, Aboriginal and stakeholder groups and the general public through a range of approaches, each of which have been designed and implemented from both an "information out" and an "information in" perspective. Various mechanisms have been used to provide interested groups and individuals with information on the SEA objectives and process, and on past and potential oil and gas licencing and activities in the region, as well as allowing them to review and consider this information and formulate and provide their questions and views.

The following sections provide a general overview of the key characteristics and findings of the various consultation and engagement activities that have been completed as part of the SEA Update. Further information and details are provided in the associated Consultation Report, which is included as Appendix A.

2.4.1 Public Open Houses

The consultation program for the SEA Update included a series of public open houses in 11 locations throughout Eastern Canada, including communities in Newfoundland and Labrador, Québec, and the Maritime Provinces, in September and October 2012. The locations and dates of, and the numbers of participants that attended, each of these public open house sessions are summarized in Table 2.1 and Figure 2.2:

Table 2.1 Public Open Houses Conducted as Part of the SEA Update (September – October 2012)

Location	Date	Number of Attendees
Port aux Basques, NL	September 30 2012	22
Stephenville, NL	October 1 2012	24
Corner Brook, NL	October 2 2012	87
Rocky Harbour, NL	October 3 2012	44
Lourdes de Blanc Sablon, QC	October 4 2012	7

Location	Date	Number of Attendees
Miramichi, NB	October 9 2012	23
Charlottetown, PEI	October 10 2012	32
Sydney, NS	October 11 2012	19
Cap-aux-Meules, Îles-de-la-Madeleine (Magdalen Islands), QC	October 24 2012	289
Havre-Saint-Pierre, QC	October 25 2012	31
Gaspé, QC	October 29 2012	65

The public open houses were advertised through local newspapers and radio / television advertisements, and were covered by local media both before and following the events.

The public open houses took the form of an evening "drop in" session, held at the identified venue in each community. Upon arrival at the open house sessions, participants were greeted by a SEA study team representative at a sign-in table, who provided them with an overview of the open house purpose and format and a number of handouts (including a map showing the SEA Update Area and existing exploration licences, and additional information about the C-NLOPB). The open house included a number of information stations arranged within the meeting venue, consisting of tables and/or stands with information panels that focussed on the following themes:

1) *C-NLOPB Overview* (purpose, role, mandate);

2) *Western NL Offshore Area* (boundaries, existing licences, oil and gas activities undertaken to date);

3) *SEA Overview* (SEA objectives, initial (2005 / 2007) Western NL SEA, nature and purpose of the current SEA Update);

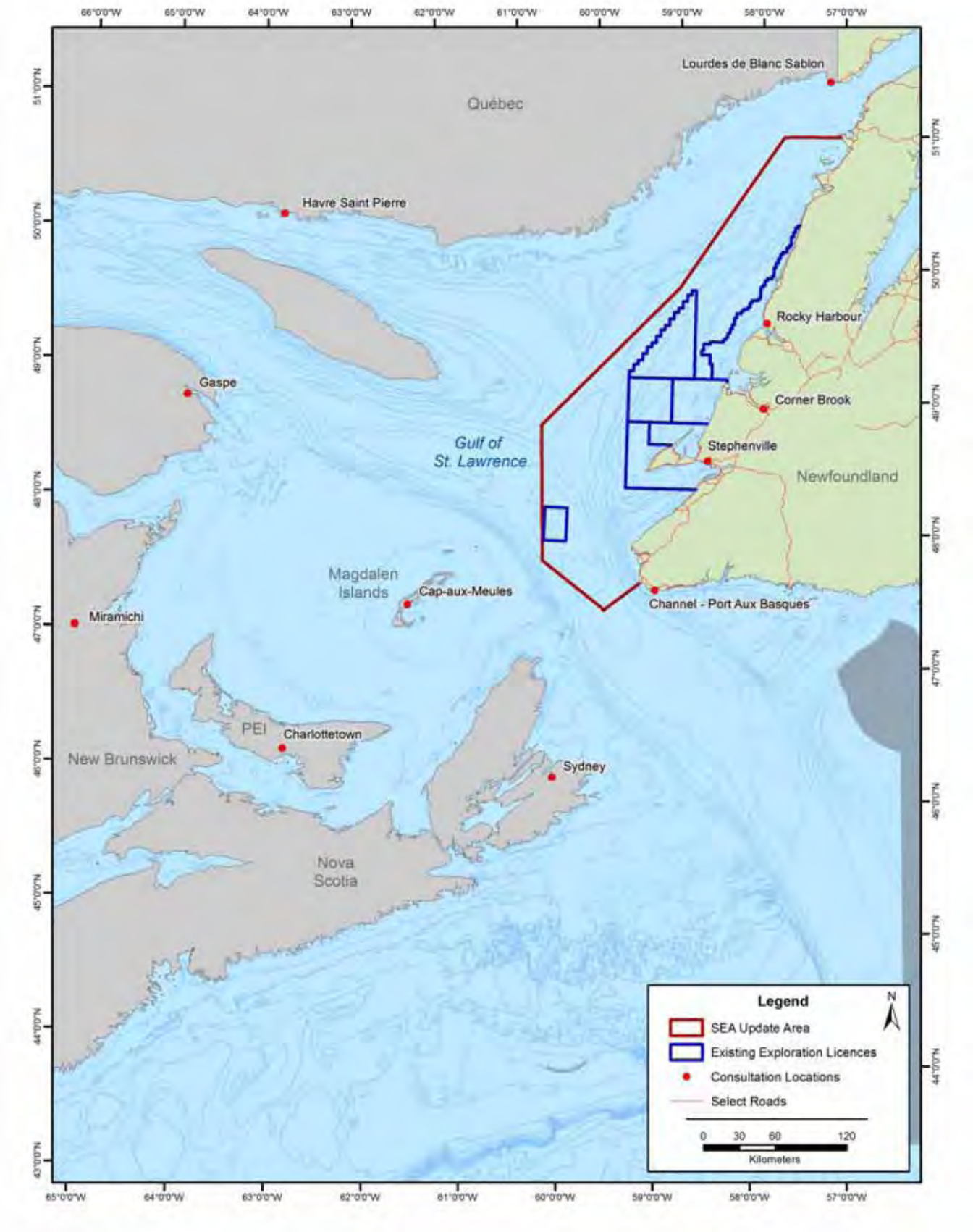
4) *Offshore Oil and Gas Exploration* (overview of the types of exploration activities that may be undertaken); and

5) *Environmental Setting and Considerations* (components of the existing environment that are being addressed in the SEA Update, environmental considerations that are often associated with marine oil and gas activities, standard mitigation measures)

The purpose of the information panels was to provide some general background information, recognizing that participants would have varying levels of knowledge regarding the nature and purpose of the SEA Update, as well as on past and potential oil and gas activities in the region and on environmental components and possible effects. The information panels were therefore intended primarily to serve as a basis for prompting dialogue and the sharing of information and input by participants. At each of the consultation locations in Québec and in New Brunswick the information panels and other materials were displayed in both English and French.

Representatives of the C-NLOPB and SEA Update Study Team (AMEC) were on hand to provide information and clarification and to answer questions, as well as to record any and all questions, issues and perspectives raised verbally (both individually, and through a detailed discussion and "de-briefing" by the consultation team at the end of each session). Bilingual SEA study team members were present at all sessions.

Figure 2.2 Western NL SEA Update: Public Consultation Session Locations



Participants were also given the option of providing written input, either at or following the open house session. Information on, and materials from, the public open houses have also been posted on the C-NLOPB's website.

2.4.2 Stakeholder Meetings

As part of the SEA Update consultation program, a series of stakeholder meetings were also arranged with identified organizations in each area. These meetings were similar to the consultation approach that was adopted for the initial Western NL SEA (2005), and in this case were intended to supplement the larger public sessions. In particular, they provided a further opportunity to meet with identified stakeholder groups while the SEA study team was in the local area, during the daytime "working hours" for these organizations.

Relevant groups who would potentially have an interest in the subject matter being addressed by the SEA Update were identified by the SEA Study Team through general internet and telephone directory searches, and through discussions with local contacts and the SEA Working Group. Each of these identified organizations were sent an invitation to the stakeholder meeting(s) in their area by email or fax. Given the number of communities and regions being visited and the sheer number of potentially relevant stakeholder groups involved, the challenges of identifying and reaching all such groups were recognized from the onset. The invitations therefore also asked those contacted to identify and recommend any other stakeholder groups that they felt would have an interest and who should thus also be contacted and invited to attend. Through this "snowball" process, a number of additional groups were identified and invited, and in some cases organizations received the invitation through other means of direct and indirect distribution and were able to attend these meetings.

The stakeholder meetings were not in any way planned to be closed or exclusive, and attempted to reach the largest number of groups possible, and at very least, to include a good cross section of the various types of groups and interests that may be interested in the SEA update – including local communities, fishers groups, environmental and social interest groups, industry and business associations, and others. Any and all organizations that requested an invitation or who otherwise received it and chose to attend a meeting were permitted to do so and were welcomed at the meetings.

These stakeholder meetings took place at each consultation location either in the afternoon immediately before the public open house or the following morning (depending on travel times and logistics). The format involved an approximately two hour meeting at the open house venue, which began with a short presentation by the SEA study team (in English or French, depending on location) outlining the nature and purpose of the SEA Update, followed by a general round table discussion. Notes were again taken by the SEA Update Study Team at each meeting, highlighting the various questions, issues and perspectives raised by participating stakeholders.

In addition to the planned stakeholder meetings at each consultation location, on Tuesday October 23, 2012 the SEA study team also met with a group of over 20 community and stakeholder representatives in Cap-aux-Meules, Îles-de-la-Madeleine, Québec as requested and arranged by the local Mayor. This meeting included short presentations by the C-NLOPB and by a representative of an environmental organization, followed by a round table discussion and question and answer period, again with detailed notes taken by bilingual SEA study team members.

2.4.3 Aboriginal Engagement

On September 26 2012, the C-NLOPB wrote to a number of Aboriginal communities and organizations, as identified by the SEA Study Team with the input of the C-NLOPB and its SEA Working Group. Through that correspondence, the C-NLOPB provided the following information:

- A general overview of the C-NLOPB and its role and mandate;
- A description of the SEA process, the Western NL Offshore Area (including a map), and the initial SEA and its planned update;
- An invitation to contact the C-NLOPB if the group had interests related to the SEA Update Area and scope, as well as to participate in future discussions and consultation with the Board as part of the SEA Update process (including through a future meeting, or other potential forums as suggested by the group itself); and
- Information on, and an invitation to, the upcoming public consultations being held for the SEA Update.

These letters were sent by fax and mail to 59 Aboriginal communities and organizations in Newfoundland and Labrador, Québec and each of the Maritime Provinces. Written responses were received from several groups.

As requested in a response letter received from the Innu Council of Ekuanitshit, representatives of the C-NLOPB and its SEA Study Team met with the Chief and various Band Council members on October 26 2012 in that community. During that meeting an overview of the SEA process was provided and comments and perspectives were received regarding possible future oil and gas activities in the Western NL region and its potential environmental effects.

A similar and subsequent meeting was also held with the Mi'gmawei Mawiomi Secretariat on Monday November 26, 2012 in Gesgapegiag, QC.

2.4.4 Other Submissions

Subsequent to the completion of the public and stakeholder consultation sessions and Aboriginal engagement activities described above, additional written submissions were also received from a number of individuals and organizations which provided additional information and perspectives relevant to the SEA Update. These submissions, and a summary of the main questions and issues raised in them, are also described further in the Consultation Report attached as Appendix A.

2.4.5 Overview of Consultation Findings

The following sections provide a high level summary of the outcomes and findings of the consultation activities undertaken to date as part of the SEA Update. Further details are provided in the Consultation Report (Appendix A).

The SEA Update consultation program verified that there is a considerable level of public interest related to on-going and potential future oil and gas activities in the Western NL Offshore Area at present. The questions, concerns and perspectives that were raised by the individuals and organizations that participated in the consultation process to date were also found to be wide ranging and diverse – ranging from comments that

offshore oil and gas can and will be conducted off Western Newfoundland in an environmentally acceptable and safe manner and has the potential to offer necessary and important socioeconomic benefits to the province and overall region, to calls for a prohibition of offshore oil and gas exploration and development activity in the entire Gulf of St. Lawrence due to the environmental risks that are believed to be associated with this industry.

Notwithstanding these diverse and often diverging perspectives on the part of consultation participants, a central and recurring theme that was stated and reiterated throughout the sessions was the need to prevent damage to the marine environment - and to the fisheries and other human activities that depend on them - as a result of accidental oil spills. Clearly there is a heightened awareness of the potential for, and the adverse environmental implications of, such accidental events following the 2010 Gulf of Mexico oil spill, and much of the discussion during the SEA consultations focussed on the need to prevent such an incident from occurring in the Gulf of St. Lawrence, as well as the need to ensure that appropriate procedures and measures are in place to effectively respond to any such accidental event or malfunction should one occur.

In addition to that key issue, the SEA consultation process has also resulted in the collection and documentation of a variety of other information and perspectives related to potential oil and gas activity in the Western NL Offshore Area. Although in some cases the questions and comments received were quite specific, and were considered in that form in planning and preparing the SEA Update, it is also clear that many of these touch upon several principal and recurring themes related to the existing environmental setting of the area, potential environmental outcomes, and larger regulatory, policy and procedural issues.

The following provides a summary of some of the key results of the SEA consultation program to date.

2.4.5.1 Environmental and Human Setting

- A widespread recognition of the Gulf of St. Lawrence as a relatively small and somewhat closed body of water, with significant and often complex water currents, exchanges (inputs and outputs) and other oceanographic characteristics and patterns.

- The associated ecological characteristics of the SEA Update Area and larger Gulf, which represents an area of biological productivity and diversity, and which contains important areas for fish, mammals, birds and other species, including various areas and times in which marine species feed, migrate, reproduce and otherwise exist. The need to consider the area in a holistic manner, including interrelationships between species and the human communities and activities which depend on this marine environment.

- The presence of various species at risk in and adjacent to the SEA Update Area, as well as protected and particularly sensitive areas and times (e.g., national parks, bays, bird colonies, lobster areas, krill and other food sources).

- The existence and usefulness of existing and available environmental information, as well as some as identified gaps in environmental baseline data and understanding of ecological systems and processes.

- The relevance of climate change, and observations that the marine environment is changing in recent years, including with respect to the presence and distribution of fish species and other marine biota

(e.g., seasonality, water depths, new species) which some believe is linked to changes in water temperatures.

- The need to consider human environments and issues in the SEA, in addition to biophysical components and effects.

- The importance of considering the presence and direct and indirect value of, and potential interactions with, other human activities and values in addition to the fishery, such as general vessel traffic, tourism, recreation, viewscapes, communities and infrastructure and others in the offshore and on-shore environments.

- The need to ensure adequate and appropriate environmental monitoring during and following offshore oil and gas activities.

2.4.5.2 Environmental Considerations and Possible Mitigation

- The potential for, and possible ecological and social effects of, an oil spill resulting from future petroleum exploration or development activities in the region. Concerns that such a spill could reach the coastlines of one or more provinces due to the oceanographic characteristics of the Gulf.

- A need for adequate environmental analysis and reviews for proposed oil and gas projects, including oil spill modelling based on sound information and science.

- The need to ensure that adequate and appropriate measures are in place to first avoid a potential oil spill as a result of these activities, and then to respond quickly and effectively to any such accidental event, should one occur. This would include compensation for affected fishers. Concerns with the potential for an effective oil spill response during the winter months when there is ice in the Gulf of St. Lawrence, and as a result of the overall lack of oil spill response equipment in the region.

- The possibility of having independent monitors on oil and gas units, as is the case in some other jurisdictions, was also raised as a possible measure that could be considered.

- A reminder by some that oil and gas exploration and development activities have been occurring safely throughout the NL Offshore Area and elsewhere for decades, without a large spill or evidence of other environmental damage.

- Should offshore oil and gas activities be planned, a key mitigation is considered to be the avoidance of sensitive areas and times in licencing and in the planning and implementation of specific projects.

- Recognition of the important economic and social benefits that often results from oil and gas activity, for workers, businesses, communities, governments, technology and training institutions, infrastructure and others.

- An interest in creating these economic and community opportunities and optimizing local benefits. Concerns about the potential for "take up" of such economic benefits by local persons and businesses, and the need to plan better to take advantage of these.

- A degree of uncertainty and concern around hydraulic fracturing activity and its potential effects, particularly as this is a new and as yet unknown technology in Newfoundland and Labrador (although it was noted that it has and is occurring safely in many other areas). A perceived need for further information, discussions and regulatory provisions on this issue.

- The need for adequate, clear and well communicated safety zones around any oil and gas installations in the marine environment.

- The possible implications of any offshore oil and gas activities on Gros Morne National Park.

- The cultural and economic importance of the fishing industry in Newfoundland and Labrador and throughout the Gulf of St. Lawrence, and the importance of avoiding potential for adverse effects on this industry. The need for good communication and cooperation between the fishing industry and the oil and gas sectors to indentify and avoid issues as proactively as possible.

- Concerns about seismic activity, associated sound levels, and effects on fish distributions and potential longer-term effects on fish populations and fisheries. There is uncertainty around this due to noted variation in local observations and also within the scientific research.

- The potential environmental effects of vessel traffic, lights, noise, the use of chemicals and other components and activities associated with offshore oil and gas exploration and development. Possible visual aesthetic issues where oil and gas units are near to, and visible from, the coastline.

2.4.5.3 Regulatory, Policy and Procedural Issues

- Comments and questions about the nature and purpose of the SEA process, its relationship to project EAs, and the C-NLOPB's role, mandate, composition and licencing and permitting procedures.

- The need to ensure that environmental standards and regulations are adhered to, while at the same time avoiding unnecessary regulatory duplication.

- A perceived need for clarity and certainty around offshore jurisdictions in Eastern Canada, particularly between Newfoundland and Labrador and Québec.

- Various opinions and perspectives about the SEA process and its utility, including a perceived need for an integrated planning framework and a larger, multi-jurisdictional review and decision-making process related to oil and gas activity in the Gulf of St. Lawrence as a whole.

- Differing opinions and perspectives about the nature and format of the SEA consultation, with some agreeing with and appreciating the open house format and its early and relatively informal nature,

whereas others demanded a more formal and "hearing like" process that presented the SEA results (particularly in Québec).

- Questions around whether oil and gas activity can and should be on-going while the SEA Update process is on-going.

- Suggestions that further public involvement is required once the Draft SEA Update becomes available.

The information and input gathered through the consultation process has informed and shaped the nature and focus of the SEA Update, by helping identify key information requirements and issues that require consideration in the analyses and report.

Table 2.2 provides a general listing and summary of some of the main topics and themes which were raised throughout the consultation program, as well as a general indication of where these are addressed in the SEA Update Report. Again, a more detailed description of the consultation activities and inventory of the key questions and issues raised is provided in the Consultation Report (Appendix A).

Table 2.2 Summary of Some Key Themes Raised in the SEA Update Consultation Program

General Topic / Theme	Where Addressed in the SEA Update Report
Environmental and Socioeconomic Setting	
Oceanographic currents and water flows in and out of and within the Gulf of St. Lawrence	Section 4.1.4
Water temperatures	Section 4.1.4.2
Offshore and onland geology	Section 4.1.1
Hydrocarbon potential of the region	Sections 3.4, 4.1.1.2
Sea ice and icebergs	Section 4.1.6
Biological productivity and diversity	Section 4.2 (throughout)
Sensitive times for marine fish, birds, mammals and sea turtles	Sections 4.2.1, 4.2.2, 4.2.3, 5.1.3.2, 5.2.3.2, 5.3.3.2
Fish migration routes and periods	Sections 4.2.1, 5.1.3
Fish feeding (times, areas, species)	Sections 4.2.1, 5.1.3
Fish spawning areas and times	Sections 4.2.1, 5.1.3
Salmon presence, migration and ecological, economic and cultural importance	Sections 4.2.1 , 4.3.5
Consideration of commercial and non-commercial marine species	Sections 4.2.1, 4.3.5
Water Bird migrations	Sections 4.2.2, 5.2.3
Sensitivity of coastal, nearshore and estuary / riverine environments	Sections 4.2.1, 5.1.3
Marine mammals and their movements through and use of the Gulf	Sections 4.2.3, 5.3.3
Species at risk	Sections 4.2.1.6, 4.2.2.5, 4.2.3.6, 5.1.3.1, 5.2.3.1, 5.3.3.1
Reproduction times and activities for marine animals	Sections 4.2.1, 4.2.2, 4.2.3, 5.1.3.2, 5.2.3.2, 5.3.3.2
Parks and protected areas	Sections 4.2.4, 5.4
Other sensitive areas (offshore and coastal)	Sections 4.2.1, 4.2.2, 4.2.3
Bonne Bay and Port au Port Bay as particularly important and sensitive areas	Sections 4.2.1, 5.1
The Gulf ecosystem and interrelationships between its various components and areas	Sections 4.2, 5.1.3, 5.2.3, 5.3.3
Recent environmental changes in the Gulf (climate change)	Sections 4.2.1, 4.2.2, 4.2.3

General Topic / Theme	Where Addressed in the SEA Update Report
Changes in marine species presence and distributions in the Gulf	Sections 4.2.1, 4.2.2, 4.2.3
Existing and available information sources on the marine biophysical environment	Section 4.2
Socioeconomic environments and issues	Sections 4.3, 5.4, 5.5
Aboriginal cultures and values	Sections 2.4.3, 4.3, 5.4, 5.5
Local and regional infrastructure	Sections 4.3.1, 4.3.3, 4.3.6
Fisheries management and available datasets	Sections 4.3.5, 5.5, Appendices C - F
Cultural and economic importance of the fishing industry throughout the Gulf	Sections 4.3.5, 5.5, Appendices C - F
Important fishing areas and times	Sections 4.3.5, 5.5, Appendices C - F
Marine based tourism activities	Sections 4.3.6, 5.4
Marine vessel traffic to and through the area	Section 4.3.6
Environmental and Socioeconomic Considerations and Possible Mitigation	
Potential environmental effects of oil spills	Sections 3.2.6, 5.1, 5.2, 5.3, 5.4, 5.5
Potential socioeconomic effects of oil spills	Sections 3.2.6, 5.1, 5.2, 5.3, 5.4, 5.5
The potential for an oil spill in the Gulf to reach land	Sections 3.2.6, 5.1, 5.2, 5.3, 5.4, 5.5
Oil spill prevention measures (equipment and procedures)	Sections 3.2.6, 5.1, 5.2, 5.3, 5.4, 5.5
Oil spill response / clean up procedures and requirements	Sections 3.2.6, 5.1, 5.2, 5.3, 5.4, 5.5
Oil spill response capabilities and times in Western Newfoundland	Sections 3.2.6, 5.1, 5.2, 5.3, 5.4, 5.5
Possible oil spills in winter and associated response	Sections 3.2.6, 5.1, 5.2, 5.3, 5.4, 5.5
Compensation for damages resulting from accidental events	Sections 3.2.6, 5.1, 5.2, 5.3, 5.4, 5.5
Limits of liability for spills and financial capacity	Sections 3.2.6, 5.1, 5.2, 5.3, 5.4, 5.5
Past spills into the NL marine environment and the industry's record to date	Section 3.2.6.2
Other past and on-going disturbances in the marine environment	Sections 4.2.1, 4.2.2, 4.2.3, 5.1.4, 5.2.4, 5.3.4, 5.4.4, 5.5.4
Drill muds and cuttings and their environmental effects	Sections 3.2.2.3, 5.1, 5.2, 5.3
Well abandonment procedures	Sections 3.2.2, 5.1, 5.2, 5.3
Possible introduction of invasive species	Sections 4.2.1, 5.1
Possible avoidance of sensitive species, areas and times	Sections 5.1, 5.2, 5.3, 5.4, 5.5
Possible avoidance of bays and coastal areas	Sections 5.1, 5.2, 5.3, 5.4, 5.5
Potential social and economic benefits of oil and gas activity	Sections 2.4.5, 4.3.4
Optimization of local social and economic benefits (jobs, business opportunities and training)	Sections 2.4.5, 4.3.4
Potential effects of hydraulic fracturing and requirements for further information and review	Sections 3.2.4, 5.4
Safety zones around offshore platforms and their communication	Sections 3.2.2, 5.5
Importance of, and potential adverse effects on, Gros Morne National Park	Sections 4.2.4, 5.4
Potential interference with fishing activity	Section 5.5
Effects of spills on commercial fisheries (direct and indirect)	Sections 5.1, 5.5
Communication and cooperation between the petroleum and fishing industries	Section 5.5
Potential effects of seismic noise on marine animals and associated uncertainty	Sections 5.1, 5.2, 5.3
Proximity of seismic and drilling activity to shore	Sections 5.1, 5.4
Visual aesthetic issues with onshore or near shore petroleum activities	Section 5.4
Possible emissions and discharges due to fuel and chemical use	Section 3.2
Vessel traffic and its effects	Sections 3.2, 5.1, 5.2, 5.3, 5.4, 5.5
Lights and noise in the marine environment	Sections 3.2, 5.1, 5.2, 5.3, 5.4, 5.5
Possible direct / indirect effects on other sectors such as tourism	Sections 4.3, 5.4

General Topic / Theme	Where Addressed in the SEA Update Report
Water use during hydraulic fracturing	Sections 3.2.4, 5.4
Potential effects of fracturing on groundwater	Sections 3.2.4, 5.4
Environmental management and protection plans for offshore operators	Sections 3.1, 3.2, 5.1, 5.2, 5.3, 5.4, 5.5
Use of oil spill dispersants and their potential effects	Sections 3.1, 3.2, 5.1, 5.2, 5.3, 5.4, 5.5
Cumulative environmental effects	Sections 2.6.5, 5.1.4, 5.2.4, 5.3.4, 5.4.4, 5.5.4
Environmental compliance and effects monitoring during oil and gas activities	Sections 3.2, 5.1, 5.2, 5.3, 5.4, 5.5
Regulatory, Policy and Procedural Issues	
C-NLOPB and its role, mandate, composition and regulatory responsibilities	Section 3.1
Nature and purpose of the SEA Update	Sections 1.0, 2.0
Relationship of the SEA Update to project EA reviews	Sections 1.0, 2.0
Relationship of the SEA Update to Québec SEAs	Section 1.1, 2.2
Environmental regulations and standards	Sections 3.1, 3.2, 5.1, 5.2, 5.3, 5.4, 5.5
Offshore jurisdictions in the Gulf of St. Lawrence	Sections 1.1, 2.2
Interjurisdictional and policy considerations around petroleum activity in the Gulf	Sections 1.1, 2.1, 2.2
Nature and format of the SEA Update consultations	Section 2.4, Appendix A
Aboriginal communities and engagement	Section 2.4.3, Appendix A
Past licencing and exploration activities in the SEA Update Area	Section 3.3
Potential cessation of all oil and gas activity in the Gulf of St. Lawrence	Section 2.1
Required consultation with a range of stakeholders and interests	Section 2.4, Appendix A
Further public involvement in the SEA process	Section 2.4, Appendix A

2.5 Identification of Valued Environmental Components

It is generally acknowledged that an EA should identify and focus on those components of the environment that have the potential to be significantly or materially affected by the proposed project, program, plan or policy in question, including those which are particularly valued by society and/or which can serve as recipients, pathways and/or indicators of environmental change. In an EA context, these are known as VECs, and may include both biophysical and socioeconomic elements of the environment.

The above sections have generally described a number of activities and initiatives that have helped to identify the key environmental issues and interactions associated with possible future oil and gas activity in the Western NL Offshore Area and which require consideration in the SEA Update. These have included the Scoping Document prepared and issued by the C-NLOPB and its SEA Working Group in early 2012 following public review and input, as well as a series of public open houses, stakeholder meetings, and correspondence and meetings with Aboriginal communities, as well as the continuous provision of information, updates and opportunities to provide input through the Board's website and other means.

In addition to these past and on-going consultation activities, the scoping exercise for the SEA Update has also included consideration of the nature of past and potential future oil and gas activities in the Western NL Offshore Area (Chapter 3), and the existing biophysical and human environments of the region (Chapter 4), in order to identify key potential interactions and issues (Chapter 5). Other SEAs and generic EAs undertaken in relation to offshore exploration in Newfoundland and Labrador and elsewhere were also reviewed and considered, as well as project-specific EAs conducted in relation to individual seismic surveys, exploration drilling programs and development projects. The results of these previous assessments and studies were considered as

part of the scoping exercise, as appropriate, with due consideration of differences between their environmental settings and study areas and that for this SEA Update.

Based on the results of the issues scoping exercise described above, and as specified in the SEA Update Scoping Document, the following VECs are considered in this assessment:

- Fish and Fish Habitat;
- Water Birds;
- Marine Mammals and Sea Turtles;
- Species at Risk;
- Protected and Sensitive Areas; and
- Marine Fisheries.

The rationale for the selection of these VECs is generally described below:

Fish and Fish Habitat: Fish resources are an important consideration in the EA of any proposed activities that occur within, and that may affect, the marine environment. This rather broad VEC includes coverage of relevant fish species, as well as plankton, algae and benthos and relevant components of their habitats (such as water and sediment), given the clear interrelationships between these environmental components. The consideration of Fish and Fish Habitat within a single VEC is in keeping with current and standard practice in EA, and provides for a more comprehensive, holistic approach while at the same time reducing repetition and optimizing brevity.

Water Birds: A variety of bird species inhabit the marine and coastal environments off Western Newfoundland and occur within the larger Gulf of St. Lawrence at various times of the year, including seabirds, waterfowl, shorebirds and other bird species. Water Birds are important from an ecological, social and economic perspective, as they typically function near the top of the food chain, may be relatively vulnerable to certain types of environmental disturbances (such as oil spills) and are an important resource for recreational and tourism related pursuits.

Marine Mammals and Sea Turtles: Whales, seals and other marine mammal species have been and remain an important element of the marine and socio-cultural environments of the region, due to historic (whale) or current (seal) harvests, and because whale watching and associated activities is an important tourism attraction in parts of Eastern Canada. A number of marine mammal species are of special conservation concern and have been designated as species at risk under Canadian legislation. Although sea turtles are generally uncommon in the Gulf, they are also typically included as part of this VEC, particularly given their rare and protected status.

Species at Risk: A number of marine fish, bird, mammal and reptile species that occur in the Western NL Offshore Area have been designated as being of special conservation concern under provincial and/or federal legislation. These species are identified and their known or likely presence, abundance and geographic and temporal distribution are described integrally under the existing environment sections for each of the above components. In the subsequent environmental issues and mitigation analyses (Chapter 5), and within each of the above VECs, these species at risk are given special attention and emphasis in the identification and analysis of potential environmental issues, planning considerations and other mitigation measures.

Protected and Sensitive Areas: Several locations within the SEA Update Area and in other parts of the Gulf of St. Lawrence have been designated as protected under provincial, federal and/or other legislation and processes, due to their ecological, historical and/or socio-cultural characteristics and importance. These areas, and the potential for interactions and effects resulting from future oil and gas activities on them, are also given particular attention in the SEA Update. In addition to areas that have existing and formal designations as being protected, a number of other locations have been identified as being relatively sensitive to possible environmental disturbances, including some that are especially important ecologically and/or for associated human activities and values. Where these were identified through the existing information and SEA consultations, they are described integrally under the existing environment sections for each of the above components (e.g., fish spawning areas, bird colonies). Again, however, in the subsequent environmental issues and mitigation analyses (Chapter 5) these areas are given special attention and emphasis in the identification and analysis of potential environmental issues, planning considerations and other mitigation.

Marine Fisheries: Fisheries (commercial, recreational and Aboriginal) were also identified and selected as a VEC given that these have been key elements in shaping the history and socioeconomic character of Newfoundland and Labrador and other areas of Canada, and remain very important aspects of the economic and socio-cultural environments of Newfoundland and Labrador, other provinces, and Canada as a whole. These fisheries have the potential to be affected both directly (through possible interactions between offshore petroleum operations and fishing activity and gear) and indirectly (due to any negative changes in the size, distribution and health of fish populations). Avoiding potential interactions between offshore petroleum operations and fisheries is a high priority for both industries.

These VECs represent the key environmental components which are assessed in this SEA Update, and have formed the basis of previous EAs conducted in relation to offshore petroleum (exploration and development) activities off Newfoundland and Labrador and elsewhere. This SEA focuses on those environmental components and potential interactions which are of primary concern, and thus, which have the most relevance to strategic planning and decision-making related to possible future oil and gas exploration in the SEA Update Area.

The following sections describe the approach and methods used in conducting the environmental effects analysis for each of the VECs under consideration.

2.6 SEA Update: Approach and Methodology

As SEA - by definition and design - occurs at a relatively early stage of strategic planning and decision-making, they typically entail a relatively “broad-brush” and “issues based” approach to EA, focusing on larger strategic policy and planning decisions and on regional-scale environmental components and considerations rather than specific environmental effects (Bissett 1996; Noble 2000).

At the early stages of strategic planning processes (such as during exploration licencing, for example), there is typically little or no information available regarding the specific nature, timing and location of projects and activities as these have yet to be defined, designed and proposed. Whereas an EA of a proposed offshore exploration drilling program would, for example, consider particular project characteristics and activities (e.g., seismic survey areas, drilling locations) and predict specific environmental effects (e.g., area covered by released drill cuttings, oil spill probability and behaviour), SEAs usually describe potential environmental issues and effects in relatively broad terms. SEAs therefore usually focus on providing a general and regional-scale

description of the overall environmental setting, and on identifying and attempting to manage general environmental issues through appropriate strategic planning and decision-making.

2.6.1 Environmental Setting

The SEA Update initially provides a description of the environmental setting of the SEA Update Area, including the relevant components of its physical and biological environments and human activities based on existing information that has become available since the initial SEA Reports were completed in 2005 and 2007. As is typical at an SEA level of analysis, the objective is to provide an overview of the existing environment of the SEA Update Area, as a basis for identifying potential environmental issues and interactions, required mitigation and associated planning considerations to attempt to avoid or reduce potential adverse environmental effects.

This description of the existing environment in the SEA Update Area does not focus exclusively upon the identified VECs, but rather also includes other aspects of the biophysical environment and human activities which are relevant and/or have been specified in the Scoping Document for the SEA Update.

2.6.2 Potential Environmental Interactions and Effects

This SEA Update includes the identification of general environmental issues which may be associated with offshore petroleum activities in the Western NL Offshore Area. The analysis for each of the identified VECs includes consideration of the components and activities which are typically associated with seismic surveys and drilling programs (Chapter 3) and the region's existing environment (Chapter 4), in order to identify potential interactions between them (Chapter 5).

This analysis has been generally informed by the available literature and other existing information on the effects of offshore oil and gas activities and their associated environmental interactions on each of the VECs, a detailed review and discussion of which was provided in the 2005 SEA Report (LGL Limited 2005), and which has been reported extensively in other sources. Indeed, a discussion of such "existing knowledge" has formed a significant proportion of the total report content in previous SEAs completed in the NL Offshore Area, and the intent is not to repeat that information here. Instead, these sections of the SEA Update provide a general identification and overview of the known and likely environmental issues and interactions associated with offshore exploration and/or development activities, only as background and context for identifying key issues and associated environmental planning considerations.

2.6.3 Environmental Mitigation Measures

These sections provide a summary overview of standard mitigation measures which are often implemented during offshore oil and gas exploration activities to avoid or reduce potential environmental effects. Environmental monitoring and follow-up programs which are typically required are also discussed where applicable.

2.6.4 Environmental Planning Considerations

Based on the updated overview of the existing environmental setting of the Western NL Offshore Area and the potential environmental interactions and issues identified through the above, the SEA Update also then

identifies any key environmental planning considerations to help guide future planning and decision-making regarding the possible issuance of further exploration licences in the region.

In doing so, this section highlights relevant aspects of the existing environmental setting of the area (particularly any particularly important species, areas and/or times), as possible based on the availability and scale of the existing information. Key planning and management considerations that may help to inform future licencing discussions are identified and described here, as well as any other activity, issue, site or time-specific measures which may help to avoid or reduce potential environmental effects.

2.6.5 Cumulative Environmental Effects

The environmental effects of individual projects and activities are not necessarily mutually exclusive of each other, but can accumulate and interact to result in cumulative environmental effects. SEA allows for an early, regional analysis of the potential environmental effects of policies, plans and programs, and thus, the overall cumulative effects of the actions that may occur as a result of these larger strategic decisions (Bonnell and Storey 2000). It is often only at the strategic level that we can identify and appreciate the overall environmental consequences of the projects and activities which may result from policies, plans and programs (FEARO 1992).

Cumulative effects which may result from future offshore exploration (seismic and drilling) programs in the Western NL Offshore Area are therefore assessed as part of the analyses, to the degree possible given the fact that the specific number, characteristics, locations and timing of these activities is not known at this stage. For each VEC, the SEA Update also considers the potential cumulative effects of offshore petroleum activities in the Western NL Offshore Area in combination with other projects and activities in the region, including general marine vessel traffic, fisheries and others. The overall objective at the SEA level is to generally identify and evaluate potential issues with regard to possible cumulative effects, at an early and relatively broad scale of analysis, for general consideration in licencing decisions, but also, for planning and assessing any future associated exploration projects that may result from same to avoid or reduce such effects.

2.6.6 Information Availability and Requirements

The SEA Update also discusses the overall nature and adequacy of available information on the VEC in the SEA Update Area, and identifies any important data gaps and information requirements that may be relevant to planning and decision-making at the strategic (licencing) and/or project level.

3 OFFSHORE OIL AND GAS ACTIVITIES IN THE WESTERN NL OFFSHORE AREA

The following sections provide an overview description of the regulatory and planning processes that apply to offshore petroleum activities in the Western NL Offshore Area (summarized from C-NLOPB 2013). This is followed by a general description of the various elements and activities that are typically associated with oil and gas exploration and development projects, as well as an overview of existing exploration licences and past and proposed petroleum activities in the region as additional background and context information for the SEA Update.

3.1 Overview of the Canada-Newfoundland and Labrador Offshore Petroleum Board and Associated Regulatory Processes

The C-NLOPB was created in 1985 through the *Atlantic Accord,* and is responsible, on behalf of the Governments of Canada and Newfoundland and Labrador, for petroleum resource management in the NL Offshore Area (see Chapter 1). The Board reports to both the federal and provincial Ministers of Natural Resources and is comprised of seven persons, three of which are appointed by the federal government, three by the provincial government, and a Chair and CEO that is appointed jointly by both governments.

The overall mandate and objectives of the C-NLOPB are as summarized below:

Mandate

- To interpret and apply the provisions of the *Atlantic Accord* and the *Atlantic Accord Implementation Acts* to all activities of Operators in the Newfoundland and Labrador Offshore Area, and to oversee Operator compliance with those statutory provisions

Objectives

Safety

- To verify that Operators have appropriate safety plans in place
- To verify, through audits and inspections, that Operators follow their safety plans and applicable statutory requirements
- To verify, through compliance actions, that deviations from approved plans and applicable statutory requirements are corrected

Environmental Protection

- To verify that Operators assess and provide for the effects of the environment on the safety of their operations
- To verify that Operators perform an EA pursuant to Canadian regulations, of the effects of their operations on the environment, and prepare a plan and provide for mitigation where appropriate
- To verify, through compliance actions, that Operators comply with their environmental plans

Resource Management

- To effectively and efficiently administer land tenure
- To oversee production activities for consistency with maximum recovery, good oilfield practice, production accounting and approved plans

- To build a knowledge base for the Newfoundland & Labrador Offshore Area through the acquisition and curation of samples and data from exploration and production activity

Industrial Benefits

- To verify Operators have an approved Canada / Newfoundland & Labrador Benefits Plan that addresses their statutory obligations

The *Canada-Newfoundland Atlantic Accord Implementation Act* and the *Canada-Newfoundland Atlantic Accord Implementation Newfoundland Act,* administered by the C-NLOPB, govern all petroleum operations in the NL Offshore Area (which covers some 185 million hectares in total).

The Board's responsibilities under these Acts include: issuance and administration of petroleum and exploration and development rights; administration of statutory requirements regulating offshore exploration, development and production; and approval of Canada-Newfoundland benefits and development plans.

3.1.1 Land Rights Issuance Process

The annual cycle for the disposition of petroleum rights in the NL Offshore Area includes a number of stages to identify particular marine areas to be made available for possible future activity, followed by the three associated documents of "title", namely the: 1) exploration licence, 2) significant discovery licence, and the 3) production licence. Normally an interest owner begins with an exploration licence, potentially moving to a significant discovery licence and ultimately to a production licence.

As of January 2013 there were 38 active exploration licences, 52 active significant discovery licences and 11 active production licences in the NL Offshore Area (C-NLOPB 2013).

3.1.1.1 Call for Nominations

The C-NLOPB issues an official call for nominations in the fall of each year, normally opening in early October and closing in late December. This call for nominations is a preliminary step prior to a competitive call for bids, and provides interested parties with the opportunity to nominate lands of interest to potentially be included in a subsequent call for bids.

Included in the call for nominations is a generic description of the terms and conditions that may apply to a subsequent call for bids, as well as information on the maximum and minimum parcel size for nominating lands and the administrative procedures for the posting and submittal of nominations. The Board is not obligated to proceed with a call for bids regarding any nominated lands, nor is a nominee required to bid on lands nominated and included in a subsequent call for bids. The Board is also able to itself nominate lands for inclusion. The identity of the nominee and information concerning the lands nominated remain confidential. Pursuant to the *Acts*, the Board is required to submit to the provincial and federal Ministers for approval a plan outlining the anticipated decisions of the Board during that year respecting calls for bids and the terms and conditions of any interest to be issued as a result of such call.

3.1.1.2 Calls for Bids

Upon receipt of the above referenced Ministerial approval, the Board will initiate a call for bids, normally commencing in early March and closing in late September. A call for bids specifies the form and manner in which a bid is to be submitted, any terms and conditions that a bid must satisfy to be considered by the Board, and other applicable terms and conditions. A call for bids must address the sole criterion that the Board will apply in assessing bids that are submitted (expressed in terms of a cash bonus bid or work expenditure bid).

3.1.1.3 Exploration Licence

Based on the results of the call for bids and their subsequent review by the C-NLOPB, and upon receipt of the required security deposit and Ministerial approval, an exploration licence is issued to the successful bidder. An exploration licence confers:

- the right to explore for, and the exclusive right to drill and test for, petroleum;
- the exclusive right to develop those portions of the offshore area in order to produce petroleum; and
- the exclusive right, subject to compliance with the other provisions of the Act, to obtain a production licence.

The term of an exploration licence does not exceed nine years and cannot be extended or renewed thereafter. Exploration licences have a maximum nine year term consisting of two consecutive periods of five years and four years. The interest owner is required to drill or spud and diligently pursue one exploratory well on or before the expiry date of Period I as a condition of obtaining tenure to Period II. Failure to drill or spud a well will result in reversion to Crown reserve of the licence, and forfeiture of the security deposit or any balance thereof. If the licence requirement is fulfilled, the interest owner is entitled to obtain tenure to Period II.

It is also important to note that the issuance of an exploration licence for a particular portion of the NL Offshore Area does not, in and of itself, authorize the licence holder to carry out physical exploration activities (fieldwork) within that licence area. The drilling of an exploration well, for example, requires various project-specific regulatory approvals and authorizations, through which the operator must present detailed information on its planned exploration activities, and in doing so, demonstrate that they can undertake such work in a manner that is in keeping with applicable requirements and standards for safety and environmental protection. These required authorizations and approvals are described further in subsequent sections.

3.1.1.4 Significant Discovery Licence

At the expiration of the term of an exploration licence, any portions of the associated offshore area that are not subject to a significant discovery or production licence become Crown reserve. If a drilling program results in a significant discovery and a declaration of same has been made, an interest owner is entitled to a significant discovery licence. A significant discovery is defined in the *Acts* as:

> *A discovery indicated by the first well on a geological feature that demonstrates by flow testing the existence of hydrocarbons in that feature and, having regard to geological and engineering factors, suggests the existence of an accumulation of hydrocarbons that has potential for sustained production.*

Upon receipt of an application for a declaration of significant discovery, the C-NLOPB first determines whether a significant discovery has been made, and if so, indicates the portions of the offshore area where there are reasonable grounds to believe that the significant discovery may extend. The applicant is then notified of the Board's decision and, pursuant to the *Acts*, may request a hearing with respect to that decision. A declaration of significant discovery may also be made by the Board on its own initiative.

A significant discovery licence confers the same rights as that of an exploration licence, and is the document of "title" by which an interest owner can continue to hold rights to a discovery area while the extent of that discovery is determined and, if it has potential to be brought into commercial production in the future, until commercial development becomes viable. A significant discovery licence is effective from the application date and remains in force for so long as the relevant declaration of significant discovery is in force, or until a production licence is issued for the relevant lands. The Crown's position as resource owner is fully protected, notwithstanding this grant of open-ended tenure, by provisions empowering the making of drilling orders, and in the event the discovery is established to be a commercial discovery, development orders.

3.1.1.5 Production Licence

In cases where a commercial discovery is declared, the interest owner is then entitled to a production licence. A commercial discovery is defined as:

> *A discovery of petroleum that has been demonstrated to contain petroleum reserves that justify the investment of capital and effort to bring the discovery to production.*

A declaration of commercial discovery is made in accordance with the same procedure as outlined above for a declaration of significant discovery. A production licence confers:

- the right to explore for, and the exclusive right to drill and test for, petroleum;
- the exclusive right to develop those portions of the offshore area in order to produce petroleum;
- the exclusive right to produce petroleum from those portions of the offshore area; and
- title to the petroleum so produced.

A production licence is effective from the date it is issued for a term of 25 years or for such period thereafter during which commercial production continues.

3.1.2 Authorizations and Approvals

The C-NLOPB's regulatory role also includes the issuing of specific authorizations and approvals pertaining to offshore petroleum exploration (geophysical and drilling programs) and development projects and activities in the NL Offshore Area.

Before carrying out any work or activity respecting petroleum operations, an Operator must obtain both an Operating Licence and an Authorization as specified in the *Atlantic Accord Act*. Various authorizations and approvals are also required for particular activities and other matters. A centralized regulatory coordination function has been established within the C-NLOPB to ensure a consistent and timely review of applications for authorizations and approvals.

The following sections provide a brief overview of a number of these authorizations and approvals which are particularly relevant to the SEA Update.

3.1.2.1 Operating Licence

Again, an Operating Licence is a prerequisite for any oil and gas activity in the NL Offshore Area which involves fieldwork. An individual or corporation may apply for an Operating Licence by completing and forwarding the relevant application form to the C-NLOPB's Legal and Land Department. Operating Licences are issued for a maximum period of one year, are valid from their commencement date until March 31st of the following year and are not transferable. The statutory requirements pertaining to Operating Licences are specified in the *Atlantic Accord Act* and in the Newfoundland and Labrador *Offshore Area Oil and Gas Operations Regulations*.

3.1.2.2 Authorizations

There are three types of authorizations administered by the C-NLOPB:

1) Operations Authorization
2) Geophysical Program Authorization
3) Diving Program Authorization

In order to obtain an authorization, the Operator must ensure that the statutory and regulatory requirements pertaining to the work or activity are satisfied, including with regard to safety, environment, resource management, exploration, legal and land and industrial benefits.

An Operations Authorization (OA) may include authorization for a drilling program, production project, well operations or all of these activities or other activities or components that are not covered by other types of authorizations. The expiry date of an OA depends on the anticipated duration of the program, and for a drilling program or production project an OA is normally issued for a maximum of three years.

Operators applying to undertake a seismic program, a wellsite seabed survey, vertical seismic profiling, an electromagnetic program, any other type of geological or geophysical program (including any that do not involve fieldwork), a geotechnical program or an environmental program, may apply for a Geophysical Program Authorization (GPA) by submitting one of the following applications to the C-NLOPB:

- Geophysical Program Authorization (2D, 3D Seismic, Wellsite Survey)
- Geological Geotechnical Environmental Program Authorization
- Geophysical Geological Application for Programs Without Field Work
- Vertical Seismic Profile Program Application
- Electromagnetic Program Authorization

The process for obtaining a GPA and a description of the information to be provided in support of the application for authorization is described in the C-NLOPB's *Geophysical, Geological, Environmental and Geotechnical Program Guidelines* (C-NLOPB 2012), including various processes and measures related to environmental planning, mitigation and reporting. For producing projects, wellsite seabed surveys and vertical seismic profiling can be addressed as part of the OA.

Although an exploration licence is required to undertake drilling activity, such a licence is not required to conduct geophysical surveys. Seismic survey areas can therefore extend considerably beyond exploration licence boundaries.

3.1.2.3 Approvals

C-NLOPB approvals may involve the approval of certain documents, plans or other matters as specified by the legislation or regulations, or the approval of specific activities conducted under an earlier authorization. These include an:

- Approval to Drill a Well
- Approval to Alter the Condition of a Well
- Approval of a Formation Flow Testing Program
- Development Plan Approval
- Approval of a Canada-Newfoundland and Labrador Benefits Plan
- Approval of Flow System and Flow Calculation and Allocation Procedures
- Approval to Commingle Production

Of particular relevance to previous and potential future offshore petroleum exploration activities in the Western NL Offshore Area, an Approval to Drill a Well (ADW) is required for operations involving drilling within or under the marine environment. An ADW covers the operations on a well up to, and including, the termination of the well, which itself could include suspension, abandonment or completion. A wellsite seabed survey must be completed prior to the issuance of such an ADW. If the well is to be tested, Approval of a Formation Flow Testing Program is also required in accordance with the Newfoundland and Labrador *Offshore Petroleum Drilling and Production Regulations*.

A Notification to Abandon / Suspend or a Notification to Complete is required to be provided to the C-NLOPB no later than five working days prior to suspending, abandoning or completing any well. A Well Termination Record is required to be provided to the C-NLOPB within 30 days of completing the well termination operations. Any operation following the termination of a well is covered by an Approval to Alter the Condition of a Well (ACW), including re-entering a well following completion of the scope of activities covered by the ADW.

3.1.3 Environmental Assessment

In Newfoundland and Labrador, proposed projects may be subject to provincial and/or federal EA legislation and processes.

The Newfoundland and Labrador *Environmental Protection Act* (*NL EPA*, Part 10) requires anyone who plans a project that could have a significant effect on the natural, social or economic environment (an "undertaking") to present it for examination through the provincial EA process. The associated *Environmental Assessment Regulations* list those projects that require registration and review, and outlines the various procedures and timelines associated with the initiation and completion of the EA review of projects and eventual regulatory decision-making. Although proposed projects that involve components and activities that occur primarily or exclusively in the offshore marine environment often do not trigger provincial regulatory interest or associated EA requirements, EA registration and review is at times required for proposed oil and gas exploration and

development projects that involve or include on-land or near shore elements. Any such projects that involve both provincial and federal EA interests and requirements are often completed in a cooperative and "harmonized" manner involving both the Governments of Newfoundland and Labrador and Canada (as described further below).

The *Canadian Environmental Assessment Act* (*CEAA*) is the legislative basis for federal EA in Canada. On July 6, 2012 a new *CEAA* and associated *Regulations* came into force, which updated the nature and focus of the federal EA process, including the projects that it applies to and its various procedural elements. The new federal EA process focuses on potential adverse environmental effects that are within federal jurisdiction, including: fish and fish habitat; other aquatic species; migratory birds; federal lands; effects that cross provincial or international boundaries; those that affect Aboriginal peoples, such as their use of lands and resources for traditional purposes; and changes to the environment that are directly linked to or necessarily incidental to any federal decisions about a project.

The new *CEAA* also has an associated set of *Regulations Designating Physical Activities*, which identify the physical activities that constitute the "designated projects" that may require a federal EA. These Regulations specify a number of types and scales of onshore and offshore oil and gas development activities that are now subject to federal EA review, including, for example:

> *10. The construction, installation and operation of a facility for the production of oil or gas, if the facility is located offshore and*
>
> *(a) is outside the limits of a study area delineated in*
>
> *(i) an environmental assessment of a project for the offshore production of oil or gas that was conducted by a review panel or as a comprehensive study under the Canadian Environmental Assessment Act, or*
>
> *(ii) an environmental assessment of a proposal for the offshore production of oil or gas that was conducted by a Panel under the Environmental Assessment Review Process Guidelines Order; or*
>
> *(b) is inside the limits of a study area delineated in an environmental assessment described in subparagraph (a)(i) or (ii) and is not connected by an offshore oil and gas pipeline to a previously assessed facility in the study area.*

Offshore exploration (seismic and drilling) projects and program are not specifically listed in the *CEAA Regulations Designating Physical Activities*. The Minister of the Environment may designate a project that is not currently listed in the *Regulations* if there is the potential for environmental effects in areas of federal jurisdiction or public concerns about such environmental effects.

If the federal EA process does apply to a proposed project, it commences with the proponent's submission of a Project Description document to the Government of Canada for review. Upon receipt of an adequate Project Description from a proponent, the Canadian Environmental Assessment Agency will have 45 days, including a 20-day public comment period, to determine whether to require a federal EA. During this "screening" step, government will examine whether the project may cause adverse environmental effects on areas of federal jurisdiction or as a result of an associated federal decision. If further EA review is deemed to be required, this may take one of two forms: 1) Standard EAs, or 2) Review Panels. (with legislated timelines being defined for each). Designated projects that are regulated by the Canadian Nuclear Safety Commission or the National

Energy Board automatically require an EA by those regulators. The federal EA process culminates in a decision as to whether or not the project can proceed, and if so, under what conditions.

Following the July 2012 changes to the federal EA process pursuant to *CEAA* (2012) and its *Regulations*, the C-NLOPB announced that it would be continuing with the various EAs that were in progress prior to this new EA legislation. The C-NLOPB has also indicated that, notwithstanding the recent changes to the federal EA legislation and process (and its application), it will be continuing to require that project-specific EAs be conducted and submitted by proponents in relation to proposed oil and gas exploration activities in the NL Offshore Area, as part of the information submitted in its application for regulatory approval(s).

As of the time of writing, eight EAs were in progress related to proposed petroleum related projects in the NL Offshore Area, including the following on-going assessments related to proposed exploration (seismic and drilling) programs in the SEA Update Area:

1) Ptarmigan Energy Inc. *Geophysical Program for Anticosti Basin Offshore Western Newfoundland and Labrador EL 1120; EL 1128 and EL 1127 2012-2018*;

2) Corridor Resources Inc. *Drilling of an Exploration Well on the Old Harry Prospect - EL 1105*; and

3) Black Spruce Exploration Corp. and Shoal Point Energy Ltd. *Western Newfoundland Drilling Program, 2013 to 2019.*

3.2 Generic Description of Oil and Gas Activities

Various types of petroleum activities may occur in the Western NL Offshore Area following the issuance of exploration licences and other authorizations and approvals by the C-NLOPB. The following sections provide a general and relatively high-level description of offshore geophysical (seismic) surveys and drilling programs as they are typically proposed and carried out in the NL Offshore Area. More detailed and specific descriptions of these activities are typically included in project-specific regulatory approval documentation.

3.2.1 Geophysical Surveys

In petroleum exploration, it is imperative to understand the subsurface geology of an area. Drilling is an effective way to learn what is underneath the surface but provides information for a specific location only. For this reason, prior to drilling, geophysical investigations are often conducted in order to get an understanding of what is below the surface.

The science of geophysics applies physical principles to study the Earth. Geophysical surveys can be carried out at or near the surface and provide information about how the subsurface varies vertically and laterally. The scale of a survey can range from an entire Earth investigation down to a small, localized area of interest. By studying and interpreting the results of various geophysical surveys, one can predict the subsurface geology.

3.2.1.1 Types of Geophysical Survey Methods

The following provides an overview of various types of geophysical surveys that may be conducted as part of offshore petroleum exploration activities (summarized from: Kearey et al 2002; OGP 2011).

Surveying methods generally fit into two categories: 1) those that use the natural fields of the Earth; and 2) those that require an input of artificially generated energy. The natural field methods use Earth processes such as gravitational, magnetic and electromagnetic fields. Knowing how these parameters generally behave, one can look for localized disruptions from the normal background value in the collected data, perhaps caused by a concealed geologic feature. In artificially generated methods, most commonly seismic acquisition, acoustic waves are generated and propagate through the subsurface, reflecting off, refracting along and transmitting through geologic layers of various characteristics. The transmission path of the waves is mapped and subsequently provides information about the geological boundaries at depth.

Generally speaking, natural source methods are logistically easier to carry out and the depths of investigation tend to be greater. Conversely, artificial methods tend to result in a more detailed picture of the Earth's subsurface. Depending on the survey type, data can often be collected via marine, airborne or land-based surveys. Factors such as physical location, cost, time, accessibility and data quality are all considered when deciding which type of survey to carry out, and in some instances, several methods can be carried out.

Natural Source Methods

Gravity Surveying: In gravity surveying, variations in the Earth's gravitational field due to density differences between diverse subsurface rock types are measured and recorded. A geological body, whose density differs greatly from its surroundings, will cause a change in the Earth's gravitational field, which is known as a gravity anomaly. These anomalies allow the interpreter to gain ideas about the size, depth and rock type of various features. Gravity data can be collected quite easily from an aircraft or a marine vessel using a gravimeter. Due to the relative ease of collecting from a ship, gravity data is often recorded in conjunction with a marine seismic acquisition program.

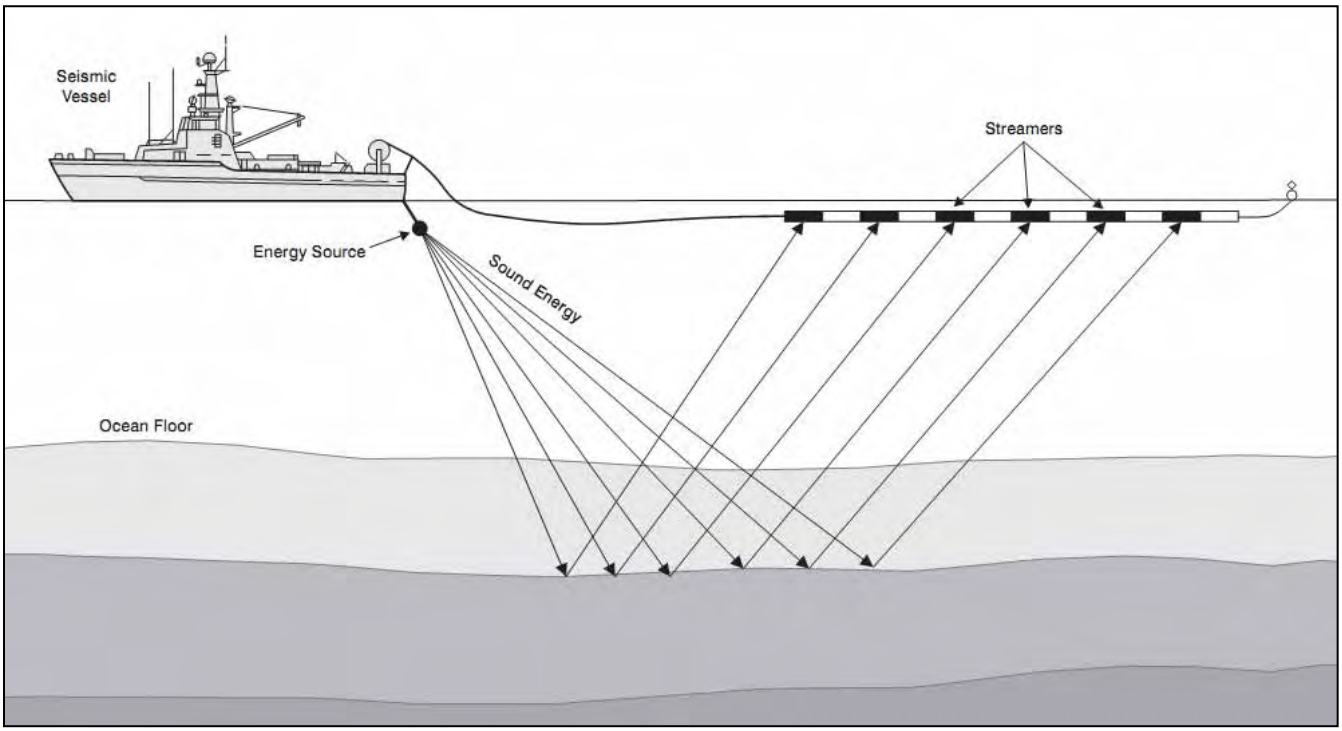
Magnetic Surveying: Magnetic surveys investigate subsurface geology by mapping anomalies in the Earth's magnetic field that result from varying magnetic properties in the underlying rocks. Most of the minerals that compose rocks are essentially non-magnetic; however, some iron rich minerals can produce significant magnetic anomalies. While the nature of magnetism makes it a more suitable survey type for mining prospects, it can provide large scale information about regional geologic structure. Magnetic surveys are performed on land, at sea and in the air using a magnetometer and are likewise often completed in conjunction with other surveys.

Electromagnetic Surveying: Electromagnetic surveying measures the ground's response to propagating electromagnetic fields. Electromagnetic fields are comprised of alternating electrical and magnetic fields, as the changing of one field generates the other. As such, any conductive body beneath the surface will result in the production of strong secondary electromagnetic fields, thus making this a useful tool in remote sensing for ore bodies. Electromagnetic principal can also be utilized for hydrocarbon exploration. Controlled Source Electromagnetics (CSEM), for example, is a marine geophysical technique used to map potential hydrocarbon accumulations below the seafloor. A dipole source that transmits an electromagnetic field is towed by the ship just above the seafloor. The field is altered by the underlying lithology, subsequently detected and recorded by a receiver array positioned on the seafloor. Interpretation of the data can help identify layers that are conductive or resistive. Typically, for hydrocarbon exploration, one looks for the more resistive features, as hydrocarbon bearing formations are relatively more resistive than the surrounding layers.

Artificial Source Methods

The primary components of an offshore geophysical survey for petroleum exploration using artificial sources typically include a seismic vessel, a sound source, receivers (hydrophones) and associated supporting elements and activities. In an offshore seismic survey, high-energy sound sources (airguns) are towed behind a survey vessel while it travels along a track line in a prescribed grid crossing known or suspected hydrocarbon accumulations. During the survey, the sound source is fired at regular intervals and directs high energy (low frequency) sound bursts toward the seafloor which can penetrate below the surface. The reflected sound energy is then recorded by sensitive hydrophones (streamers, up to several kilometres in length) which are towed behind the vessel. Computer-based data processing systems then convert the reflected sound (acoustic signals) into seismic data that can be used to map possible hydrocarbon accumulations within the survey area (Figure 3.1).

Figure 3.1 Conceptual Illustration of a Typical Seismic Survey



Two-Dimensional (2D) Seismic Surveys: These seismic surveys cover relatively large geographical areas, and are therefore of short-term duration at any given location. Survey lines tend to be over 1 km apart, and are often laid out in a number of different directions. The 2D survey is typically used for exploring a large area in order to identify sites or zones which may warrant further study, and typically uses a single source array and streamer.

Three-dimensional (3D) Seismic Surveys: These enable a greater resolution of potential and known oil and gas fields, and provide a more detailed picture of the area under investigation. These surveys may concentrate activity over a relatively small geographical area for extended periods (often several weeks), with survey lines typically spaced several hundred meters apart. 3D surveys typically use multiple source arrays and streamers.

2D-High Resolution Survey: Prior to the spud of a well, an operator must ensure that the well can be drilled legally, environmentally prudently and safely at the chosen location, and its exact location must therefore be verified. The seabed and the geological units just below the seafloor also need to be studied in detail to assess the potential presence of seabed features which might affect drilling and natural gas in the shallow region. For increased resolution of the seafloor and the shallow section surrounding the potential wellbore, 2D High Resolution data is often acquired. The technique is similar to a standard 2D marine seismic program except the source is a small volume compressed air source or a device that generates an acoustic pulse from an electrical discharge. The streamer used is also much shorter and is towed (along with the source) at shallower depths than conventional 2D seismic programs, which allows for higher frequency content from the source and therefore higher resolution data. In addition, side scan sonar and seafloor imagery data may also be gathered, which can further aid in studying marine life and in determining seafloor surface integrity for drilling equipment.

Wide Azimuth Seismic Survey: A wide azimuth survey attempts to capture wider offset data than a conventional seismic survey. Although a source produces a spherical wave, the streamers (being essentially linear in a typical seismic program) will only detect rays from a small range of source azimuths. By having additional sources on vessels separate from the streamer towing vessel, the streamer is better able to detect a broader range of signal azimuths. The desired outcome of this is enhanced data quality, in particular the capacity to resolve complex geological features, improved signal to noise ratio, and other outcomes.

As of 2012, nearly 2.5 million line kilometres of seismic survey work had been conducted in the NL Offshore Area, of which approximately 30 percent was 2D and the remaining 70 percent was 3D (C-NLOPB 2013). While an exploration licence is required to undertake drilling activity, such a licence is not required to conduct seismic surveys, although individual geophysical survey projects require authorizations from the C-NLOPB.

3.2.1.2 Seismic Survey Equipment and Methods (Artificial Source Methods)

An offshore seismic survey vessel is typically approximately 75-90 m (250-300 feet) in length, depending on local conditions and the particular characteristics of the survey and associated equipment requirements, with a crew of about 40-50 personnel. A high-energy sound source in the form of one or more airguns (each usually comprised of a steel cylinder charged with high pressure air) is towed behind the survey vessel at approximately 5-10 m below the water surface. The vessel travels along the track line in a prescribed grid at a speed of approximately 4-5 knots (7.5–10 km/h) while recording (or approximately 10 knots (20 km/hr) while in transit with towed gear onboard), similar to trawling fishing vessels. The seismic survey grid and its associated transects are carefully chosen to cross any known or suspected hydrocarbon prospects in the area.

During the survey, the sound source(s) is typically fired approximately every 25 m, and directs bursts of sound downward toward the seafloor. These source arrays are towed approximately 100-200 m behind the survey vessel, and send sound waves through the water, with geological formations beneath the seafloor then reflecting the sound waves back to one or more hydrophone streamers trailing behind the vessel. Each of these receiver arrays are typically between 5 and 10 km long and several hundred meters wide, and are towed approximately 5-15 m below the water surface. A tail buoy with radar reflectors is often attached at the end of each streamer (Figure 3.1). During a seismic survey, the vessel sails along a track for approximately 12-20 hours, depending on the size of the study area and local conditions. At the end of each transect the vessel turns around (which can take several hours and cover a radius of up to 10- 15 km) and then continues along the next transect to complete the survey grid. Seismic operations can usually continue in sea states of up to approximately 5, or significant wave heights of about 3 m (10 feet).

3.2.1.3 Sound Propagation During Offshore Seismic Surveys

During seismic surveys, multiple (often 20-30) airgun units are typically used, with individual source unit volumes ranging from about 70 to 250 cubic inches with a combined chamber volume of between 2,000 and 5,000 cubic inches and operating at about 2,000 pounds per square inch (psi). Based on these specifications, the total pressure per source for those array source volumes would be between 137 to 172 Bar-meters, and the peak-to-peak pressure output will be between approximately 240 and 260 dB re 1 µPa @ 1 m. The larger source units are typically positioned at the front of the array with progressively smaller volumes towards the back. For each air source unit, the amplitude (or loudness) of the acoustic signal is a function of the volume and pressure of the air inside the cylinder and the cylinder's depth under the water surface, measured as the output Sound Pressure Level (SPL).

At the commencement of a planned offshore seismic survey, just prior to arriving at the start of a survey line, the airgun array is slowly brought up to a specified power, a procedure referred to as a "ramp up" or "soft start". This procedure is intended to allow mobile marine animals to temporarily vacate an area if they perceive the sound levels as a disturbance (this standard mitigation measure is discussed further in later sections of this report). The firing of an air source generates an oscillating bubble in the surrounding water. At the time of firing, the pressure of the air inside the cylinder exceeds the outside pressure in the surrounding water. This difference in pressure causes a bubble to rapidly expand in the water around the air source, and it is this initial bubble expansion that generates the relatively broadband seismic pulse.

The output of an air source array is a function of the time vs. pressure and frequency involved. During the conduct of an offshore seismic survey, airguns are usually fired at approximately 5-10 second intervals, with seismic shots being of short duration, at most a few tens of milliseconds (ms). Although peak energy levels within a shot may be high, the short signal duration limits the total energy transmitted into the water column. The frequency characteristics of an air source array signature relate to how the signal sounds, with hertz (Hz) being the unit of measure for frequency. Air source signatures are referred to as broadband, as they contain a range of frequencies. Most of the sound energy produced by an airgun array is in the range of 10-300 Hz, with highest levels at frequencies of less than 100 Hz (Turnpenny and Nedwell 1994). For the purpose of evaluating the environmental implications of an air source, the signature is typically reported at the widest bandwidth.

During an offshore seismic survey, the arrays are configured in such a way as to maximize the amount of seismic energy projected vertically into the geologic formation being surveyed (a characteristic known as "directivity"). Although the direction of the greatest sound intensity is directed vertically downwards from the array, some energy is radiated in directions away from the beam axis and into the surrounding environment. Because of the pattern of air source placement in an array, the signature changes as a function of direction (azimuth) and emission angle (angle from the vertical). The firing times for all the air sources in the array are synchronized to ensure that the primary pulses from each gun align exactly with one another along the vertical axis of the array. These differences in the array signature with respect to direction and angle from the vertical are referred to as the array response. It means that the "sound" (i.e., frequency content) and "loudness" (i.e., pressure strength) of the array signature will be different at different locations in the water. These differences are known as the acoustic radiation pattern and can be calculated and mapped in three dimensions.

The sound from a seismic array diminishes with increasing distance from the source. This is referred to as transmission loss, and it is influenced by geometric spreading losses and attenuation. Pressure measured at some distance away for the air source array is often determined by using a model of spherical and cylindrical

spreading. Sound travels out in a progressively large area from the sound source in all directions. This unrestricted spreading in water is called spherical spreading. The loss of sound is described as 20logR dB, where R is distance from the source in metres. This calculates to a transmission loss of about 6 dB with each doubling of distance from source.

There are, however, various other factors that contribute to the nature and rate of decay in a sound wave in the marine environment, including frequency as well as local conditions such as water temperature, water depth and bottom conditions. The sound can also be compressed between the sea surface and the seafloor and other obstructions (e.g. thermal layers), thus channelling it. Therefore, sound in the marine environment typically spreads in a cylindrical fashion (Davis et al 1998; Thomson et al 2000). The transmission loss is half that of spherical spreading, and is then described as 10logR dB, a loss of about 3 dB with each doubling of distance.

In areas of very strong acoustic contacts at the seafloor (i.e., bedrock), much of the acoustic signal will be reflected back into the water column, and there will be lower decay rate with distance than expected. As these seismic surveys map sub-sea structures, in most cases the seafloor conditions will be transparent to the low frequency seismic signals and the variation in seafloor sediment (sand, till, and silt) will not have a significant effect on sound propagation from seismic surveys. The sea surface can also act as a mirror for sound waves causing ghost reflections of the real source. These two signals cancel each other out at the sea surface. This effect can result in rapid decay of the waterborne seismic signal. There are also some conditions that cause lower energy decay, the most prevalent being sound channels. Sound channels in the sea are formed by temperature and pressure which changes sound propagation velocity. Sound channels act as ducts that can focus sound energy and attenuation is much less than normal for spherical spreading, and the sound can travel considerable distances.

In summary, therefore, although this simple spreading discussion provides some general insight into the attenuation of sound from seismic surveys through the marine environment, a number of other activity and site-specific factors may also influence sound propagation in the marine environment.

3.2.1.4 Other Emissions and Potential Accidental Events and Malfunctions

Other potential emissions and discharges that may be associated with marine-based seismic surveys include vessel discharges (such as deck drainage, sanitary waste), atmospheric emissions (exhaust) and the noise and general presence of vessels and lights associated with offshore survey activity.

Because seismic surveys do not result in the recovery of petroleum, the potential for and likely magnitude of any accidental events that could be associated with such surveys are considerably lower than for other type of offshore activities. As is the case for marine vessel activity of any sort, there is, however, always the possibility of accidental events occurring at sea, ranging from small spills of fuel and other materials to possible collisions with marine life, fishing gear and/or other vessels and human activities, which may in turn have implications for the natural and human environments.

3.2.2 Offshore Well Drilling

Exploration and delineation wells are drilled to confirm the presence, or define the extent, of petroleum resources at particular locations. Exploration wells are drilled to determine whether areas of interest identified from previous geophysical surveys contain petroleum resources. Depending on the results of these wells, an operator may then drill delineation wells into different parts of the identified hydrocarbon accumulation to confirm its size and the characteristics of the hydrocarbons found.

As of January 2013 there had been 382 wells drilled in the NL Offshore Area, including exploration and delineation wells and those associated with petroleum production activity. The following sections provide a brief description of typical well drilling equipment and procedures that have been or may be used in the Western NL Offshore Area.

3.2.2.1 Offshore Drilling Installations

A number of types of offshore drilling rigs can be used to drill a well once a specific drill site or target is determined, with three types of installation typically being used to drill offshore wells in Atlantic Canada:

1) *Semi-Submersible Drilling Units*;
2) *Drill Ships*; and
3) *Jack-Up Drilling Units*.

The type of rig chosen is often based primarily on the characteristics of the physical environment at the proposed drill site, particularly water depth, expected drilling depth and expected weather and ice conditions and associated mobility requirements. A brief description of these various types of drill rigs is included below (summarized from CAPP 2006).

Semisubmersible Drilling Units are typically used in relatively deep waters (70-1,000 m on anchor or at greater depths using dynamic positions systems) or in areas where increased mobility is required due to ice or other factors and operational risks. These units can either be towed to the drill site or move under their own power, and are designed for drilling in rougher seas. The main deck of the unit is supported by a series of vertical columns, which in turn sit atop steel pontoons that float below the water surface during operations. The pontoons are filled with water so that the unit floats with the main deck above water and the remainder below the surface, and the platform can be raised or lowered by adjusting the amount of ballast water they contain. Because much of the mass of the rig is below water, these units are relatively stable in rough seas. On site, the unit is moored to the bottom with a series of large anchors, and in deeper waters (over 1,000 m), these units utilize a dynamic positioning system in which thrusters position the vessel and keep it steady (Figure 3.2).

Figure 3.2 Typical Semisubmersible Drilling Unit

Drill Ships are the most mobile type of drilling installation, and are also typically used in areas of relatively deep water. These are ships which contain complete drilling systems, and are almost entirely self-contained and can therefore operate at remote sites with limited support. Drill ships can be anchored to the bottom in water depths of approximately 200-1,000 m, with dynamic positioning systems allowing some drill ships to operate in waters depths of over 1,000 m. Drill ships typically have a derrick near the centre of the vessel hull which contains and operates the drilling equipment, where a moon pool provides access from the deck surface through the centre of the ship to the water surface (Figure 3.3).

Figure 3.3 Typical Drill Ship

Jack-Up Drilling Units are typically used in shallow water depths of between 10 and 100 m. These units are towed to a drill site, at which time the rig's 3-4 retractable legs are placed above the hull structure. Once on site, the legs are lowered until they come into contact with and rest upon the sea floor, and the drilling barge or unit platform is elevated up the legs until it is at the desired height above the sea surface (Figure 3.4).

Figure 3.4 Typical Jack-Up Drilling Unit

The overall purpose of a drill rig is thus to provide a stable and safe supporting infrastructure at the drill site in order to house and operate the drilling equipment, the main components of which include the:

- *Drill String* (piping which connects the rig to the drill bit);
- *Drill Bit* (the device at the end of the drill string that cuts through the seabed);
- *Rotation Equipment* (electric or hydraulic motors for turning the drill string, and thus the drill bit), and
- *Drilling Muds* (fluids which lubricate and cool the drill bit and hole, circulate cuttings and carry them back to the surface, and maintain pressure in the well).

Drill rigs therefore allow for the raising and lowering of the drill pipe and drill bit, the movement (rotation) of the drill bit, and the installation and circulation of drilling fluids. Each of these types of drill rigs are essentially self-contained, provide access to the ocean surface and water column to facilitate drilling into the seabed, and include the above noted drilling equipment housed within a derrick mounted over the drill floor.

Offshore drilling installations also contain associated support infrastructure and facilities such as transportation facilities (for helicopters and support vessels), work areas, safety equipment and crew accommodations.

3.2.2.2 Offshore Drilling Activities

The following provides a general description of the various drilling activities that may occur in the SEA Update Area. This overview is based on existing and available (general) descriptions of offshore drilling (such as from LGL Limited et al 2000; CAPP 2005, 2011) and is intended to provide general background and context for the SEA

Update. Again, more detailed and specific descriptions of offshore drilling equipment and activities is typically included in project-specific EAs and other documentation.

Once the drilling unit being used in a particular offshore drilling project arrives and is positioned at the planned well site, drilling typically occurs in a number of stages. Geohazard surveys are often conducted prior to drilling to assess the potential for hazards (such as potential obstructions, seabed instability), typically using sonar (multi-beam or side scan), video surveys, bottom sampling or small seismic arrays.

Offshore exploration wells are usually drilled over a period of one to several months, as follows:

1) *Conductor hole*: Initially a large diameter (approximately 1 m wide) hole is drilled at the beginning of the well, usually to several hundred meters below the seafloor, which is then used to install and set the equipment required for drilling the well to depth. Water-based drilling mud (WBM) is used to drill this portion of the well, and as there is no equipment in place to return them to the drilling unit at this early stage (before the riser is installed), these drilling muds and rock cuttings are released onto the seabed.

2) *Casing installation*: Once the conductor hole is completed, the drill string is removed, followed by the running and cementing of steel pipe and the installation of the blow-out preventer and drilling riser. The casing helps to strengthen and stabilize the wall of the conductor hole and to prevent the seepage of muds and other fluids during drilling. The blowout preventer comprises a system of high pressure valves that prevent water or hydrocarbons from escaping into the environment in the event of an emergency or equipment failure during drilling. The drilling riser connects the casing set at the seafloor up to the drilling unit, and therefore allows muds and cuttings to travel back to the rig for processing and disposal.

3) *Well drilling*: With the casing and associated equipment in place, the drill bit and riser are lowered into the conductor hole from the derrick. Drilling begins at the bottom of the initial (conductor) hole and then continues on to the desired depth under the seabed. Drill pipe sections are added as drilling continues and progresses. As sections of well are completed, the drill string is pulled out of the well and the sections of the casing are joined together, lowered into the well, and cemented into place. The circulation equipment includes high pressure pumps, equipment to separate rock cuttings from the fluids, and storage facilities for the used fluids once retrieved.

4) *Vertical Seismic Profile (VSP):* Also referred to as a check-shot survey, a VSP is undertaken following completion of drilling to confirm well depth. The VSP is undertaken by placing a string of receiver (geophones) down the well, with a seismic source (usually mid-sized airguns) suspended from the drilling unit. The checkshots are recorded at multiple intervals down the well, and the resulting information assists in determining and confirming the depth of the drilled well and for reconciling drilling information with that obtained through seismic survey work.

5) *Well evaluation and testing*: If significant hydrocarbons are found during an exploration drilling program, formation fluids (which may contain hydrocarbons and/or water) flow to the drilling unit are often obtained and tested. During such testing, produced hydrocarbons are separated from any produced water on the drilling unit and are analysed. Any produced water is sent to the rig's flare or treated for disposal.

6) *Well abandonment*: Once drilling and any associated well testing is completed, offshore wells are typically then abandoned. Cement mixtures or mechanical devices are used to plug the well, the casing is cut and removed just below the surface of the seafloor and all equipment is removed. Wellheads are removed from the seafloor, often using a mechanical casing / wellhead cutting device. In the event that this device fails, operators often use a chemical / directed explosive method to detach the wellhead. A remotely operated vehicle (ROV) or other equipment is then used to inspect the seabed to ensure that no equipment or obstructions remain in place.

Supply vessels and helicopters are used to transport personnel, equipment and materials to and from a drilling rig during an offshore drilling program. Supply vessels typically make several round trips per week to the drilling unit throughout a drilling program, and a dedicated stand-by vessel also usually attends the rig throughout the drilling program. Personnel are usually transported to and from the drilling rig by helicopter, according to work schedules and rotations, workforce numbers, distances and the type of aircraft being used.

Throughout the duration of an offshore drilling program in the NL Offshore Area, other marine vessel traffic is restricted within a defined area surrounding the drill unit as a safety precaution. As specified in the Newfoundland and Labrador *Offshore Petroleum Drilling Regulations*, this safety zone is usually the greater of either the area within a 500 m radius of the drill unit or, if the unit is anchored, a zone 50 m from the anchor pattern. Notices to Mariners and other measures are also used to communicate the presence and nature of these drilling activities and associated safety zones to other vessels and marine operations in the area.

3.2.2.3 Potential Environmental Emissions Associated with Offshore Drilling Activities

Although there may be some variations in drilling equipment and activities between operators and their programs, for the most part the various elements of a drilling program are fairly typical in terms of the primary equipment, materials, and actions involved, and therefore, in the types and volumes of their associated emissions and discharges.

The primary potential environmental emissions and discharges that are typically associated with offshore drilling operations include:

- Drill muds and cuttings;
- Other liquids and solids (such as solid waste, sanitary wastes, deck drainage); and
- Atmospheric and noise emissions.

Again, drilling muds are fluids that are circulated in oil and gas wells to clean and condition the hole, to lubricate the drill bit and to counterbalance formation pressure. Wells may be drilled using either water-based mud (WBM) or a combination of WBM and synthetic-based mud (SBM). All substances that make up drilling muds are evaluated through the chemical management system developed by the operator in consideration of the *Offshore Chemical Selection Guidelines for Drilling and Production Activities on Frontier Lands* (NEB et al 2009).

As indicated, the initial drilling phase typically uses WBM, the primary component of which is seawater, with other additives (primarily bentonite (clay), barite and potassium chloride). Other approved chemicals are also added as required to control and achieve the required mud properties. As the initial (conductor) portion of a

well is drilled without a riser in place, the drilling muds and cuttings that are used in and result from these initial drilling activities are discharged directly to the seabed. WBMs are essentially non-toxic, and spent and excess WBM may therefore be discharged onsite from offshore installations where these meet applicable guidelines and other regulatory requirements. Much of the drilling activity in the NL Offshore Area, particularly the shallower exploratory wells, has been completed with WBMs alone.

Synthetic-based muds (SBMs) may be used in drilling lower well sections if the use of water-based fluids is technically impractical. SBMs are used in potentially difficult drilling situations, such as wells drilled in reactive shales, deep wells, and horizontal and extended-reach wells where WBMs do not offer consistently good drilling performance. SBM does not react with high clay content shales where WBM may hydrate and expand into the wellbore causing collapse of the holed or stuck drilling pipe. Gas hydrates are suppressed with SBM and the stability and flexibility of mud properties allows proper hole cleaning. SBM also prevents the formation of hydrates in blowout preventers in deepwater wells. SBMs were developed to replace oil-based muds that were historically used in drilling activities, and are comprised of non-toxic synthetic fluids. Other than residual base fluid retained on cuttings (as described below) no whole SBM or any whole mud containing these constituents as a base fluid, should be discharged to the sea.

During the drilling of an offshore well, once the conductor hole is completed and when the riser and blow-out preventer are installed and in place, drill muds and cuttings can be returned to the surface and on to the drill rig for recovery and reuse. Once onboard the rig, drill (rock) cuttings are removed from the drilling muds in successive separation stages. Some fluids are reconditioned and reused, while spent SBM is returned to shore for disposal. SBM-associated drill cuttings may be discharged at the drill site provided they are appropriately treated prior to discharge in accordance with proven and practicable best available technologies and practices (defined as a concentration of 6.9 g / 100 g or less oil on wet solids) (NEB et al 2010).

Drilling units may also produce a variety of other solid, liquid and gaseous wastes and emissions, including:

- produced water;
- sewage and food waste;
- ballast water;
- bilge water;
- deck drainage;
- discharges from machinery spaces,
- cement and cementing products;
- cooling water;
- blowout preventer fluid;
- other solid wastes;
- atmospheric emissions; and
- noise.

Waste materials and other discharges and emissions associated with offshore drilling rigs must be managed in accordance with the *Offshore Waste Treatment Guidelines* (OWTG) (NEB et al 2010), which typically involves treatment of these materials prior to discharge and/or required on-shore disposal. Although adherence with these guidelines does not completely prevent the potential for any environmental effect, they do outline recommended practices and standards for the treatment and disposal of wastes from petroleum drilling and production operations in Canada's offshore areas, and for sampling and analysis of waste streams to ensure compliance with these standards. The Guidelines are intended to be the minimum standards to be applied by the C-NLOPB in making decisions related to waste treatment, disposal and monitoring. The OWTG are periodically reviewed (scheduled every five years) or if circumstances determine that it is necessary (e.g. information on certain wastewater treatment technologies has shown a decrease in the loadings of the OWTG parameters to the receiving environment).

All chemicals to be used in drilling programs in the Western NL Offshore Area are screened through the *Offshore Chemical Selection Guidelines for Drilling and Production Activities on Frontier Lands* (NEB et al 2009). These Guidelines are used by industry in making decisions related to the selection of chemicals to be used in offshore drilling and production activities, and to the treatment and disposal of the chemicals selected. Although adherence to these Guidelines does not completely avoid the potential for any type or level of environmental effect, the Guidelines are intended to provide a consistent framework for chemical selection as part of the environmentally responsible management of chemicals used in offshore drilling and production activities. They are also periodically reviewed (scheduled every five years) or if circumstances determine that it is necessary (e.g. information on certain chemical usage has shown impacts to the receiving environment).

Atmospheric emissions during drilling activities may include exhaust from equipment, as well as emissions from the storage and flaring of hydrocarbons associated with well testing (where required). From the burning of diesel fuel for power generation on the drill unit and other routine activities, the primary criteria air contaminants would be carbon dioxide (CO_2), carbon monoxide (CO), sulphur oxides (SO_x), nitrogen oxides (NO_x) and particulate matter. Depending on the type and size of the drilling unit, the estimated consumption of marine diesel would typically be in the range of 100-150 barrels per day, with the associated air emissions therefore being comparable to that from a single large container ship of the type that commonly transits through Newfoundland and Labrador waters (Stantec 2011).

If hydrocarbons are present and well testing is conducted, produced water may be encountered. Water contaminated with hydrocarbons generated during flow testing (within certain tolerances), can be atomization in the flare (using high efficiency burners) or shipped on-shore for disposal. If this capacity is exceeded, small amounts of treated produced water may be treated to comply with the *Offshore Waste Treatment Guidelines* and disposed of offshore or brought ashore for disposal through a licenced waste management contractor. The amount of produced water potentially encountered during exploration drilling is typically very small compared to that during production operations. Flaring, if required at all during exploration drilling, is therefore typically an intermittent and short-term activity. Noise emissions associated with an offshore drilling program include those associated with drilling itself, as well with the rig's position systems, support vessel traffic and other activities. Environmental Protection Plans (EPPs), including a Waste Reduction Plan, are typically required for offshore exploration projects to address these routine discharges and emissions.

Other potential environmental issues and interactions which may be associated with offshore drilling activities (exploration, delineation and/or production) are described in Chapter 5.

3.2.3 Onshore to Offshore Drilling

Of particular relevance to the Western NL Offshore Area, offshore exploration drilling may also entail or include horizontal directional drilling from on-land locations to investigate potential hydrocarbon resources located below the marine environment. Onshore to offshore drilling may be used where these hydrocarbon prospects are located close enough to shore to be explored using this technology. Indeed, the majority of the exploration wells that have been drilled to date in this region (see Section 3.3) have been undertaken from on-land locations.

Many of the components and activities associated with onshore to offshore drilling activities that have or may occur in the Western NL Offshore Area are essentially the same as those described above for offshore exploration and delineation wells,. These may include the following:

- Development or upgrading of any new transportation infrastructure (roads, trails), as required;
- Establishment of a drill pad of appropriate size (typically several hectares) at the drill site, which often includes berms and/or liners to contain any spilled materials;
- Sourcing of an appropriate drill rig (example shown in Figure 3.5) and its transportation to and set-up at the drill site (often in modules which are later assembled at the planned well location, with drill mud handling and cuttings cleaning systems, blowout prevention and pressure control equipment, crew facilities, and other components);
- Construction or installation of associated equipment and ancillary infrastructure (generators, water sources, crew accommodation or other on-site facilities, fuel and chemicals storage, waste disposal systems, containment ponds, emergency response equipment);
- Regular movements of other equipment, materials and personnel to and from the drill sites as required;
- Drilling operations (usually 24 hours per day for the duration of the drilling program, often multiple weeks or months or even longer), including associated production and management of drill cuttings, any produced water, etc; and
- Eventual completion and cessation of drilling operations, followed by well abandonment procedures (temporary or permanent), equipment removal and site rehabilitation procedures, in accordance with applicable regulatory standards and approvals.

Figure 3.5 Typical Onland Oil and Gas Exploration Drill Rig

Some of the potential environmental emissions and other interactions that may be associated with onshore to offshore drilling operations therefore include:

- Light, noise and air emissions associated with on-site equipment use, drilling activities, any flaring required as part of well testing;
- Possible effects on vegetation, wetlands and other habitats due to site clearing activities, as well as potential disruption of historic and heritage resources as a result of clearing and excavating activity;
- Potential spills of fuel, drill fluids, chemicals, produced water or other materials during their use, transportation and storage;
- Solid and liquid waste generation and disposal, including drilling fluids and cuttings (treatment, storage and on-land disposal), grey / black water, cooling water, garbage, etc;
- Increased access to previously remote areas (through the development or new or expanded roads and trails, if and as required) and associated environmental issues; and
- Effects on other adjacent communities and land and resource use activities (recreational, commercial), due to site access restrictions and/or indirectly through project-related noise, visual intrusions or other changes to the nature, distribution and/or enjoyment of such areas and activities by local residents and/or visitors.

Onshore-to-offshore drilling activity in Newfoundland and Labrador also typically involves jurisdictions and regulatory processes and authorities other than the C-NLOPB, such as the provincial Departments of Natural Resources, Environment and Conservation and others.

3.2.4 Hydraulic Fracturing Activities

Hydraulic fracturing (also at times referred to as "fracking") is a stimulation process that may be performed on oil and gas wells that involve low-permeability reservoirs. In these situations, the hydrocarbons present are trapped in the pores of the surrounding rock. The hydraulic fracturing process involves pumping high pressure fluid down a well to create a network of fractures in the reservoir rock, which establish a series of pathways that allow the hydrocarbons to move more freely from the rock pores to the wellbore. The objective of this process is thus to help acquire oil and gas from identified hydrocarbon reservoirs that would not otherwise be obtainable. Hydraulic fracturing was developed initially in the late 1940s (Charlez 1997), and have been utilized in Canada since the 1950s. Since that time nearly 2.5 million fracture treatments have been performed worldwide (Montgomery and Smith 2010). With increasing experience and advancing technologies, the use of hydraulic fracturing has also spread to other areas and well types, including unconventional oil and gas (shale) and offshore petroleum wells.

The particular equipment and methods used in hydraulic fracturing varies somewhat according to the specific situation and application, but generally involves the following elements and approaches:

- The fluids used comprise a mixture of water, sand / proppant (particles that help hold fractures open) and various chemical additives, based on the specific characteristics and requirements of each well.

- Water is used as a base and comprises most of the overall fluid volume, and the flow of water acts as a delivery mechanism for the sand / proppant and chemicals. The sand / proppant fills the newly created fractures and prevents them from closing when the pumping pressure is released. The associated chemicals serve multiple purposes such as increasing the viscosity of the fluid and initiating fractures in the rock.

- At the onset of the fracturing process, plugs are set in specific locations within the wellbore to help ensure correct placement of the fractures.

- The fluid (potentially large amounts of up to several million litres) is then forced through perforations made in the wellbore, being pumped at a pressure that surpasses the fracture gradient of the surrounding rock.

- This then creates a network of fractures in the rock which are typically narrow (a few millimetres wide) in size and may extend for up to a hundred meters or more. Again, the network of fractures in the reservoir rock that is established through the hydraulic fracturing procedures creates a series of fissures that allow the hydrocarbons to move more freely from the rock pores to and up through the wellbore to the surface.

- The plugs are then removed and pressure is reduced to allow the fluid to flow back up through the well for treatment or re-use.

Hydraulic fracturing can therefore allow for optimized and enhanced recovery of hydrocarbons from a well, as well as helping to extend production by stimulating older wells which have stopped being economically viable. It can also allow for the recovery of oil and natural gas from formations that would not necessarily otherwise be technically or economically viable. Hhydraulic fracturing is an activity that has recently been proposed from an onshore to offshore exploration program in Western Newfoundland.

Potential environmental issues that may be associated with hydraulic fracturing activities include: the potential for hydrocarbons and/or the chemicals used in fracturing to reach and contaminate groundwater sources (including public drinking water sources), or for the resulting rock fractures to extend to the ocean floor resulting in the release of hydrocarbons or chemicals into the marine environment; the amount and sources of water used; the type, amounts and possible toxicity of chemicals used in the fracturing process; and the potential for chemical spills into the environment during the activity itself as well as through the transportation of chemicals and other materials on-land or in the marine environment. An additional environmental concern associated with hydraulic fracturing is the possibility of inducing geological movements, including small earthquakes (Nelson 2011).

The potential for hydraulic fracturing to occur, and questions regarding this activity and its potential environmental issues, was a topic of some discussion during the consultation activities carried out for the SEA Update (see Chapter 2 and Appendix A). As noted above, there have been recent proposals to conduct fracturing in association with planned petroleum exploration activities in Western Newfoundland (in some cases pursuant to existing exploration licences). This has resulted in a degree of interest in, and on-going discussion around, this matter amongst local residents, communities, stakeholders and relevant government agencies, which has overlapped with the completion of this SEA Update.

Although overall questions and decisions related to whether and how fracturing should be carried out in Newfoundland and Labrador in general (and the regulatory approvals for such activities) are not specific to the Western Newfoundland region (and especially, to offshore exploration licencing decisions by the C-NLOPB in the Western NL Offshore Area), this activity is considered in the SEA Update through the general identification of issues raised and potential future planning considerations, pursuant to the nature and scope of the SEA Update.

Individual, proposed exploration or production projects that involve hydraulic fracturing will require the receipt of applicable (project-specific) permits and authorizations from relevant regulatory departments and agencies.

3.2.5 Petroleum Production Activities

Offshore oil and gas production activities in the eastern portion of the NL Offshore Area has been on-going since the 1990s, and has involved the use of a number of types of production (Figure 3.6) and support infrastructure and activities (Government of Newfoundland and Labrador 2012):

- The Hibernia oilfield was discovered in 1979, and is operated by the Hibernia Management and Development Company Ltd. (HMDC). The development phase of that project commenced in late 1990 and continued until the mating of the Gravity Based Structure (GBS) and its topsides at Bull Arm NL in 1997, after which the platform was towed to and installed at its site on the Grand Banks in June of that year. With estimated recoverable reserves of 1.4 billion barrels, commercial production from the Hibernia field commenced in November 1997 and is on-going. In recent years the project has been

further expanded to include the Hibernia South Extension Unit, from which production commenced in 2011.

- The Terra Nova oilfield was discovered in 1984, declared a significant discovery in 1985, and has an estimated 419 million barrels of recoverable reserves. The Terra Nova Project is currently in operation by Suncor Energy Inc. using a floating production, storage and offloading (FPSO) vessel. Dry-dock construction of the Terra Nova FPSO vessel began in early 1999, and it arrived at Bull Arm in May 2000 where outfitting, hook-up and commissioning of the vessel took place. The FPSO arrived at the oilfield in August 2001 and began producing oil in January 2002.

- The White Rose oilfield was discovered in 1984, and a significant discovery licence for the field was issued in January 2004. The White Rose oilfield and its satellite expansions are operated by Husky Energy Inc. utilizing a FPSO vessel, and first oil was produced in November 2005. Including the oil already extracted, recoverable reserves in the White Rose and White Rose Expansion fields (North Amethyst, West White Rose and South White Rose Extension) are estimated at approximately 337 million barrels.

- The Hebron oil field was first discovered in 1980, and is estimated to contain in excess of 700 million barrels of recoverable resources. The Hebron Project is currently under development and will utilize a stand-alone concrete GBS being constructed at Bull Arm, which will be designed for an oil production rate of 150,000 barrels of oil per day. First oil from the Hebron Project is planned for 2017.

Figure 3.6 Typical Offshore Oil Production Facilities used in the NL Offshore Area

Although the specific nature of these existing oil production projects in the NL Offshore Area and their associated components and activities varies somewhat between them, in general there are a number of common elements in that they typically involve:

- Construction of production platforms (GBS, FPSO and associated topsides) or portions thereof at a Newfoundland and Labrador and/or international location, and their eventual assembly. This has also involved the development / expansion of suitable construction and fabrication facilities in the province.

- Drilling of the required on-site production and injection wells, and installation of the required subsea facilities, including wellheads, trees, manifolds, flowlines, umbilicals, risers, seabed structures (including glory hole excavations), control systems and all interfaces required to control and operate the facilities and associated test, installation, inspection and maintenance equipment.

- The eventual transportation of the production platform to the site and its interconnection to the subsea infrastructure, followed by system testing, inspection and commissioning and eventually, first oil.

- On-going operational (petroleum production) and maintenance activities, including: well drilling; petroleum recovery, storage and regular transportation by shuttle tankers to processing facilities; water and gas injection into the geological reservoir for pressure maintenance; associated supply vessel and helicopter traffic; on-shore management and administrative functions; and other operational and maintenance activities throughout the life of the project, and

- Eventual decommissioning and well abandonment procedures.

Predictions concerning likely numbers of production facilities in the SEA Update Area cannot presently be undertaken since no offshore discoveries have yet been declared and the commercial resource potential of the area is unknown. Moreover, the nature of any potential future petroleum development types, levels and overall scenarios in the Western NL Offshore Area cannot currently be defined or described with any degree of accuracy or certainty. Any attempt to do so at this point would be purely hypothetical and conjectural, and is therefore not likely to be particularly informative or meaningful at this stage. Experience with offshore petroleum discoveries and associated planning, design, regulatory approval and implementation processes and timelines in other portions of the NL Offshore Area also suggests that these can take well over a decade to advance to production from the time of a commercially significant discovery. Therefore, even if they were to occur, these activities would almost certainly fall outside of the temporal scope of the current SEA Update (Chapter 2).

Many of the overall potential environmental issues and interactions which may be associated with oil and gas production activities are similar to those associated with exploration drilling (offshore and on-shore), and include: air emissions, lights, noise, domestic and sanitary waste, and cooling water (LGL Limited 2005), although some of these will differ in magnitude or relative importance as compared to exploration programs given the nature, larger scale and longer duration associated with production activities (e.g., produced water and its management, seabed excavation and associated habitat alteration and sedimentation, support vessel and aircraft traffic, etc).

In the event that the results of any future oil and gas exploration licencing and associated seismic and drilling projects are positive and commercially significant and technically and economically viable petroleum resources

are located, any associated production activities will have to be planned and implemented in an environmentally appropriate and acceptable manner, in accordance with relevant legislation, regulations and applicable authorizations, approvals and guidelines of the day. These projects will also be subject to EA and other regulatory reviews under provincial and/or federal processes (as applicable) by the proponent(s) of those developments, as they are determined and become defined. Indeed, the above described oil production projects and other proposed petroleum related development projects in the NL Offshore Area have been subject to detailed EA reviews and a range of other regulatory requirements and standards intended to help avoid or reduce their environmental effects.

3.2.6 Potential Accidental Events and Malfunctions

During an offshore exploration drilling or petroleum production project, an accidental event or malfunction is an unlikely, although unfortunately possible, occurrence. Environmental incidents that may be associated with offshore drilling activities include potential blowouts (subsea and surface), as well as other possible spills of hydrocarbons or other substances from a drill rig, production platform and/or associated vessel activities, which may vary considerably in terms of their nature, scale, duration and potential environmental consequences.

A blowout is an unplanned and uncontrolled release of petroleum from a subsea oil or gas well after a failure in the drilling system and its associated pressure control mechanisms, resulting in the continuous discharge of hydrocarbons into the surrounding waters. Blowout events could potentially occur at various stages of drilling and locations within the drilling installation (subsea, above surface), the nature, duration, behaviour and outcomes of which depend on various factors, such as water depth, the amount and properties of the hydrocarbons involved, currents and other oceanographic features, and other factors.

In addition to accidental events such as blowouts, the standard and routine use, storage and movement of fuels, drilling fluids, lubricants and other chemicals and substances on offshore installations and supply vessels also has the potential to result in accidental spills into the marine environment. These often comprise instantaneous or short-duration discharges of oil or other materials into the marine environment during planned drilling activities.

3.2.6.1 Spill History of the Offshore Petroleum Industry

Several information sources and statistics are available to characterize and quantify the relative proportion of petroleum types and sources released from oil and gas exploration and production activities into the marine environment. United States sources are often quoted due to the relatively long reporting period (since 1964) with frequent updates since then, as well as the high standard of reporting and analyses completed. As well, the proximity of the US operations to Atlantic Canada and generally similar drilling equipment and practices render these data particularly relevant and informative. Updates are made to the spill record as incidents occur so that an evaluation of the most recent occurrence of events and possible trends is also possible using this information.

Statistics compiled by the US National Research Council (NRC 2002) describe the sources and inputs for oil released to the ocean. These take into account the occurrence of natural seeps of oil, as well as anthropogenic sources associated with the extraction (from platform, atmospheric and produced water releases), transportation, and consumption of petroleum. Table 3.1 presents average, annual releases of petroleum by source during the period from 1990-1999 for North American and worldwide waters.

Table 3.1 Annual Petroleum Spill Statistics from Natural and Artificial Sources for the Period 1990-1999

Average Annual Releases (1990-1999)						
Petroleum Spill Source	**North America (thousands of tonnes)**			**Worldwide (thousands of tonnes)**		
	Best Estimate	**Min**	**Max**	**Best Estimate**	**Min**	**Max**
Natural Seeps	160	80	240	600	200	2000
Extraction of Petroleum	3.0	2.3	4.3	38	20	62
Platforms	0.16	0.15	0.18	0.86	0.29	1.4
Atmospheric Deposition	0.12	0.07	0.45	1.3	0.38	2.6
Produced Water	2.7	2.1	3.7	36	19	58
Transportation of Petroleum	9.1	7.4	11	150	120	260
Pipeline Spills	1.9	1.7	2.1	12	6.1	37
Tank Vessel Spills	5.3	4.0	6.4	100	93	130
Operational Discharges (Cargo Washings)	na[A]	na	na	36	18	72
Coastal Facility Spills	1.9	1.7	2.2	4.9	2.4	15
Atmospheric Deposition	0.01	trace	0.02	0.4	0.2	1
Consumption of Petroleum	84	16	2000	480	130	6000
Land-Based (River and Runoff)	54	2.6	1900	140	6.8	5000
Recreational Marine Vessel	5.6	2.2	9	nd[B]	nd	nd
Spills (Non-Tank Vessels)	1.2	1.1	1.4	7.1	6.5	8.8
Operational Discharges (Vessels 100 GT)	0.10	0.03	0.30	270	90	810
Operational Discharges (Vessels <100 GT)	0.12	0.03	0.30	nd[C]	nd	nd
Atmospheric Deposition	21	9.1	81	52	23	200
Jettisoned Aircraft Fuel	1.5	1.0	4.4	7.5	5.0	22
TOTAL (thousands of tonnes)	260	110	2300	1300	470	8300

Source: NRC (2002)
A: Cargo washing is not permitted in US waters, but is not widely restricted worldwide
B: Worldwide recreational vessel population data were not available.
C: Insufficient data for this class of vessels.

Spills related to extraction of petroleum accounted for 1.2 percent (3 ktonnes / 260 ktonnes) of the total annual release in North America, and 2.9 percent (38 ktonnes / 1,300 ktonnes) worldwide. At least 90 percent of the amounts related to extraction of petroleum are associated with controlled releases during the disposal of produced water that contains low concentrations of hydrocarbons. The largest sources of petroleum into the ocean are naturally occurring seeps from geologic strata beneath the seafloor. From 1990 to 1999, natural seeps amounted for 45 percent (160 ktonnes / 260 ktonnes) of the total annual oil released into the world's oceans, and 60 percent for North American waters. Seeps can be a useful indicator of potential economic reserves of petroleum, but they also represent natural laboratories for studying the adaptive responses of the marine ecosystems under prolonged chemical exposure (NRC 2002). Overall, offshore platform spills have been a relatively minor contributor to the total amount (Table 3.1).

In the US, the Bureau of Ocean Energy Management, Regulation and Enforcement (BOEMRE), formerly the Minerals Management Service (MMS), was replaced in October 2011 by the Bureau of Ocean Energy Management (BOEM) and the Bureau of Safety and Environmental Enforcement (BSEE) as part of a major reorganization. Together with the US Coast Guard (USCG), BSEE shares responsibility for reporting on all deaths, serious injuries, major fires and major oil spills resulting from oil and gas exploration, development and production on the US Outer Continental Shelf (OCS). This includes Gulf of Mexico (GOM) and Pacific (PAC) activities, although over the past number of years the vast majority of activity has been in the Gulf of Mexico. While some drilling close to shore (generally between 3 and 9 nautical miles) falls under the respective state jurisdictions, this comprises a very small percentage of offshore activity in the US, and so that the sample set considered in these statistics is considered representative of the vast majority of drilling activities.

For the US OCS, the comprehensive database of substantial spills (greater than 50 bbl, or 7.95 m^3) resulting from oil and gas activities compiled by BSEE provides up-to-date statistics (BSEE 2013). Figure 3.7 presents annual counts of the numbers of all petroleum spills from OCS oil and gas activities from 1964 to 2012. This includes platforms / rigs, pipelines, and vessels, and counts of spills greater than or equal to 1 bbl and greater than or equal to 50 bbl. Figure 3.8 presents the total volume of all spills for the same activities and time period. Figure 3.9 presents a breakdown of the product associated with each spill incident which has been reported since 1996.

As shown in Figure 3.7, the number of spills reported for the US OCS was comparatively small from 1964 until peaking in 1971 with 274 spills greater than or equal to 1 bbl and 11 spills greater than or equal to 50 bbl. A decreasing trend is evident until about 1989 after which the number of spills remained about constant, averaging 34.6 and 5.5 spills per year until 2003. The number of spills increased again in 2004 and 2005, and again in 2008, before 24.8 and 6.8 spills per year were averaged between 2009 and 2012. As noted by MMS at the time (August 2006), "The 2004 increase is due to Hurricane Ivan which accounted for 15 of the 24 spills. Ivan is the first hurricane for which unrecovered petroleum and chemicals on destroyed, heavily damaged, and/or missing structures were reported in a comprehensive manner", and "The 2005 increase is due to Hurricane Katrina which accounts for 24 spills, and Hurricane Rita which accounts for 18 of the spills. Only seven of the spills are not hurricane related. Katrina and Rita are the second and third hurricanes (following Ivan) for which unrecovered petroleum and chemicals on destroyed, heavily damaged, and/or missing structures were reported in a comprehensive manner".

Due to a range of circumstances and conditions it is difficult to predict occurrence rates for oil spills with a high degree of certainty. It is clear, however, from the above described hurricane events that exacerbated spill incidents in the Gulf of Mexico, that environmental conditions can play a significant role in determining spill occurrence rates. As noted in Chapters 4 and 5, although the SEA Update Area may not be prone to major hurricanes, tropical and extra-tropical storms in the North Atlantic are somewhat of a normal occurrence for June through November and their possible implications for a drilling project must be considered in planning. Ever-changing environmental conditions will also continue to be a possible compounding factor.

The total annual volume of spills in the US OCS is shown in Figure 3.8. There are peaks in the total spill volumes up to 90,000 to 161,000 bbl (~26,000 m^3 or 26 million L) from 1967 to 1970. Total annual spill volumes reached about 20,000 bbl in 1973, 1974, 1988 and 1990. Excluding those four years, from 1971 through 2009 the annual spill volume is fairly constant, averaging 2,600 bbl. The Deepwater Horizon spill in 2010 resulted in an estimated 4.9 million barrels (before accounting for containment) of crude oil released (USCG 2011), although the actual spill amount remains to be determined (BSEE 2013).

Figure 3.7 Number of Petroleum Spills from US OCS Oil and Gas Activities (1964–2012, Data from BSEE 2013)

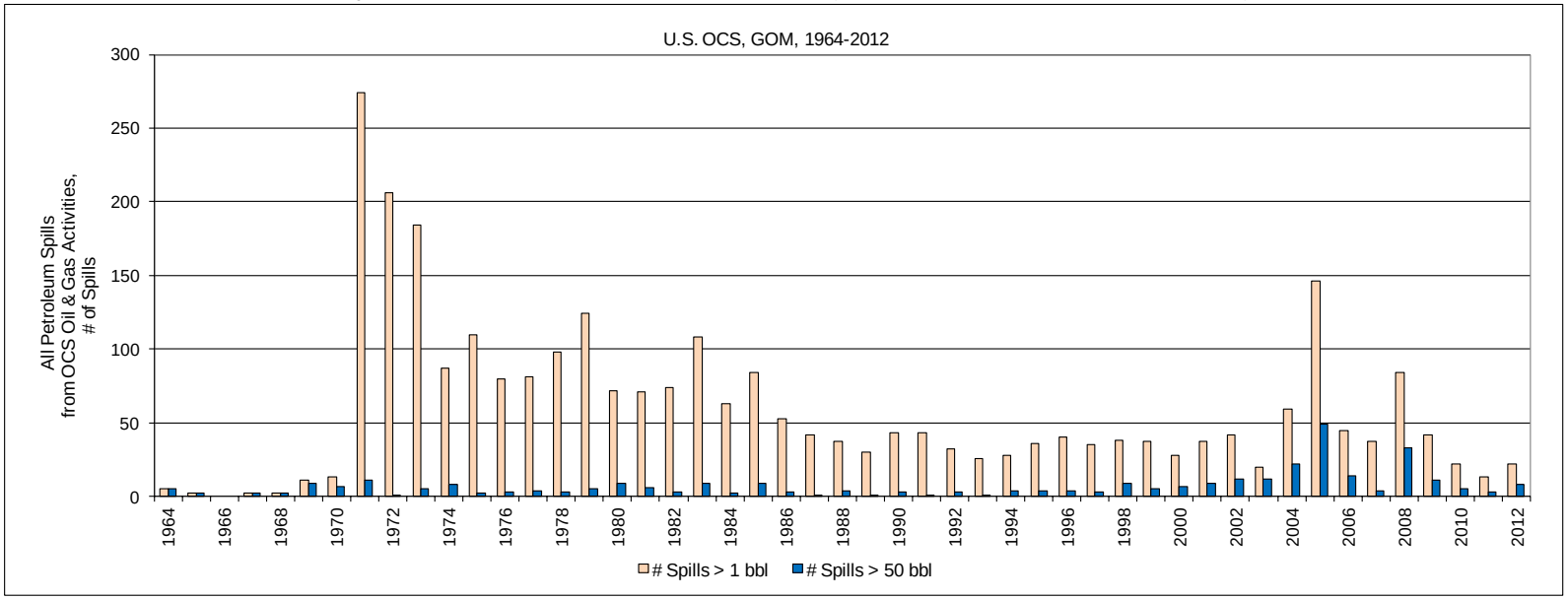


Figure 3.8 Total Spill Volumes from US OCS Oil and Gas Activities (1964–2012, Data from BSEE 2013)

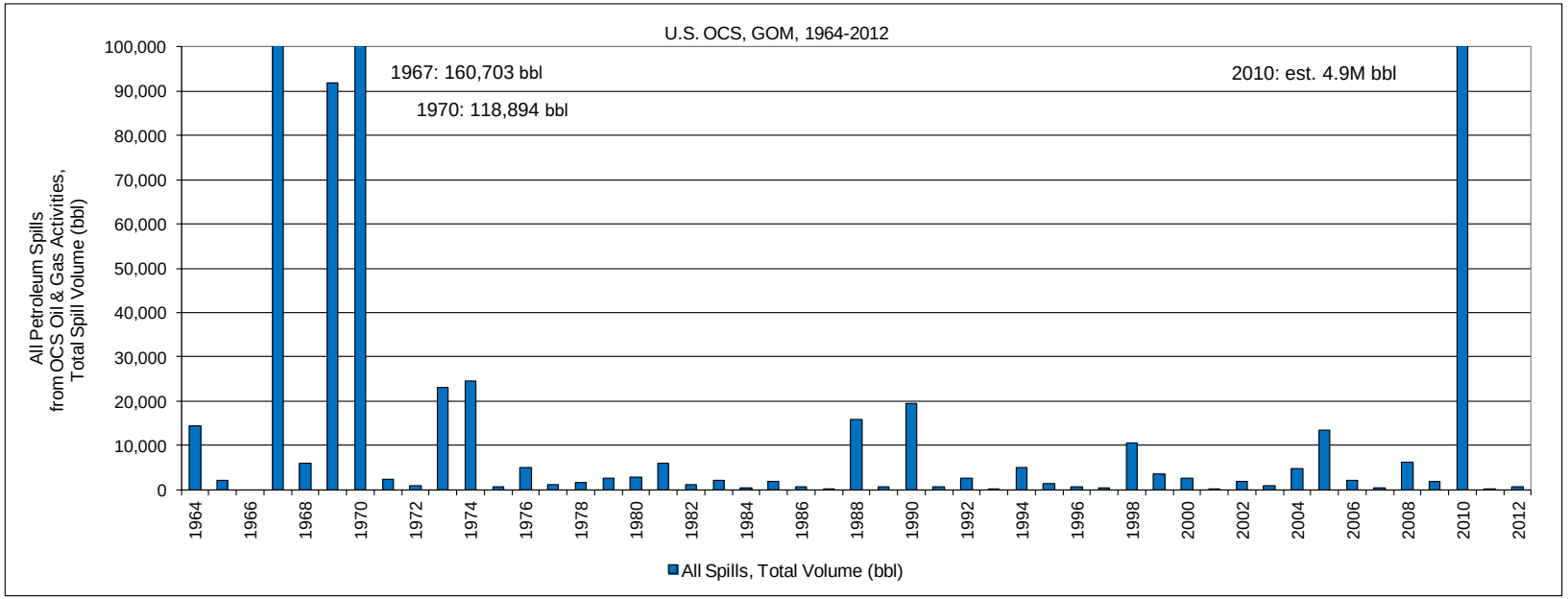
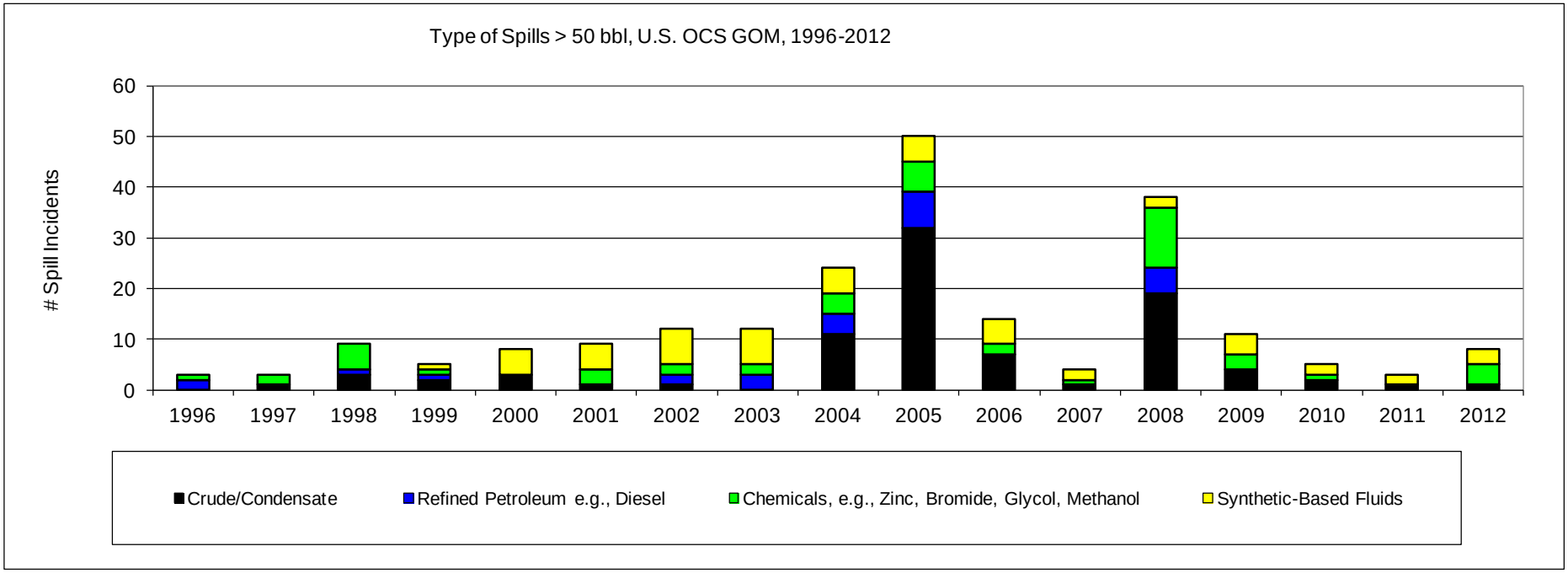


Figure 3.9 Petroleum Spills from US OCS Oil and Gas Activities by Type of Spills (1996-2012, Data from BSEE 2013)



Although drilling activity details such as type of drilling platform, water depth, and type of well would be typically recorded with many incidents, a breakdown of spill statistics by these parameters to identify possible occurrence rates or trends is not readily available from any of the above-described sources.

The worst case scenario in terms of an offshore accident resulting in the release of oil in the marine environment likely consists of a well blowout that could discharge large quantities of oil over a period of time. A blowout, or loss of well control, is defined as "the uncontrolled flow of formation or other fluids, including flow to an exposed formation (an underground blowout) or at the surface (a surface blowout), flow through a diverter, or uncontrolled flow resulting from a failure of surface equipment or procedures" (Etkin 2011).

There have been two blowouts in Canadian waters to date, both of which took place in the Nova Scotia Offshore Area (Angus and Mitchell 2010). The first one was a Shell exploratory gas well, at a water depth of 153 m, which experienced a blowout in February 1984, and subsequently released approximately 2 million m^3 (70 million ft^3) of gas and 48 m^3 (1700 ft^3) of condensate per day for 13 days. The second one was a Mobil exploratory gas well at a water depth of 38 m, which experienced a subsurface blowout in April 1985. The second event did not result in any release of hydrocarbons to the ocean or to the atmosphere (Angus and Mitchell 2010), and therefore, was not included as a blowout event causing a spill to the environment (Table 3.2).

In US waters there have been three oil well blowouts involving spills larger than 50,000 barrels since offshore drilling began in the 1950s, including the 2010 Deepwater Horizon Macondo well blowout in the Gulf of Mexico (Stantec 2011). Due to the relatively small number of blowouts in North American waters, the worldwide record of very large and extremely large blowout spills (following the spill categories outlined in Table 3.3) was considered for a more robust estimate of the blowout probability of occurrence. The recorded blowouts involving spills of more than 10,000 barrels are listed in Table 3.4.

The historical spill data presented in Table 3.4 include the categories of very large and extremely large spills. Apart from the spills listed here, there have been no large (>1,000 barrel) spills during offshore drilling in the waters of the US Outer Continental Shelf (OCS) and the North Sea, and only one occurrence of a 2,380 barrel spill in India in 1998 (Stantec 2011). Hereinafter these categories are therefore collectively referred to as "large spills". The frequency of these spills was considered in the context of approximately 50,433 offshore exploration and delineation wells drilled worldwide by May 2010 (Deloitte Petroleum Services 2010; Stantec 2011).

The trend of historical frequencies of large spills through the decades is shown in Table 3.5. It is apparent that there is a downward trend until the 2000s, with an increase again in the most recent decade.

Table 3.2 Blowout Frequencies for Exploration and Development Wells in Eastern Canada

Region	Number of Exploratory Wells	Number of Development Wells	Number of Blowouts	Exploration Blowout Frequency	Overall Blowout Frequency
Newfoundland and Labrador	198	164	0	0	0
Nova Scotia	154	53	1 (exploration)	6.5×10^{-3}	4.8×10^{-3}
Total	352	217	1 (exploration)	2.8×10^{-3}	1.8×10^{-3}
Source: Adapted from Stantec (2011), Data by Deloitte Petroleum Services (2010)					

Table 3.3 Definitions of Hydrocarbon Spill Categories by Size

Hydrocarbon Spill Category	Spill Size	
	bbl	m^3
Extremely Large	>150,000	>23,850
Very Large	>10,000	>1,590
Large	>1,000	>159
Small	<1	<0.159
Sources: Stantec (2011). Note: The large, very large and extremely large categories are cumulative		

Table 3.4 Historical Large Spills from Offshore Oil Well Blowouts Worldwide

Area	Reported Spill Size (bbl)	Date	Operation
US, Santa Barbara	77,000	1969	Production
US, S. Timbalier 26	53,000	1970	Wireline
US, Main Pass 41	30,000	1970	Production
Trinidad	10,000	1973	Development
Norway, North Sea	158,000	1977	Workover
Mexico (Ixtoc 1)[A]	3,000,000	1979	Exploration
Nigeria	200,000	1980	Development
Iran	100,000	1980	Development
Saudi Arabia	60,000	1980	Exploration
Mexico	247,000	1986	Workover
Mexico	56,000	1987	Exploration
US, Timbalier Bay / Greenhill	11,500	1992	Production
Australia[B]	30,000	2009	Development
US, Gulf of Mexico[B]	4,000,000	2010	Exploration
Source: adapted from Stantec (2011) Notes: A: Spill volume likely underestimated. B: Spill estimates are not final.			

Table 3.5 Historical Frequencies of Large Offshore Drilling-Related Blowouts by Decade

Period	Incidents	Number of Wells Worldwide	Blowout Frequency	Probability
1971 – 1980	5	20,116	2.49×10^{-4}	1 in 4,020 wells
1981 – 1990	1	29,527	3.39×10^{-5}	1 in 29,500 wells
1991 – 2000	0	28,118	0	0
2001 – 2010	2	26,732	7.48×10^{-5}	1 in 13,400 wells
Source: Adapted from Stantec (2011), Data by Deloitte Petroleum Services (2010)				

Well blowouts can cause considerable damage to drilling rigs, injuries or fatalities to rig personnel and may result in discharges of reservoir fluids to the ocean and atmosphere. Where a gas formation is being drilled, the well would flow gas whereas an oil formation would be expected to flow mostly oil, and where the formation contains both oil and gas, a mixture of oil and gas would be released. Whether and what volume of hydrocarbons reach the surface will depend on well and site specific characteristics and other factors.

In order to take into account the occurrence of all blowouts, US OCS data representing the period from 1980 to 2010 have been compiled in Table 3.6. Although not shown in the Table, Stantec (2011) estimated from data by Deloitte (2010) that approximately 12,000 exploration wells were drilled during this period. Therefore, the estimated blowout frequency during exploration drilling was estimated at 3.75×10^{-3} blowouts per well, or 1 in 267 wells (45 blowouts / 12,000 wells).

An estimate based on more recent data (22 years from January 1, 1988 through December 31, 2009) by Scandpower (2010), and reported in Acona Wellpro AS (2010) was lower at 1.6×10^{-4} blowouts per well, equivalent to 1 in 6,250 wells drilled.

Table 3.6 Blowout and Spill Occurrence Statistics from US Federal Offshore Wells (1980-2010)

Year	Well Starts	Drilling Blowouts				Non-drilling Blowouts						Total Blowouts		OCS Production
		Exploration		Development		Production		Workover		Completion				
		#	bbl	#	bbl	#	bbl	#	bbl	#	bbl	#	bbl	MMbbl
1980s	11,071	19	0	21	0	7	0	19	113	6	60	72	173	3,407.3
1990s	8,765	17	300	16	0	2	0	5	0	3	0	44	302	4,292.4
2000s	8,390[A]	9	4M[B]	9	1	8	378	7	12	1	0	29	380	5,389.64
Total	28,226	45	4M[B]	46	1	17	378	31	125	10	60	145	855	13,089.34

Source: Stantec (2011)
Notes:
A: Most recent three years estimated.
B: Total includes an estimated 4,000,000 bbl from Macondo spill, and 316 barrels in 44 other incidents

Certainly one objective of reviewing historical spill information is to learn from past experiences and identify areas for future planning and continuous improvement. Despite oil and gas activity technological advances, as well as enhancements in the associated safety, environmental protection and regulatory practices that have been achieved, the possibility (and prevention) of large spills remains an ongoing concern and key priority for both offshore oil and gas operators, spill responders, regulators and the public (Etkin 2011). This has been further illustrated and reinforced as a result of the recent Deepwater Horizon incident. Amongst the conclusions of the Deepwater Horizon Study Group were that the Macondo well blowout was a preventable incident had progressive guidelines and practices been followed, amongst other contributing factors (Deepwater Horizon Study Group 2011).

3.2.6.2 Previous Spills in the NL Offshore Area

The C-NLOPB reports spill incidents for activities offshore Newfoundland and Labrador. Details include numbers of incidents, spill volumes, spilled product, spill size and a description of the incident. Exploration and production hydrocarbon spill Information for the NL Offshore Area can be obtained and reviewed on the C-NLOPB web site (C-NLOPB 2013).

Figure 3.10 presents annual counts of the number of all spills greater than 1 L from 1997 to 2012, based on C-NLOPB data. The total number is 238 spill incidents over this 16-year period, with an average of 14.9 spills per year. The number of spills each year has ranged from three in 2012 to 39 in 2011.

Figure 3.11 presents a corresponding (including those spills smaller than 1 L) annual total spill volume. The maximum annual spill total volume was 274,000 L in 2004 resulting from the November spill of 165,000 L of crude oil at Terra Nova due to produced water separation process failure, and the October spill of 96,000 L synthetic based mud. The total spill volume over this 16-year period is 469,144 L, with an average of 29,322 L of oil spilled per year.

Figure 3.12 presents a breakdown of the spill product associated with each spill incident. Hydraulic and lubricating oil accounted for about 35 percent of the spill incidents, while crude oil accounts for about 26 percent. Spills have occurred in every year, although there are no obvious trends over the 1997-2012 time period for the number of spills, amount of oil spilled or types of product spilled.

Figure 3.10 Number of Spill Incidents (> 1 L), NL Offshore Area (1997-2012)

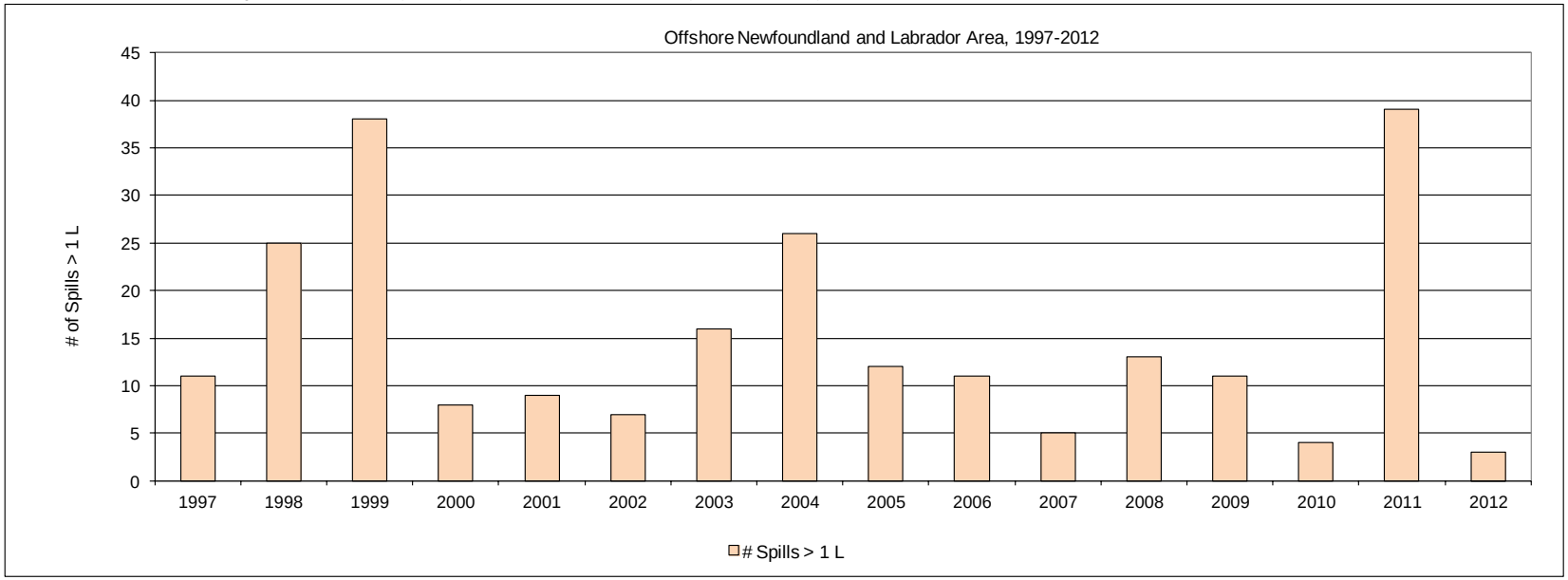


Figure 3.11 Total Spill Volume, NL Offshore Area (1997-2012)

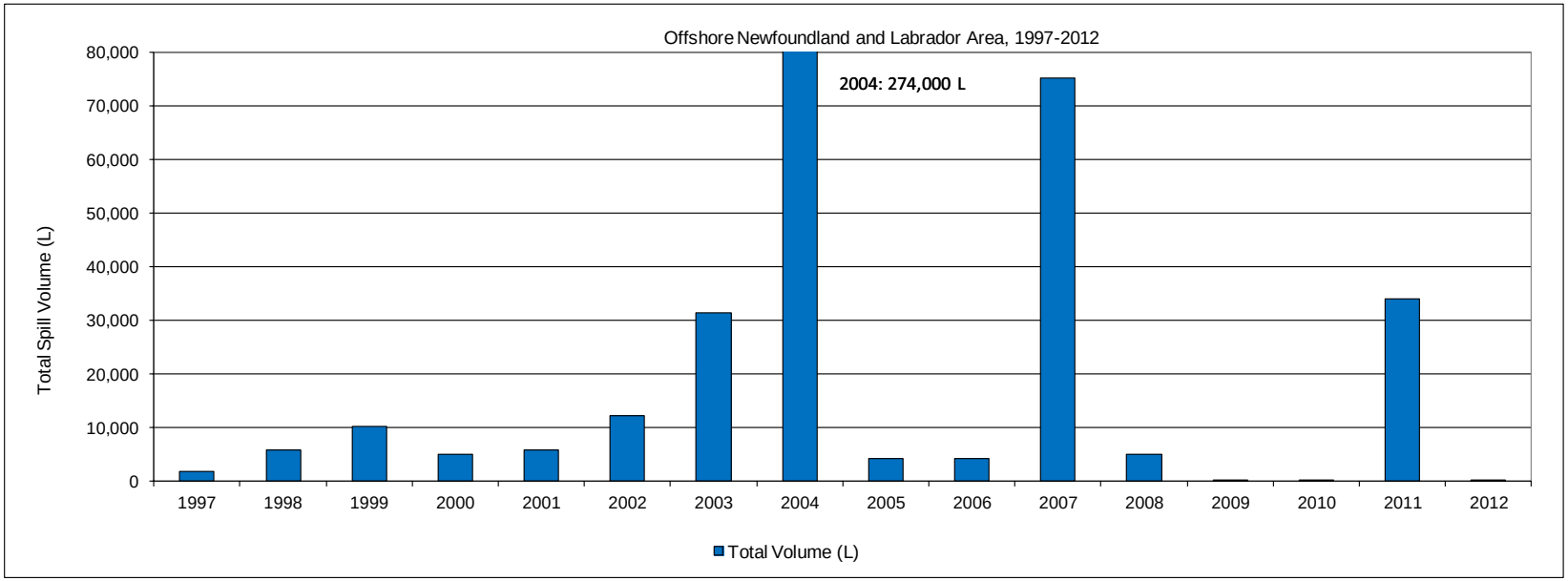
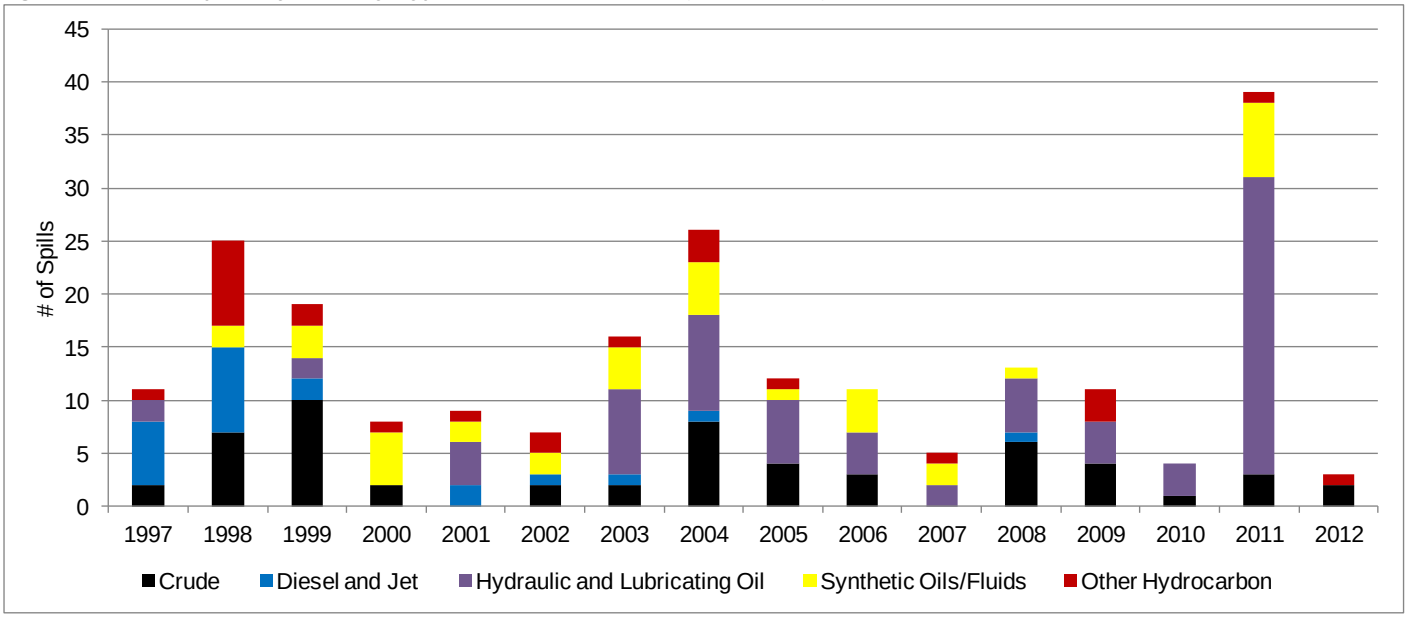


Figure 3.12 Spills by Year by Type, NL Offshore Area (1997-2012)



The following Figures present the cumulative (1997-2011) spill frequency and spill volume by type for both exploration drilling (Figures 3.13 and 3.14) and development drilling and production (Figures 3.15 and 3.16) in the NL Offshore Area, based on available C-NLOPB data. For exploration drilling in the NL Offshore Area from 1997-2011, synthetic oils and fluids constituted 14.5 percent of all spill incidents, while making up 95.1 percent of the total volume of spills. For development drilling and production, synthetic oils and fluids constitute a similarly low proportion (10.8 percent) of all spill incidents, while making up 49.3 percent of the total volume of spills. Spills of crude oil accounted for only 2.3 percent of the total volume of materials spilled during exploration drilling in the NL Offshore Area from 1997-2011, and 49.9 percent of spilled volumes as a result of development drilling and production activities.

Figure 3.13 Spill Frequency by Type, Exploration Drilling - NL Offshore Area, 1997-2011 (% of Incidents)

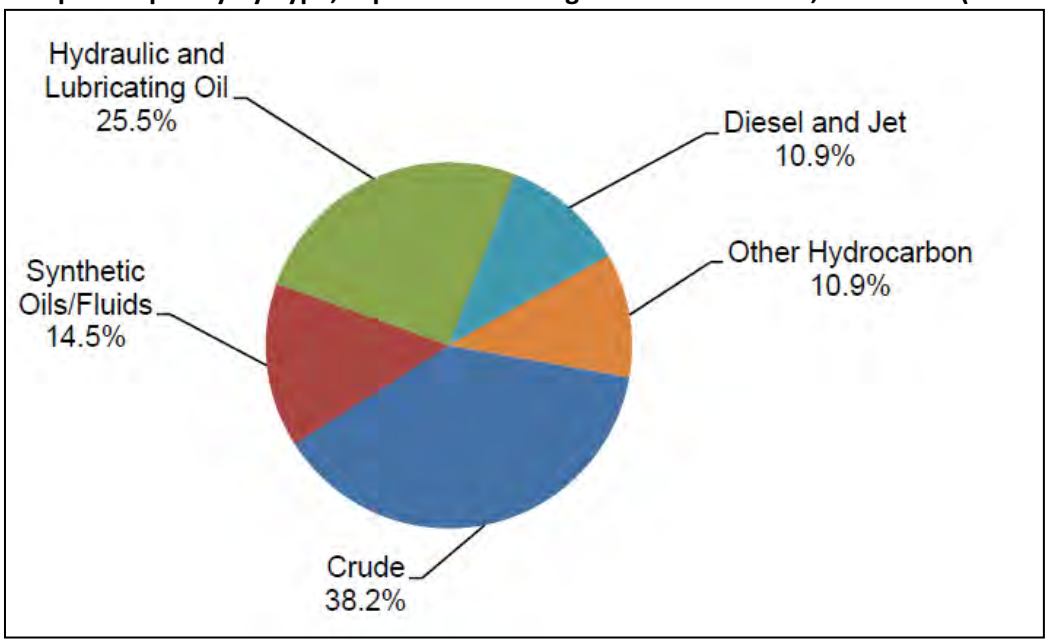


Figure 3.14 Spill Volume by Type, Exploration Drilling - NL Offshore Area, 1997-2011 (% of Volume)

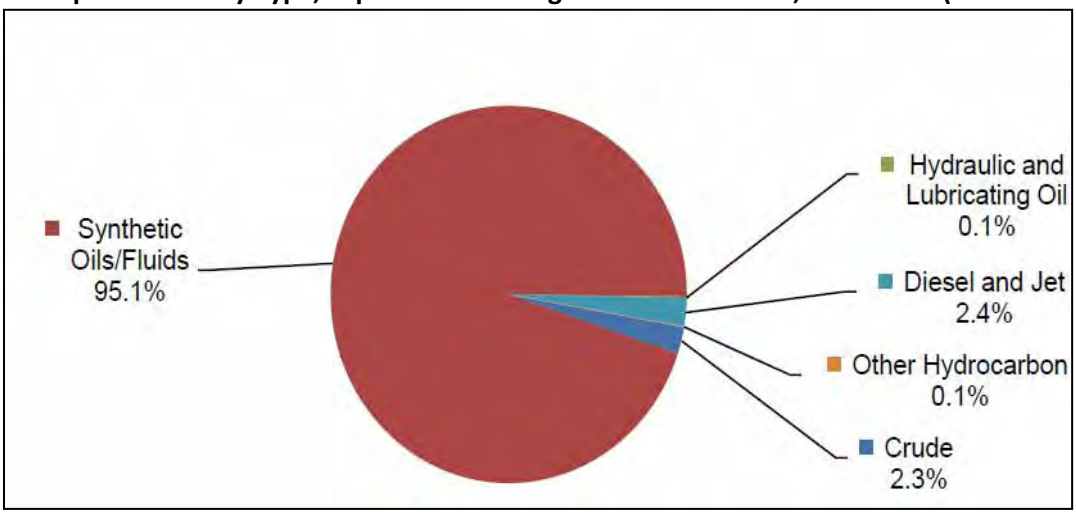


Figure 3.15 Spill Frequency by Type, Development Drilling and Production - NL Offshore Area, 1997-2011 (% of Incidents)

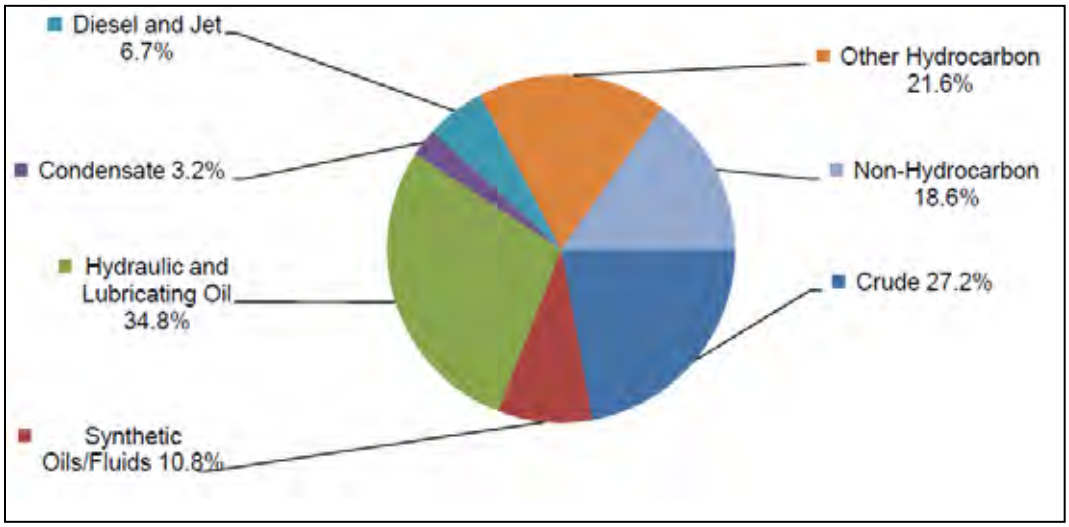


Figure 3.16 Spill Volume by Type, Development Drilling and Production - NL Offshore Area, 1997-2011 (% of Volume)

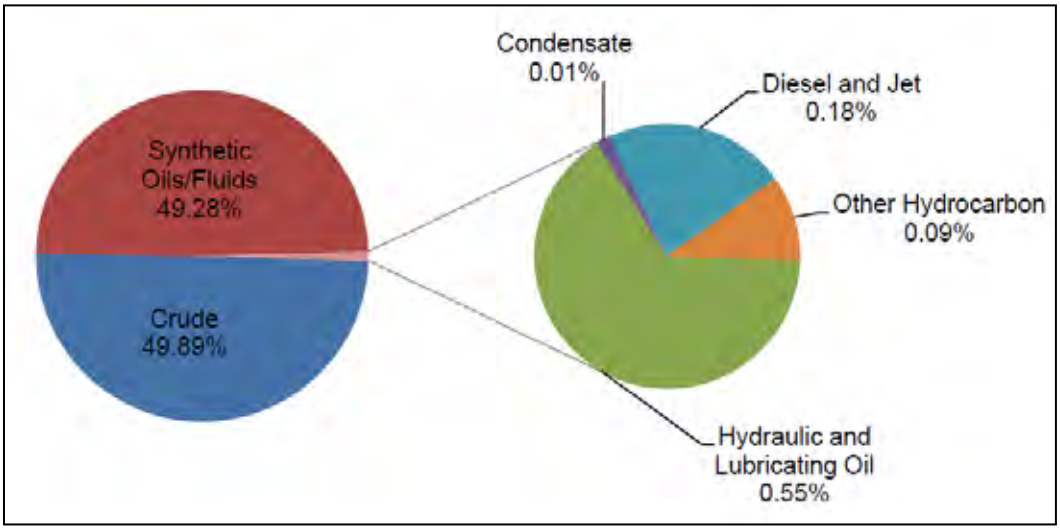
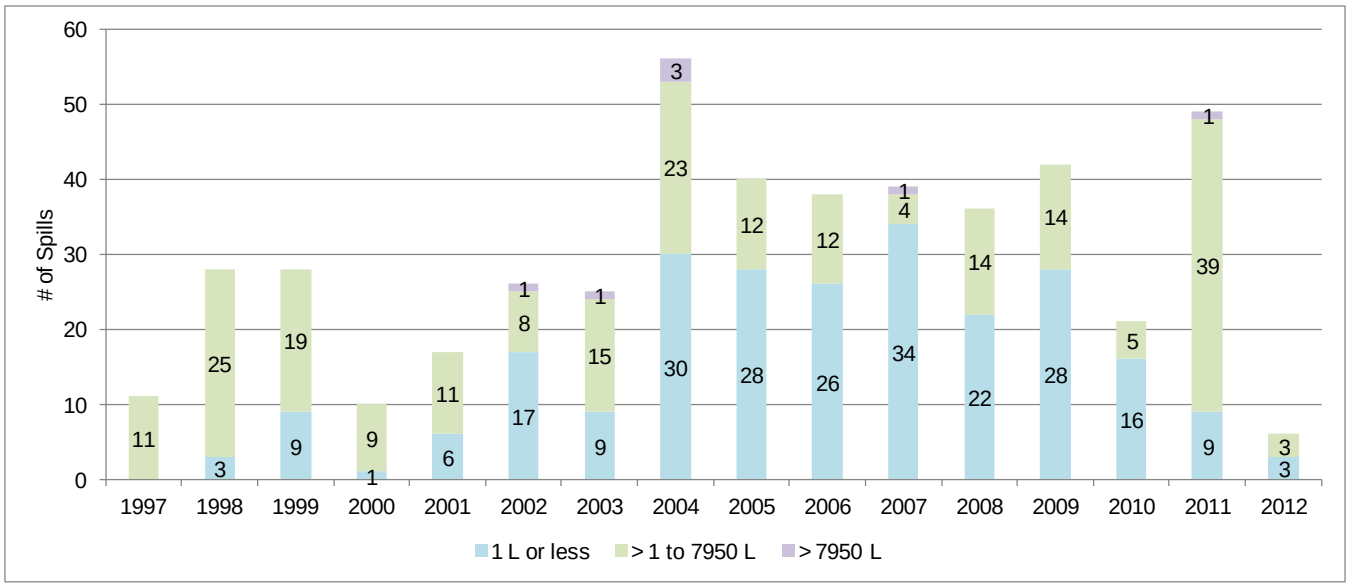


Table 3.7 provides annual and overall spill statistics for exploration and production activities in the NL Offshore Area for the five-year period from 2007-2011. Over that timeframe there were from 19 to 49 spills per year, and a total of 187 spills, which resulted in 115,625 L of synthetic based drilling fluid and other hydrocarbons being spilled into the marine environment. The total number of spills resulting specifically from exploration activities off Newfoundland and Labrador over that five-year period was 16, which collectively totalled 102,796 L of spilled material. Almost 100 percent (99.94) of the material spilled during that period was comprised of SBMs, with the remaining 0.06 percent coming from 10 spills totalling 58 L of other hydrocarbons (Table 3.7; C-NLOPB 2013).

Figure 3.17 presents an annual inventory of oil spills for the NL Offshore Area for the period 1997 to 2012 by spill size, where three categories have been defined: a) 1 L or less; b) 1 L to 7,950 L (about 50 bbl in order to generally align with the US OCS threshold); and c) greater than 7,950 L. During this 16-year period there have been a total of 472 spills: 241 spills of 1 L or less, 224 spills of 1 L to 7950 L, and seven spills greater than 7,950 L.

Figure 3.17 Spills by Size, NL Offshore Area (1997-2012)



Source: Data from C-NLOPB (2013)

The large scale oil spills discussed in the previous sections therefore continue to represent a rare occurrence, with most recorded spills consisting of small amounts of hydrocarbons released to the environment.

Table 3.7 Exploration and Production Hydrocarbon Spill Information, NL Offshore Area (2007 – 2011)

	2007		2008		2009		2010		2011		Total 2007-2011	
	Number	Volume (L)	Number	Volume (L)	Number	Volume (L)	Number	Volume (L)	Number	Volume (L)	Number	Volume (L)
Exploration Drilling												
Synthetic Based Drilling Fluid	1	74000.00	0	0.00	1	1.00	0	0.00	4	28737.00	6	102738.00
All Other Hydrocarbons	0	0.00	1	0.02	4	10.10	3	3.84	2	43.79	10	57.75
TOTAL	1	74000.00	1	0.02	5	11.10	3	3.84	6	28780.79	16	102795.75
Development Drilling and Production												
Synthetic Based Drilling Fluid	1	1089.00	1	100.00	1	0.10	0	0.00	4	5606.00	7	6795.10
All Other Hydrocarbons	37	97.28	36	4809.62	36	286.34	16	185.05	39	655.88	164	6034.17
TOTAL	38	1186.28	37	4909.62	37	286.44	16	185.05	43	6261.88	171	12829.27
Total: Exploration and Production												
Synthetic Based Drilling Fluid	2	75089.00	1	100.00	2	1.10	0	0.00	8	34343.00	13	109533.1
All Other Hydrocarbons	37	97.28	37	4809.64	40	296.44	19	188.89	41	699.67	174	6091.92
TOTAL	39	75186.28	38	4909.64	42	297.54	19	188.89	49	35042.67	187	115625.02
Source: Environment Statistics, Summary Information (1997-2011) Spill Frequency and Volume, C-NLOPB (2013)												

Oil Spill Fate and Behaviour

The fate and behaviour of accidental spills are dependent upon site and well-specific characteristics, such as the type and specific properties of the hydrocarbons involved, oceanographic conditions at the well site (e.g., wind and currents, and potentially ice), as well as the specific size, location and timing of the spill. Regulatory reviews for individual proposed drilling programs in the NL Offshore Area therefore typically include a project- and site-specific analysis of oil spill probabilities, as well as of oceanographic conditions at the drill site and hydrocarbon properties which are used to carry out detailed trajectory modelling studies of the likely behaviour of possible (hypothetical) oil spills. These modelling outputs, in turn, inform the EA analyses for these projects in terms of the probability of accidental events and malfunctions, required mitigation (prevention and response) measures, and potential for significant adverse environmental effects.

Although the probability of a large-scale oil spill is low, operators off in the Western NL Offshore Area may have to contend with sea ice in the Gulf of St. Lawrence for part of the year. Depending on location, this may be from January to as late as mid-June. The location will also determine the magnitude and extend of sea ice presence. In practice, the presence of sea ice will tend to slow the advection of an oil spill and to reduce evaporation and dispersion (McKenna and McClintock 2005). In the presence of sea ice, the evaporation rate is reduced and can be approximated to consider only the open water fraction, while the dispersion rate also is reduced due to the ice's damping effect on motion of the sea surface. Where ice is present in significant concentrations, potential spills will be transported with and fully integrated into the ice. Sea ice conditions and influences, as well as wind, current and sea surface temperature at the time of a spill, will be geographically dependent and therefore also quite site and project specific.

Synthetic Based Mud Spills

SBMs are drilling muds in which the continuous phase consists of a synthetic base fluid, while the dispersed phase consists of brine and other additives. SBMs have been developed as a more environmentally benign alternative to oil-based muds (OBM), as the synthetic fluids that comprise the continuous phase exhibit low toxicity to aquatic life and are more biodegradable in marine sediments than OBM. SBM have been adopted for use in offshore drilling operations for nearly two decades. They exhibit several performance advantages over the more commonly used WBMs; therefore, they are commonly used for challenging wells in deep water, or in wells with highly deviated wellbores. They serve several essential functions during the drilling process: transport of cuttings to the surface; cooling, cleaning and lubrication of the drill bit; maintaining a pressure balance between the geological formation and the borehole; reduction of friction in the borehole; sealing of permeable formations; and maintaining stability of the borehole walls (Burke and Veil 1995).

Where there is technical justification (e.g., requirements for enhanced lubricity or for gas hydrate mitigation), operators may use SBMs or enhanced mineral oil based mud (EMOBM) in the drilling of wells and well sections. Other than the residual base fluid retained on cuttings as described in the Operator's EPP, no whole SBM or EMOBM base fluid, or any whole mud containing these constituents as a base fluid, should be discharged to the sea (NEB et al 2010). The aforementioned C-NLOPB spill incident database contains a listing of the reported accidental spills of SBM, the amounts spilled, the operators and rigs involved, as well as the locations on the rig system where the reported spill likely originated.

The SBM spills recorded in the 1997 – 2010 period have been classified by spill size in Table 3.8. The frequencies of occurrence of the various spill categories have been calculated based on 219 wells drilled during that period.

The largest SBM spill to date in the NL Offshore Area was recorded in 2004, with approximately 96,600 L (96.6 m^3) of SBM spilled from the diverter line of the GSF Grand Banks at the White Rose location (Stantec 2011). The most substantial SBM release in Atlantic Canada of 354,000 L (354 m^3) occurred at the Crimson F-81 well in 2004 in the Nova Scotia Offshore Area (C-NSOPB 2005).

Table 3.8 Synthetic Based Mud Accidental Spills in Newfoundland and Labrador (1997 – 2010)

SBM Spill Size Range	Number of Spills	Frequency per Well
1 L to 159 L	36	0.16
159 to 7934 L (1 to 49.9 bbl)	18	0.082
7,935 to 159,000 L (50 to 999 bbl)	5	0.023
Greater than 159,000 L (1,000 bbl)	0	0
Source: Stantec (2011)		

SBM exhibit a unique behaviour in the marine environment due to the fact that they are immiscible in water, and are typically negatively buoyant. Unlike WBMs, they tend to form distinct jets and droplets that fall relatively rapidly through the water column, and are prone to form visible and clearly-defined streams and pools at the seafloor, where their dispersion is in large part driven by gravity in conjunction with the local seafloor features. Approaches for modeling the dispersion of water-based fluids are therefore not applicable to SBM. Some key aspects of SBM behaviour that determine how they would spread in the marine environment include the breakup of the fluid into droplets of varying sizes and the stability of the SBM emulsion under different release and environmental conditions, as well as the terminal fall velocity of the droplets.

The SwRI (2007) conducted an experimental study of fall velocities for five different batches of SBM, exhibiting a range of densities used by industry in offshore drilling in the Gulf of Mexico. They designed their experiment in such a way as to capture the most frequent spill modes. Furthermore, their experimental setup allowed them to simulate overboard spills of SBM (dropped above the sea surface), as well as to capture the different flow regimes for low- and high-speed jets for each of the SBM samples, and to measure the fall velocity distributions for each of the spill scenarios. It is not yet clear to what extent their laboratory findings are applicable to field conditions, however, but their quantitative estimates of SBM fall velocities represent a rare and valuable contribution and a basis for modeling the dispersion and spatial extent of SBM spills in the marine environment. No known studies have been completed to date that have investigated the physical dispersion and spatial extent of potential accidental SBM spills in the SEA Update Area.

3.2.6.3 Oil Spill Prevention and Response

The C-NLOPB, other federal and provincial regulatory agencies, stakeholders, and offshore petroleum operators have clearly recognized and stated that the prevention of oil spills is by far the preferred and most effective way to avoid the potentially significant environmental consequences that may result from a large scale spill event. Indeed, in response to the recent *Report of the Commissioner of the Environment and Sustainable Development* (CESD 2012), the C-NLOPB has reiterated that while more can and will be done to prepare for major oil spills, the priority of operators and the Board must continue to be spill prevention and risk reduction. Despite the priority placed on spill prevention, an accidental event or malfunction, although unlikely, can occur during an offshore exploration or development project, and it is important that relevant parties be prepared to respond to a spill in order to help mitigate its potential effects.

Spills may vary considerably in terms of their nature, scale, duration and possible environmental outcomes. The potential for, and possible adverse environmental outcomes of, an accidental oil spill resulting from future petroleum activities in the Western NL Offshore Area and elsewhere in the Gulf of St. Lawrence was by far the main concern raised during the consultation program for the SEA Update (see Chapter 2 and Appendix A).

The review and approval processes and associated regulatory requirements that apply to oil and gas activities in the NL Offshore Area are amongst the most rigorous in the world. As part of these processes, operators are required to demonstrate that they have the ability and capacity to undertake such activities in a safe and environmentally responsible manner – both in terms of the prevention of hydrocarbon spill events, as well as appropriate procedures and resources to respond to a spill.

As part of its regulatory review and decision-making regarding proposed drilling programs and other activities in the NL Offshore Area, the C-NLOPB receives and considers information from operators that detail the proposed drilling location and activities, the equipment and procedures involved, and the qualifications and training of personnel. As described earlier in this Chapter, the C-NLOPB's regulatory approval process is two-tiered in nature and requires, firstly, an authorization of the overall drilling program in the form of an Operations Authorization (OA), and secondly, a well approval in the form of an Approval to Drill a Well (ADW) for each well to be drilled.

Prior to issuing an OA, a number of statutory obligations must be met pursuant to the *Accord Acts* as well as other applicable legislation. As noted previously and in subsequent sections of this SEA Update, any required EA review of a proposed drilling project includes an assessment of the potential for, and possible effects of, any accidental event or malfunction (including a spill). Operators must also:

- File a Safety Plan, an Environmental Protection Plan and a Contingency Plan that includes an Oil Spill Response Plan as part of their application for an OA;

- Submit documentation respecting financial responsibility to show that they have sufficient monetary resources for responding to a spill and providing compensation to affected parties in the event of a spill;

- Provide a Declaration of Fitness attesting that the equipment and facilities to be used during their program are fit for purpose, and the operating procedures relating to them are appropriate;

- Demonstrate that the personnel to be involved in the drilling program are appropriately qualified and competent; and

- Demonstrate that the installation meets all applicable Canadian standards.

Only after all of this documentation is presented to, and approved by, the Board may an Operator proceed with the proposed drilling activity.

The second tier of the approval process involves obtaining an ADW, which is required for each and every well that is proposed to be drilled. The application for an ADW must provide detailed information on the proposed drilling program and well design for review, with drilling and well control being critical aspects of offshore operations. This involves a review of the operator's well planning and technical capabilities regarding such aspects as:

- Well and casing design, well control matters, kick prevention and detection;
- The definition of severe weather operating limits and associated procedures;
- Emergency disconnect requirements;
- Relief well drilling arrangements; and
- Personnel training in well control and blowout prevention.

A review is also conducted to ensure the adequacy, utility and suitable redundancy of the blowout preventer (BOP) activation and control systems.

Oversight of these matters is achieved in a systematic manner through the Board's Safety Assessment System, which includes a review of the operator's safety management system and confirmation that the operator has identified the hazards and the measures to be put in place to reduce risks to a level that is "as low as reasonably practicable" (C-NLOPB 2013). This application is reviewed by a multi-disciplinary team within the C-NLOPB consisting of engineers, technicians, geologists, geophysicists and environmental scientists. This information and analysis is then considered in associated regulatory decisions around whether and how the particular drilling program in question may proceed.

Operators are also required to have oil spill prevention and response plans and procedures that include ensuring they have the ability to respond to a spill in an effective and timely manner. Oil Spill Response Plans normally describe a three tier system for responding to spills in the NL Offshore Area, as follows:

1) *Tier 1 (In-field / At-site Resources):* Where spill response involves the activation of on-board equipment, usually sufficient to address small scale batch spills, nominally less than 30 m^3 (200 bbls);

2) *Tier 2 (NL / Regional Resources):* Where equipment and resources on site are insufficient and requires mobilizing equipment and resources that are located locally onshore, such as the operator's own equipment, equipment available through East Coast Spill Response Corporation (ECRC) and/or from the CCG. Tier 2 spills are typically batch or continuous releases of short duration (hours), up to approximately 3700 m^3 (100,000 bbls); and

3) *Tier 3 (National / International Resources):* If the equipment that is available locally is insufficient and national or international resources are needed to respond to the spill, the response moves to Tier 3. A Tier 3 spill would be a continuous release spanning days, such as a very large batch release or a blowout.

Each operator exercises their Emergency Response Plan, and collectively or individually conducts a field exercise each year which involves the deployment of spill response equipment.

In the event of a spill, there are a number of processes and measures to compensate affected parties for any associated losses or damages resulting from the spill. These are listed and described in the *Compensation Guidelines Respecting Damages Relating to Offshore Petroleum Activity* (C-NLOPB and C-NSOPB 2002), some relevant excerpts of which are provided in italics below:

Inherent in the nature of oil and gas operations in offshore areas is the risk of damage to the environment and to the property and economic interests of people working and living in areas affected by such operations. Such damage may occur either as a consequence of a "spill" or as a result of "debris" left on the ocean floor. The risk takes on special significance along Canada's east coast where fishing is a dominant factor in the economy.

These Compensation Guidelines have been prepared to:

> *i) describe the various compensation sources available to potential claimants for loss or damage related to petroleum activity offshore .... Newfoundland and Labrador; and*
>
> *ii) outline the regulatory and administrative roles which the Boards exercise respecting compensation payments for actual loss or damage directly attributable to offshore operators.*

Damage caused by offshore oil and gas operations will most likely occur as a result of debris, spill or authorized discharge, emission or escape of petroleum. The appropriate compensation program for persons sustaining actual loss or damage will be determined by whether or not the responsible petroleum operator can be identified.

In most cases, spills associated with offshore petroleum operations can be readily attributed to a specific operator. Operators are required to immediately report any such spills to the appropriate Board and the Canadian Coast Guard. The location of the spill or damage resulting from a spill, combined with the ability to match oil samples through chemical analyses are also valuable in identifying the responsible party.

There are three options available to a claimant for the recovery of actual loss or damage when the work or activity giving rise to such loss or damage can be attributed to an offshore operator:

- *i) voluntary settlement by the operator for direct compensation*
- *ii) application to the appropriate Board for recovery of damages, from the operator's security deposit; and*
- *iii) a civil suit for recovery through the appropriate court of law*

While each of these three options remain available to the claimant at any time, a settlement from the operator responsible for the work or activity giving rise to the damages should be sought before proceeding with other options.

In the event that a claimant is unsuccessful in obtaining satisfactory compensation from the responsible offshore operator, compensation may be sought through the appropriate Board. The Board will review the claim and, depending upon the merits of each case, may award a damage settlement (in whole or in part) directly from the financial security provided to the Board by the operator. In the east coast offshore area, the operator is required to provide proper financial security in the amount of $30 million for any damages incurred as a result of spills, discharges of petroleum or debris from oil and gas operations...

The Acts do not limit a claimant's right to bring a civil suit against the responsible operator in seeking to recover damages. While court action may be initiated at any time, such action would likely be considered if the claimant remains unsatisfied after failing to obtain satisfactory compensation either from the operator or through the appropriate Board.

Claims in excess of the amount of security provided to the Board by the operator and which therefore require proof of fault or negligence by the operator will have to be settled through the operator directly or through the courts.

There are [also] two mechanisms in place for compensation for damages of a non-attributable nature:

i) Canadian Association of Petroleum Producers' Commercial Fisheries Compensation Program for Loss Resulting from Non-Attributable Gear and Vessel Damage ... and

ii) Ship-source Oil Pollution Fund

The basic objectives which the proof of financial responsibility documentation submitted by an operator are intended to achieve therefore include:

a) Providing financial compensation to any party respecting claims attributable to the work or activity. These would include without limitation, claims by third parties, the Crown or its agents, the Board including the Chief Conservation Officer and Board delegates. Eligible claims would include those relating to loss of or damage to property, financial loss, or injury/death;

b) Restoring and preserving of the natural environment, including the seabed, while the work or activity is going on and after it is completed and abandoned; and

c) Ensuring that the operator will properly terminate the authorized work or activity, having regard to environmental, safety, and other concerns.

A spill is a strict liability offence pursuant to Section 161 (*Federal Accord Act*), and referring to Sections 162 and 163 of this legislation, Canada's offshore liability regime is comprised of three elements:

1) *Financial Responsibility Requirements*: The applicant for an authorization (operator) must demonstrate, to the satisfaction of the appropriate regulator, proof of financial responsibility. A portion of this financial responsibility, typically in the amount of the applicable absolute liability limit, must be furnished in a form that allows the appropriate regulator unfettered access to that money in the event of a spill.

2) *Unlimited "At-Fault" or Negligence" Liability*: All parties who are at fault or negligent for a spill are jointly and severally liable, without limit, for all actual loss or damage incurred by any person as a result of the spill. This can be determined by an operator accepting responsibility for its action and paying claimants out or via the courts.

3) *Limited Absolute Liability*: The operator of the activity from which the spill emanated is absolutely liable up to $30 million for all actual loss or damage incurred by any person as a result of the spill, and costs and expenses reasonably incurred by the appropriate Board, governments, or any other person taking action in response to the spill. There is also a $70 million promissory note required to be filed by an operator with the Board.

The Guidelines respecting financial responsibility can be found on the C-NLOPB's website at *http://www.cnlopb.nl.ca/pdfs/guidelines/respecting_financial_responsibility_requirements.pdf.*

In early 2013, the C-NLOPB responded to the Commissioner of the Environment and Sustainable Development's Fall 2012 Report (CESD 2012) on issues regarding oil spill preparation and response in the NL Offshore Area. This included various observations and recommendations regarding: the receipt of adequate assurances that operators are ready to respond effectively to a spill; the content of emergency response plans; coordination and cooperation between the Board and supporting federal departments and other organizations; and lessons learned from past incidents. In particular, the C-NLOPB committed to complete a review of the spill response capability of operators under its jurisdiction (C-NLOPB 2013).

In April 2011 the Department of Natural Resources, Government of Newfoundland and Labrador also released Captain Mark Turner's report on oil spill prevention and response in the NL Offshore Area. The Report (Turner et al 2010) contained 25 recommendations stemming from associated consultations with the C-NLOPB, other provincial and federal government departments and agencies, as well as various offshore operators. Most of these recommendations have been identified as being the joint responsibility of various government departments, and those within the C-NLOPB's areas of responsibility and mandate are also being reviewed and considered by the Board.

3.3 Previous Oil and Gas Activity in the Western NL Offshore Area

The Western NL Offshore Area is thought to have petroleum resource potential, and exploration activity has occurred and is currently being proposed in the region pursuant to previous exploration licencing and other regulatory decisions and actions by the C-NLOPB and others. This includes a number of previous and potential seismic and exploration drilling programs.

A total of 14,906 line km of seismic survey data has been acquired in the Western NL Offshore Area up to and including 2010 (Figure 3.18), with seismic survey activity occurring in 18 individual years since 1969, and with survey efforts ranging from 90 to 4,420 line km completed annually. Most recently, Geophysical Services Inc. (GSI) acquired 2,555 line km of 2D non-exclusive seismic data over the existing Exploration Licences 1097, 1098 and 1103 in 2008, and 148 line km of seismic data were acquired on EL 1105 in support of a well site survey in 2010. All of the seismic survey work conducted in the region thus far has been 2D.

Past exploration activity has also consisted of the drilling of nine wells (plus one well re-entry), all but one of which were drilled from onshore locations (Table 3.9, Figure 3.19). The latest well (Shoal Point 3K-39Z) was spudded (commenced) on October 4, 2011 and completed on July 17, 2012.

Table 3.9 Exploration Wells Drilled in the SEA Update Area to Date

Exploration Well Name	Well #	Drilling Unit(s)	Water Depth (m)	Total Depth (MD) (m)	Spud Date	Well Termination Date	Well Status
Long Point M-16	141	Noble Drilling OW842E	0	3810	10-Sep-1995	19-Jan-1996	Abandoned
Long Range A-09	142	Noble Drilling OW842	0	3685	24-Feb-1996	26-Jun-1996	Abandoned
St. George's Bay A-36	143	Rowan Gorilla IV	83.8	3240.4	15-May-1996	27-Jul-1996	Abandoned
Man O'War I-42	147	HS 150-2	0	677	20-Nov-1997	11-Mar-1998	Abandoned
Shoal Point K-39	159	Nabors 375 ETD	0	3035	08-Feb-1999	26-May-1999	Abandoned
Glori E-67	330	n/a	0	10.6	14-Jan-2008	15-Jul-2008	Abandoned
Shoal Point 2K-39	331	Nabors Rig 45	0	2740	04-Mar-2008	26-Jun-2008	Abandoned
Shoal Point 2K-39 Z	336	Nabors Rig 45	0	3629	27-Jun-2008	30-Jul-2008	Abandoned
Shoal Point 3K-39 (Re-entry)	365	Nabors 112	0	n/a	18-Feb-2011	2-Aug-2011	Suspended
	365	E-Can Rig #3				8-Feb-2012	Abandoned
Shoal Point 3K-39Z	372	E-Can Rig #3			4-Oct-2011	17-Jul-2012	Suspended
Note: All wells to date have been onshore to offshore except Well #143 St. George's Bay A-36 (water depth 83.8 m)							

Currently, there are seven Exploration Licences in the Western NL Offshore Area, totalling approximately 1,063,841 ha (10,638.41 km^2), as summarized in Table 3.10 and illustrated in Figure 3.20.

Table 3.10 Current Exploration Licences in the Western NL Offshore Area

Exploration Licence	Current Area	Interest Holder(s)	Effective Date	Expiry Date (Period 1)
EL 1070	103,040 ha	Shoal Point Energy Ltd PDI Production Ltd	January 15 2002	January 15 2011 (January 15 2008)
EL 1097R	202,838 ha	Shoal Point Energy Ltd	November 23 2011	January 15 2015 (January 15 2012)
EL 1105	51,780 ha	Corridor Resources Inc	January 15 2008	January 15 2017 (January 15 2015)
EL 1116	211,985 ha	Enegi Oil Inc	January 15 2009	January 15 2018 (January 15 2014)
EL 1120	140,210 ha	Ptarmigan Energy Inc	January 15 2010	January 15 2019 (January 15 2015)
EL 1127	218,468 ha	Ptarmigan Energy Inc	January 15 2012	January 15 2021 (January 15 2017)
EL 1128	135,520 ha	Ptarmigan Energy Inc	January 15 2012	January 15 2021 (January 15 2017)

Figure 3.18 Released Seismic Data Completed in the Western NL Offshore Area

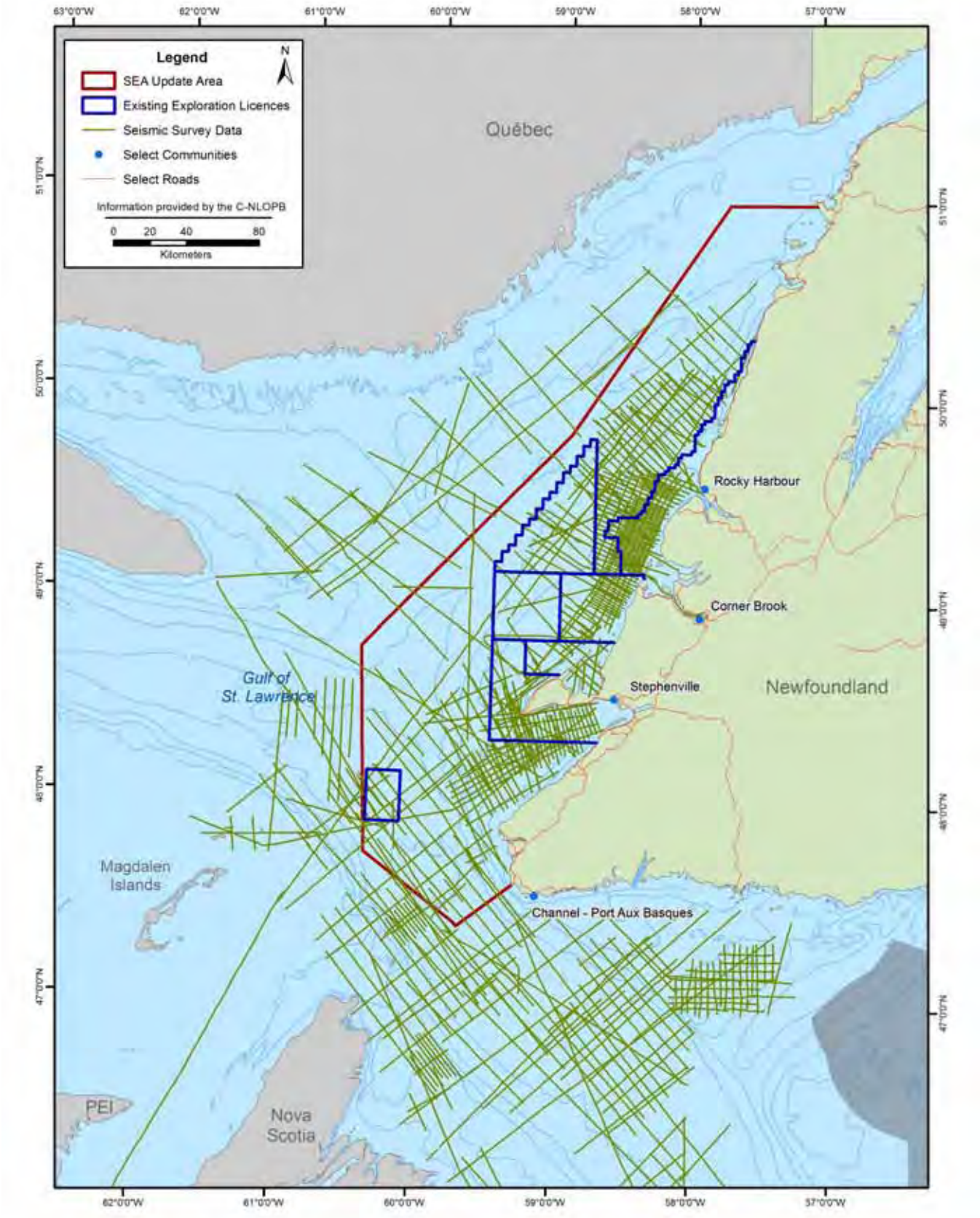


Figure 3.19 Previous Exploration Wells Drilled in the Western NL Offshore Area

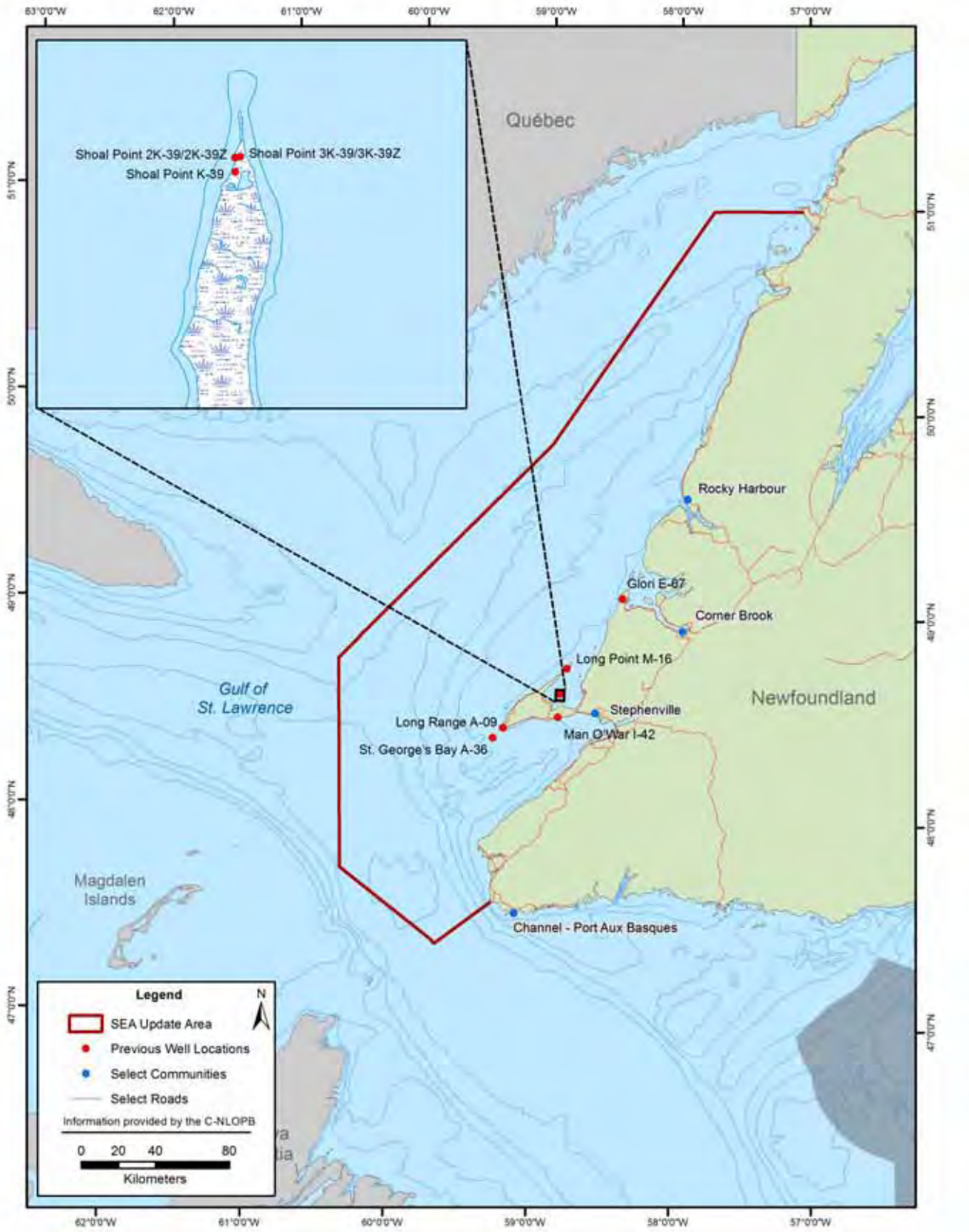
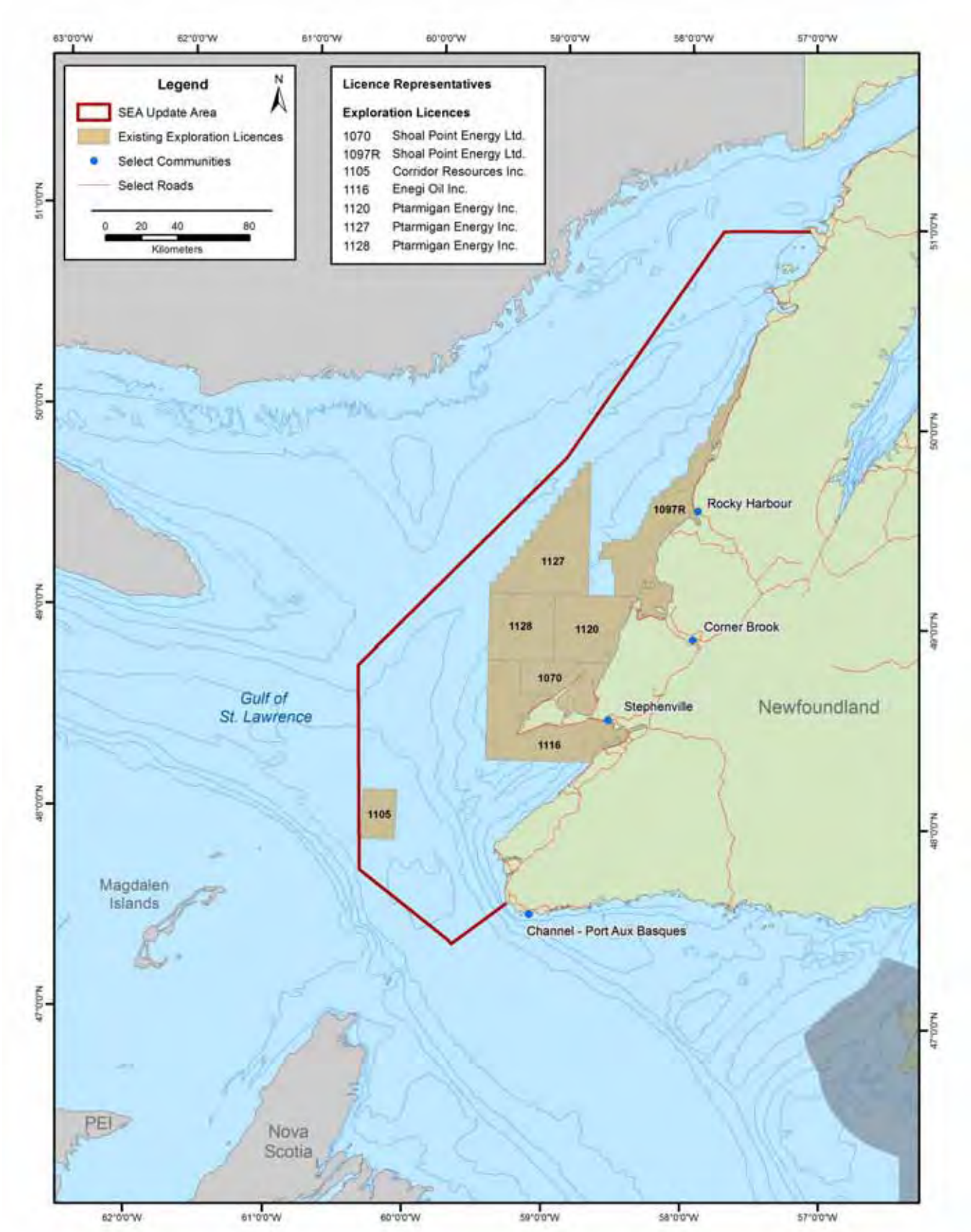


Figure 3.20 Existing Exploration Licences in the Western NL Offshore Area



On May 12 2011, the C-NLOPB announced a Call for Bids NL11-01 (Area "B" – Western Offshore Region), which offered two parcels for bid. These parcels were also included in the SEA Update Area. The Call for Bids closed on November 15, 2011 with two successful bids, resulting in the issuance of Exploration Licence 1127 and Exploration Licence 1128 in January 2012.

On November 23 2011, former Exploration Licences 1097, 1098, 1103 and 1104 were consolidated into a new licence 1097R. Interests in several of the Exploration Licences in the area (1097R and 1102) have also been partially or entirely relinquished by their owners within the past year.

3.4 Potential Future Offshore Exploration and Production Activities

As described at the beginning of this Chapter, the C-NLOPB is responsible for the petroleum resource management in the NL Offshore Area, including the administration and issuing of specific licences, authorizations and approvals pertaining to offshore oil and gas exploration and development projects and activities in that region. This SEA Update is intended to help inform the Board's future decisions around whether to issue further exploration licences in the Western NL Offshore Area, and to identify any environmental issues and mitigation options which should be considered in taking these future decisions and actions.

Given the relatively early (licencing) stage of such planning and regulatory decision-making, details on the specific number, characteristics, location and timing of potential future offshore exploration activities in the Western NL Offshore Area are, of course, not currently available. Past exploration activity has consisted of the drilling of nine wells from 1995 to 2011, ranging from 0 to 3 wells per year over that time. There are currently seven Exploration Licences in the SEA Update Area, which cover approximately one-third of the total area of the Western NL Offshore Area and which extend to various expiry dates over the next 10 years. In consideration of the above, it is assumed for the purposes of the SEA Update that approximately 4 -6 exploration wells could potentially be proposed in the region over the next 10 years. Moreover, based on past experience with exploration drilling activity in the Western NL Offshore Area, it is anticipated that at least half (and likely more) of any such wells would be drilled from on-land (near shore) locations.

As also indicated, nearly 15,000 line km of seismic survey data were acquired in the Western NL Offshore Area between 1969 and 2010, with seismic survey activity occurring in 18 of these years. Due to the limited number of available seismic vessels, operators also often coordinate their seismic programs to share a vessel when it is in the area, and surveys therefore tend to be undertaken sequentially in a given region rather that concurrently. For the purposes of the SEA Update, it is therefore also (conservatively) assumed that there may be up to approximately 1-2 seismic program applications for the Western NL Offshore Area annually over the next 10 years.

The SEA Update has a key focus upon the on-going "exploration phase" of offshore petroleum activity in the Western NL Offshore Area. This is the case because such exploration activity has been conducted and is being proposed in the region (pursuant to past licencing and permitting activities), and because the purpose of the SEA Update is to inform future associated decisions and actions by the C-NLOPB regarding exploration licencing in the region. The SEA Update therefore includes consideration of all of the elements and activities which may be associated with potential seismic surveys and well drilling programs in the region, as described earlier in this Chapter. Additional oil and gas exploration is a prerequisite for any possible future petroleum development (production) activity in the region, and would clearly occur at an earlier time (and can be somewhat more clearly defined) that any future production activities.

As described above, the likelihood, characteristics, location and timing of any possible oil and gas development (production) activity in the region is unknown and cannot currently be predicted or defined. This would obviously depend on the type and quantity of any hydrocarbons found, the location, area, depth and other characteristics of any such reserves, and other factors. These and numerous other technical and economic considerations will determine the requirement for, and specific characteristics of, any future petroleum development activities and associated infrastructure, activities and timeframes. Predictions concerning the likely numbers of production facilities in the SEA Update Area therefore cannot be undertaken since no offshore discoveries have yet been declared and the commercial resource potential of the area is unknown.

4 ENVIRONMENTAL SETTING

The following sections provide an updated overview of the existing environmental setting of the Western NL Offshore Area (also referred to interchangeably as the SEA Update Area), including the relevant components of its physical, biological, and human environments. The SEA Update Area covers a marine area of approximately 36,000 km^2 offshore Western Newfoundland (see Figure 1.1), which comprises and fully encompasses the Study Areas from the 2005 and 2007 SEA Reports (LGL Limited 2005, 2007) as well as expanding the area of coverage further to the west.

The description that follows is based primarily upon existing information that has become available since the initial SEA Reports were completed in 2005 and 2007, and although a degree of overlap is inevitable, it is not intended to provide or repeat all of the information contained in (or available to) the 2005 and 2007 SEA Reports. The Chapter also provides information on any additional environmental components or issues that have been identified for inclusion in the scope of the SEA Update that were not included in the original SEA, as well as considering the larger Gulf of St. Lawrence area where possible and as relevant with respect to particular environmental components, systems and/or issues.

As is typical at an SEA level of analysis, the purpose is to provide a relatively high-level overview of the existing environmental setting of the SEA Update Area, as a basis for identifying potential environmental issues and associated planning considerations and other mitigation, rather than a detailed and site-specific description of the existing environment.

4.1 Physical Environment

The following sections provide an overview of relevant aspects of the physical environment of the SEA Update Area, including its geology, geomorphology, bathymetry, climatology, oceanography and ice conditions.

4.1.1 Geology and Geomorphology

The geology of Western Newfoundland and the adjacent Gulf of St. Lawrence (Figures 4.1 and 4.2) is complex and dynamic, and the current geological and geomorphic characteristics of the coastal and marine environments of the SEA Update Area have been shaped by various natural and human factors and processes over time.

4.1.1.1 Bedrock and Surficial Geology

Geologically and tectonically, the Island of Newfoundland can be divided into a number of zones:, the 1) Humber (or Western) Zone; 2) Dunnage and Gander Zones (combined by some authors into a single Central Zone); and 3) the Avalon (or Eastern) (Williams et al 1988; Hodych and King 1989; Colman-Sadd et al 1990; Batterson and Liverman 1995; Williams 1995; Miall et al 2008; Dietrich et al 2011). The onshore regions of the SEA Update Area include parts of the Dunnage Zone, forming the Lewis Hills, located south of Humber Arm, and the Tablelands-Trout River area, located from the north shore of Humber Arm to Bonne Bay. Most of the remainder of the shoreline of Western Newfoundland, from Cape Ray north to Fox Island River, the interior of Humber Arm at Corner Brook, and the shoreline north of the north shore of Bonne Bay, lies within the Humber Zone.

Figure 4.1 Western NL Area - Geological Overview (On-land)

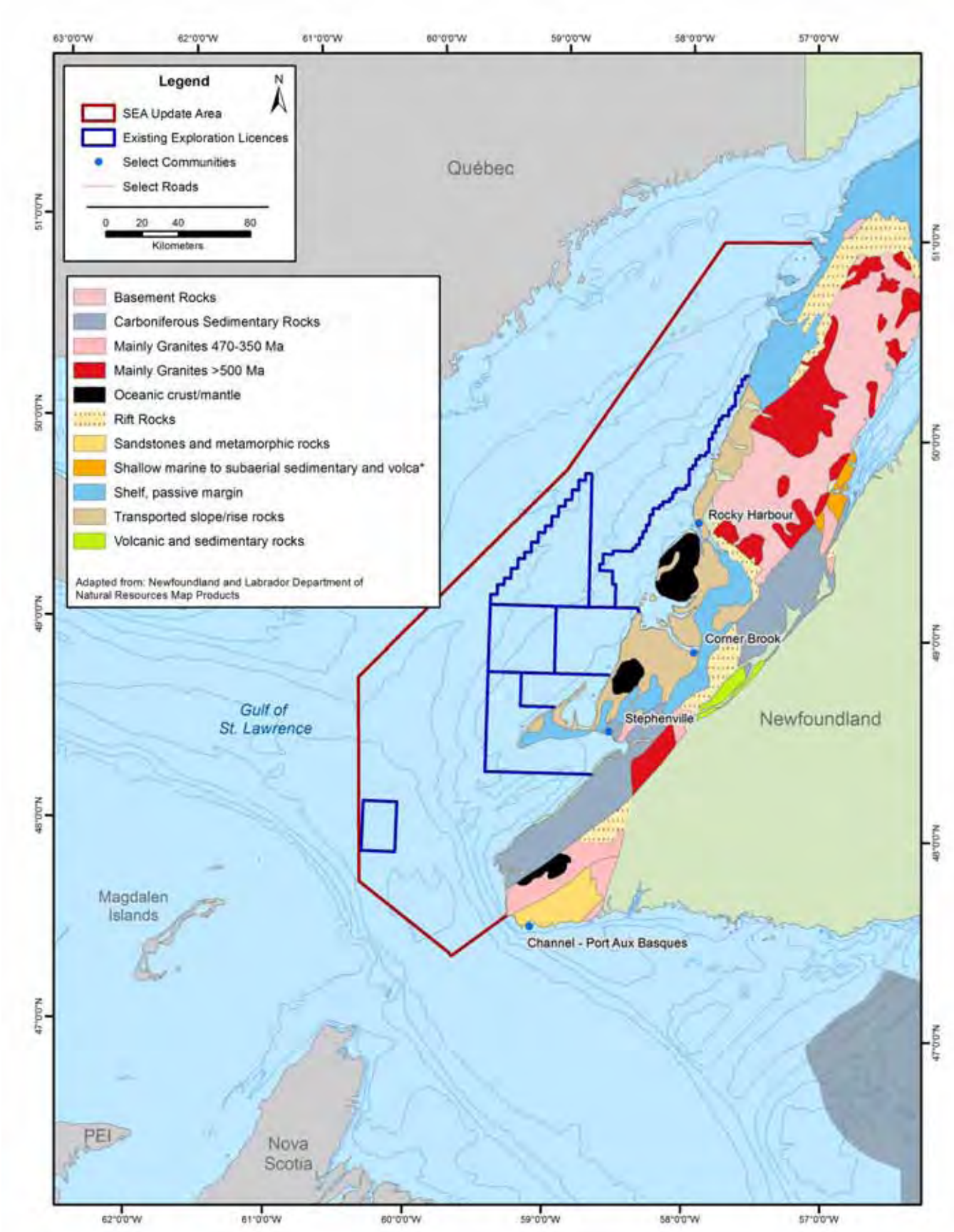
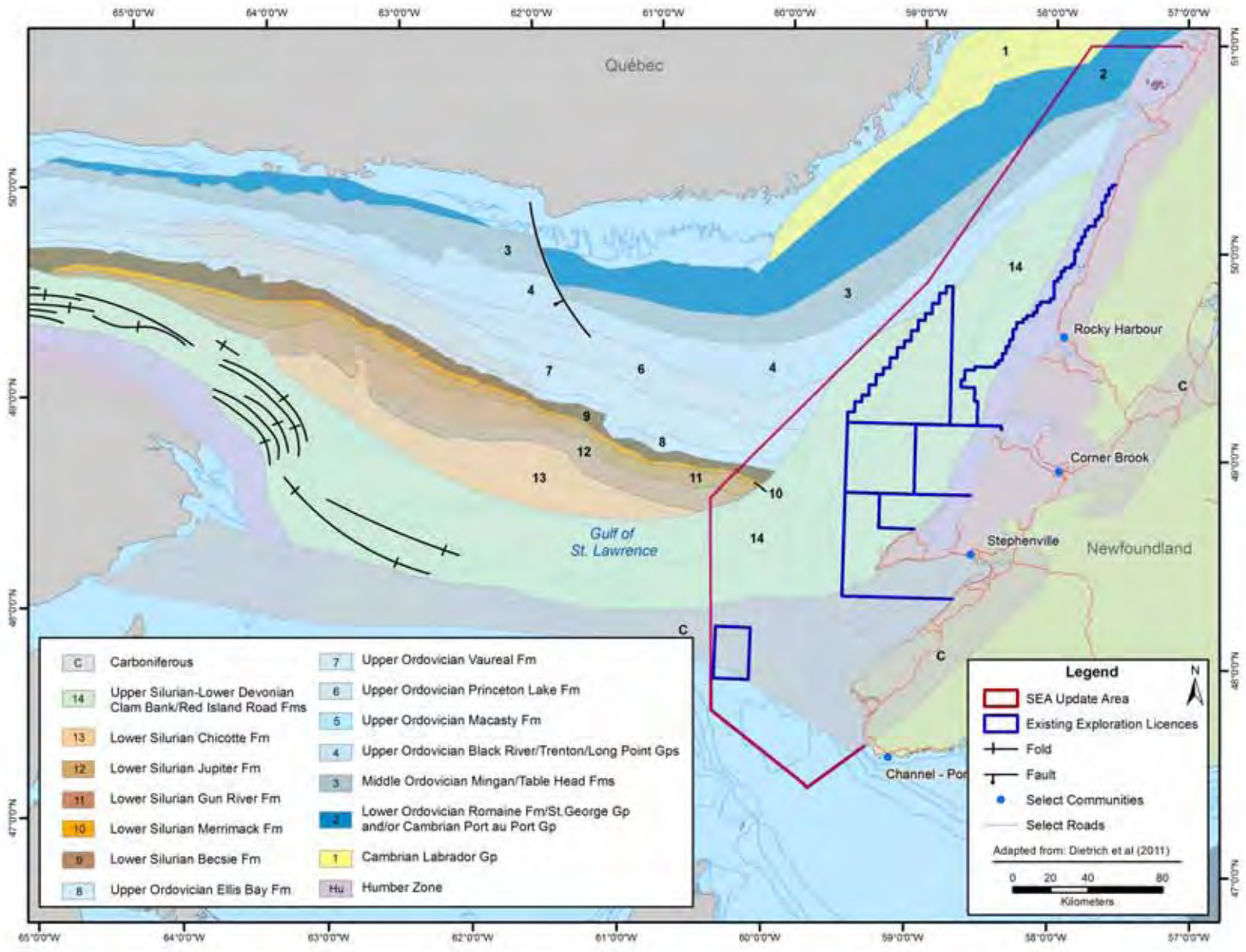


Figure 4.2 Western NL Area - Geological Overview (Marine)



The Dunnage Zone units include the oceanic crustal ophiolite sequences of the Tablelands, which are of Ordovician age. These rocks, formed as oceanic crust, consist of peridotite and dunite rich in nickel, chromium, and vanadium. Olivine is the most common mineral found in unweathered rock, but most has weathered to soft serpentine and chlorite. Pillow basalts, formed by submarine eruptions of volcanoes, are also present.

The Humber Zone includes early Palaeozoic sedimentary rocks (Cambrian to mid-Silurian), commonly deformed into south-southwest trending thrust belts. These units are well exposed throughout the centre of Gros Morne National Park, particularly along the coast. The rock types include shale, limestone, dolomite, sandstone, and carbonate breccia. At Cow Head, in Gros Morne, extensive exposures of the Cow Head carbonate breccia represent the collapsed margin of a coral reef that grew when Gros Morne lay at approximately 20°S latitude (Bambach et al 1980; Stanley 1986; Hodych and King 1989; see Miall et al 2008). The Humber Zone extends offshore into the Gulf of St. Lawrence, where the early Palaeozoic strata are overlain by younger units.

In coastal outcrops, fracture patterns in the Palaeozoic limestone-dolostone-shale succession reflect the tectonic stresses applied during deformation (e.g. at The Arches Provincial Park). Major fractures tend to parallel the attitude of the bedding (in most cases, parallel to the coast). Minor fractures in the limestone tend to be oriented either approximately orthogonal to the main fractures, or vertically. Fractures in coastal limestone outcrops are accentuated by karst dissolution, producing wider openings (grikes) that allow frost penetration, further opening the fracture system. Limestone pavements show intense, interlocking patterns, with multiple joint sets. Surface rilling (karren) is also common. The fracture pattern in limestone units not exposed to subaerial weathering during the Quaternary (i.e. below glacial sea level) would not be expected to be as “open”, and many joints would be tight. Dolostone shows similar fracture/joint patterns, but with less karst modification. Shale units tend to have smaller, less continuous fractures, but exhibit a greater scatter in their pattern. The larger fractures follow the tectonic stresses and mirror the alignments in adjacent limestones. The younger gypsum-shale succession in the south (Anguille-Codroy) has much less consistent fracture and joint patterns in coastal exposures. Local dissolution and plastic flow of gypsum under pressure results in fracture patterns in the adjacent or overlying shales. Surface rilling (karren) dominates over the fracture pattern in gypsum outcrops. Evidence of annealing of fractures is preserved. Shale fractures tend to be discontinuous, many of which are curved. Much of the fracture/joint pattern in coastal outcrops is due to local environmental modification, combined with changes in rheologic stress resulting from adjacent slope failures and coastal erosion, and may not be indicative of conditions offshore. Assessment of joint patterns offshore is often somewhat limited where only relatively small-diameter core samples are available.

Calcium carbonate-rich mud was initially deposited in a shallow, tropical sea. Groundwater circulated through the limestone, resulting in the removal of some calcium ions from the crystal structure of the limestone, and depositing magnesium ions in their places to form dolomitic limestone, which contains approximately equal amounts of calcium and magnesium ions. The limestone and dolomitic limestone units are subject to chemical and biochemical dissolution through karst action (Ford and Williams 2007). In some instances, chemical dissolution is entirely dominant, but in other cases it is accompanied by significant erosional activity (running water and/or gravitational mass movement), along with biological and biochemical processes. The dominant processes, including climate, previous geological history, and bedrock type all play roles in the formation of karst terrain. In Western Newfoundland, the dominant process is surface dissolution, which produces numerous small-scale features, termed karren. Common karren forms include rill-like rillkarren, spike-like spitzkarren, parabolic-bottomed rundkarren, and semi-circular rinnenkarren, among many others. Cumulatively, these features form a pavement karst in limestone barrens areas.

The combined rate of chemical dissolution and erosional processes, termed denudation, is very low - millimeters per thousands of years. The denudation rate is proportional to the annual precipitation and surface runoff, the amount and type of vegetation cover (influencing CO_2 production), and the density, jointing pattern, and crystal form of the bedrock (White 2009). The denudation rate for carbonate terrain is inversely proportional to the temperature (for temperatures above freezing) and to the clay content in the limestone. Using the formulas proposed, estimated denudation rates of limestone surfaces under Western Newfoundland climates vary from 30-60 mm / 1,000 years. These rates are much less than those of many erosional processes: at the maximum rate of 60 mm / 1,000 years, a terrain deglaciated for 10,000 years would only have undergone 60 cm of denudation. Increasing temperature would act to slow the rate of dissolution. This effect would, however, be countered by increased dissolution resulting from a longer frost-free period, reduced snow cover, and increased precipitation. Further investigation would be required to more precisely determine the effects of changing meteorological parameters on the dissolution rate. As well, the differences in jointing pattern and proportion of dolomitic limestone along the Western Newfoundland coast will result in differences in the rates of weathering, due to both dissolution and frost action. Dolomitic limestone tends to dissolve at slightly slower rates than does purer calcium-rich limestone.

Limestone and dolomite are both subject to subsequent alteration by subsurface diagenesis, and through circulation of hydrothermal groundwater. In Southwestern Newfoundland, the Ordovician St. George Group contains abundant evidence of post-depositional modification resulting from the migration of high-salinity hydrothermal brines through the carbonates, resulting in increased porosity as the original limestone was partially dolomitized (Conliffe et al 2010). Modification appears to have occurred largely during the Devonian, possibly in conjunction with renewed tectonic activity centred to the southwest of Bay St. George. The dolomites of the St. George Group represent a potential petroleum reservoir target, both onshore and offshore.

In the westernmost areas of Newfoundland, the deformed Humber Zone rocks are overlain by the younger Devonian-Carboniferous (Mississippian-lowermost Pennsylvanian) sedimentary rocks of the Upper Paleozoic Maritimes Basin. The Maritimes Basin extends across the Gulf of St. Lawrence to the Iles-de-la Madeleine and Prince Edward Island, where younger Permian sandstones and shales are exposed (Van de Poll 1989). Alternative terminologies include “St. Lawrence Platform” and “Anticosti Basin” (Pinet et al 2008; Dietrich et al 2011), whereas in this section, the term “Maritimes Basin” will be used.

The Maritimes Basin assemblages, including sandstones, conglomerates, shales, and evaporate rocks (gypsum), were formed in terrestrial and isolated high-salinity environments. During this time, the Maritimes Basin lay in the heart of the supercontinent Pangaea, and was subjected to a continental climate. All the sediments were exposed to the air for prolonged periods following deposition, and consequently most were oxidized extensively. The ferric oxide coatings can be readily detached from the clasts by rubbing or walking over sandstone surfaces, or by aeolian reworking.

Across the Gulf of St. Lawrence, the age of the rocks increases successively from the north coast of Prince Edward Island to the northeast, and thus the oldest rocks of the assemblage are exposed along the coastline of Bay St. George, extending from Stephenville to Kippens, and in the Codroy Valley of Southwestern Newfoundland. All of these sedimentary rocks are subject to erosion, and form relatively weak, crumbling cliffs that consistently supply sediment to the shoreline. Frost wedging is the dominant process responsible for initiation of weathering and erosion. Wave action is responsible for periodically removing frost-displaced debris from talus aprons at the cliff bases.

Carboniferous sandstones, with lesser shale and very thin coal seams, are exposed in the Barachois Pond Park area. Little Barachois Brook flows within a broad valley excavated in the Barachois Group rocks, deposited between 360 and 310 million years ago. In Western Newfoundland, coal seams are thin and discontinuous, and cannot be mined economically. The most common Carboniferous rock in the Barachois Pond area is sandstone. The Carboniferous rocks are easily eroded, and in most areas they are covered by a thick blanket of younger Quaternary glacial, glaciofluvial, and lake deposits.

In the Kippens-Romaine and Woodville-Codroy areas, the younger Mississippian deposits contain anhydrite and gypsum strata, which are exposed locally along the coast. Gypsum is deposited as a chemical precipitate, $CaSO_4 \bullet 2H_2O$, in shallow saline lakes and coastal lagoons. Deposition requires a tropical climate, high rates of evaporation from the water surface, and minimal or no current activity. Both calcium and sulphate ions are soluble in water at normal surface temperatures. Precipitation thus requires that the water remain over saturated in both ions, and that currents not disturb the accumulation of precipitated crystals on the bottom. The gypsum of the Codroy Group was formed during the Mississippian period ca. 330-340 million years ago (Knight 1983, 1991; Knight et al 2008). These units are subject to karst development and enhanced erosion.

Cliffs with steeply dipping or vertical beds of gypsum of the Codroy Group, ranging from 0.8 to 30 m in thickness (Knight 1983; Knight et al 2008; House and Catto 2008) are actively eroding in the Woodville-Codroy area. The combination of gypsum's softness and bedding structure, which makes the material susceptible to frost wedging, mechanical abrasion, and geochemical modification.

The Mississippian gypsum is consolidated, but has been pervasively deformed during folding and faulting. When exposed to water that is not saturated with respect to either calcium or sulphate, dissolution occurs. The rate of dissolution depends upon the concentration of SO42- ions in the water (low concentrations promoting dissolution), the concentration of hydrogen ions (high concentrations or acidic water favoring dissolution), and the presence of humic acids and organic compounds in the water. In addition to these chemical factors, the volume of water flowing through or across the gypsum surface (discharge), the duration of contact between individual water molecules and gypsum crystals, and the turbulence of the water also influence the rate of dissolution. Temperature is also a factor, but the relatively low temperatures common in Southwestern Newfoundland limit its importance for gypsum dissolution.

Under normal circumstances, the rate of surface dissolution over a flat expanse of gypsum would be on the order of millimetres / 100 years. Accelerated dissolution occurs in the Woodville area, as the gypsum beds are confined laterally by other rock units that are not susceptible to dissolution, and are subject to wave action. Increases in the amount of precipitation through climate change, or in the rate at which precipitation enters the groundwater system, resulting from clearing of forest cover, will also result in increased dissolution.

Western Newfoundland was glaciated on several occasions during the Quaternary. The most recent glaciations, during Marine Isotope Stage 2 (ca. 28,000-11,700 BP), resulted in complete or almost complete coverage of the landmass of Western Newfoundland. The tip of the Northern Peninsula, including sites such as Burnt Cape, Watts Point, and Pistolet Bay, was glaciated by southeastward moving Laurentide ice from Labrador. Striations exposed on the pillow basalts and the presence of erratic boulders of granite and gneiss, derived from the Grenville Province of the Canadian Shield in Labrador. These indicate that this area was covered by Laurentide ice (Grant 1989, 1992), which crossed the Strait of Belle Isle and merged with the glaciers from the Long Range to the south, near Ten Mile Lake. Ice from Labrador thus extended to cover all inland areas north of St. Barbe.

Labrador ice also extended south-southwest through the exposed offshore area of the Gulf of St. Lawrence, paralleling the coastline and coalescing with glaciers extending from Newfoundland. Although different interpretations were previously presented as to the timing and extent of glaciations, particularly in southwestern Newfoundland (see Brookes 1974; Grant 1989, 1991; Sparkes 1989; Taylor 1994; Batterson 1999; Sheppard et al 2000; Bell et al 2001; Batterson and Catto 2001; Shaw et al 2002, 2006; Shaw 2003), the current consensus among researchers is that the southwestern Newfoundland coastline was influenced by ice flowing from two directions. Ice flowed from the Anguille and Long Range Mountains towards the Gulf of St. Lawrence. In addition, an ice stream within the present Gulf of St. Lawrence flowed southwest, parallel to the modern coastline. Much of the granitic material (quartz, orthoclase feldspar, plagioclase feldspar, and mafic minerals) transported by this ice stream was subsequently incorporated in the beaches of southwestern Newfoundland.

The coastal areas north of Corner Brook were glaciated by ice originating from the Long Ranges, which also accentuated the pre-existing fjordal topography. Trim lines, erosional features, and differential zones of environmental modification of bedrock indicate that a minimum of three distinct glacial events have occurred in Western Newfoundland during the past 200,000 years. Discussion as to whether the highest points of the Long Range Mountains, and exposed summits such as the Tablelands in Gros Morne, remained unglaciated has persisted for several years, but the most recent research suggests that all areas of Western Newfoundland were covered by glacial ice at least once during the past 200,000 years. For example, the presence of erratics and striated bedrock surfaces found on the Lewis Hills, Blow-Me-Down Mountain, and North Arm Mountain shows that these areas supported or were crossed by glacier ice. Surfaces with similar characteristics in Gros Morne National Park were ice-covered prior to 15,000 years ago, as demonstrated through cosmogenic isotopic analysis (Gosse et al 2006; Osborn et al 2007). Striations indicating ice flow towards the west-northwest occur near Blow-Me-Down Mountain, and at the western end of Humber Arm (Taylor 1994).

Glacial retreat from the coastline began ca. 15,000-14,000 BP (Grant 1989, 1991; Batterson 1999; Batterson and Catto 2001; Shaw et al 2002, 2006). In the Gros Morne area, an emerged delta present at the mouth of Shoal Brook suggests that ice persisted in the heads of the fjords for ± 3,000 years after the outer coast was deglaciated between 13,000 and 12,000 BP. By ca. 10,000 BP, all glacial ice had disappeared from Western Newfoundland (Shaw et al 2002, 2006).

The development of continental glaciation resulted in a substantial drop in sea level, ~110-120 m ca. 18,000 years ago (Fader 1989; Piper et al 1990; Miller 1999), resulting in terrestrial glaciation across the entire exposed area of the Gulf of St. Lawrence (Grant 1989; Shaw et al 2002, 2006; Piper 2005). Subsequently, glacio-isostatic depression caused the sea to flood over the isostatically depressed land as the glaciers melted. Sediments and landforms along the Western Newfoundland coast provide evidence of elevated sea level following deglaciation. The maximum level of marine inundation declines from 150 m asl at Burnt Cape, along the Strait of Belle Isle (Grant 1989 1992), to 140 m at Watts Point, 135 m at St. Barbe (Grant 1989), 110-120 m between Port-au-Choix and The Arches (see Bell et al 2005), 100 m above sea level at Cow Head (Brookes and Stevens 1985; Grant 1989), 75 m asl at Bonne Bay (Proudfoot et al 1988; Grant 1989), 50 m asl at Deer Lake and Corner Brook (Batterson 1999; Batterson and Catto 2001), and 27 m asl in St. Georges Bay (Bell et al 2001, 2003a). At Cape Ray, an eroded rock platform indicates that maximum postglacial sea level was less than 10 m asl (Grant 1991).

Changes in sea level are driven by a combination of local, regional, hemispheric, and global factors (Catto 2011). Each coastal area responds differently to a diverse combination of factors, and the change in sea level is not identical, throughout the world, along Canada's Atlantic marine coastlines, or around the Island of Newfoundland. Archaeological sites at Ferryland and Fort Frederick (Placentia) NL (Catto et al 2000, 2003),

among others, indicate that sea level has risen since ca. 1600. Longer-term sea level rise is indicated by archaeological sites at Burgeo (Rast 1999; Ingram 2004; Ingram and Catto 2005; Catto et al 2006), and Port au Choix (Renouf and Bell 2000, 2006; Bell and Renouf 2003; Bell et al 2005; Westley et al 2011). Evidence of enhanced erosion along many Newfoundland beaches, and inundation of terrestrial peat deposits and trees, indicates that transgression is currently occurring. Relative rising sea level is evident on the Great Northern Peninsula at L'Anse-Aux-Meadows (Catto 2006b; Vasseur and Catto 2008; Westley et al 2011); Port-aux-Choix (Bell et al 2005; Smith et al 2005; Westley et al 2011); and along the Gulf of St. Lawrence coastline (Proudfoot et al 1988; Grant 1989; Catto 2006b, 2011; Daly et al 2007). Sea level at these localities is currently rising slowly, approximately 1 mm/y. Sea level rise of 3.3 mm/y over the past 50 years has been documented at Port-aux-Basques (Catto et al 2006). Additional recent research on sea level changes in southwestern Newfoundland has been conducted by Batterson (1999), Bell et al (2001, 2003a), Catto (2006b, 2011), and Catto et al (2006).

Future changes in sea level will be determined by combinations of ongoing glacioisostatic adjustment, and increases in volume of the oceans due to glacial melting (e.g. James et al 2010). Thermal expansion, which is the increase in the volume occupied by water molecules without an increase in mass (due to temperature alone), will also increase sea level. The range of projections from the Intergovernmental Panel on Climate Change (IPCC 2007) for globally averaged sea-level rise at the end of the 21st century (mean for 2090-2099 relative to mean for 1980-1999) encompassed from 0.18 to 0.59 m, with a median value of 40 cm. This estimated rise of 4 mm/y is greater than the currently observed rates of relative sea level rise of 3.0-3.5 mm/y observed for locations in southern Newfoundland (Catto et al 2006; Catto 2006a, 2006b, 2011). Some subsequent publications have projected considerably higher rates of global mean sea-level rise (e.g. Rahmstorf 2007; Horton et al 2008; Pfeffer et al 2008; Grinsted et al 2009; Vermeer and Rahmstorf 2009), up to 1.90 m by 2100. These values are, however, global averages, and do not predict what could happen in individual areas of Western Newfoundland. They are also values for change in global absolute sea level, not relative sea level at any particular locality. The observed relative sea level rise, and the projected rise for the future, depends upon the interaction between the changing volume of the oceans and glacio-isostatic activity.

4.1.1.2 Hydrocarbon Occurrence

A recent review by Dietrich et al (2011) recognized petroleum reservoir potential in Ordovician strata in the Humber Zone (onshore); Ordovician strata offshore associated with the Humber Zone (extensively deformed), grading westward to the St. Lawrence Platform (less deformed), and Carboniferous strata offshore in the Maritimes Basin. Dietrich et al (2011) documented 15 potential petroleum plays are recognized in Paleozoic strata throughout eastern Canada. Quantitative assessments of petroleum resource potential are possible for six of these plays.

The Humber Zone is part of a large autochthonous tectonic domain that flanks the eastern margin of the present continent of North America, extending from Texas to Newfoundland (Williams et al 1988; Hodych and King 1989; Williams 1995; Miall et al 2008; Pinet et al 2008). Hydrocarbon production is significant in most areas of the southwestern and south-central sectors in the United States. Exploration in Canadian waters and along coasts (Cooper et al 2001; Pinet et al 2008) indicates that significant potential exists for both petroleum and natural gas production. Bertrand (1987, 1990, 1991) and Pinet et al (2008) have identified the Macasty Formation (exposed on Anticosti Island) as being of particular significance, both due to its structural and stratigraphic attributes and because it contains Type I and II organic matter, with total organic carbon values ranging from 1-3 percent. Stratigraphic units with enhanced porosity, resulting from combinations of transtensional faulting and recrystallization during dolomitization, are present in the Humber Zone stratigraphy. The Early Ordovician

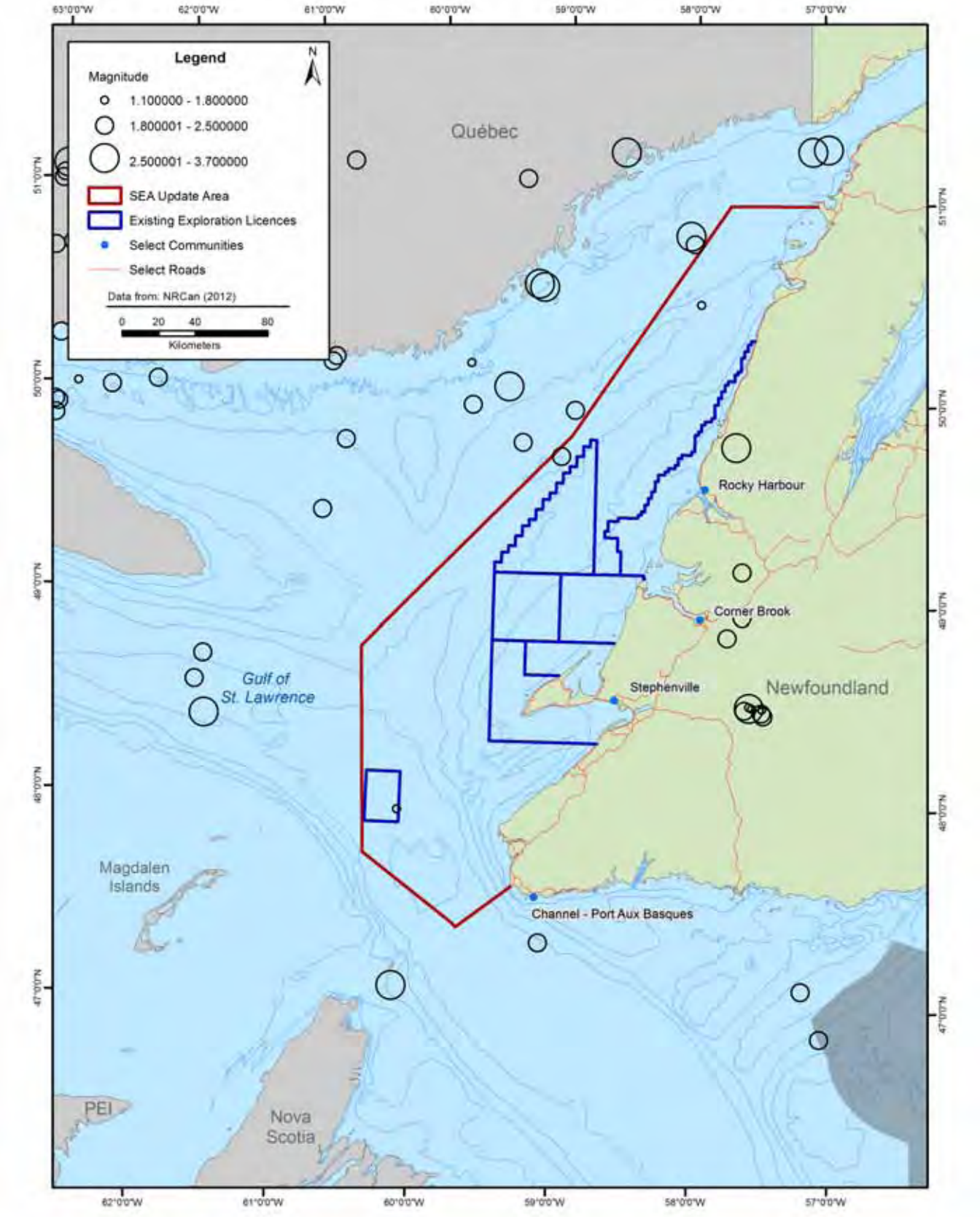
Romaine Formation (Lavoie et al 2005) and the Ordovician St. George Group Strata (Conliffe et al 2010) are examples of stratigraphic units which have undergone dolomitization, leading to enhanced porosity and permeability and potentially increasing their suitability as hydrocarbon traps. Overthrusting of shales over limestones and dolomitized limestones in the eastern Gulf of St. Lawrence and along the Newfoundland coastline also could form structural traps (Dietrich et al 2011).

The sedimentary strata of the Maritimes Basin also contain potential hydrocarbon occurrences, generally considered as substantially greater than those associated with Humber Zone structures. Dietrich et al (2011) estimated that the Maritimes Basin plays account for about 60 percent and 95 percent of the total oil and gas resource potential, respectively. The natural gas potential is substantially greater than was previously estimated.

4.1.1.3 Seismicity

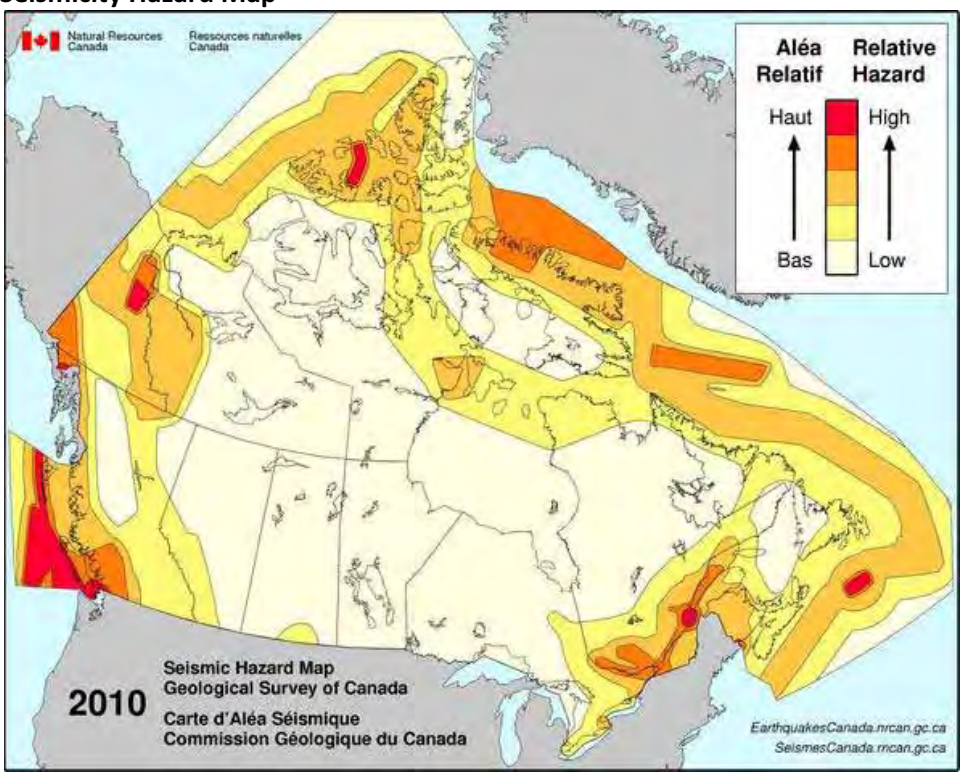
The seismicity and associated earthquake risks present in an area can be evaluated based on several factors and information sources. Earthquake information for the period 1997-2012 is available from the National Earthquake Database (Natural Resources Canada 2012) and is presented in Figure 4.3, which illustrates the approximate locations of the epicentres for those earthquakes recorded within or immediately adjacent to the SEA Update Area over that period and their magnitudes.

Figure 4.3 Earthquake Epicentres (1997 - 2012)



The most recent edition of the Seismic Hazard map prepared by Natural Resources Canada (Figure 4.4) further indicates that the eastern Gulf of St. Lawrence and the adjacent coastline of Newfoundland have relatively low seismic hazard.

Figure 4.4 Seismicity Hazard Map



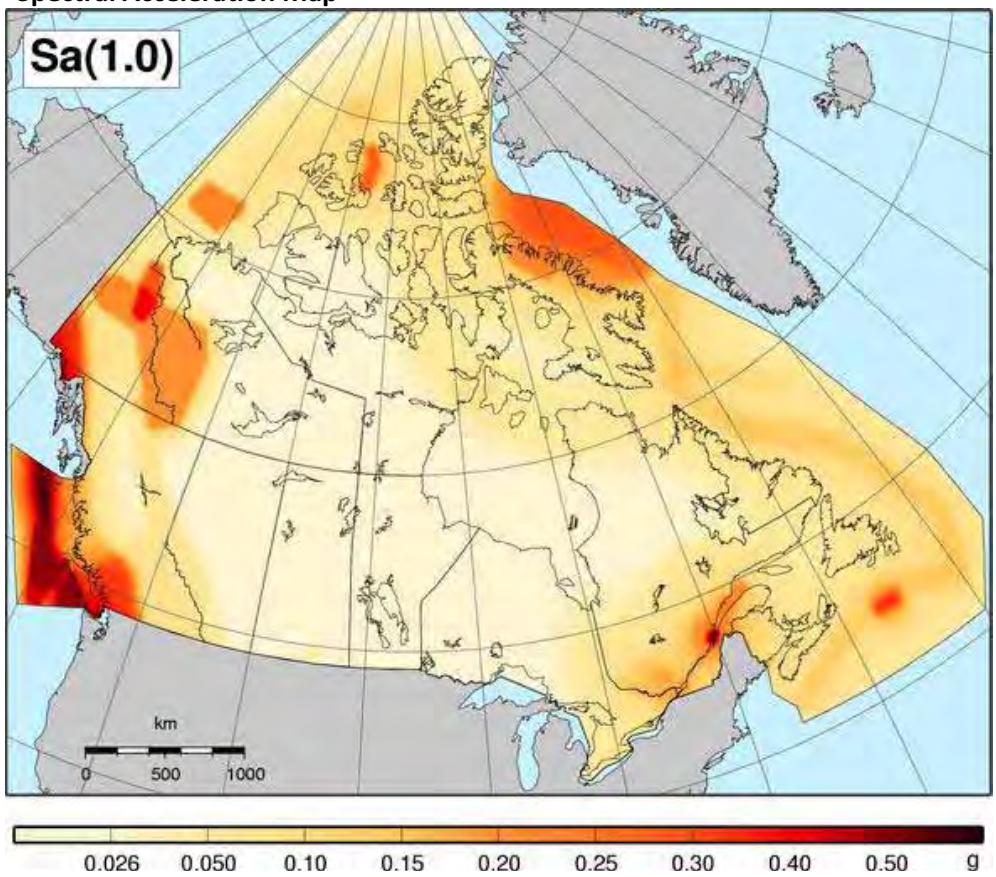
Source: Natural Resources Canada (2012)

A Seismic Hazard map indicates the areas that are most likely to experience an earthquake, but it does not directly indicate the effects on any activities or infrastructure in these areas. It also does not include information about the type of underlying sediment, which may fail by liquefaction and cause damage. Spectral Acceleration maps (Figure 4.5) are therefore developed to indicate the acceleration that would result from shaking by seismic waves with a particular frequency, assuming that these conditions would occur approximately once every 50 years. These values are valid for structures constructed on firm ground, not susceptible to liquefaction.

This Spectral Acceleration map indicates the acceleration that would result from shaking by seismic waves with a period of 1.0 second (s), compared to the acceleration due to gravity. The hazard in the eastern Gulf of St. Lawrence and westernmost Newfoundland also ranks low under this measure, with maximum values typically 0.05 to 0.15 of g (i.e., 0.5 to 1.5 m/s^2). A complete assessment of earthquake hazard, however, requires consideration of the ground on which any equipment or infrastructure is established. Soft muds and sands prone to liquefaction can cause failure of otherwise well-designed infrastructure, and slope failures can also occur. The effects of seismic waves can be further amplified as they move through sediments. Assessment of the combined seismic hazard must therefore include consideration of all of these factors.

The presence of pock marks in the sediments of the Gulf indicates that some could be prone to liquefaction and slope failure. However, the low frequency of seismic activity, as represented by the relative scarcity of earthquakes with epicentres located in the region (see above), indicates that the seismic hazard is low.

Figure 4.5 Spectral Acceleration Map



Source: Natural Resources Canada (2012)

4.1.1.4 Slope Stability

Offshore slope stability is affected by the presence of subaqueous channel / bank sedimentation and debris flow plumes, largely a legacy of lowered sea level during glacial periods in combination with earlier channel development in the late Neogene (Piper 2005). Channels and intervening banks form alternating bathymetric patterns on the floor of the Gulf of St. Lawrence. Although similar banks elsewhere are subject to disruption by earthquake activity, producing turbidity currents and slumping, the limited seismic regime in the eastern Gulf of St. Lawrence limits the potential for disruption from this cause. Submerged marine beaches, formed during periods of lower sea level in the late Quaternary, are also subject to slope failure.

Pock marks, formed by fluid release (water, methane), are common in some areas of the Gulf of St. Lawrence and St. Lawrence Estuary (Pinet et al 2008; St-Onge et al 2011). These features are recognized on multi-bean bathymetric images along the northwestern flank of the Laurentian Channel (in the southernmost part of the SEA Update Area). Aligned successions of pockmarks are associated with submarine slope failures, and locally form assemblages up to 12 km in length (Pinet et al 2008). The position of the pock mark assemblages suggests that many originate from discharge of methane gas from underlying Palaeozoic strata (lower part of the Maritimes Basin assemblage through the offshore Humber Zone assemblage). The pock marks thus serve as indicators of the presence of mature hydrocarbons in the underlying strata (St-Onge et al 2011).

Coastal slope failures occur where glacial and glaciomarine sediments are subject to undercutting by wave and storm action. Excessive overland flow, overloading by saturation, and removal of vegetation from coastal bluffs

are also factors in many coastal slope failures. Slope failures have been recorded along the west coast of Newfoundland at several locations, including Port au Port, Bonne Bay, and Daniel's Harbour (Catto 2012; Batterson et al in review). Slope failure styles include sacking, rockfalls, hyperconcentrated flows, channelized debris flows, rotational slumps, and several styles of creep. Many incidents are documented, with over 80 having been recorded as affecting communities and infrastructure throughout Newfoundland and Labrador (Batterson et al 2006). Rotational slumps of large volumes of sediment have occurred at Port au Port East (1994), near Journois, St. George's Bay (1996), Daniel's Harbour (2006 2007), and Trout River (several since 2002). The two largest failures at Daniels Harbour and Trout River, resulted in considerable property damage, although fortunately no loss of life. Numerous lesser examples have been documented, with the most recent occurring at Norris Point in mid-September 2012.

4.1.1.5 Coastal Geomorphology

The SEA Update Area includes nearly 1,000 km of coastline, stretching from Cape Ray near the Island of Newfoundland's southwest corner to New Ferolle on the Great Northern Peninsula. This extensive section of coast is characterized by various, and quite diverse, shoreline types and characteristics.

An overview summary of the geomorphologic characteristics of the coastline from Cape Ray to New Ferolle is presented below (from south to north):

1) Much of the southern section, from Cape Ray to Highlands, consists of a 50 km linear coastline dominated by cliffs of the Anguille Mountains that rise directly out of the sea. Faulting and erosion of gypsum strata, combined with glaciations and fluvial activity, has formed the Codroy Valley. To the north of Cape Anguille, the coastline has relatively few, small pocket beaches (e.g. Snakes Bight, Mary Ann Cove).

2) The shoreline of St. George's Bay extends northeastward from Highlands to Stephenville Crossing, and westward from Stephenville to Cape St. George. Thick Quaternary units of glacial diamticon, glaciomarine, and marine sediments form elevated coastal bluffs and raised deltas that are up to 75 m above present sea level. In the northeastern area of the shoreline, from St. Teresa to Flat Bay, Stephenville Crossing, and Port Harmon, coastal sediments derived from erosion of proglacial deposits have accumulated to form large strand plains and beaches.

3) The Port au Port Peninsula and Port au Port Bay include segments of steep bedrock cliffs, with flat, saltwater marshes along the shorelines of West Bay and East Bay. Shoal Point forms a prominent bedrock-cored feature. The segment from the Port au Port isthmus to Fox Island River is characterized by a broad coastal plain with beach systems and barachoix. To the north, from Fox Island River to Bottle Cove, the coastline is generally dominated by steep bedrock cliffs of the Long Range Mountains.

4) The coastline north from Bottle Cove to Parsons Pond is marked by deep embayments (Humber Arm, Bonne Bay) separated by straight segments with steep bedrock cliffs (Cape St. Gregory, Gros Morne National Park). Emerged deltas and glaciomarine sediments are preserved in relatively sheltered areas of the embayments. At Trout River, a glacially-overdeepened valley is impounded by an end moraine, which has subsequently been eroded to form a post-glacial marine terrace and ice-marginal delta and then downcut by the modern Trout River. The deglacial marine limit seaward of the front of the moraine is 70 m asl. Intertidal platforms are locally present (such as at Green Point).

5) The coastline from Parsons Pond to Hawkes Bay is linear, generally with low sediment bluffs overlying bedrock typically exposed along long, linear beach systems. Offshore, platforms underlain by Ordovician limestone and shale and covered by gravel slope seaward at gentle angles. The development of the rock platform offshore was primarily the result of frost action during intervals of lower sea level when the rock was exposed, reflecting incremental formation influenced by changing sea level.

6) The coastline from Hawkes Bay to New Ferolle is characterized by headlands (Port au Choix, New Ferolle), flanking the linear shoreline of St. John Bay, with relatively thin sediment layers over limestone, dolostone and shale. Seasonal iceshove results in the formation of boulder ramparts. Karsdt modification of the carbonate bedrock is apparent. The elevation of deglacial marine features increases northward to approximately 130 m asl inland of New Ferolle.

The various coastal segments that comprise the shoreline of the SEA Update Area are therefore diverse in nature, and thus, vary somewhat in terms of their history of, and potential for, erosion and other natural and anthropogenic influences and disturbances.

Factors, processes, rates, and vulnerabilities to coastal erosion for sites around the Island of Newfoundland were documented in a report prepared for the NL Department of Environment and Conservation (Catto 2011). The report classifies the coastline of the Island of Newfoundland, focusing on the sensitivity of the coastline to erosion and petroleum contamination. It involved mapping data at 50-100 m intervals, combined with more detailed local investigations. Intended to form the first phase of a detailed study of the Newfoundland coastline, the summary report will be followed by a subsequent report discussing individual locations along the coast.

The report contains four major chapters, beginning with discussion of the Shoreline Classification system, which considered coastal geomorphology and sedimentology and involved 27 shore classes. Two subsequent chapters discussed the sensitivity to short-term coastal erosion in Newfoundland coastal locations, using a newly-developed Coastal Erosion Index (CEI); and the longer-term factors involved in coastal erosion and sensitivity to sea level rise (CSI Index). The final introduced the Petroleum Vulnerability Index (PVI) and applied the PVI to sites around coastal Newfoundland.

Most beach sites along the west coast south of Bonne Bay contain mixed assemblages of sand, pebbles, and cobbles. Pebble-cobble beaches dominate the area north of Bonne Bay to New Ferolle. Sand-dominated beaches are developed adjacent to coastal sand dunes (Portland Creek, Western Brook Pond outlet). Shallow Bay has the largest sand beach / dune system in Western Newfoundland. Gypsum cliffs (shore class 27) susceptible to erosion are present at Woodville, Codroy, Robinsons, Flat Bay, and Romaines.

The dominant shoreline classes represented south of Bonne Bay are mixed gravel-sand steep beaches (18), narrow (17) to wide (16) mixed gravel-sand flats, mixed sand-gravel pocket beaches (9), and bedrock cliffs (3). North of Bonne Bay, steep gravel beaches (15), and gravel beaches developed on wide (4) or narrow (5) rock platforms are more common.

The Coastal Erosion Index (CEI) involves consideration of five factors: sediment type (parameter values 1-4), shoreline classification (1-5), sediment flux (1-5), aspect (1-5), and extent of seasonal ice and snow cover (1-2). After each parameter was determined, the CEI was calculated as:

CEI = (product of five parameter values / 10)

A higher CEI value indicates greater sensitivity to coastal erosion. The maximum possible CEI value is (4 x 5 x 5 x 5 x 2 / 10), equalling 100. The minimum possible value is 0.1.

The mean CEI value for all Newfoundland (island) coastal sites is approximately 10.3 (median 9.5), with values locally reaching 40. Qualitative assessment of the CEI scores involved dividing the numerical values into 5 categories:

1) *Very Low Sensitivity*: CEI < 4.9 (e.g. St. Andrews, Humbermouth, Goose Arm)
2) *Low Sensitivity*: CEI 5.0-9.9 (e.g. Corner Brook, River of Ponds, Fox Island River)
3) *Moderate Sensitivity*: CEI 10.0- 14.9 (e.g. New Ferolle, Cow Head, Lourdes)
4) *High Sensitivity*: CEI 15.0-19.9 (e.g. Highlands, Stephenville Crossing, Norris Point)
5) *Extreme Sensitivity*: CEI > 20.0 (e.g. Bear Cove, Woodville, Flat Bay, Long Point, Broad Cove)

Thus, sites with CEI values approximating the mean of 10.3 for the Island of Newfoundland are considered to have moderate to low sensitivity to coastal erosion resulting from shorter-term processes and events. This conclusion reflects the resistant nature of much of Newfoundland's coast (bedrock, coarse gravel beaches), locally high sediment fluxes, and the prevalence of offshore seasonal ice cover. Changes in the latter two factors would affect the CEI values as calculated.

The CEI values do not directly indicate the severity of erosion (i.e. how much sediment is removed), or the amount removed temporarily by a single event (perhaps eventually to be replaced by sediment flux). Importantly, from a coastal management perspective, they do not indicate the likelihood of damage to infrastructure or dwellings, or possible effects on the residents of coastal communities.

The sensitivity to sea level rise (CSI Index) is modified from the formulation presented by Shaw et al (1998) for conditions prevalent along the Newfoundland coast (Catto et al 2003; Catto 2011), within seven parameters:

- sea-level change (amount of rise or fall per year);
- relief;
- mean annual maximum significant wave height;
- rock and/or sediment type exposed along the shore;
- landform type (e.g. cliff, beach, salt marsh);
- shoreline displacement (laterally, expressed in m/a); and
- tidal range

Each of these were assigned an equal weight, with variations within each ranked from 1 (very low sensitivity) to 5 (very high sensitivity). By combining the scores for each parameter, coastal sensitivity indices (CSI) can be calculated as:

$$CSI = \sqrt{(\text{product of scores of all 7 parameters}/7)}$$

Thus, a shore with the least sensitivity to coastal erosion would have a CSI of √(1/7), or ~ 0.38, whereas the greatest value possible is √(5 x 5 x 5 x 5 x 5 x 5 x 5/7), or ~105.6.

The median CSI value for all coastal sites on the Island of Newfoundland is approximately 18.5 (mean 18.0), with values locally exceeding 45. Qualitative assessment of the CSI scores involves dividing the numerical values into 5 categories:

1) *Very Low Sensitivity*: CSI <4.9 (Cape St. George)
2) *Low Sensitivity*: CSI 5.0-14.9 (e.g. Lourdes, Corner Brook, Bellburns, Port Saunders)
3) *Moderate Sensitivity*: CSI 15.0- 24.9 (e.g. Robinsons, Mainland, Picadilly, Port-au-Choix)
4) *High Sensitivity*: CSI 25.0-34.9 (e.g. Woodville, Stephenville, Western Brook Pond outlet)
5) *Extreme Sensitivity*: CSI >35.0 (none in Western Newfoundland)

Thus, sites with CSI values approximating the median of 18.5 for the Island of Newfoundland are considered to have moderate sensitivity to coastal erosion resulting from sea level rise.

Petroleum and its products represent a potential pollution hazard to the shoreline of Western Newfoundland. In addition to offshore events, accidental discharge of petroleum and gasoline at the shoreline during refinery and tanker operations (Williams et al 1985, 1988), removal and disposal of waste from vessels in port (Olson 1994) and leakages from strictly terrestrial sources are also matters of concern. Petroleum products can thus arrive at Western Newfoundland shorelines from both offshore and onshore sources, and as a result of both routine operations and accidental events.

Analyses for Canadian coastal systems (e.g. Owens 1977, 1993, 1994; Reinson 1979; Woodword-Clyde Consultants 1981; Owens and White 1982; Owens et al 1982; McLaren 1980; Environment Canada 1988; Cameron et al 1990; Dickins 1990; Harper and Reimer 1991; British Columbia Ministry of the Environment 1993) have established that sand to fine gravel beaches and flats, with relatively gentle slopes, low to moderate prevailing energy conditions, and primarily dissipative regimes, are potentially vulnerable to long-term petroleum contamination.

An additional issue involves the source of the petroleum contamination. Low energy areas such as tidal mudflats and salt marshes are less likely to be contaminated by offshore spills, as these areas are generally isolated from the prevailing pattern of current and wave motion. However, oil reaching such an environment as a result of a terrestrial-based or shoreline spill would be extremely difficult to remove. Estuarine and lagoonal areas are particularly susceptible to pollution from terrestrial sources.

Rating the vulnerability of the coastal environments of Newfoundland to petroleum pollution thus requires consideration of the geomorphology and sedimentology of the shoreline, the dynamics and energy, the biological assemblages, and the location with respect to potential offshore and onshore sources of contamination. Previous quantitative vulnerability assessments for selected beaches in Eastern Newfoundland were provided by Catto et al (2003), Etheridge (2005), Catto and Etheridge (2006), and McNeil (2009).

The sensitivity and exposure of shorelines to petroleum contamination were considered separately. Three parameters were considered in the assessment of sensitivity: shoreline class and sediment type (S, 1-5), shoreline energy level (E, 1-5), and energy regime (R, 1-5). Assessment of exposure included the possibility of accidental or deliberate discharges from marine vessels at sea (M, 1-5), contamination from terrestrial sources (T, 1-2.5), and current direction with respect to shoreline orientation (D, 1-2).

The Petroleum Vulnerability Index (PVI) was calculated by multiplying the sensitivity and exposure parameters, and then determining the square root, as:

$$PVI = \sqrt{(S * E * R) (M2 * T * D)}$$

The maximum possible value for the PVI is √(125)*(125) = 125; the minimum possible value is 1. The median PVI value for all Newfoundland coastal sites determined in this study is approximately 17 (mean 17.1), with values locally exceeding 35 (compared to a theoretical minimum of 1, and a theoretical maximum of 125).

Assessment of the PVI scores involves dividing the numerical values into 5 categories:

1) *Very Low Vulnerability*: PVI < 15.0 (e.g. Port-au-Port West, Goose Arm)
2) *Low Vulnerability*: PVI 15.0-19.9 (e.g. Bartletts Harbour, Irishtown, Codroy)
3) *Moderate Vulnerability*: PVI 20.0-29.9 (e.g. St. Davids, St. Pauls, York Harbour, Corner Brook)
4) *High Vulnerability*: PVI 30.0-34.9 (e.g. Shallow Bay)
5) *Extreme Vulnerability*: PVI > 35.0 (e.g. Stephenville, Portland Creek, Grand Jardin)

Sites with PVI values approximating the median of 17 for the Island of Newfoundland are considered to have low to moderate vulnerability to petroleum contamination.

Each of these indexes (CEI, CSI, PVI) was calculated for 1,472 sites along the coast of Newfoundland, including 126 within the SEA Update Area for which data are presented in Table 4.1. As indicated, many of the identified areas of relatively high sensitivity are located at or near the mouths of rivers and streams.

Table 4.1 Shoreline Classification Results for Coastal Sites in Western Newfoundland

Locality	Substrate*	Shore Class	CEI	CSI	PVI
Cape Ray	r	3	5.0	7.8	8.7
Bear Cove	s, p, c	18,21	33.6	21.5	22.0
Wreckhouse Cove	s, p, c	9	15.8	16.9	17.9
Trainvain Brook Outlet	s, p, c	18	15.8	16.9	17.9
St. Andrews	o, w, s, p	17,18,23,26	2.4	18.1	21.9
Searston	s, p, c	16,17,18	16.0	18.5	22.0
Great Codroy	o, w, s, p	23,26	6.3	13.4	17.9
Millville	s, p, c	3,9	9.6	15.6	19.6
Woodville	r, g	3,27	28.4	26.2	29.4
Codroy	s, p, g	3,9,27	25.2	25.3	19.6
Cape Anguille	r	3	5.0	7.8	10.0
Snakes Bight	r	3	5.0	7.8	17.0
Little Friars Cove	r	3	5.0	7.8	17.0
Highlands	s, p, c	18	16.0	18.1	25.5
Maidstone	s, p, c	9	16.0	14.6	25.5
St. Davids	s, p, c	9,18	16.0	17.9	25.5
Jeffreys	s, p, c	9	14.4	14.6	25.5
McKay's	s, p, c	18	16.0	18.1	25.5

Locality	Substrate*	Shore Class	CEI	CSI	PVI
Robinsons	s, p, g	3,9,27	16.5	19.1	27.0
Heatherton	r	3	5.0	11.1	17.0
Fischell's	s, p, c	18	16.0	18.1	25.5
St Teresa	s, p, c	9	16.0	14.6	25.5
Flat Bay	s, p, c, g	9,27,24	30.6	19.1	27.0
Shallop Cove	s, p, c	18	16.0	18.1	25.5
St Georges	s, p, c	18	16.0	18.2	27.0
Seal Rocks	s, p, c	18	14.4	20.2	27.0
Barachois Brook	s, p, c	18	14.4	22.6	36.0
Stephenville Crossing	s, p, c	16,17,18	15.0	28.6	36.0
Stephenville Airport	s, p, c	16,17,18	15.6	23.3	36.0
Noels Pond	s, p, c	17	15.0	25.8	36.0
Stephenville	s, p, c	18,17	14.6	25.8	36.0
Kippens	s, p, c	9	21.0	17.8	27.0
Romaines	s, p, c, g	9,27	28.8	18.6	27.0
Berry Head	r	3	5.0	7.9	12.0
Port-au-Port West	s, p, c	18	16.0	28.6	12.0
Bellmans Cove	r	3	5.0	7.9	12.0
Felix Cove	s, p, c	9	21.0	19.5	27.0
Campbells Creek	s, p, c	9	21.0	19.5	27.0
Abrahams Cove	s, p, c	9	21.0	20.5	27.0
Jerrys Nose	r	3	5.0	9.0	6.9
Ship Cove	s, p, c	18	21.0	18.1	27.0
Lower Cove	s, p, c	18	21.0	18.1	27.0
Sheaves Cove	s, p, c	9	21.0	20.5	27.0
Marches Point	s, p, c	9	21.0	20.5	27.0
Red Brook	s, p, c	9	21.0	20.5	27.0
De Grau	s, p, c	9	21.0	20.5	27.0
Grand Jardin	s, p, c	9	24.5	21.3	36.0
Petit Jardin	s, p, c	9	28.0	21.3	36.0
Cape St George	r	3	5.0	4.1	6.9
Mainland	s, p, c	18	21.0	18.1	27.0
Three Rock Cove	s, p, c	18	24.0	14.2	27.0
Salmon Cove	p, c	6	14.4	7.4	20.8
Lourdes	p, c	6	14.4	7.4	20.8
Winterhouse	p, c	6	14.4	7.4	20.8
Long Point	s, p, c	18	24.0	23.3	21.2
West Bay	s, p, c	14,15,18	7.6	18.5	18.0
Picadilly	s, p, c	9,18	7.6	18.5	18.0
Boswarlos	s, p, c	9,18	12.5	18.5	18.0
Aguathuna	s, p, c	9	12.5	15.4	18.0

Locality	Substrate*	Shore Class	CEI	CSI	PVI
Point au Mal	s, p, c	14,15,17,18	15.0	15.4	18.0
Fox Island River	s, p, c	14,15,17,18	7.0	15.4	18.0
Broad Cove	s, p, c	18	32.0	14.8	22.0
Molly Ann Cove	s, p, c	9	28.0	12.2	22.0
Bear Cove	p, c	6	19.2	14.8	22.0
Little Port	p, c	15	18.0	20.8	22.0
Bottle Cove	p, c	15	14.4	19.6	22.0
Lark Harbour	p, c	13,14,15	13.5	20.8	22.0
York Harbour	p, c	14,15	14.4	18.9	27.0
Frenchmans Cove	p, c	15	18.0	18.1	22.0
Johns Beach	p, c	6	9.6	11.9	27.0
Benoits Cove	p, c	15	18.0	18.1	22.0
Halfway Point	s, p, c	18	9.6	11.9	22.0
Mount Moriah	s, p, c	9	9.6	11.9	22.0
Petries	s, p, c	9	11.2	11.9	22.0
Curling	s, p, c	9	11.2	12.4	22.0
Corner Brook	s, p, c	18	8.0	11.6	23.2
Humbermouth	w, s, p	9, 23	4.8	10.3	24.0
Wild Cove	w, s, p	21,18	9.6	18.1	24.0
Irishtown	s, p, c	9,18	18.8	14.6	19.6
Summerside	s, p	18,9	19.8	18.1	22.0
Meadows	s, p, c	9	18.8	18.1	22.0
Gillams	p, c	15	16.6	20.2	22.0
McIvers	s, p, c	13,15	16.6	22.1	24.5
Cox's Cove	p, c	14,15	16.6	16.6	19.6
Goose Arm	s, p, c	14,15,23	3.5	5.2	4.0
North Arm	p, c	14	7.0	5.2	4.0
Trout River	p, c	14,15	18.0	19.7	24.5
Curzon	p, c	6	11.2	10.1	19.6
Woody Point	s, p, c	18	18.0	14.8	22.0
Shoal Brook	s, p, c	18	18.0	14.8	22.0
Winterhouse Brook	s, p, c	18	18.0	12.9	22.0
Birchy Head	s, p, c	9	11.2	14.0	22.0
Glenburnie	s, p, c	16	15.8	14.8	22.0
Lomond	s, p, c	9,16,23	15.8	13.8	22.0
Norris Point	s, p, c	18,15	18.0	12.9	22.0
Rocky Harbour	p, c	4,15	15.6	15.6	22.0
Bear Cove	p, c	15	16.8	15.0	11.3
Lobster Cove	p, c	5	16.8	14.4	9.0
Western Brook Pond outlet	s	19,20,21	32.4	26.5	39.2
Sally Cove	s, p, c	5,18	16.8	14.4	24.0

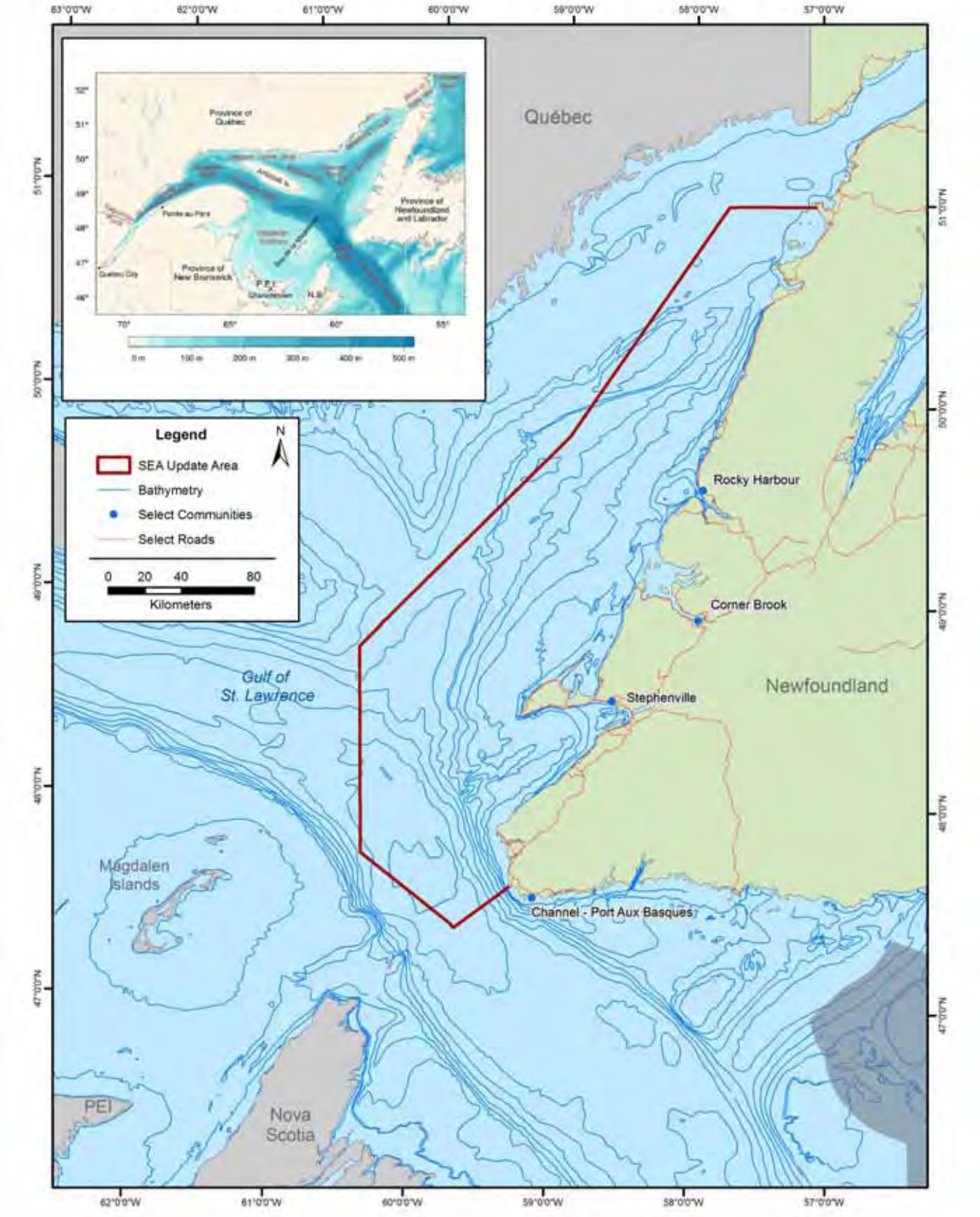
Locality	Substrate*	Shore Class	CEI	CSI	PVI
St. Pauls	o, s, p, c	18,24,26	7.2	11.7	26.8
Cow Head	s, p, c	16,17,18	12.2	15.7	24.0
Shallow Bay	s	19,20,21	27.0	22.9	31.2
Parson's Pond	s, p, c	18	21.6	20.2	24.0
The Arches	p, c	2,5	5.4	14.2	9.0
Portland Creek	s	21	24.3	26.5	39.2
Daniels Harbour	s, p, c	15,18	21.6	20.2	24.0
Spudgels Cove	p, c	5	9.6	9.1	11.3
Bellburns	p, c	15	9.6	10.2	12.7
Bateau Cove	p, c	15	9.6	10.2	12.7
River of Ponds	p, c	5,4	7.2	10.2	14.7
Spirity Cove	p, c	5	9.6	9.1	12.7
Hawkes Bay	p, c	4,5	9.6	9.1	12.7
Hawkes Bay N	p, c	4	9.6	9.1	12.7
Port Saunders E	p, c	4	7.2	8.3	11.3
Port Saunders	p, c	5	8.4	9.1	12.7
Port au Choix	p, c	15	21.6	16.5	14.7
Port au Choix NHS	p, c	15	21.6	17.2	19.6
Port au Choix Back Cove	p, c	15	17.4	14.3	12.7
Bustard Cove	p, c	4	9.6	8.7	11.3
Eddies Cove West	p, c	4	9.6	9.1	11.3
Barr'd Harbour	p, c	4,5	9.6	9.1	11.3
Squid Cove	s, p, c	8	11.2	14.2	19.6
Castors River	s, p, c	5,7,8	9.6	14.2	19.6
Bartletts Harbour	p, c	15	11.2	14.2	19.6
New Ferolle	p, c	5,15	12.4	14.2	19.6
*Substrate Types: c= cobbles; g= gypsum; o=organics; p=pebbles; r=bedrock; s=sand; w=silt					

4.1.2 Bathymetry

The physiography within the SEA Update Area exhibits a wide range of features, from intertidal flats near the coast, to a continental shelf further offshore, to the steep slopes of the Esquiman Channel and the northern part of the Cabot Strait (Figure 4.6).

As a result, water depths within the region range from several meters along the western coast of Newfoundland, to 100 to 300 m further offshore toward the Esquiman Channel, to more than 500 m in the Laurentian Channel and Cabot Strait in the southern part of the SEA Update Area (Figure 4.6).

Figure 4.6 General Bathymetry of the SEA Update Area



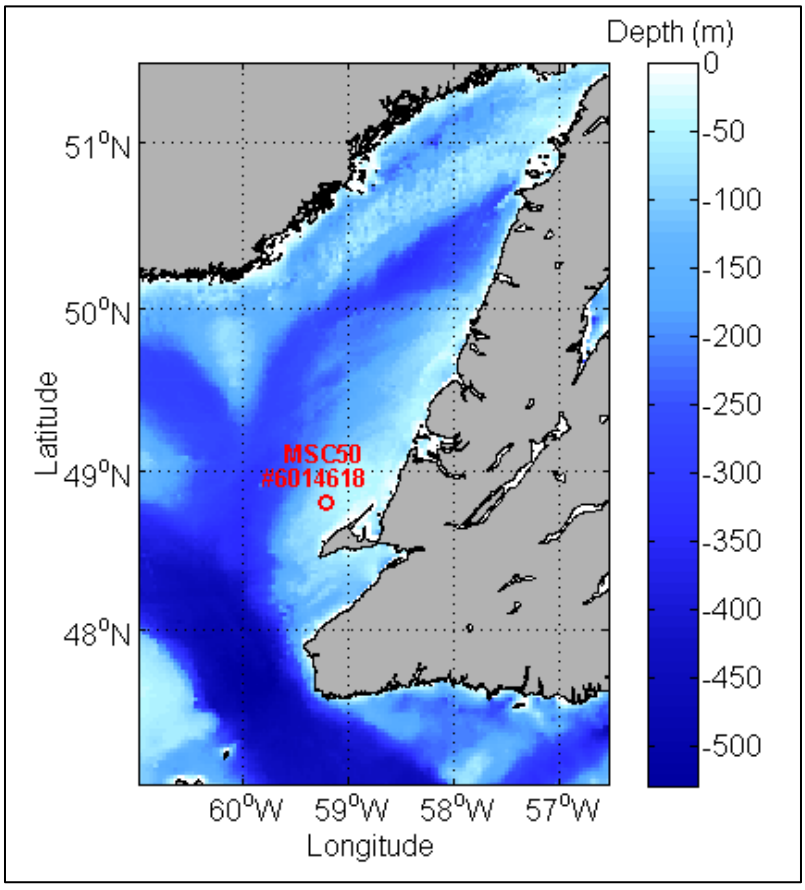
4.1.3 Climatology

The following sections provide an updated overview of the key climatological conditions and characteristics of the SEA Update Area, including wind, air temperatures, precipitation, fog and visibility and wave conditions.

4.1.3.1 Wind Conditions

The wind climatology in the region has been characterized from robust statistics derived from the latest MSC50 wind and wave hindcast dataset, spanning the period from 1954 to 2011 inclusive (MSC 2012). The data were extracted from the data node 6014618 (48.8°N; 59.2°W), located within the central part of the SEA Update Area (Figure 4.7). The dataset includes hourly wind and wave parameters, of the North Atlantic Ocean and includes consideration of iced-over periods (Swail et al 2006). The hindcast data were produced through the kinematic reanalysis of all significant tropical and extra-tropical storms in the North Atlantic for the continuous period 1954-2011.

Figure 4.7 Location of the MSC50 Node Used to Describe Wind and Wave Climatology (1954-2011)



The hourly wind speed and direction data have been used to derive annual (Figure 4.8) and monthly plots (Figure 4.9) of speed and directional distributions. Quantitative descriptions of these distributions have also been tabulated in Tables 4.2 to 4.4.

Figure 4.8 Annual Directional Distribution of Wind Speed (1954-2011)

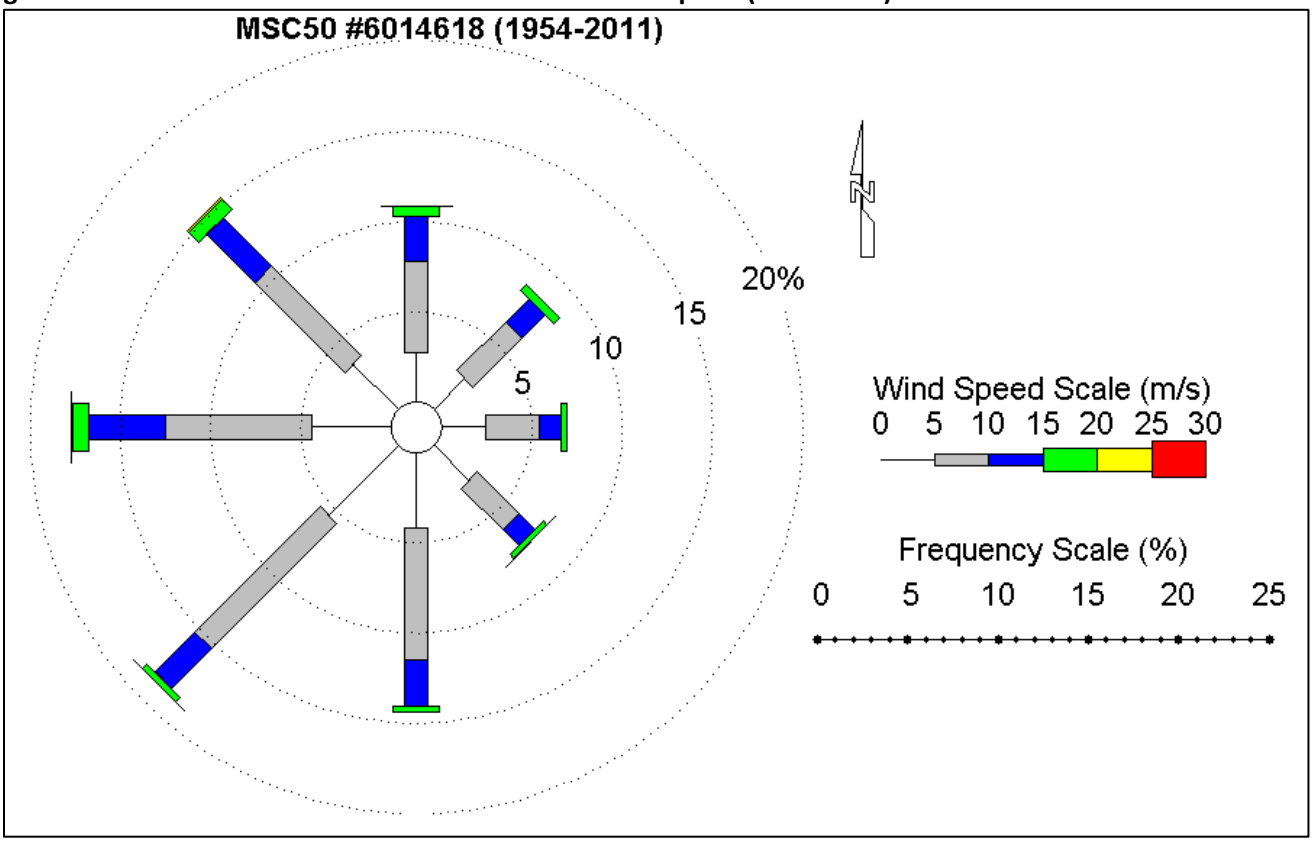


Table 4.2 Annual Bivariate Frequency Distributions of Wind Speed and Direction (1954 – 2011)

Wind Speed (m/s)	Annual Frequency of Occurrence (%) per Direction (from)								
	N	NE	E	SE	S	SW	W	NW	Total
0 – 5	2.754	2.378	2.410	2.716	4.137	5.476	4.407	3.562	27.839
5 – 10	5.020	3.839	2.977	3.282	7.383	9.808	8.053	7.029	47.391
10 – 15	2.485	1.826	1.254	1.246	2.551	3.146	4.265	3.784	20.557
15 – 20	0.541	0.441	0.261	0.271	0.324	0.326	0.941	0.803	3.909
20 – 25	0.044	0.034	0.014	0.020	0.013	0.018	0.080	0.079	0.303
25 – 30	0.001	0	0	0	0	0	0	0	0.001
Total	10.844	8.519	6.916	7.536	14.408	18.774	17.746	15.257	100.000

The prevailing winds through most of the year have a northwesterly, westerly or southwesterly direction, depending on the time of the year. The monthly plots reveal that westerly and northwesterly winds are dominant during the period from November to March, while southwesterly and southerly winds are more frequent during the warmer months from May to September (Figures 4.8 to 4.10).

Mean hourly wind speeds range from about 5.3 m/s (July) to 10.1 m/s (December), while the strongest winds in excess of 25 m/s are most likely to occur in December (from the southwest) and January (from the north), and at times during August when tropical storms are likely to pass through the region. Overall, wind speeds in excess of 20 m/s occur very infrequently (about 0.3 percent of the time).

Figure 4.9 Monthly Directional Distributions of Wind Speed (1954 – 2011)

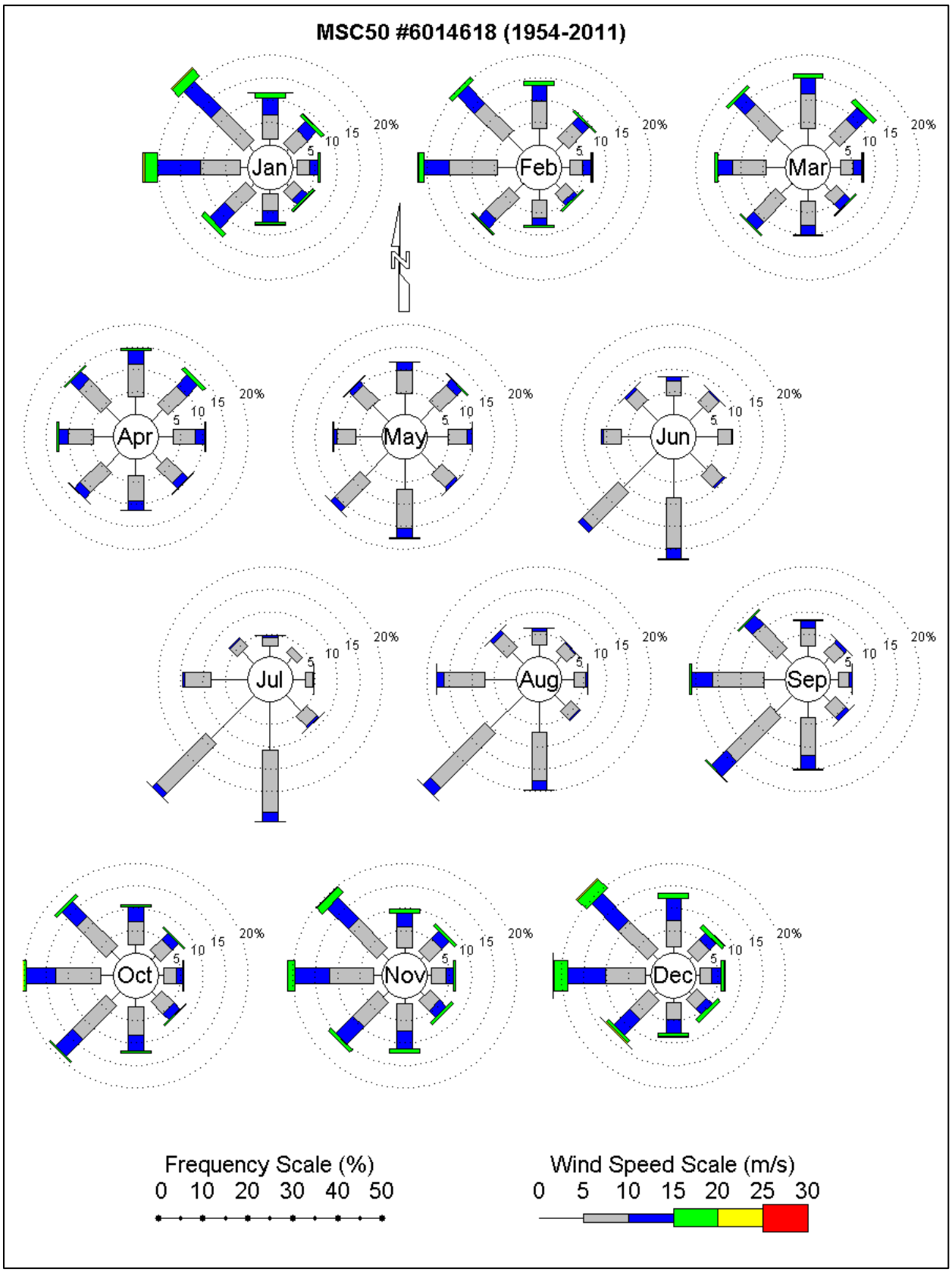


Table 4.3 Monthly and Annual Frequency Distributions of Wind Direction (1954 – 2011)

Month	Wind Direction Frequency of Occurrence (%)							
	N	NE	E	SE	S	SW	W	NW
January	11.74	8.65	6.18	5.68	7.84	13.46	23.42	23.03
February	14.24	9.7	6.92	5.6	8.39	12.96	22	20.19
March	15.8	13.31	7.36	6.86	10.26	13.14	15.88	17.39
April	14.75	13.68	10.57	9.81	11.4	12.87	12.63	14.3
May	11.76	11.64	10.07	10.17	17.61	16.72	11.04	10.99
June	8.46	8.04	8.24	9.67	22.27	23.32	11.05	8.95
July	4.78	3.57	4.63	8.6	26.78	30.63	14.52	6.49
August	6.41	5.01	5.84	6.36	19.65	29.98	17.87	8.9
September	8.35	5.78	4.9	6.45	15.33	23.99	21.44	13.76
October	10.83	7.11	5.62	7.56	12.16	19.05	20.28	17.39
November	9.85	8.05	6.31	7.1	12.15	15.68	21.14	19.72
December	13.41	7.84	6.45	6.5	8.63	13.01	21.9	22.27
Year Mean	10.84	8.52	6.92	7.54	14.41	18.77	17.75	15.26

Table 4.4 Monthly and Annual Frequency Distributions of Maximum Wind Speeds (Rounded to nearest 1 m/s) for Each Wind Direction (1954 – 2011)

Month	Monthly Wind Speed Maximum per Direction (m/s)								Monthly Max	
	N	NE	E	SE	S	SW	W	NW	Min	Max
January	25	24	24	23	23	22	23	25	22	25
February	22	22	22	21	23	22	22	22	21	23
March	20	23	22	22	20	20	21	20	20	23
April	22	21	19	19	18	18	18	21	18	22
May	17	19	16	17	17	19	20	17	16	20
June	17	17	14	15	16	15	15	20	14	20
July	16	14	16	19	17	18	14	14	14	19
August	18	16	20	25	19	18	18	17	16	25
September	21	17	22	20	20	20	21	22	17	22
October	23	24	20	20	19	19	22	21	19	24
November	21	20	20	21	21	22	24	24	20	24
December	24	24	23	22	23	26	25	24	22	26
Year Max	25	24	24	25	23	26	25	25	23	26

The maximum hourly wind speeds (Table 4.5) indicate that gale force winds, in the range from 17.5 - 24.2 m/s (MSC 2012), occur throughout the year, while storm force winds, in the range from 24.7 - 32.4 m/s, are expected to occur in December and January. There is no indication that sustained hurricane force winds (stronger than 32.9 m/s) occur in the SEA Update Area. An analysis of maximum expected wind speeds for periods ranging from a year to a century is also presented.

Table 4.5 Wind Speed and Direction Descriptive Statistics, MSC50 Data (1954 – 2011)

Parameter	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Mean hourly speed	9.9	8	7.7	7.2	5.9	5.4	5.3	6	7.4	8.5	9.4	10.1	7.6
Standard deviation of hourly speed (m/s)	3.9	3.9	3.8	3.6	3.2	3	2.7	2.8	3.3	3.5	3.7	4	3.8
Most frequent direction (from)	W	W	NW	N	S	SW	SW	SW	SW	W	W	NW	SW
Maximum hourly speed (m/s)	25.4	22.5	22.6	22.1	19.6	19.9	18.5	25.1	21.9	24.5	24.1	25.5	25.5
Direction of max. hourly speed (from)	N	S	NE	N	W	NW	SE	SE	NW	NE	W	SW	SW

The detailed bivariate frequency distributions for hourly wind speeds are provided in Tables 4.6 to 4.17.

Figure 4.10 Monthly Frequency Distributions of Wind Speed (1954-2011)

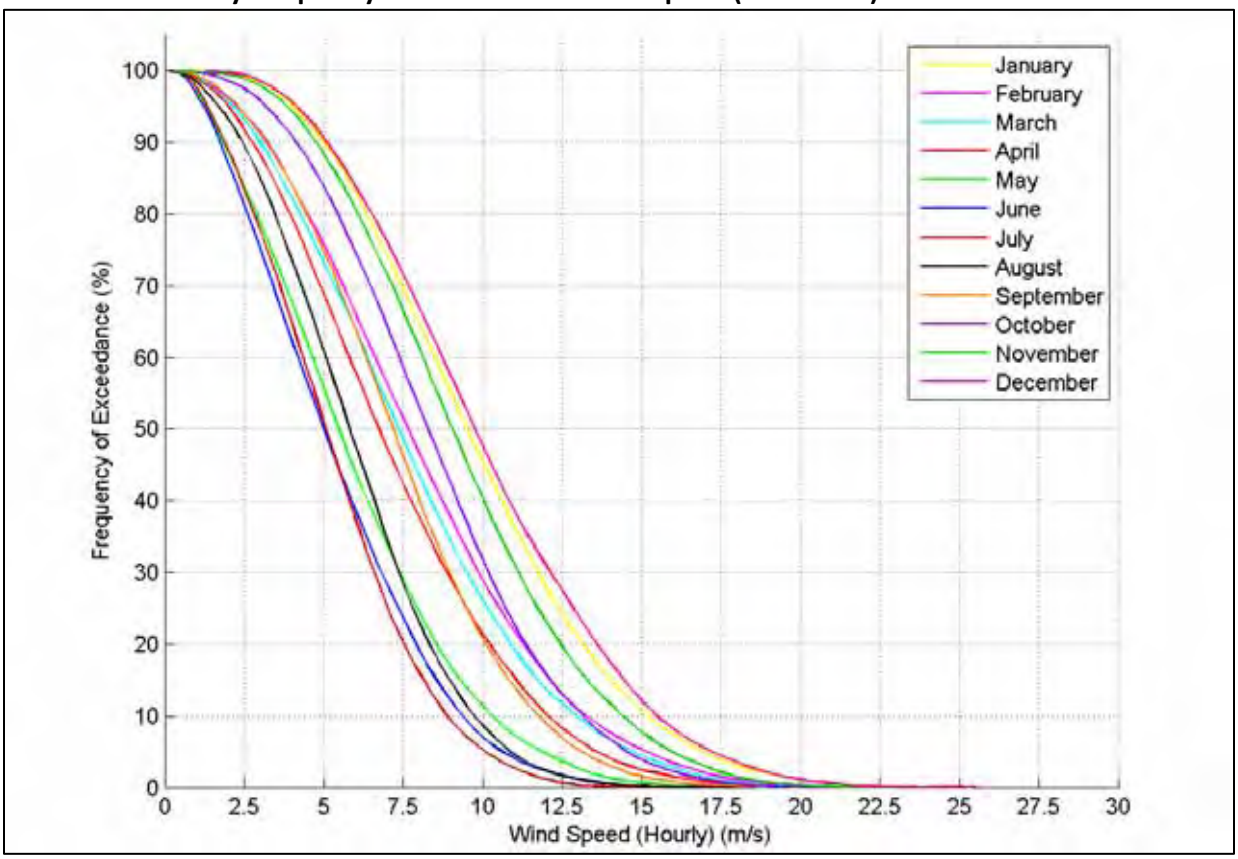


Table 4.6 Bivariate Frequency Distributions of Wind Speed and Direction, January (1954 – 2011)

Wind Speed (m/s)	January, Frequency of Occurrence (%) per Direction (from)								
	N	NE	E	SE	S	SW	W	NW	Total
0 – 5	1.279	0.932	1.013	0.881	0.929	1.244	1.567	1.926	9.77
5 – 10	5.513	4.164	2.730	2.593	3.740	6.463	9.042	10.173	44.42
10 – 15	3.645	2.688	1.875	1.495	2.463	4.690	9.552	8.477	34.886
15 – 20	1.147	0.790	0.514	0.607	0.628	1.029	2.869	2.153	9.738
20 – 25	0.144	0.072	0.046	0.104	0.083	0.035	0.392	0.304	1.18
25 – 30	0.007	0	0	0	0	0	0	0	0.007
Total	11.735	8.646	6.178	5.680	7.844	13.462	23.422	23.033	100.000

Table 4.7 Bivariate Frequency Distributions of Wind Speed and Direction, February (1954 – 2011)

Wind Speed (m/s)	February, Frequency of Occurrence (%) per Direction (from)								
	N	NE	E	SE	S	SW	W	NW	Total
0 – 5	3.610	2.584	1.857	1.689	2.211	2.928	4.243	4.853	23.975
5 – 10	6.156	4.523	2.895	2.544	3.953	7.074	10.808	8.809	46.762
10 – 15	3.571	2.073	1.740	0.995	1.798	2.508	5.741	5.431	23.858
15 – 20	0.829	0.493	0.397	0.366	0.410	0.392	1.157	1.051	5.095
20 – 25	0.071	0.028	0.028	0.005	0.020	0.061	0.053	0.043	0.31
25 – 30	0	0	0	0	0	0	0	0	0
Total	14.237	9.702	6.916	5.599	8.392	12.963	22.003	20.187	100.000

Table 4.8 Bivariate Frequency Distributions of Wind Speed and Direction, March (1954 – 2011)

Wind Speed (m/s)	March, Frequency of Occurrence (%) per Direction (from)								
	N	NE	E	SE	S	SW	W	NW	Total
0 – 5	3.726	3.314	2.396	2.188	2.398	3.430	4.243	4.762	26.458
5 – 10	7.731	5.226	2.728	2.899	5.569	7.082	7.673	8.343	47.249
10 – 15	3.469	3.613	1.819	1.548	1.993	2.405	3.214	3.655	21.716
15 – 20	0.871	1.124	0.368	0.216	0.297	0.211	0.744	0.628	4.459
20 – 25	0.005	0.037	0.049	0.007	0	0.009	0.007	0.005	0.118
25 – 30	0	0	0	0	0	0	0	0	0
Total	15.802	13.313	7.360	6.857	10.257	13.137	15.881	17.392	100.000

Table 4.9 Bivariate Frequency Distributions of Wind Speed and Direction, April (1954 – 2011)

Wind Speed (m/s)	April, Frequency of Occurrence (%) per Direction (from)								
	N	NE	E	SE	S	SW	W	NW	Total
0 – 5	3.915	3.606	3.439	3.127	3.561	4.562	4.373	4.459	31.042
5 – 10	7.261	5.769	4.739	4.859	5.773	6.324	5.721	6.980	47.426
10 – 15	3.091	3.482	2.105	1.664	1.928	1.909	2.177	2.625	18.98
15 – 20	0.426	0.783	0.283	0.163	0.134	0.072	0.364	0.213	2.438
20 – 25	0.055	0.041	0	0	0	0	0	0.019	0.115
25 – 30	0	0	0	0	0	0	0	0	0
Total	14.749	13.681	10.565	9.813	11.396	12.866	12.634	14.296	100.000

Table 4.10 Bivariate Frequency Distributions of Wind Speed and Direction, May (1954 – 2011)

Wind Speed (m/s)	May, Frequency of Occurrence (%) per Direction (from)								
	N	NE	E	SE	S	SW	W	NW	Total
0 – 5	4.558	4.556	4.723	5.163	6.586	7.552	5.844	4.968	43.952
5 – 10	5.305	5.038	4.255	4.139	8.813	7.803	4.287	4.797	44.436
10 – 15	1.743	1.845	1.087	0.832	2.157	1.323	0.774	1.105	10.866
15 – 20	0.155	0.202	0.005	0.037	0.056	0.037	0.132	0.123	0.746
20 – 25	0	0	0	0	0	0	0	0	0
25 – 30	0	0	0	0	0	0	0	0	0
Total	11.761	11.640	10.069	10.171	17.612	16.715	11.038	10.994	100.000

Table 4.11 Bivariate Frequency Distributions of Wind Speed and Direction, June (1954 – 2011)

Wind Speed (m/s)	June, Frequency of Occurrence (%) per Direction (from)								
	N	NE	E	SE	S	SW	W	NW	Total
0 – 5	4.176	4.248	4.938	5.386	8.578	10.939	6.549	4.887	49.701
5 – 10	3.305	3.396	3.027	3.669	11.205	11.078	4.042	3.379	43.099
10 – 15	0.908	0.371	0.273	0.615	2.443	1.307	0.457	0.611	6.985
15 – 20	0.069	0.024	0	0	0.050	0	0	0.072	0.216
20 – 25	0	0	0	0	0	0	0	0	0
25 – 30	0	0	0	0	0	0	0	0	0
Total	8.458	8.039	8.238	9.670	22.275	23.324	11.049	8.949	100.000

Table 4.12 Bivariate Frequency Distributions of Wind Speed and Direction, July (1954 – 2011)

Wind Speed (m/s)	July, Frequency of Occurrence (%) per Direction (from)								
	N	NE	E	SE	S	SW	W	NW	Total
0 – 5	2.494	1.928	2.797	4.911	10.723	13.700	8.292	3.766	48.610
5 – 10	1.782	1.481	1.722	3.270	13.909	15.682	5.692	2.445	45.982
10 – 15	0.487	0.162	0.109	0.392	2.125	1.240	0.535	0.283	5.332
15 – 20	0.021	0	0.002	0.023	0.023	0.007	0	0	0.076
20 – 25	0	0	0	0	0	0	0	0	0
25 – 30	0	0	0	0	0	0	0	0	0
Total	4.783	3.571	4.630	8.595	26.780	30.629	14.518	6.493	100.000

Table 4.13 Bivariate Frequency Distributions of Wind Speed and Direction, August (1954 – 2011)

Wind Speed (m/s)	August, Frequency of Occurrence (%) per Direction (from)								
	N	NE	E	SE	S	SW	W	NW	Total
0 – 5	2.672	2.202	2.732	3.495	6.762	10.475	7.022	3.578	38.937
5 – 10	3.061	2.466	2.681	2.556	10.813	17.237	9.126	4.322	52.262
10 – 15	0.596	0.317	0.417	0.297	2.044	2.253	1.666	0.973	8.563
15 – 20	0.081	0.021	0.002	0	0.028	0.014	0.056	0.025	0.227
20 – 25	0	0	0.002	0.007	0	0	0	0	0.009
25 – 30	0	0	0	0.002	0	0	0	0	0.002
Total	6.410	5.006	5.835	6.357	19.647	29.978	17.869	8.899	100.000

Table 4.14 Bivariate Frequency Distributions of Wind Speed and Direction, September (1954 – 2011)

Wind Speed (m/s)	September, Frequency of Occurrence (%) per Direction (from)								
	N	NE	E	SE	S	SW	W	NW	Total
0 – 5	2.426	1.762	1.944	2.129	3.463	5.227	4.749	3.321	25.022
5 – 10	4.088	3.156	2.318	3.144	8.434	13.903	11.568	7.344	53.956
10 – 15	1.585	0.797	0.625	1.104	3.168	4.646	4.672	2.751	19.349
15 – 20	0.206	0.065	0.005	0.072	0.249	0.213	0.445	0.309	1.564
20 – 25	0.043	0	0.010	0.002	0.012	0	0.007	0.036	0.110
25 – 30	0	0	0	0	0	0	0	0	0
Total	8.348	5.781	4.902	6.451	15.326	23.989	21.442	13.762	100.000

Table 4.15 Bivariate Frequency Distributions of Wind Speed and Direction, October (1954 – 2011)

Wind Speed (m/s)	October, Frequency of Occurrence (%) per Direction (from)								
	N	NE	E	SE	S	SW	W	NW	Total
0 – 5	1.791	1.272	1.235	1.451	1.979	2.660	2.915	2.598	15.902
5 – 10	5.351	3.555	2.786	3.842	6.248	10.727	10.011	9.552	52.072
10 – 15	3.126	1.854	1.346	1.972	3.427	5.346	6.419	4.588	28.08
15 – 20	0.494	0.382	0.246	0.299	0.508	0.320	0.908	0.640	3.796
20 – 25	0.065	0.051	0.002	0	0	0	0.025	0.007	0.151
25 – 30	0	0	0	0	0	0	0	0	0
Total	10.827	7.114	5.615	7.564	12.162	19.054	20.279	17.385	100.000

Table 4.16 Bivariate Frequency Distributions of Wind Speed and Direction, November (1954 – 2011)

Wind Speed (m/s)	November, Frequency of Occurrence (%) per Direction (from)								
	N	NE	E	SE	S	SW	W	NW	Total
0 – 5	1.193	1.070	0.987	1.269	1.327	1.657	1.832	2.071	11.406
5 – 10	4.713	3.910	3.331	3.044	6.037	7.933	9.914	9.162	48.044
10 – 15	2.909	2.474	1.542	2.182	3.963	5.326	7.665	6.597	32.658
15 – 20	0.989	0.580	0.448	0.575	0.817	0.747	1.648	1.681	7.483
20 – 25	0.043	0.012	0	0.036	0.007	0.012	0.086	0.213	0.409
25 – 30	0	0	0	0	0	0	0	0	0
Total	9.847	8.046	6.307	7.105	12.150	15.675	21.145	19.725	100.000

Table 4.17 Bivariate Frequency Distributions of Wind Speed and Direction, December (1954 – 2011)

Wind Speed (m/s)	December, Frequency of Occurrence (%) per Direction (from)								
	N	NE	E	SE	S	SW	W	NW	Total
0 – 5	1.305	1.119	0.860	0.853	0.966	1.122	1.233	1.682	9.14
5 – 10	6.053	3.471	2.561	2.816	3.858	6.143	8.971	9.156	43.029
10 – 15	4.737	2.253	2.137	1.856	3.075	4.760	8.375	8.373	35.565
15 – 20	1.210	0.825	0.864	0.895	0.698	0.871	2.945	2.737	11.045
20 – 25	0.107	0.169	0.025	0.076	0.037	0.104	0.375	0.320	1.214
25 – 30	0	0	0	0	0	0.005	0.002	0	0.007
Total	13.411	7.837	6.447	6.496	8.635	13.005	21.902	22.268	100.000

4.1.3.2 Air Temperatures

The atmospheric properties over the ocean surface broadly spanning the SEA Update Area are characterized using the International Comprehensive Ocean-Atmosphere Data Set (ICOADS), as it represents the most extensive available database of observations of atmospheric and sea conditions. The dataset consists of global marine observations recorded from 1662 to the present, compiled by the United States National Centre for Atmospheric Research (NCAR 2012). The period from January 1950 to August 2012, inclusive, was selected for the analysis as data in the area of interest are scarce for the preceding period. The following subsections present monthly statistics in which the seasonal trends and changes are noted for air temperature, precipitation and visibility. Monthly estimates of vessel icing potential derived from both atmospheric and sea surface properties are also presented.

The monthly air temperature statistics are plotted in Figure 4.11 and presented in Table 4.18. The air temperature values exhibit strong seasonal variations, with mean temperatures ranging from -0.7°C in February to 14.4°C in August. The coldest observed air temperature on record (-26.7°C) was in January, while during the summer months the coldest observed temperatures were around -1°C in June. The highest observed temperatures during winter months are approximately 17°C, while in summer the values reach as high as 27°C. Throughout the year the mean daily minimum and maximum temperatures generally stay within about 3°C of the mean temperature. There is a notable north-south air temperature gradient within the SEA Update Area, with annual average temperatures being about 4°C higher at Blanc Sablon compared to Port aux Basques, and winter (January-March) average temperatures 6°C higher, documented in detail by Galbraith et al (2011).

Figure 4.11 Monthly Air Temperature (Based on ICOADS 1950-2012)

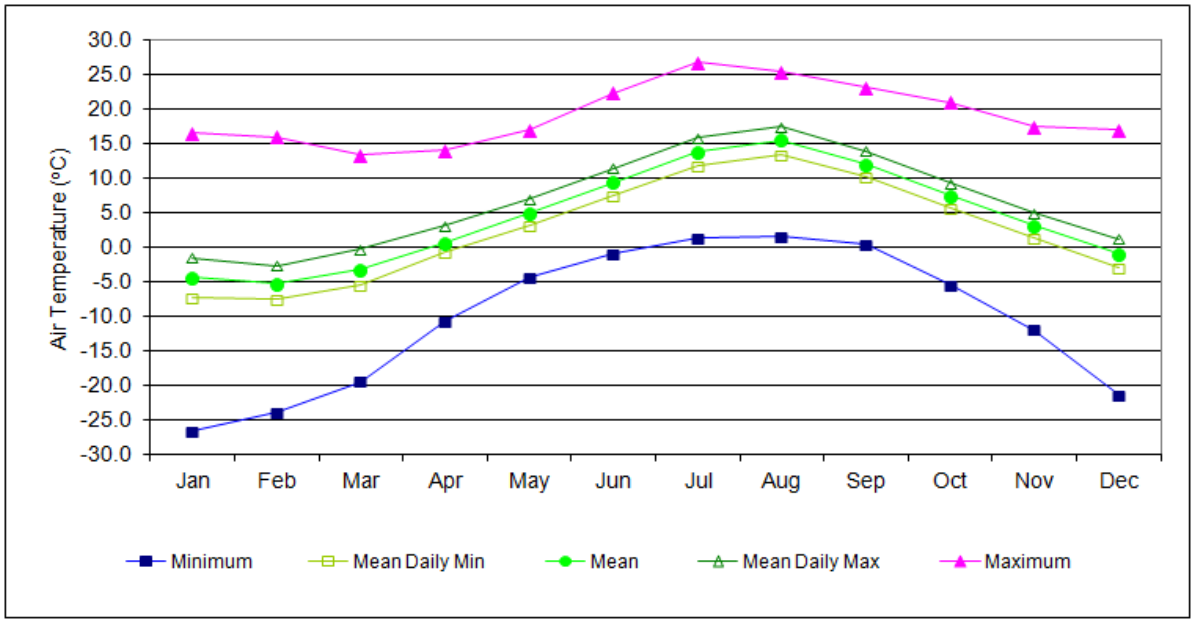


Table 4.18 Monthly Air Temperature Statistics (based on ICOADS 1950-2012)

Month	Mean	Max	Min	Std Dev	Mean Daily Max	Mean Daily Min
January	-4.4	16.6	-26.7	6.1	-1.5	-7.3
February	-5.3	16.0	-24.0	5.9	-2.7	-7.6

Month	Mean	Max	Min	Std Dev	Mean Daily Max	Mean Daily Min
March	-3.3	13.4	-19.5	5.1	-0.3	-5.5
April	0.6	14.0	-10.7	3.3	3.2	-0.8
May	4.9	17.0	-4.3	3.2	7.0	3.1
June	9.4	22.4	-1.0	3.3	11.5	7.4
July	13.9	26.8	1.4	3.0	15.9	11.9
August	15.5	25.5	1.5	2.8	17.4	13.4
September	12.0	23.1	0.4	3.1	14.0	10.2
October	7.5	21.0	-5.5	3.4	9.2	5.6
November	3.1	17.5	-12.0	3.8	4.9	1.3
December	-0.9	17.0	-21.5	4.9	1.2	-3.1

In recent years, the air temperatures over the Gulf of St. Lawrence have exhibited significant positive anomalies compared to the climate normals relative to the 1981-2010 period (Galbraith et al 2011). In particular, Galbraith et al (2011) found that the monthly averages for the November 2009 to December 2010 season have been above the climate normal for the last 3 decades (except for September 2010, which was near-normal at +0.5 standard deviation). They also indicate that the sustained run of positive anomalies was spatially consistent through the Gulf, and contributed to an exceptionally warm winter. Gulf-wide monthly average temperatures were at their record high in February, April and December 2010.

4.1.3.3 Precipitation

The ICOADS database contains observations of several precipitation types and thunderstorm occurrence. Every occurrence of a weather state is recorded and categorized as an event based on the type, but not the amount, of precipitation during that event. The frequency of occurrence of the different precipitation types and thunderstorms have been calculated as a percentage of the total monthly and annual weather observations for the period 1950 – 2012.

The trends are plotted in Figures 4.12 and 4.13 and the associated statistics are presented in Table 4.19. The statistics show the percentage of a certain distinct weather state (e.g. rain, thunderstorms, hail, etc.) for all weather reports available on record for that month (e.g. January). The weather states have been consolidated from 50 different ICOADS classifications, separating (without overlap) rain from freezing rain and snow (although some overlap may exist between these states and mixed rain/snow, hail and thunderstorm, which represent a small percentage of the data). The weather state is reported for approximately half of all ICOADS data points in the SEA Update Area. The frequency of occurrence can most closely be characterized as representing unspecified periods of time, for a percentage of all days. The data indicate that most of the observed precipitation events are in the form of rain and snow, while other precipitation types, such as mixed rain and snow, freezing rain, and hail, occur far less frequently. The monthly frequency of rain events is lowest in January and February (about 4 percent of the time), when the snow occurrence frequency is at its peak (32 to 34 percent). The situation is somewhat reversed between May and October, with maximum rain frequency (15 percent) in October, and minimum snow frequency from June to September (0.1 to 0.3 percent).

Figure 4.12 Frequency of Occurrence of Several Precipitation Types (Based on ICOADS 1950-2012)

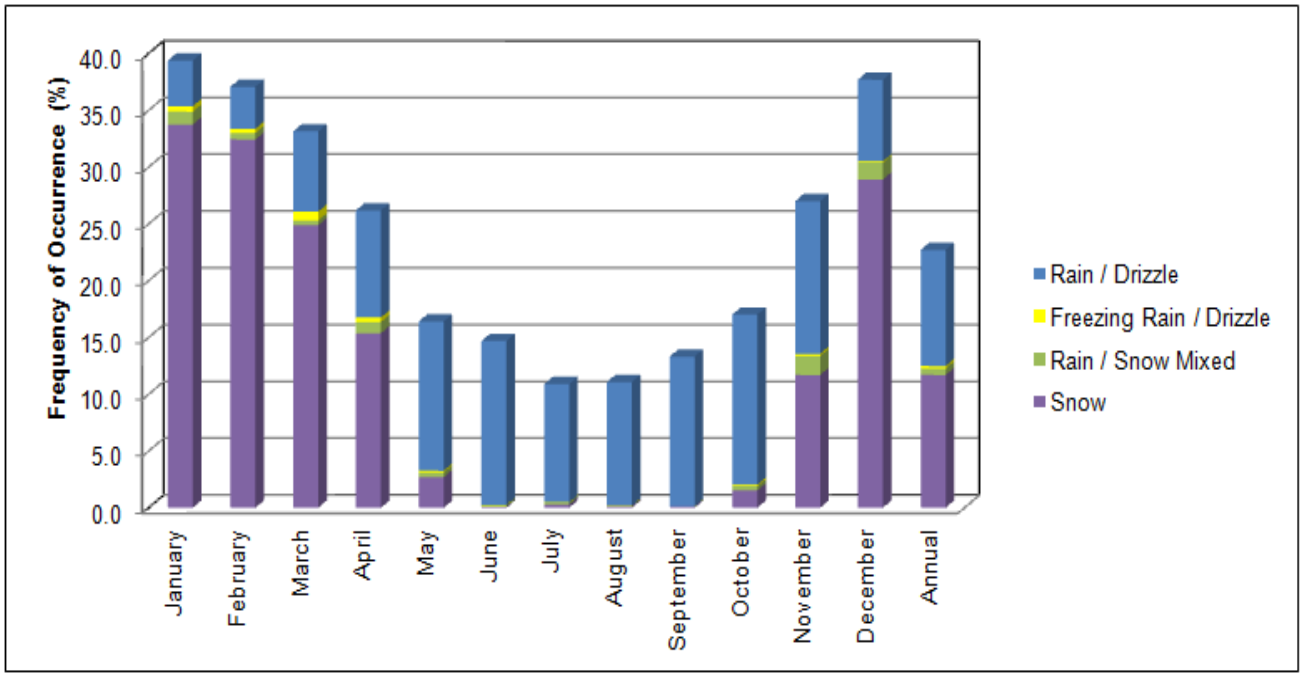


Figure 4.13 Frequency of Occurrence of Hail and Thunderstorms (Based on ICOADS 1950-2012)

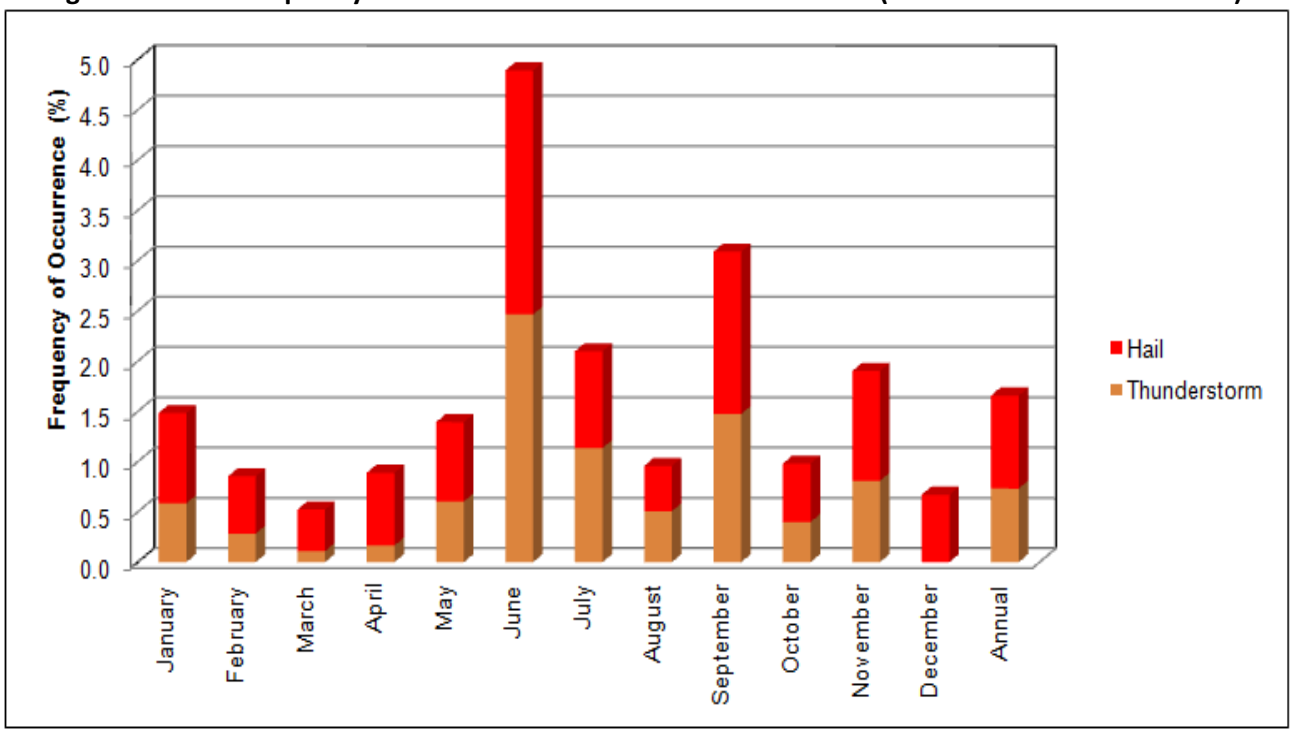


Table 4.19 Monthly and Annual Frequencies of Occurrence of Precipitation and Thunderstorms (Based on ICOADS 1950-2012)

Month	Rain / Drizzle	Freezing Rain / Drizzle	Rain / Snow Mixed	Snow	Hail	Thunderstorm	Total
Jan	4.0	0.5	1.1	33.7	0.9	0.6	40.8
Feb	3.7	0.4	0.6	32.4	0.6	0.3	37.9
Mar	7.1	0.8	0.4	24.9	0.4	0.1	33.7
Apr	9.4	0.4	1.0	15.4	0.7	0.2	27.1
May	13.1	0.1	0.4	2.7	0.8	0.6	17.8
Jun	14.4	0.0	0.1	0.1	2.4	2.5	19.6
Jul	10.4	0.0	0.2	0.3	1.0	1.1	13.0
Aug	10.9	0.0	0.1	0.1	0.5	0.5	12.0
Sep	13.2	0.0	0.0	0.1	1.6	1.5	16.4
Oct	15.0	0.1	0.4	1.5	0.6	0.4	18.0
Nov	13.4	0.2	1.7	11.7	1.1	0.8	28.9
Dec	7.2	0.1	1.5	28.9	0.7	0.0	38.4
Annual	**10.2**	**0.2**	**0.6**	**11.7**	**0.9**	**0.7**	**24.4**

Freezing rain and drizzle are relatively infrequent, occurring less than one percent of the time during any given month, and do not occur at all between June and September. Thunderstorms are the main generating mechanism of hail, therefore the observation of hail is expected during thunderstorms. The data show that hail and thunderstorms indeed occur with similar frequencies, although during some months the frequency of hail is higher than that of thunderstorms. This may be due to other forms of precipitation, such as ice pellets, being inaccurately categorized as hail by observers. There is a year-round potential for thunderstorms and hail, with the highest frequency of occurrence occurring in the month of June (2.5 percent of the time).

Based on the observed air temperature gradient reported in Section 4.1.3.2 by Galbraith et al (2011), it is also expected that there would be a considerable degree of variability of precipitation patterns within localized regions of the SEA Update Area. Therefore, it would be prudent for project-specific planning and implementation to consider and account for the expected site-specific conditions and variability in the occurrence and rates of precipitation based on the nearest and most current weather records applicable to the site.

4.1.3.4 Fog and Visibility

Visibility in the SEA Update Area can be affected by the occurrence of fog, the number of daylight hours, as well as frequency and type of precipitation. Visibility observations from the ICOADS dataset have been classified as very poor (<0.5 km), poor (0.5 – 2 km), fair (2 – 10 km) or good (> 10 km). The monthly and annual frequencies of occurrence of each state are plotted in Figure 4.14 and shown in Table 4.20.

It is clear from the data that visibility varies significantly throughout the year, with good and fair visibility combined accounting for at least 85 percent of the observed states every month. Good visibility (greater than 10 km) is most frequent during September and October (about 63.5 percent of the time), and least frequent in January (31.6 percent). During the fall and winter good visibility is observed more frequently, between 40 to 60 percent of the time.

Poor and very poor visibility states occur at a relatively low frequency year round, with the combined maximum occurrence of about 14 percent occurring in January and July, and the combined minimum of less than 5 percent per month occurring in September and October. The highest frequency of occurrence of very poor visibility (<0.5 km) of 8.5 percent occurs in July. In general, the seasonal variation trends indicate that there is a tradeoff between good and fair visibility throughout the year, while poor and very poor visibility vary to a smaller degree.

Again, therefore, fog and visibility conditions and seasonal variability are expected to vary across the SEA Update Area, along with air temperatures and precipitation rates. Therefore site-specific conditions and the possible implications of these would have to be characterized from local visibility datasets for project-specific planning and analysis.

Figure 4.14 Frequency of Occurrence of Visibility States (Based on ICOADS 1950-2012)

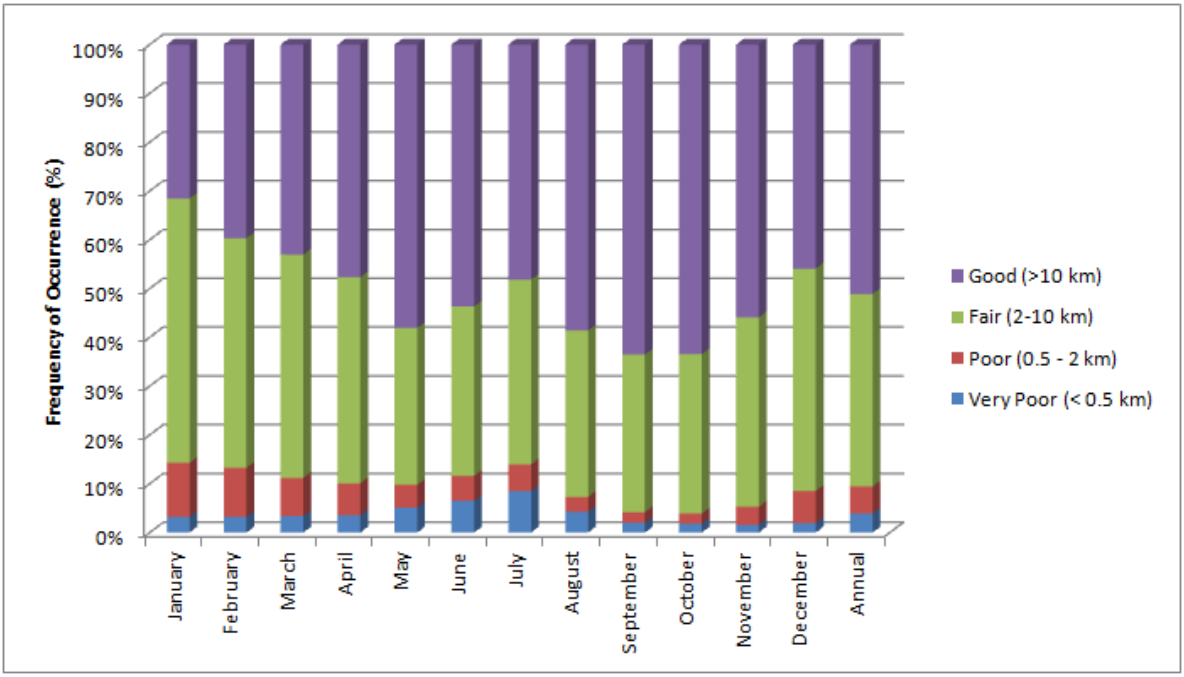


Table 4.20 Monthly and Annual Frequencies of Occurrence of Visibility States (Based on ICOADS 1950-2012)

Month	Very Poor (<0.5 km)	Poor (0.5 – 2 km)	Fair (2 – 10 km)	Good (>10 km)
Jan	3.2	11.0	54.2	31.6
Feb	3.2	10.1	47.1	39.7
Mar	3.4	7.9	45.7	43.0
Apr	3.6	6.5	42.2	47.7
May	5.1	4.6	32.1	58.1
Jun	6.5	5.1	34.7	53.7
Jul	8.5	5.5	37.9	48.2
Aug	4.3	3.0	34.1	58.6
Sep	2.0	2.2	32.3	63.5
Oct	1.8	2.1	32.7	63.4
Nov	1.6	3.7	38.8	55.9
Dec	1.9	6.6	45.6	45.9
Annual	3.9	5.6	39.4	51.1

4.1.3.5 Wave Climate

The wave climate in the SEA Update Area has been characterized by descriptive statistics derived from the aforementioned MSC50 wind and wave hindcast dataset. The wind hindcast involved the kinematic reanalysis of all significant tropical and extra-tropical storms in the North Atlantic for the continuous period 1954 – 2011. The wave hindcast was conducted by using the wind field reanalysis to force a third generation wave model (Swail et al 2006) over the North Atlantic Ocean. The model used was Oceanweather's OWI-3G, adopted onto a 0.5 degree grid on a basin-wide scale, thus improving upon the .625 by .833 degree grid used in the AES40 hindcast dataset presented in the initial (2005) SEA Report. Inscribed in the 0.5 degree model was a further refined 0.1 degree shallow water implementation of the OWI-3G model, which allowed for shallow water effects to be accounted for in the wave propagation calculations near the coastline of Western Newfoundland as well as the rest of the maritime region. The MSC50 methodology and results have been extensively documented and validated (Swail and Cox 2000, Woolf et al 2002, Caires et al 2004).

The wave climate is described in terms of the significant wave height (Hs, defined as 4 times the square root of the total variance of the energy spectrum), and the peak wave spectral period (Tp, defined as the period of waves with the highest contribution to the energy spectrum). Both parameters are reflective of the dominant atmospheric forcing, both within the SEA Update Area as well as far offshore, and are expected to exhibit significant seasonal variability.

The descriptive statistics for wave height, peak period and direction are provided the Tables that follow, and the annual and monthly directional distributions of significant wave heights are plotted in Figures 4.15 and 4.16, respectively. The monthly frequencies of occurrence of significant wave height are plotted in Figure 4.17.

The statistics indicate that the most severe sea states would occur between October and January, with a peak in December, when maximum significant wave heights of up to 9.5 m from the west are expected, with an associated peak period of 12.9 s. In contrast, the maximum expected significant wave height is lowest (4.3 m) in July, with an associated peak period of 9.4 s. Significant wave heights in excess of 5 m are expected to occur during every month except for July (Table 4.21).

The values of the peak wave period associated with the maximum significant wave heights are generally in the range of 10 – 13 s, while the mean peak period is on average about 5.1 s, ranging from 2.2 – 4 s between February and April, to 6.1 – 6.8 s from October to December. The elevated peak periods associated with highly energetic storm-generated waves reflect the more frequent passage of severe storms through the Gulf of St. Lawrence during the late fall and winter period, while the below average mean periods and mean significant wave heights from February to April likely reflect the presence of sea ice that tends to prevent the formation or attenuate the severity of the storm-generated waves. Due to the spatial and interannual variability in ice cover through the SEA Update Area, the wave climate is expected to vary among different locations, particularly during the winter months, with ice-presence as a modifying variable for wave climate statistics specific locations.

The detailed distributions of frequencies of occurrence for significant wave height and peak wave period are presented below.

Table 4.21 Wave Direction, Significant Wave Height and Peak Period (Descriptive Statistics, MSC50 Data 1954 – 2011)

MSC#6014618 Wave Parameters													
Parameter	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**	**Year**
Mean Hsig (m)	1.7	0.8	0.6	0.8	0.9	0.9	0.9	1	1.4	1.7	1.9	2.2	1.2
Standard deviation of Hsig (m/s)	1.4	1	0.9	0.9	0.7	0.6	0.5	0.6	0.9	1	1.1	1.3	1.1
Most frequent direction (from)	W	W	SW	SW	SW	SW	SW	SW	SW	SW	W	W	SW
Mean Tp (s)	5.4	3	2.2	3.9	5.2	5.3	5.2	5.2	5.8	6.1	6.5	6.8	5.1
Maximum Hsig (m)	9	7.5	5.6	6.3	6.6	5.8	4.3	5.8	7.2	8	8.4	9.5	9.5
Direction of max Hsig (from)	W	W	W	W	W	NW	W	W	NW	W	W	W	W
Tp of max. Hsig (s)	12.3	11.2	10	10.9	10.9	9.8	9.4	10.5	11	11.6	11.9	12.9	12.9
Max. Tp (s)	15.5	16.5	15.6	21	15.7	15.8	16.2	15.8	16	12	12.1	15.6	21

Figure 4.15 Annual Directional Distribution of Significant Wave Height (1954-2011)

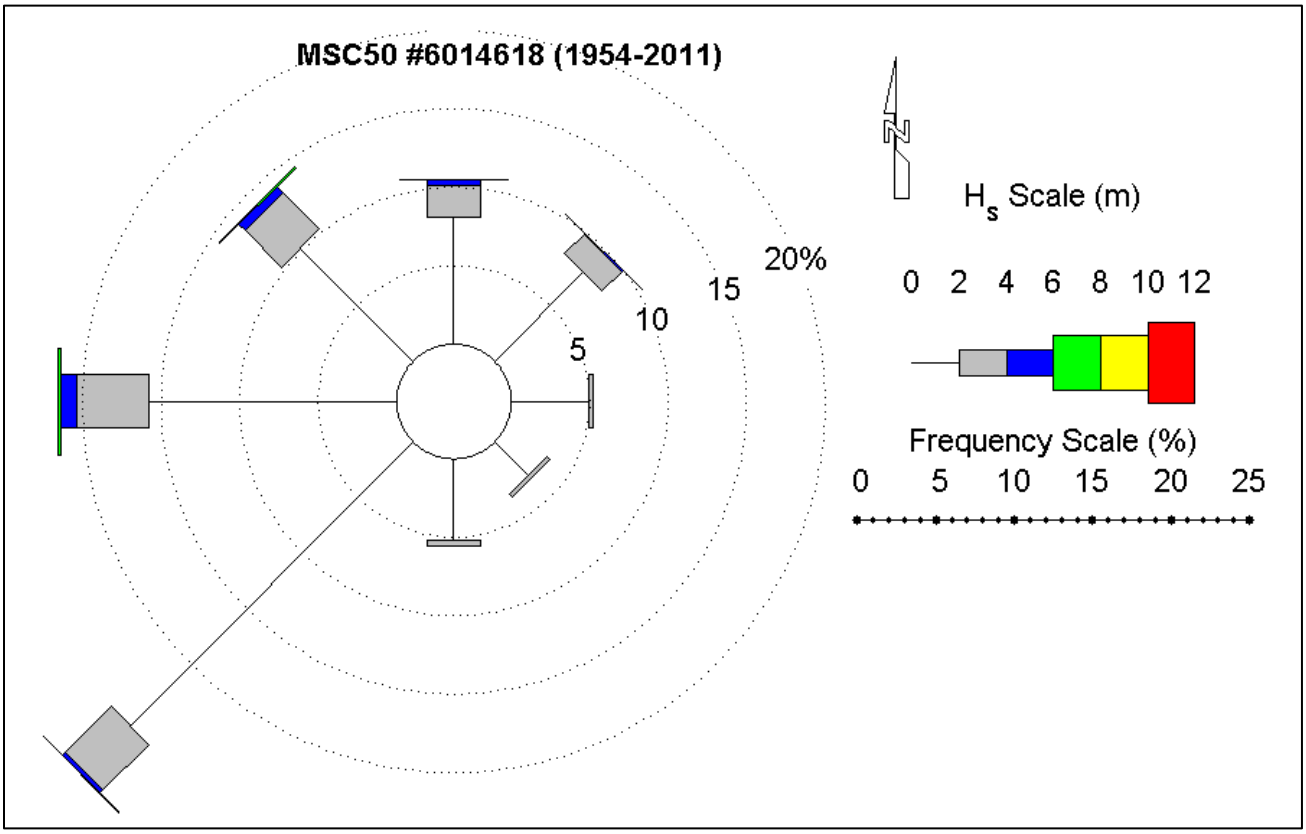


Figure 4.16 Monthly Directional Distributions of Significant Wave Height (1954-2011)

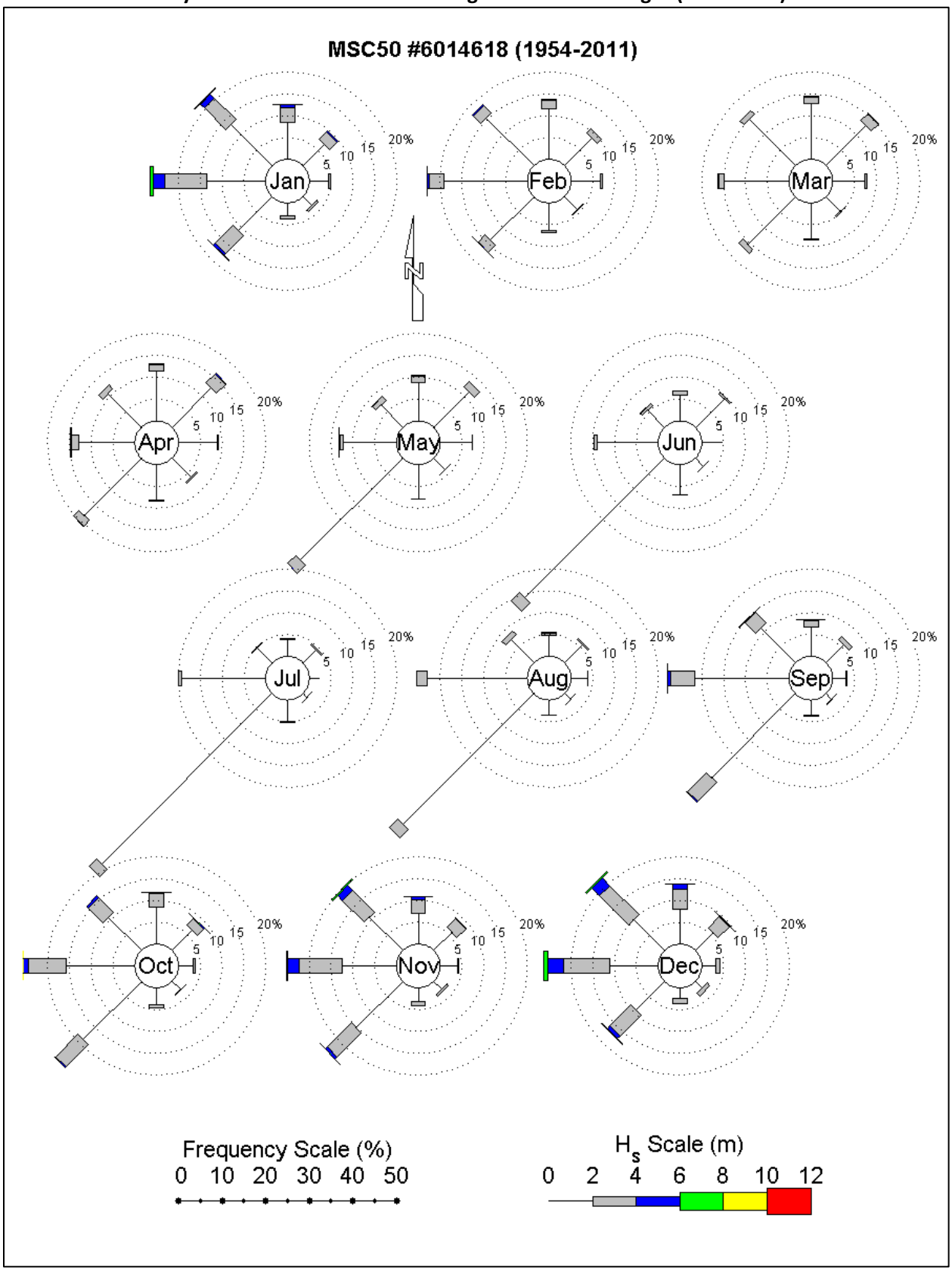


Table 4.22 Frequency Distributions (% Occurrence) of Peak Period (1 second bins), MSC50 Data (1954 – 2011)

Tp (s)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1	0	0.366	0.498	0.74	0.355	0.029	0	0.012	0.007	0.002	0	0
2	0.127	0.819	1.159	1.281	1.74	1.815	1.448	1.124	0.486	0.083	0.014	0.016
3	1.529	3.215	2.881	5.381	5.634	5.96	5.353	4.924	2.646	1.745	1.147	0.795
4	8.883	11.34	9.177	17.644	24.497	25.659	28.506	25.487	17.799	12.229	9.667	7.485
5	16.493	13.383	10.403	18.173	24.886	28.166	30.119	31.815	27.775	23.756	20.251	16.989
6	16.004	10.218	7.249	11.889	16.187	17.694	18.333	19.832	22.589	23.139	20.884	19.336
7	17.737	7.308	5.298	8.18	9.439	9.325	8.234	10.176	15.635	20.562	21.7	23.086
8	11.272	4.006	3.191	5.345	8.869	8.02	4.943	4.34	8.604	11.188	13.688	15.181
9	6.496	1.386	0.98	0.97	0.66	0.548	0.225	0.503	2.198	4.906	7.28	9.636
10	3.622	1.547	0.904	2.531	3.451	2.778	2.737	1.745	1.858	2.1	4.612	5.596
11	0.869	0.084	0.012	0.036	0.046	0	0.002	0.023	0.072	0.209	0.668	1.52
12	0.218	0.17	0.058	0.103	0.079	0	0	0	0.23	0.081	0.089	0.28
13	0.002	0.028	0.03	0	0	0	0	0	0	0	0	0.058
14	0	0	0.016	0	0	0	0	0	0	0	0	0
15	0.007	0.013	0.002	0	0	0	0	0	0.029	0	0	0
16	0	0.056	0.007	0	0.021	0.005	0.1	0.019	0.072	0	0	0.021
17	0	0	0	0	0	0	0	0	0	0	0	0
18	0	0	0	0	0	0	0	0	0	0	0	0
19	0	0	0	0	0	0	0	0	0	0	0	0
20	0	0	0	0	0	0	0	0	0	0	0	0
21	0	0	0	0.017	0	0	0	0	0	0	0	0
Note: Periods are rounded to the nearest integer												

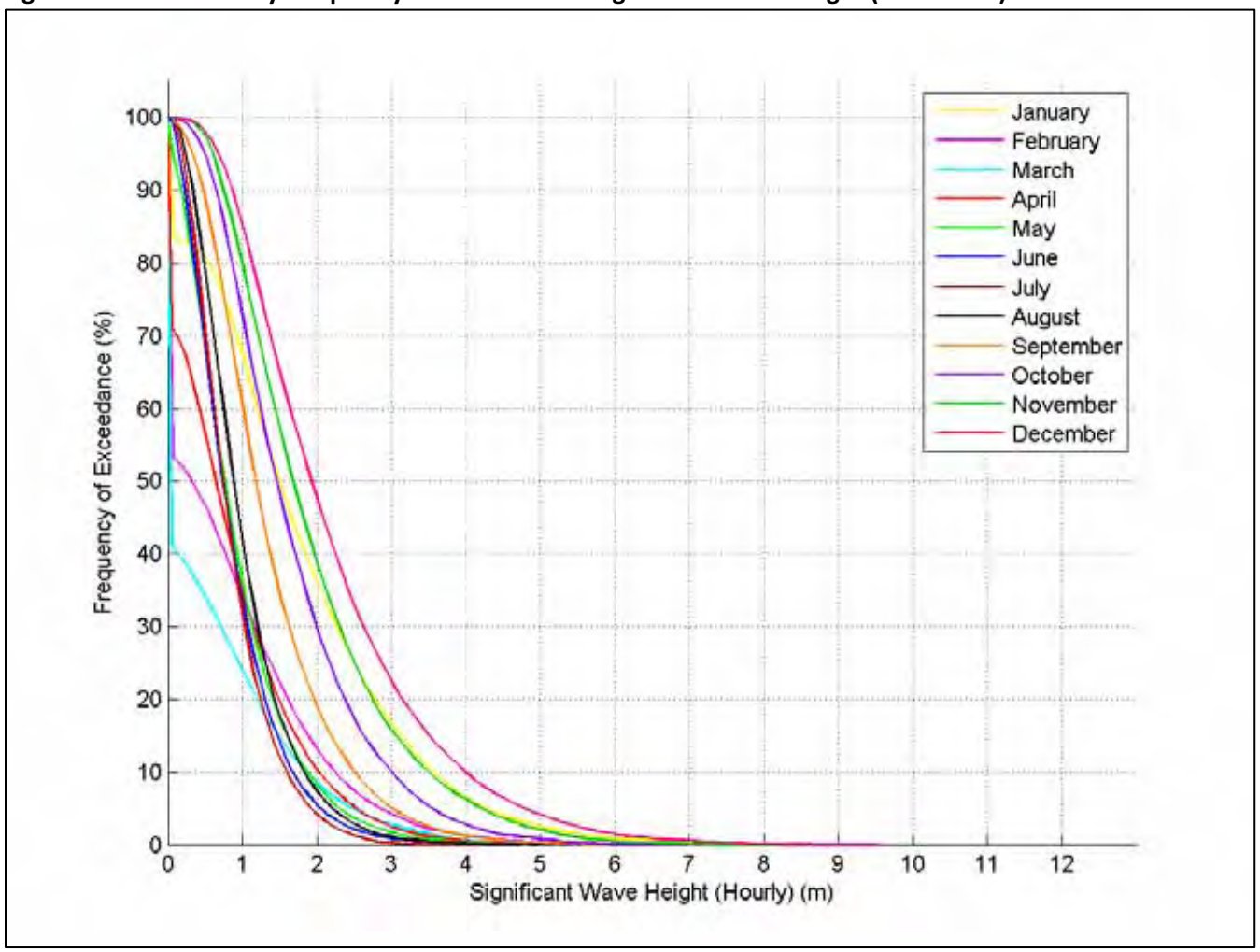
Table 4.23 Bivariate Frequency Distribution (% Occurrence) of Significant Wave Height Versus Peak Period, MSC50 Data (1954 – 2011)

Tp (s)	Hs, Significant Wave Height (m)											
	0	1	2	3	4	5	6	7	8	9	10	Total
0	12.544	0	0	0	0	0	0	0	0	0	0	12.544
1	0.166	0	0	0	0	0	0	0	0	0	0	0.166
2	0.842	0	0	0	0	0	0	0	0	0	0	0.842
3	2.51	0.922	0	0	0	0	0	0	0	0	0	3.432
4	5.303	11.208	0.047	0	0	0	0	0	0	0	0	16.558
5	1.148	18.913	1.834	0.001	0	0	0	0	0	0	0	21.896
6	0.051	9.144	7.574	0.211	0.003	0	0	0	0	0	0	16.983
7	0.407	1.627	8.664	2.373	0.022	0	0	0	0	0	0	13.093
8	1.797	0.319	1.462	3.95	0.709	0.007	0	0	0	0	0	8.245
9	0.019	0.005	0.102	0.776	1.81	0.282	0.003	0	0	0	0	2.997
10	1.046	0.594	0.028	0.036	0.223	0.664	0.196	0.01	0	0	0	2.798
11	0.001	0	0.001	0	0.005	0.039	0.125	0.105	0.023	0	0	0.298
12	0.06	0.02	0.001	0	0	0	0	0.002	0.022	0.005	0	0.109
13	0.005	0	0	0	0	0	0	0	0	0.005	0	0.01
14	0.001	0	0	0	0	0	0	0	0	0	0	0.001

15	0.004	0	0	0	0	0	0	0	0	0	0	0.004
16	0.024	0	0	0	0	0	0	0	0	0	0	0.025
17	0	0	0	0	0	0	0	0	0	0	0	0
18	0	0	0	0	0	0	0	0	0	0	0	0
19	0	0	0	0	0	0	0	0	0	0	0	0
20	0	0	0	0	0	0	0	0	0	0	0	0
21	0.001	0	0	0	0	0	0	0	0	0	0	0.001
Total	25.928	42.753	19.713	7.347	2.773	0.992	0.323	0.117	0.045	0.009	0	100

The occurrences of (Hs = 0, Tp = 0) are due to the presence of sea ice in the SEA Update Area.
Significant wave heights and periods are rounded to the nearest integer.

Figure 4.17 Monthly Frequency Distributions of Significant Wave Height (1954-2011)



Note: The frequencies of exceedance for January through to April add up to less than 100 percent due to the presence of ice.

4.1.4 Oceanography

The SEA Update Area is located in the eastern portion of the Gulf of St. Lawrence. The Gulf is a semi-enclosed sea that covers a marine area of about 240,000 km^2 and which contains about 35,000 km^3 of water. It is bounded on the north by the Québec -Labrador Peninsula, to the east by the Island of Newfoundland, to the south by Nova Scotia, and to the west by the Gaspe Peninsula, New Brunswick and portions of Québec. The Gulf opens to the Atlantic Ocean through the Cabot Strait in the south and the Strait of Belle Isle in the north (Dufour and Ouellet 2007).

The following sections provide an updated overview of the key oceanographic conditions and characteristics of the SEA Update Area, including ocean currents and seawater properties (temperature, salinity and density).

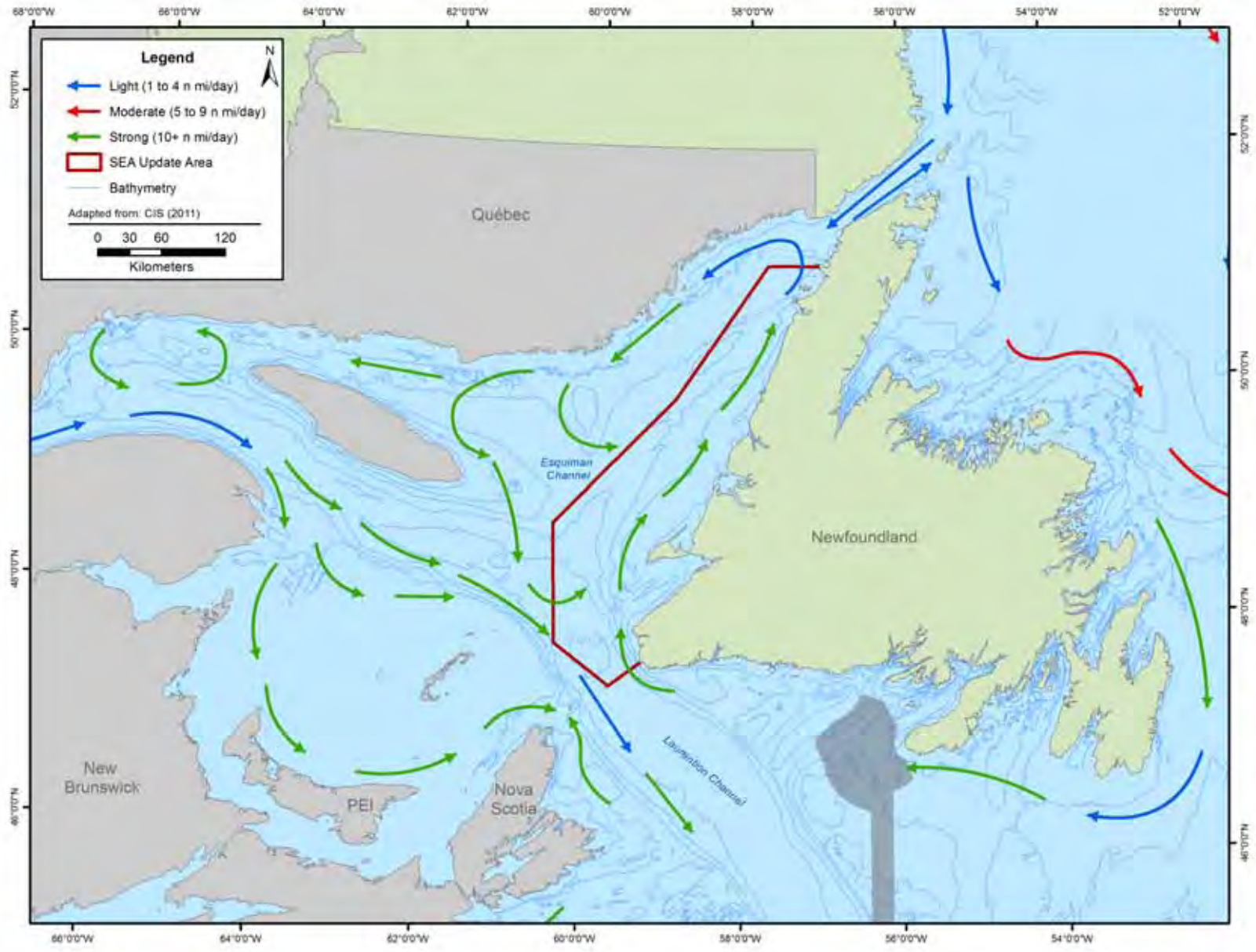
4.1.4.1 Ocean Currents

The Gulf of St. Lawrence exhibits unique physical oceanographic features and circulation patterns, owing to its isolation from the North Atlantic Ocean, the significant amount of fresh runoff from the St. Lawrence River and other sources, as well as the transport through the Cabot Strait and the Strait of Belle Isle. In areas deeper than 150 m, the water column in the Gulf generally consists of a surface layer, a cold intermediate layer (CIL), and a deeper water layer (Dufour and Ouellet 2007). The surface layer and CIL merge in winter to form a near-freezing layer until the spring, when the surface stratifies in temperature and salinity to form a distinct layer again (Galbraith, 2006).The mean circulation pattern in the Gulf is cyclonic, with transport directed to the northeast along the western coast of Newfoundland, and to the southwest along the coast of Québec in the north (Figure 4.18).

The most comprehensive resource for ocean currents forecasts in the SEA Update Area, including the entire area of the Gulf of St. Lawrence, consists of a three-dimensional numerical modeling program by the Modelling and Operational Oceanography section of the Canadian Hydrographic Service (CHS), Maurice Lamontagne Institute (MLI), and Fisheries and Oceans Canada (DFO). They issue forecasts of ocean current and ice in the Gulf, extracted from a numerical model that integrates the influence of tides (at Cabot Strait and Strait of Belle Isle), forecasts of fresh water runoff (at Québec City), atmospheric forcing from the GEM model run at the Canadian Meteorological Center (CMC), as well as sea ice observations from the Canadian Ice Service (CIS) by Environment Canada. The model has a spatial resolution of 1/12º and 46 vertical levels, and it allows for evolving temperature and salinity fields.

The seasonal circulation patterns in three depth-averaged layers have been described for the year 2010 by Galbraith et al (2011), based on the results of a prognostic three dimensional model of the Gulf of St. Lawrence, Scotian Shelf, and Gulf of Maine, which was run for the period 2006-2010. It is apparent from their results that the currents are strongest in the surface mixed layer (0-20 m) through most of the year, except during winter when currents are similarly strong in the intermediate layer, and stronger than average in the bottom layer. The strongest currents in the SEA Update Area, on the order of 10 cm/s, are found along the slopes of the Laurentian and Esquiman Channels. The current fields show the highly variable nature of the circulation on smaller spatial scales, with visible gyres, eddies and fronts appearing and disappearing between seasons.

Figure 4.18 Mean Circulation Pattern in the Gulf of St. Lawrence



4.1.4.2 Seawater Properties (Temperature, Salinity, Density)

The seawater temperature and salinity trends on the Newfoundland and Labrador continental shelf have been extensively measured over the last several decades. The statistics presented here have been extracted from the Ocean Data Inventory, the Hydrographic Climate Database, and the Sea-Surface Temperature Database of DFO (DFO 2012a). The Hydrographic Climate Database consists of data from a variety of sources, including hydrographic bottles, CTD casts, profiling floats, spatially and temporally averaged Batfish tows, expendable, digital or mechanical bathythermographs, as well as near real-time observations of temperature and salinity from the Global Telecommunications System (Gregory 2004). While initial data validation is carried out by the originating institute, all data are additionally validated by the Integrated Science Data Management (ISDM) (formerly MEDS, Marine Environmental Data Service) of DFO and the Bedford Institute of Oceanography (BIO). The data retrieved from the Sea-Surface Temperature Database consist of Pathfinder 5, seven day average composite data at a resolution of 4 km, spanning the period from 1985 to 2009, and provided by the Physical Oceanography Archive Centre of the Jet Propulsion Laboratory in Pasadena, California.

In order to characterize the average and extreme conditions, data have been extracted from a geographic region consisting of the combined polygons GSL2 and GSL3 in the hydrographic climate and sea-surface temperature databases, a region closely approximating the SEA Update Area. As such, the statistics shown here represent the broad regional conditions, and local seawater properties would exhibit spatial and temporal variability that can only be captured through a detailed, site-specific statistical analysis. The hydrographic climate dataset included over 35,000 temperature data points, and more than 18,000 data points for salinity and density in the selected study region for the period 1915-2009. Statistics were extracted from several discrete depth bins (at 0 m, 50 m, 100 m, 250 m and 450 m), for the purpose of capturing the conditions throughout the full water column. The results for seawater temperature, salinity and density are given in the following Tables, including the monthly minima, maxima, standard deviation, as well as the number of data months upon which the statistics were based. It is evident that the seawater temperature statistics are generally more robust than the salinity data, with almost twice the number of observations. The number of data samples is generally higher for the depth levels closer to the surface as opposed to depths greater than 100 m, as only a small part of the SEA Update Area (as well as the measurements obtained in it) are at levels deeper than 250 m.

It should be noted, however, that variability at the surface is rapid and CTD casts are relatively sparse through time, therefore the data from the hydrographic climate database are likely aliased and surface conditions not represented correctly, with the possibility of a single CTD cast affecting the mean, as well as minimum and maximum statistics for the top 250 m. Robust climatological analyses of sea surface temperatures (Galbraith et al 2011) therefore rely on more frequently sampled satellite data. Sea surface temperature statistics from within the SEA Update Area derived from satellite measurements (DFO 2012a) are shown for comparison in Table 4.24.

Table 4.24 Monthly Sea Surface Temperature Statistics over the SEA Update Area (DFO 2012a)

Sea Surface Temperature (°C)												
Month	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**
Min	-1.95	-1.95	-1.95	-1.95	-1.57	-0.15	3.9	6.98	7.28	1.43	-0.75	-1.72
Max	3.15	1.88	1.95	4.43	8.18	14.25	19.2	19.58	19.05	15.83	10.28	7.5
Mean	-0.18	-1.1	-1.07	-0.26	2.21	6.85	12.3	15.73	13.74	9.31	5.13	2.15
Std Dev	0.76	0.46	0.41	0.59	1.17	1.28	1.27	0.93	1.08	1.22	0.91	1.05
Data Months	25	25	24	25	25	25	25	25	25	25	25	25

The temperature statistics exhibit significant seasonal variability, particularly in the upper part of the water column (SST from Table 4.24. and 50 m depth bin from Table 4.25), while the monthly mean salinity values are comparatively more stable throughout the year. During the summer months, the surface layer becomes thermally stratified, with mean surface temperatures reaching 15.73°C in August and remaining above 5°C through the fall. The minimum mean temperature near the surface of -1.1°C occurs in February and March.

A seasonal temperature cycle is also apparent at 50 m depth, where mean temperatures range from -0.5°C in April to 3.6°C in September. In contrast, mean temperatures at 100 m vary far less throughout the year (from 0.3°C in May and June to 1.3°C in January). Mean temperatures at 250 m and 450 are similarly stable throughout the year, and generally higher than those of the overlying layer, ranging from 4.5 to 5.5°C, however due to interannual variability the temperature can exceed 6°C at the Cabot Strait in some years (with 6.9°C measured in 2012) and stay below 4°C in others (Galbraith et al 2011).

The mean surface salinity is relatively stable, ranging from 30.9 psu (August) to 32 psu (February). The seasonal contrast is even less pronounced at 50 m depth (range of 31.9 – 32.1 psu), and it is insignificant at greater depths where salinities are relatively constant year-round (about 34.5 psu at 250 m; 34.9 at 450 m) (Table 4.26).

Table 4.25 Monthly Temperature Statistics for Several Selected Depths (DFO 2012a)

Seawater Temperature (°C)													
Month		**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**
0 m*	Min	-1.8	-1.8	-1.8	-1.7	-1.7	0.9	3.6	3.1	2.5	0.9	0.7	0.5
	Max	11.3	12.8	11.1	1.3	8.8	13.0	16.1	18.6	15.6	14.1	9.2	5.6
	Mean	0.1	0.6	-0.5	-0.3	2.0	5.8	10.5	12.7	11.1	7.8	5.2	3.3
	Std Dev	0.8	3.9	2.9	0.8	1.3	1.6	1.8	1.6	1.9	2.1	1.2	0.8
	Data Months	27	12	18	13	33	43	38	57	39	31	53	14
50 m	Min	-1.8	-1.8	-1.7	-1.8	-1.6	-1.2	-1.5	-1.3	-1.0	-0.6	-0.2	0.6
	Max	9.1	10.1	9.4	2.7	3.8	7.4	12.1	14.4	13.8	10.0	8.8	4.7
	Mean	0.3	0.6	-0.3	-0.5	0.3	1.7	3.1	2.8	3.6	3.2	3.2	2.6
	Std Dev	0.7	3.0	2.7	1.0	1.0	1.3	2.1	1.9	2.6	1.8	1.1	0.6
	Data Months	27	13	16	13	31	42	37	57	39	30	51	13
100 m	Min	-1.6	-1.5	-1.5	-1.6	-1.3	-1.2	-1.3	-1.4	-1.4	-1.1	-1.3	0.2
	Max	6.3	4.9	7.6	2.8	8.7	4.5	3.1	6.5	3.9	5.5	6.7	2.8
	Mean	1.3	1.1	1.0	0.6	0.3	0.3	0.4	0.5	0.6	1.0	1.2	1.2
	Std Dev	0.6	1.2	1.9	0.7	0.6	0.6	0.8	0.7	0.9	1.1	0.7	0.3
	Data Months	27	12	16	13	29	41	32	55	37	29	51	14
250 m	Min	2.9	2.7	4.4	3.2	3.8	3.4	2.8	3.7	2.8	4.1	3.5	4.0
	Max	9.2	7.0	6.4	6.6	6.9	7.2	6.5	8.2	8.4	6.4	7.1	6.4
	Mean	5.5	5.4	5.2	5.4	5.3	5.4	5.2	5.3	5.0	5.2	5.2	5.3
	Std Dev	0.6	0.8	0.7	0.6	0.5	0.5	0.7	0.5	0.8	0.4	0.6	0.4
	Data Months	25	9	5	11	25	26	20	44	24	23	43	14
450 m	Min	4.6	4.6	4.5	4.8	4.3	4.1	4.7	4.2	4.6	4.8	4.3	4.8
	Max	7.3	5.6	4.5	4.8	5.3	5.8	5.6	5.6	7.4	5.2	5.5	5.3
	Mean	5.2	5.1	4.5	4.8	4.9	5.1	5.0	5.0	5.5	5.0	5.0	5.0
	Std Dev	0.3	0.4	0.0	0.0	0.4	0.5	0.2	0.3	1.2	0.1	0.3	0.2

Seawater Temperature (°C)													
	Data Months	17	3	1	2	8	8	6	25	3	4	25	8
*Note: The sea surface temperatures presented here are considered less robust than the satellite-derived SST in the previous Table													

Table 4.26 Monthly Salinity Statistics for Several Selected Depths (DFO 2012a)

Seawater Salinity (psu)													
Month		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0 m	Min	29.8	31.8	30.7	31.2	29.3	30.4	29.6	29.3	29.7	30.3	30.4	31.0
	Max	33.2	32.2	32.5	32.5	32.7	32.0	31.7	32.2	31.9	32.1	32.3	32.1
	Mean	31.8	32.0	31.8	31.8	31.5	31.4	31.0	30.9	31.0	31.3	31.4	31.6
	Std Dev	0.2	0.1	0.2	0.3	0.3	0.3	0.3	0.4	0.4	0.5	0.3	0.2
	Data Months	12	3	15	13	26	35	20	43	22	16	43	10
50 m	Min	31.4	31.8	22.3	31.6	29.7	31.4	31.0	29.9	31.0	30.9	30.8	31.5
	Max	34.9	32.4	32.7	33.1	32.7	32.5	32.7	33.4	32.5	32.7	32.7	33.1
	Mean	32.0	32.1	32.0	32.1	31.9	31.9	31.9	32.0	32.0	32.0	31.9	32.0
	Std Dev	0.2	0.1	0.2	0.3	0.2	0.2	0.2	0.2	0.3	0.4	0.2	0.2
	Data Months	12	3	13	13	24	31	19	42	22	16	43	10
100 m	Min	31.9	32.0	32.0	32.1	30.0	31.9	32.0	31.6	32.3	32.1	31.9	32.3
	Max	35.0	33.1	33.5	33.6	33.4	33.3	33.3	33.5	33.4	33.5	33.5	33.7
	Mean	32.7	32.6	32.6	32.8	32.4	32.6	32.6	32.6	32.7	32.7	32.7	32.8
	Std Dev	0.2	0.2	0.2	0.2	0.3	0.2	0.2	0.2	0.2	0.2	0.2	0.2
	Data Months	12	3	13	13	23	31	18	41	21	15	43	10
250 m	Min	33.7	34.2	34.2	33.9	34.1	34.0	34.1	33.8	34.1	33.9	33.9	34.0
	Max	35.4	34.7	34.5	35.0	35.1	34.7	34.7	35.0	34.7	34.7	34.7	34.7
	Mean	34.4	34.5	34.3	34.5	34.4	34.4	34.4	34.4	34.4	34.5	34.4	34.4
	Std Dev	0.1	0.1	0.1	0.2	0.1	0.2	0.2	0.2	0.2	0.1	0.2	0.2
	Data Months	12	3	3	10	17	18	11	36	14	11	37	9
450 m	Min	34.1	34.8	34.8	34.8	34.7	34.7	34.7	34.7	34.7	34.8	34.8	34.8
	Max	35.2	34.8	34.8	34.9	34.9	34.9	34.9	34.9	34.8	34.9	35.0	34.9
	Mean	34.8	34.8	34.8	34.9	34.8	34.8	34.8	34.8	34.8	34.9	34.8	34.9
	Std Dev	0.1	0.0	0.0	0.0	0.1	0.1	0.1	0.1	0.1	0.1	0.0	0.0
	Data Months	11	1	1	2	5	7	5	24	2	4	21	7

Table 4.27 Monthly Density Anomaly Statistics for Several Selected Depths (DFO 2012a)

Seawater Density Anomaly (σ_t, kg/m^3)													
Month		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0 m	Min	23.9	25.5	24.7	25.1	23.5	23.2	22.4	21.3	21.8	22.7	23.9	24.6
	Max	26.5	25.9	26.2	26.2	26.3	25.4	24.7	25.3	25.3	25.7	25.7	25.6
	Mean	25.5	25.7	25.6	25.6	25.2	24.7	23.7	23.1	23.6	24.4	24.8	25.1
	Std Dev	0.2	0.1	0.2	0.2	0.3	0.3	0.4	0.5	0.6	0.6	0.3	0.2
	Data Months	12	3	15	13	26	34	20	43	22	16	43	10

Seawater Density Anomaly (σ_t, kg/m^3)													
Month		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
50 m	Min	25.2	25.6	17.8	25.4	23.8	24.7	23.8	22.2	23.8	23.6	24.0	25.1
	Max	27.6	25.9	26.2	26.5	26.3	26.1	26.2	26.8	26.1	26.2	26.1	26.4
	Mean	25.7	25.8	25.7	25.8	25.6	25.5	25.4	25.5	25.4	25.4	25.4	25.5
	Std Dev	0.2	0.1	0.2	0.3	0.2	0.2	0.3	0.2	0.5	0.5	0.3	0.2
	Data Months	12	3	13	13	24	30	19	42	22	16	43	10
100 m	Min	25.5	25.8	25.6	25.8	24.1	25.6	25.7	25.0	25.9	25.6	25.1	25.8
	Max	27.7	26.4	26.7	26.8	26.8	26.6	26.5	26.7	26.8	26.7	26.7	26.9
	Mean	26.2	26.1	26.1	26.3	26.0	26.1	26.1	26.2	26.2	26.2	26.2	26.2
	Std Dev	0.2	0.1	0.2	0.2	0.2	0.1	0.2	0.1	0.2	0.2	0.2	0.2
	Data Months	12	3	13	13	23	30	17	41	21	15	43	10
250 m	Min	26.8	27.1	27.1	27.0	27.0	27.0	27.1	26.8	27.1	26.8	27.0	27.0
	Max	27.9	27.3	27.3	27.7	27.7	27.4	27.4	27.7	27.5	27.5	27.3	27.3
	Mean	27.2	27.3	27.2	27.3	27.2	27.2	27.2	27.2	27.2	27.2	27.2	27.2
	Std Dev	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
	Data Months	12	3	3	10	17	18	11	36	14	11	36	9
450 m	Min	27.0	27.6	27.6	27.6	27.4	27.4	27.5	27.4	27.5	27.5	27.5	27.5
	Max	27.8	27.6	27.6	27.6	27.6	27.6	27.6	27.6	27.6	27.6	27.7	27.6
	Mean	27.5	27.6	27.6	27.6	27.5	27.5	27.5	27.5	27.5	27.6	27.6	27.6
	Std Dev	0.1	0.0	0.0	0.0	0.1	0.1	0.0	0.0	0.1	0.0	0.0	0.0
	Data Months	11	1	1	2	5	6	5	24	2	4	20	6

The seasonal trends of temperature and salinity are reflected mainly in the density statistics near the surface, with the surface seawater density anomaly[1] (σt) reaching a maximum of 25.7 kg/m^3 in February, when the temperature is near its minimum, and the salinity is at its maximum. The minimum density anomaly (23.1 kg/m3) is seen in August, when the surface temperature and salinity trends are reversed. The mean density anomaly at 100 m and below is relatively constant year round, staying close to 26.2 kg/m^3 at 100 m, 27.2 kg/m^3 at 250 m, and 27.5 kg/m^3 at 450 m. It should be noted that the values for 450 m are representative of a small area in the south of the SEA Update Area.

4.1.5 Extreme Events

Each of the oceanographic and climatological parameters presented above have the potential to affect the planning and execution of marine operations. The occurrence of severe winds and waves associated with extreme storm events are of particular interest, however, and the available hindcast data allow for a detailed treatment of extreme values for these parameters.

Extremal analysis was performed to determine the highest expected values for wind speed, significant wave height and the associated peak wave period. The analysis was based on the Gumbel distribution to which the data were fitted using the maximum likelihood method. The analysis includes both tropical and extra-tropical

[1] The density anomaly σ_t represents the last two digits of seawater density expressed in [kg/m^3] at sea level, therefore density is equivalent to σ_t + 1000 kg/m^3.

storms over the entire period. Extreme values were computed for four different return periods: 1, 10, 50 and 100 years (Table 4.28).

Table 4.28 Extreme Values of Wind Speed, Wave Height and Associated Peak Wave Period

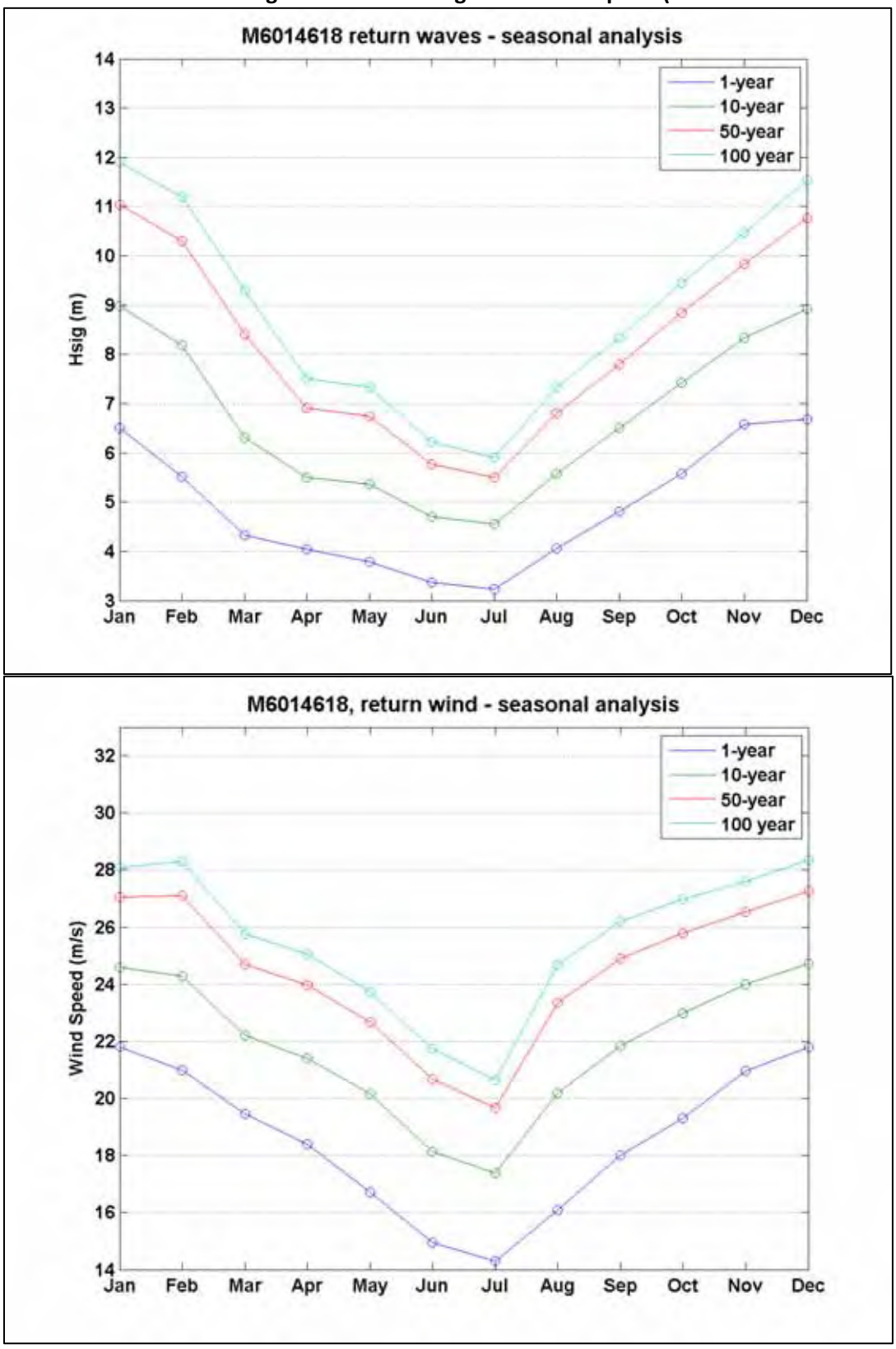
Return Period (years)	1	10	50	100
Significant Wave Height (m)	6.9	8.7	10.3	10.9
Associated Peak Wave Period (s)	10.7	12.5	13.8	14.4
Wind Speed (m/s)	19.6	24.7	27.0	28.0

Furthermore, the seasonal variability of the extreme values of significant wave height and wind speed was analyzed by estimating extremes of different return periods using a three month running window centred on each month. This produced monthly estimates of extreme values, plotted in the two panels in Figure 4.19.

The plots illustrate a general pattern of high values during winter (October to March) and lower values during summer (May to July). Summer extreme wave heights are only about 50 percent of the winter values overall, while extreme summer winds are just about two thirds (60-70 percent) of the winter ones. Winter severe levels generally begin dropping in March, and milder summer conditions end quickly with a rapid increase in severity in August that reaches a peak in December. Winter storms characterize the months of December to February with high wind and wave values (25 to 29 m/s extreme wind speed, 8 to 12 m significant wave height).

It is notable that the winter values for extreme wave heights are higher than the summer values, which is in contrast with the mean wave conditions as discussed in the above Section. These findings reflect the fact that ice presence from January to March tends to decrease the monthly mean wave heights, however during ice-free periods the wave climate is more severe than during the summer months as evidenced by the wind statistics.

Figure 4.19 Extreme Values for Significant Wave Height and Wind Speed (MSC50 Data: 1954 – 2011)



4.1.6 Ice Conditions

The seasonal occurrence of sea ice and icebergs off the west coast of Newfoundland has been extensively observed and documented throughout the last several decades. The most comprehensive sea ice dataset and associated weekly climatic statistics for Eastern Canada have been compiled and published in the Sea Ice Climatic Atlas the Canadian Ice Service (CIS 2011). The latest version of the atlas covers the climatology for the most recent 30 year period (1981 – 2010), incorporating observations from a variety of sources: RADARSAT-1, RADARSAT-2, Envisat, NOAA AVHRR and Modis imagery. The satellite data has been verified against available aircraft and ship observations, as well as datasets made available by the International Ice Patrol (IIP), under the jurisdiction of United States Coast Guard (NSIDC 2012). The following two subsections summarize the sea ice climatology, as well as iceberg occurrence in the SEA Update Area based on IIP iceberg sightings.

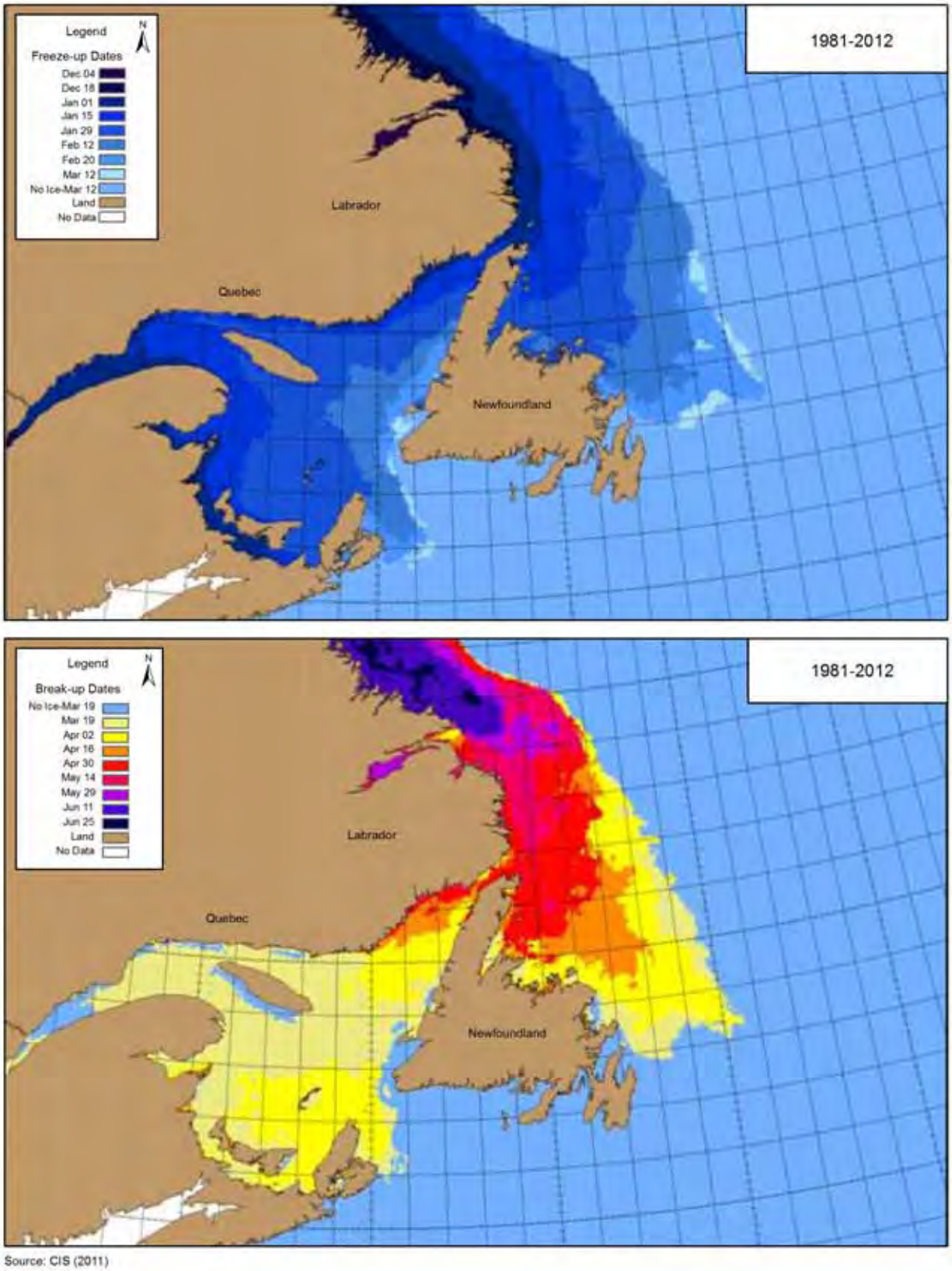
4.1.6.1 Sea Ice

Sea ice initially occurs in the northern part of the SEA Update Area, with a freeze-up date of January 15 (Figure 4.20) for the northern-most section of the region in the immediate vicinity of the Strait of Belle Isle (CIS 2011). This is consistent with the wider trend of sea ice formation in the northern parts of the Gulf of St. Lawrence, as well as advection of sea ice formed off the coast of Labrador into the Gulf through the Strait of Belle Isle (Galbraith et al 2011). The sea ice coverage then expands from north to south within the SEA Update Area, typically covering most of it by February 26, and reaching maximum coverage by the second week of March, when the maximum median ice concentration above 90 percent is reached (Figure 4.21). At the same time, warm surface waters often flow into the Gulf of St. Lawrence in winter on the eastern side of Cabot Strait, contributing to the ice free area observed in the climatology, as documented by Galbraith (2006) and Galbraith et al (2011). The maximum sea ice thickness typically forming in the SEA Update Area is in the range of 30-120 cm, consistent with the classification of first-year ice. The atlas statistics also indicate the uncommon possibility that thicker, old ice may be advected from the Strait of Belle Isle in early June during some years. As the northeastern part of the Gulf is more restricted by wind-induced drift from west to east, there is an occasional congestion in the Bay of Islands area. Additionally, an area of thick and deformed ice is often prevalent northward from the Port-au-Port Peninsula (CIS 2011).

After mid-March the ice cover begins to retreat, with the southern half of the SEA Update Area typically being ice-free by April 2, while ice break-up in the northern half of the region is expected to occur by mid-April (Figure 4.20). Most of the SEA Update Area is expected to be free of ice by May 21, however there remains a low probability (1-15 percent) of sea ice occurrence in the northernmost parts until mid-June. Throughout the ice season, the sea ice produced in the northern parts of the Gulf of St. Lawrence is typically advected toward Iles-de-la-Madeleine and Cabot Strait, where it subsequently exits the Gulf.

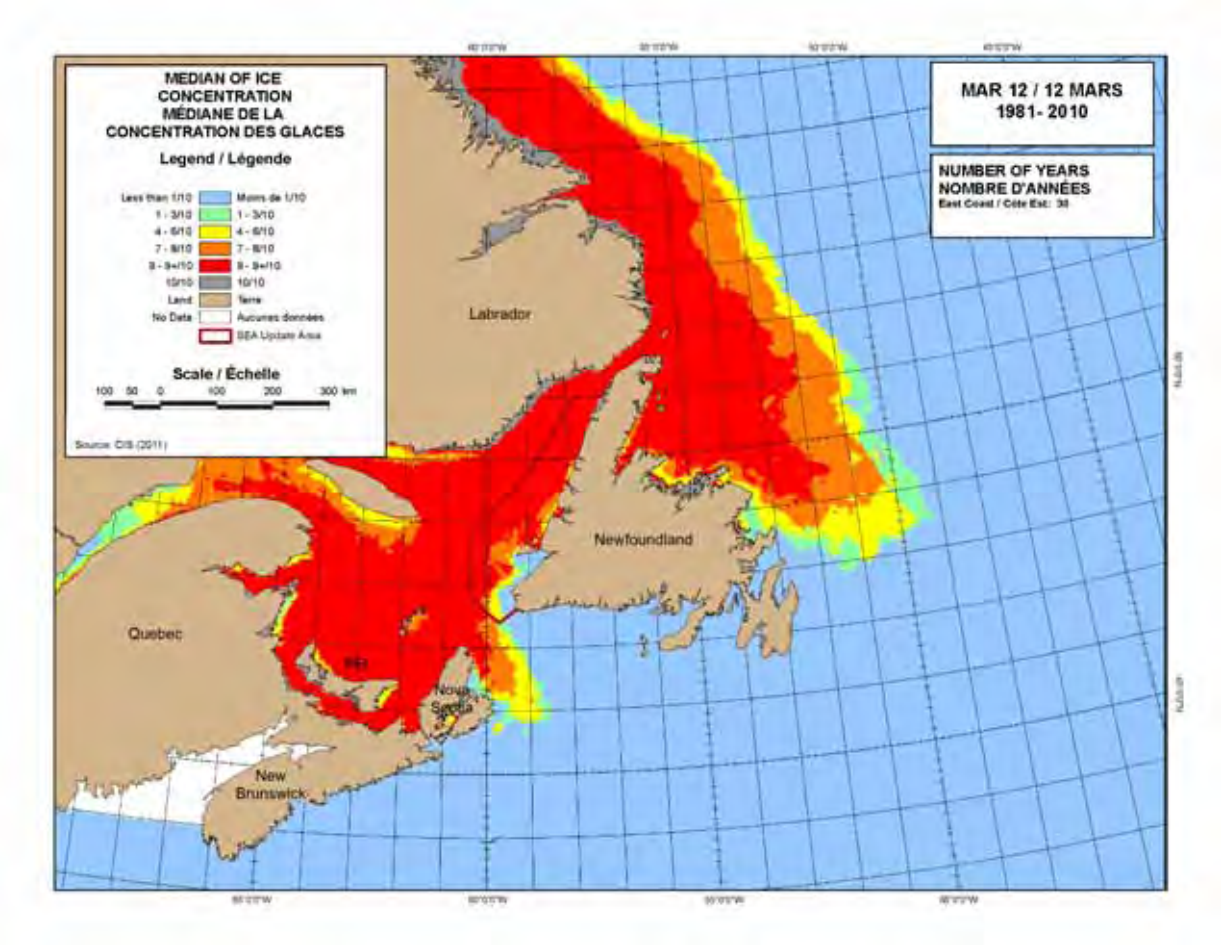
The climatological normal maximum ice volume of 70.8 km^3 for the 1981-2010 period is lower than the 76.6 km^3 for the previous 30-year period (1971-2000), however the standard deviation of the maximum ice volume has also increased from 23.7 to 30.2 km^3 (Galbraith et al 2011). The total ice coverage maximum for the 1981-2010 period occurred in the 1989/90 season, while the lowest coverage was registered in the 2009/2010 season, when the maximum ice volume was 11 km^3 and no ice was exported from the Gulf of St. Lawrence onto the Scotian Shelf. Galbraith et al (2011) also concluded that the record was consistent with the record high winter severity air temperature index during that season, defined as the January to March air temperature average.

Figure 4.20 Ice Freeze-up (top) and Break-up Dates (1981-2010)



Source: CIS (2011)

Figure 4.21 Weekly Median of Ice Concentration on March 12 (1981-2010)

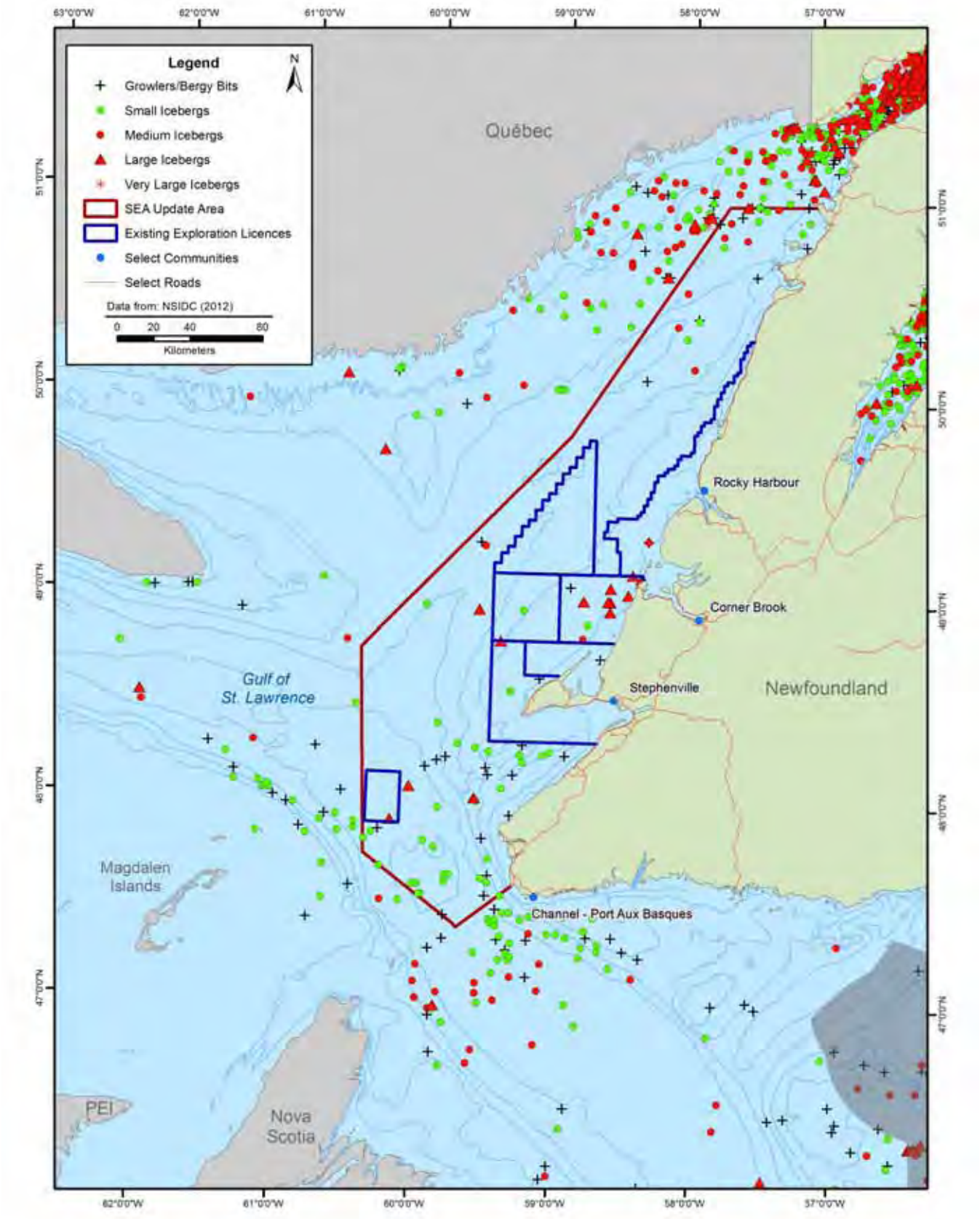


4.1.6.2 Icebergs

The most comprehensive dataset of iceberg sightings in the SEA Update Area over the past half century has been recorded by the International Ice Patrol (IIP), managed and operated by the United States Coast Guard since 1912 (NSIDC 2012). The IIP and the CIS collaboratively issue daily iceberg analyses under the North American Ice Service (NAIS), which aims to unify North American ice information and improve service to mariners. It should be noted, however, that due to differences in data management between CIS and IIP prior to 2006, there may be a relatively small subset of observations that are not represented in the IIP data discussed here. Additional historic observations dating from 1810 to 1958 have been compiled into a database for the wider NL Offshore Area by Hill (2013).

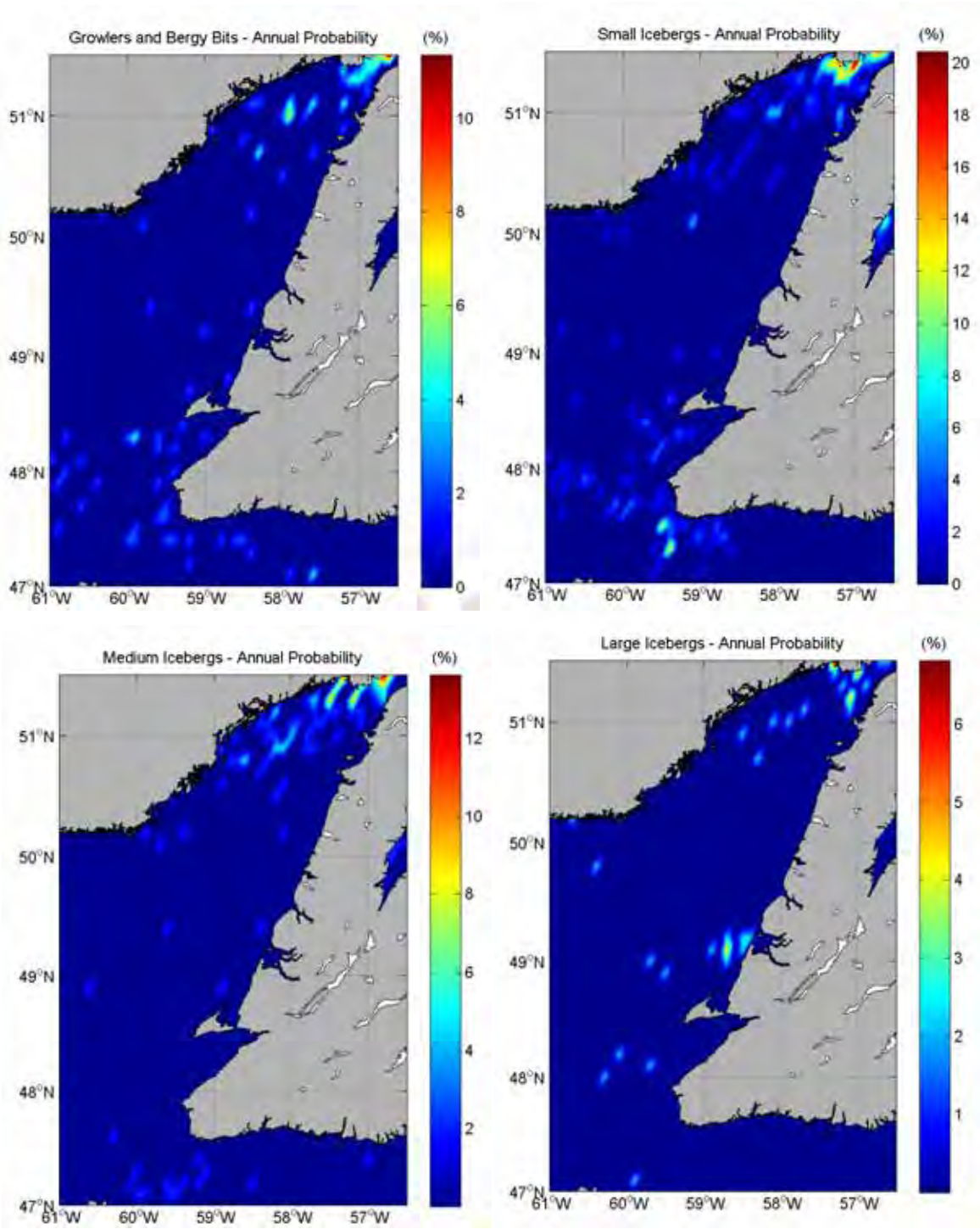
The iceberg sightings from IIP for the period 1960 to 2009 are shown in Figure 4.22. The icebergs have been classified into several size categories, from growlers and bergy bits (5 – 14 m horizontal scale), through small icebergs (15-60 m), medium icebergs (61-120 m), large icebergs (121-200 m) and very large icebergs (>200 m). There have been no recorded sightings of very large icebergs in or near the SEA Update Area. Many of the observed icebergs are advected into the Gulf of St. Lawrence through the Strait of Belle Isle, and most of the time they drift along the coast of Québec, north of the SEA Update Area. Historical iceberg sightings have a tendency to approach the SEA Update Area from the east via southern Newfoundland and Cabot Strait, their transport likely influenced by the regional ocean circulation patterns. Some of the icebergs occasionally do get transported into the SEA Update Area, including mostly small and medium icebergs in the northern parts, and growlers, bergy bits, small icebergs and large icebergs in the central and southern parts of the SEA Update Area.

Figure 4.22 Iceberg Sightings in and Adjacent to the SEA Update Area, by Size Category



Based on these sightings over the period 1960-2009, annual probability of occurrence maps have been produced (Figure 4.23). These maps show that the probabilities of iceberg sightings within the SEA Update Area in any given year are relatively low, on the order of 5 to 10 percent per year.

Figure 4.23 Annual Probability of Occurrence of Icebergs based on their Size, Computed from Iceberg Sightings for the Period 1960 – 2009



Source: NSIDC (2012)

4.1.6.3 Superstructure Icing Potential

Several factors can contribute toward vessel icing potential at any given time. These include environmental parameters such as air and sea temperature, wind speed, wave height and precipitation. However, the size, shape and configuration of the vessel itself are also critical factors for icing potential. A standardized way to determine the potential ice build-up rate has been developed by Overland (1990), who based his algorithm on empirical observations and the heat balance equation of an icing surface. The algorithm has been used to derive an estimate of icing potential in the SEA Update Area by using concurrent air and sea temperature and wind speed data from ICOADS. The results have been sorted into four different categories based on the severity (light, moderate, heavy and extreme), and are presented in the form of monthly and annual frequencies of occurrence in Figure 4.24 and Table 4.29.

Vessel icing is expected to occur in the period between November and April, with the highest frequency of 68.3 percent of the time in February. During February the highest frequency of extreme icing reaches a peak of about 18.1 percent of the time, heavy icing 10.4 percent of the time, moderate icing 15.4 percent of the time, and light icing about 24.4 percent of the time. Icing is expected to occur with a high frequency in January (65.2 percent), March (54.1 percent), and December (37.8 percent) and with relatively smaller frequencies during November and April.

Figure 4.24 Predicted Frequency of Occurrence of Icing Conditions in the SEA Update Area (Calculations based on ICOADS 1950-2012)

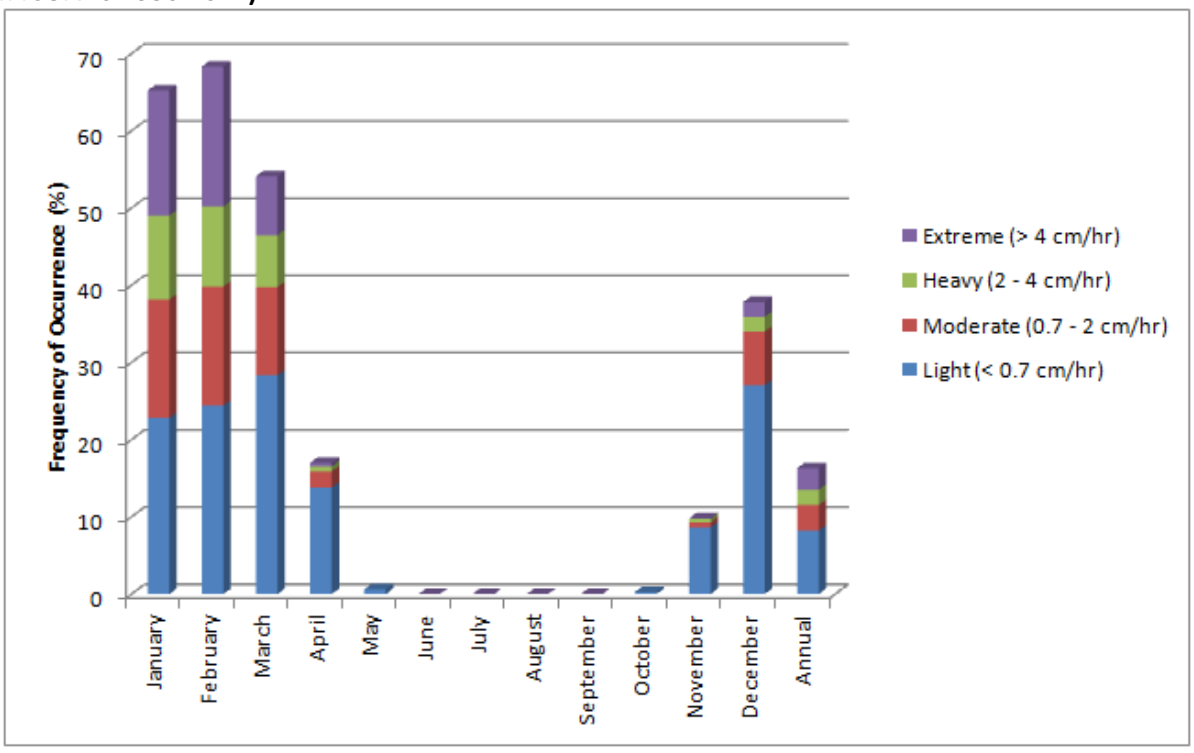


Table 4.29 Monthly and Annual Frequencies of Occurrence of Icing in the SEA Update Area (Based on ICOADS 1950-2012)

Month	Light (<0.7 cm/hr)	Moderate (0.7 – 2 cm/hr)	Heavy (2 – 4 cm/hr)	Extreme (>4 cm/hr)	Total
Jan	22.8	15.3	10.9	16.2	65.2
Feb	24.4	15.4	10.4	18.1	68.3
Mar	28.3	11.4	6.7	7.6	54.1
Apr	13.8	2.1	0.7	0.5	17.0
May	0.6	0.0	0.0	0.0	0.6
Jun	0.0	0.0	0.0	0.0	0.0
Jul	0.0	0.0	0.0	0.0	0.0
Aug	0.0	0.0	0.0	0.0	0.0
Sep	0.0	0.0	0.0	0.0	0.0
Oct	0.3	0.0	0.0	0.0	0.3
Nov	8.7	0.6	0.5	0.0	9.8
Dec	27.1	6.9	1.9	1.9	37.8
Annual	8.2	3.3	2.0	2.8	16.3

4.2 Biological Environment

The following sections provide an overview of relevant aspects of the biological environment of the SEA Update Area, including Fish and Fish Habitat, Water Birds, Marine Mammals and Sea Turtles. A listing of the common and scientific names for all species referenced in this section is provided in Appendix B.

4.2.1 Fish and Fish Habitat

For the purposes of providing an updated overview of the existing environmental setting of the Western Offshore Area, the following sections include a discussion of relevant fish species, as well as plankton, algae and benthos and relevant components of their habitats, given the clear interrelationships between these various components of the marine environment.

4.2.1.1 Approach and Key Information Sources

Marine species abundances and distributions have often been looked at independently and not as part of a complete ecosystem. The approach of identifying and considering some key species individually is still relevant, but must be complemented by a more multi-species approach in science and fisheries management. All the taxa in the grouping presented here (invertebrate, fish species, species of concern) interact and overlap, and many play key trophic roles in the Gulf of St. Lawrence ecosystem. Therefore, although human activities may affect a marine species deemed insignificant from a commercial perspective, this species may in turn play a significant role in the food web or larger ecosystem, such as being a key prey item for another species that has greater socioeconomic and/or ecological significance.

This more holistic, multi-species approach has helped researchers to understand how the trophic structure or food web of Gulf ecosystem has been changing as a result of anthropogenic (such as fishing) and environmental (temperature changes) disturbances.

Recent work has, for example, hypothesized that the ecosystem structure of the Gulf has changed (through a "regime shift") with a decrease in the population of demersal long-lived piscivorous species such as cod or red fish and an associated increase in planktivorous (plankton eating) pelagic fish and invertebrates (Savenkoff et al 2007a). This increase in planktivory is thought to have had a cascade effect on the ichthyoplankton (larval fish and eggs) community with overall abundances lower in the 2000s compared than during the mid-1980s (Bui et al 2010). Some taxa (hakes, rocklings, butterfish, windowpane, Gulf Stream flounder) within the ichthyoplankton became more abundant while others (cod, haddock, and witch flounder eggs; redfish larvae) declined considerably (Bui et al 2010). Other species such as snow crab and northern shrimp that were once a prey item of the large groundfish have also now become more abundant (Frank et al 2006).

Other authors have emphasized that factors other than the direct effects of fishing must be responsible for the lack of recovery or ongoing declines in many groundfish populations as there has been a moderate Gulf cod fishery since the mid-1990s and the large groundfish populations have not recovered. Chabot et al (2008) concluded that snow crabs are susceptible to predation by cod mostly for the first four years of post-settlement in the Gulf and that hard-shelled snow crabs are not likely to be eaten by cod minimizing the effect of cod predation on crab abundance. Marcello et al (2012) could find no consistent evidence that spawning stock or gadid biomass were significantly related to subsequent crab recruitment. The associated increase in pelagic fish such as herring may also be an artifact of bottom-trawl research methodologies (McQuin 2009).

Changes in water temperatures have been shown to play more of an influence on changes in the ecosystem than previously thought. Colder bottom water temperatures in the late 1980s and early 1990s may have led to the extension of the snow crab distribution as coldocean conditions have been associated with snow crab recruitment indices (Benoit et al 2012; Marcello et al 2012). Other authors have found that the Gulf capelin population migrated to the warmer temperatures of the southern Gulf during this time (Gregoire et al 2004). This, in turn, may have influenced the cod populations given that capelin are an important food source for cod.

Although there is still considerable discourse within the scientific community on the extent that overfishing (Frank et al 2006) or changes in the water temperature (Rothschild 2007) have caused these transitions in the ecosystem in the Gulf and the northwest Atlantic in general, it is generally agreed that both have had a significant influence in the observed regime shift (Dawe et al 2012).

Ecologically and Biologically Significant Areas (EBSA)

DFO has recently, through a series of workshops and reports, identified a number of Ecologically and Biologically Significant Areas (EBSAs) for the Gulf of St. Lawrence (Savenkoff et al 2007b). This was undertaken through an analytical ranking system of candidate areas in the Gulf, in which DFO identified various thematic layers and criteria or dimensions that had a value from 1 to 3 (Table 4.30). Ninety-six Important Areas (IAs) were identified in the Gulf based on the best scientific information available. For each of these IAs, the various layers were evaluated using the three criteria/dimensions considered independently (i.e. IA with high uniqueness value of 3 and cumulatively (i.e. IA that has medium uniqueness value of 2, a medium aggregation of 2, and uniqueness value of 2).

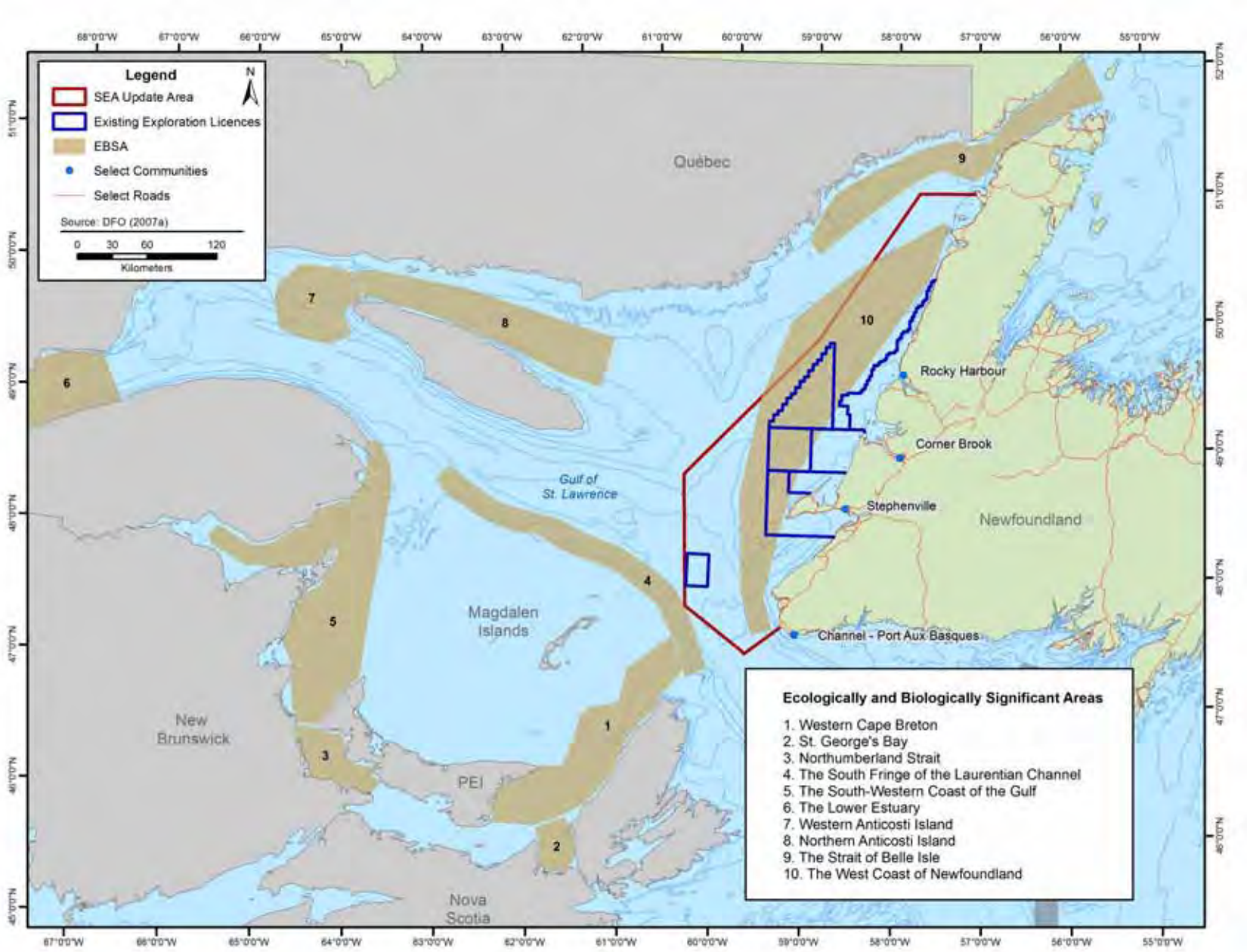
Table 4.30 Layers and Criteria for EBSA Designation

Attributes	Types	Description
Thematic Layers	Topography and Physical Processes	Physical information layer
	Primary Production	Biological information layers
	Secondary Production	
	Meroplankton	
	Benthic Invertebrates	
	Demersal Fishes	
	Pelagic Fishes	
	Pinnipeds and Cetaceans	
Criteria/ Dimension	Uniqueness	Areas whose characteristics are unique, rare, distinct, and for which alternatives do not exist.
	Aggregation	Areas where (i) most individuals of a species are aggregated for some part of the year; or (ii) some important function in their life history; or (ii) some structural feature or ecological process.
	Fitness Consequence	Areas where the life history activity(ies) undertaken make a major contribution to the fitness of the population or species present.
	Resilience*	Areas where the habitat structure or species are highly sensitive, easily perturbed, and slow to recover.
	Naturalness*	Areas which are pristine and characterized by native species.
*Resilience and naturalness are usually captured within the first three Criteria/Dimensions and not considered separately From Savenkoff et al (2007b)		

Using the approach described above, DFO identified a number of EBSAs in the Gulf of St. Lawrence (DFO 2007), one of which is located almost entirely within the SEA Update Area. These are shown in Figure 4.25.

For the Estuary and Gulf of St. Lawrence (EGSL), analyses leading to the identification of the ten potential EBSAs were based on the best scientific data available. However, several data sets were not available at the time of the analysis (because of lack of geo-referencing or suitable electronic versions) and several large areas of the Gulf were poorly sampled, leaving data gaps. So, at least for the EGSL, the EBSAs do not necessarily cover all the areas or species that contribute in a significant way to the system. For example, it is important to keep in mind that only a small proportion (approximately 0.02%) of the benthic invertebrate species known to be present in the EGSL was considered in the EBSA process (Chabot et al 2007). In particular, the lack of data for the coastal zone (e.g. a portion of the west coast of Newfoundland) is a considered to be an important information gap (Savenkoff et al 2007b).

Figure 4.25 Identified Ecologically and Biologically Significant Areas (EBSAs) in the Gulf of St. Lawrence



DFO Multi-Species Surveys

The long-term monitoring and management of fish resources in the Gulf of St. Lawrence is conducted primarily through a number of scientific surveys, including the: 1) Northern Gulf Multi-Species Survey; 2) Southern Gulf Multi-Species Survey; 3) Fixed and Mobile Gear Sentinel Surveys; 4) Snow Crab Survey; and the 5) Herring Acoustic Surveys.

The Northern and Southern Gulf multi-species RV surveys are standardized, trawl-based surveys conducted by DFO using the *CCGS Teleost* and *CCGS Alfred Needler*. The surveys incorporate a random stratified design and take place during a fixed time every year (August in the northern Gulf and September in the southern Gulf) dating back to 1990 for the northern Gulf (DFO 2011a) and to 1971 for the southern Gulf (Hurlbut et al 2010). These data are the basis for most marine fish stock assessments in the Gulf. The northern Gulf survey overlaps with the SEA Update Area (Figure 4.26, Table 4.31) and its data were obtained and used in this report for generally identifying and describing overall fish distributions. Since fish distributions and community compositions are known to have been changing in the Gulf in recent decades, data from the 2004-2011 Northern Gulf survey were used here (Table 4.31). It is important to note that the nearshore region (depths < 37 m) was not sampled by the research vessel surveys.

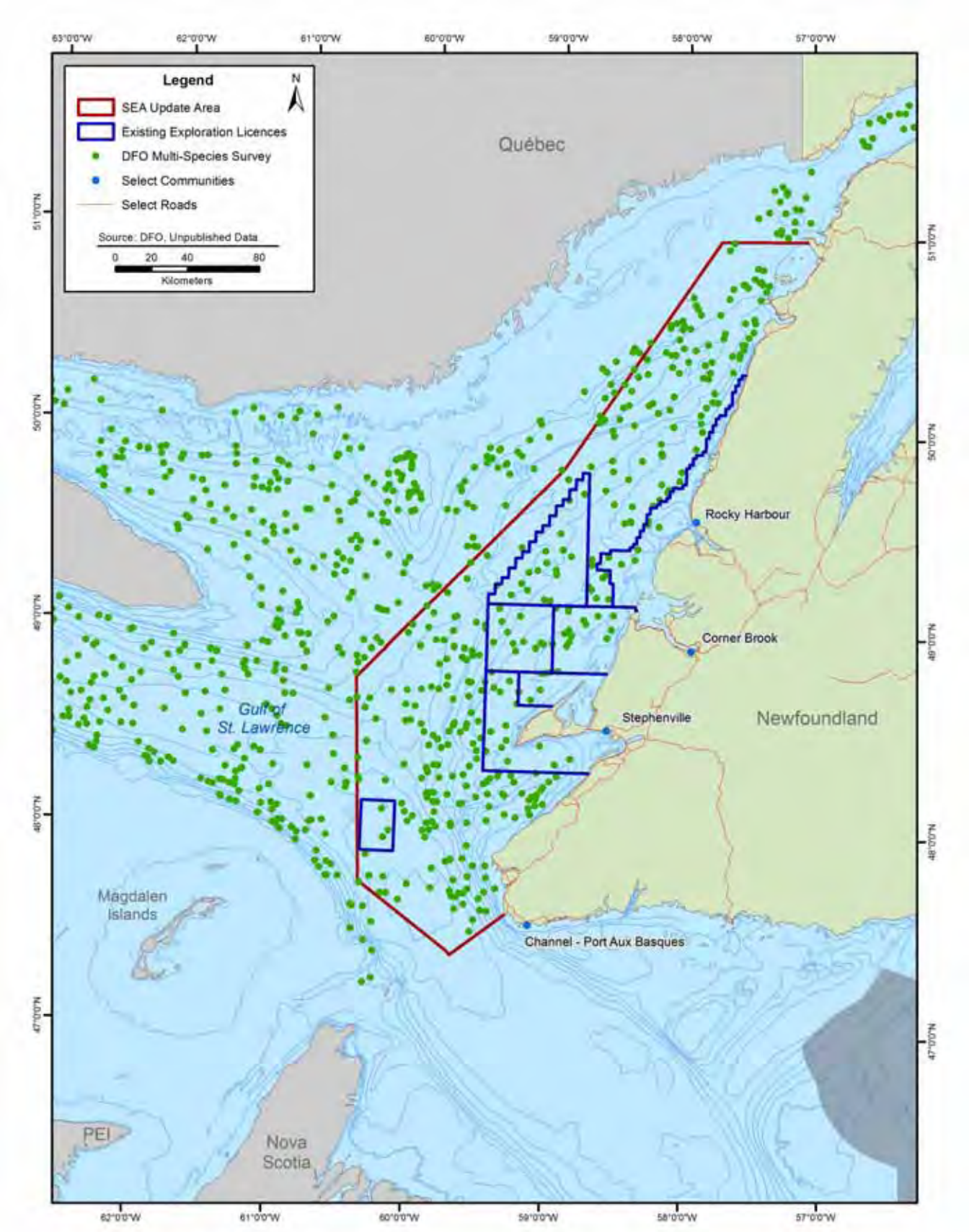
The data from the survey were further screened to identify species that had a relatively high degree of overlap with the SEA Update Area. From this process, 16 taxa were identified, and their distributions are described further and mapped in the following sections. To produce these generalized distribution maps, the SPANS potential mapping surface function was used. The method is well suited for spatially analyzing research survey data because it converts point estimates (in this case individual survey set catch rates) into continuous surfaces (density subareas) that perform as survey density strata with minimal extrapolation. Because observed fish density is used as the stratifying variable, it potentially reduces within strata variability of density. Extent and location of density constant subareas is allowed to vary according to distributional changes of the fish. That is, the technique makes use of the geo-referenced survey catch rate data to define spatial differences in fish density. The strata vary over time taking into account stock distributional shifts with a resulting lower within strata variability. Application of this technique has been "ground truthed" by overlaying the point data and their values to ensure that the surface properly represents density patterns in the catch rate data and does not extrapolate beyond the data.

Creation of a surface representative of the data is superior to a simple expanding symbol plot for two reasons: 1) it avoids the problem of masking of patterns in the data when the circles overlap and mask; and 2) the surface can then be used for further spatial modelling and overlaying of other surfaces and areas can be calculated. This is a fairly well established approach and has been used to describe fish distribution and populations in numerous studies (Kulka 1998a, 1998b; Kulka et al 2003a, b; Kulka et al 2007; Han and Kulka 2007; Kulka 2009).

Table 4.31 Survey Years Used and Number of Sets per Year for DFO Annual Surveys Used in Mapping

Year	2004	2005	2006	2007	2008	2009	2010	2011
Sets	123	172	192	183	201	177	144	166

Figure 4.26 Tow Locations for DFO Annual Trawl Surveys (2004-2011)



Sentinel surveys are also conducted jointly between DFO and the fishing industry and include the SEA Update Area (DFO 2011a). They provide additional abundance indices for stocks where the fisheries are limited or under moratorium such as the southern Gulf of St. Lawrence cod and white hake stocks (4T). The sentinel program has existed since 1995 and includes fixed and mobile gear components. Additional surveys that occur exclusively beyond the SEA Update Area include those for snow crab (since 1988, Benoit 2012) and herring (since 1991, LeBlanc et al 2010).

As part of the Atlantic Zone Monitoring Program (AZMP), scientists from the Maurice Lamontagne Institute (MLI) have developed and implemented a monitoring program for the St. Lawrence ecosystem. Different oceanographic variables are measured in the Estuary and Gulf of St. Lawrence in an effort to describe the annual and interannual variability in the environmental conditions of this ecosystem. Although the focus is on physical parameters (temperature, salinity, dissolved oxygen, etc), they also perform chlorophyll a profiles and vertical plankton tows for zooplankton. The MLI has seven transects throughout the Gulf that have been monitored since 1996 including one (7-TBB) overlapping the SEA Update Area.

Atlases of Significant Coastal and Marine Areas in Western Newfoundland

As part of integrated management planning efforts on Newfoundland's west coast, two Atlases of Significant Coastal and Marine Areas have been developed by the Bay St. George / Port au Port Peninsula Marine and Coastal Resources Steering Committee (ASCMA 2011) and the Great Northern Peninsula Integrated Coastal Zone Management (ICZM) Steering Committee for their Coastal Management Areas (ASCMA 2010).

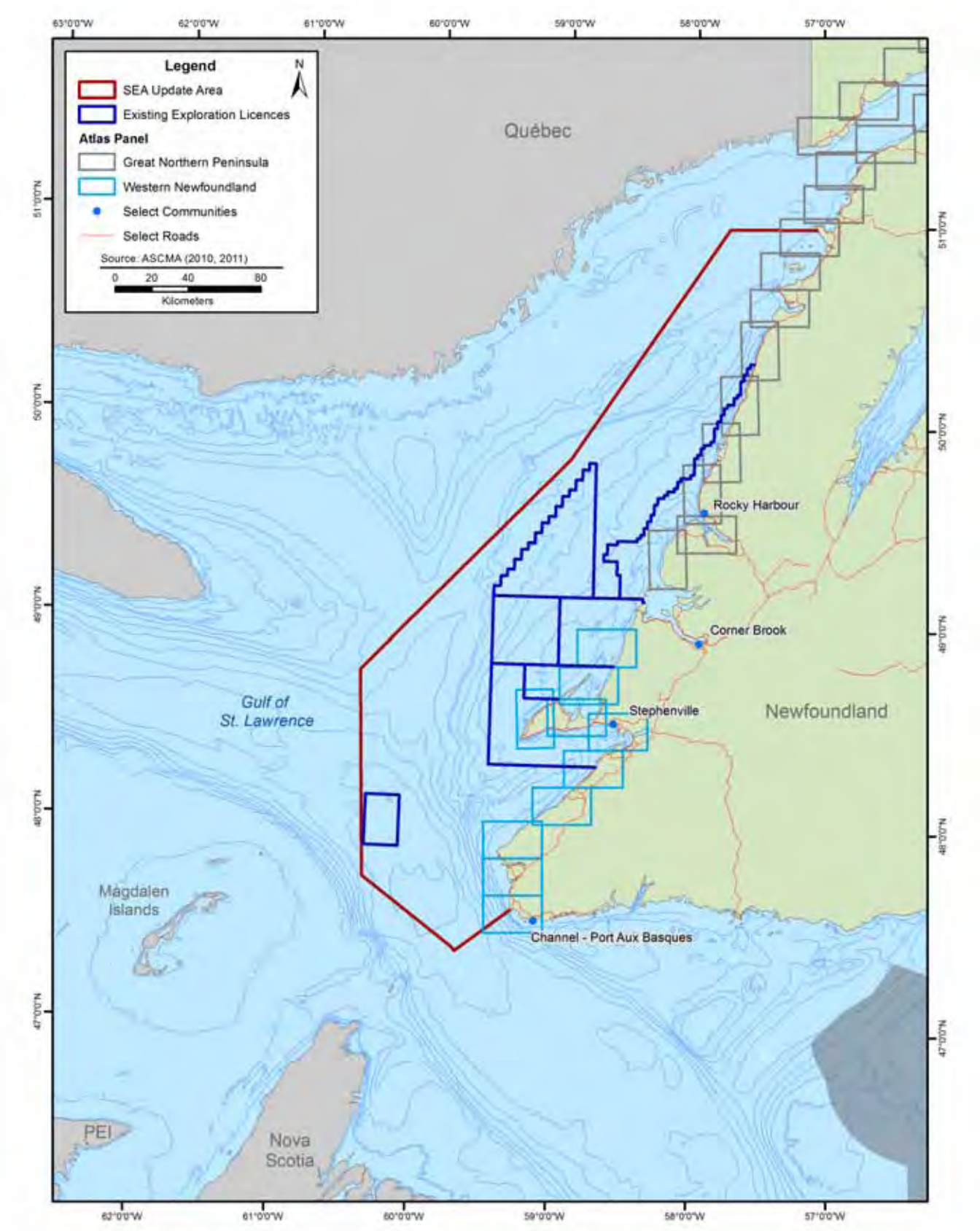
The Atlases are a collection of local knowledge that identifies important ecological, natural and historic features along the coastal and marine areas. Public sessions, which involved community leaders, fish harvesters, tourism operators, local researchers and other stakeholders, were held in 2009 (ASCMA 2010) and 2010 (ASCMA 2011) in various communities along the area in order to gather and record this information. The Atlases provide an extensive catalogue and visual representation of key ecological, natural and historic features including:

- Capelin spawning beaches
- Lobster areas and sanctuaries
- Herring spawning areas
- Snow crab areas
- Redfish Areas
- Salmon migration / staging areas
- Scallop areas
- Soft shell clam areas
- Waterfowl / seabird staging / nesting areas
- Whales / dolphins areas
- Eelgrass areas
- Artifact / fossil areas and Historic sites
- Piping plover nesting areas
- Important harbour seal areas
- Shrimp areas
- Halibut spawning areas
- Ecological reserves
- Arctic char migration / staging
- Banded killifish areas
- Eel areas
- Shipwrecks
- Smelt areas
- Mackerel spawning
- Cod spawning

The Atlases include a series of 1: 75,000 scale NTS maps, with 10 for the West Coast, 14 for the Great North Peninsula, and five for Southern Labrador (the index maps for both Atlases are illustrated in Figure 4.27). Although the scale of this information (1: 75,000) is too detailed and at too fine a scale to be reproduced here, - and, as of the time of writing, was not available in GIS mapping file formats - these Atlases comprise a useful and valuable information resource for planning and analysis at the local scale, such as in the planning and/or EA of individual projects.

Some of the attribute information identified in the Atlases are, however, available from other sources in a format and scale suitable for presentation in this the SEA Update (e.g., areas important for capelin, lobster, herring, redfish, salmon, cod, birds, eelgrass, marine mammals), and that information has been identified and/or mapped in the relevant sections of this report.

Figure 4.27 Atlases of Significant Coastal and Marine Areas (Information Coverage)



4.2.1.2 Plankton

Plankton consists of small marine organisms that exist and move passively in aquatic ecosystems, essentially drifting according to currents and other oceanographic processes. Marine plankton play an important role in the marine environment as they serve as the base layers of most food webs (primary and secondary production). Plankton comprise the largest group of organisms in the ocean both in terms of diversity and biomass. Taxa in this group include microscopic marine plants (phytoplankton), invertebrates (zooplankton), vertebrate eggs and larvae (ichthyoplankton), bacteria, fungi, and even viruses. There are 499 species of plankton that have been recorded or which might be expected to occur in the Gulf of St. Lawrence (Dufour and Ouellet 2007).

Phytoplankton

The distribution of phytoplankton (primary producers) in the Gulf of St. Lawrence is largely controlled by associated nutrient concentrations, with the northeastern part of the Gulf having lower overall production compared to the southwestern portion (Boulva 1991).

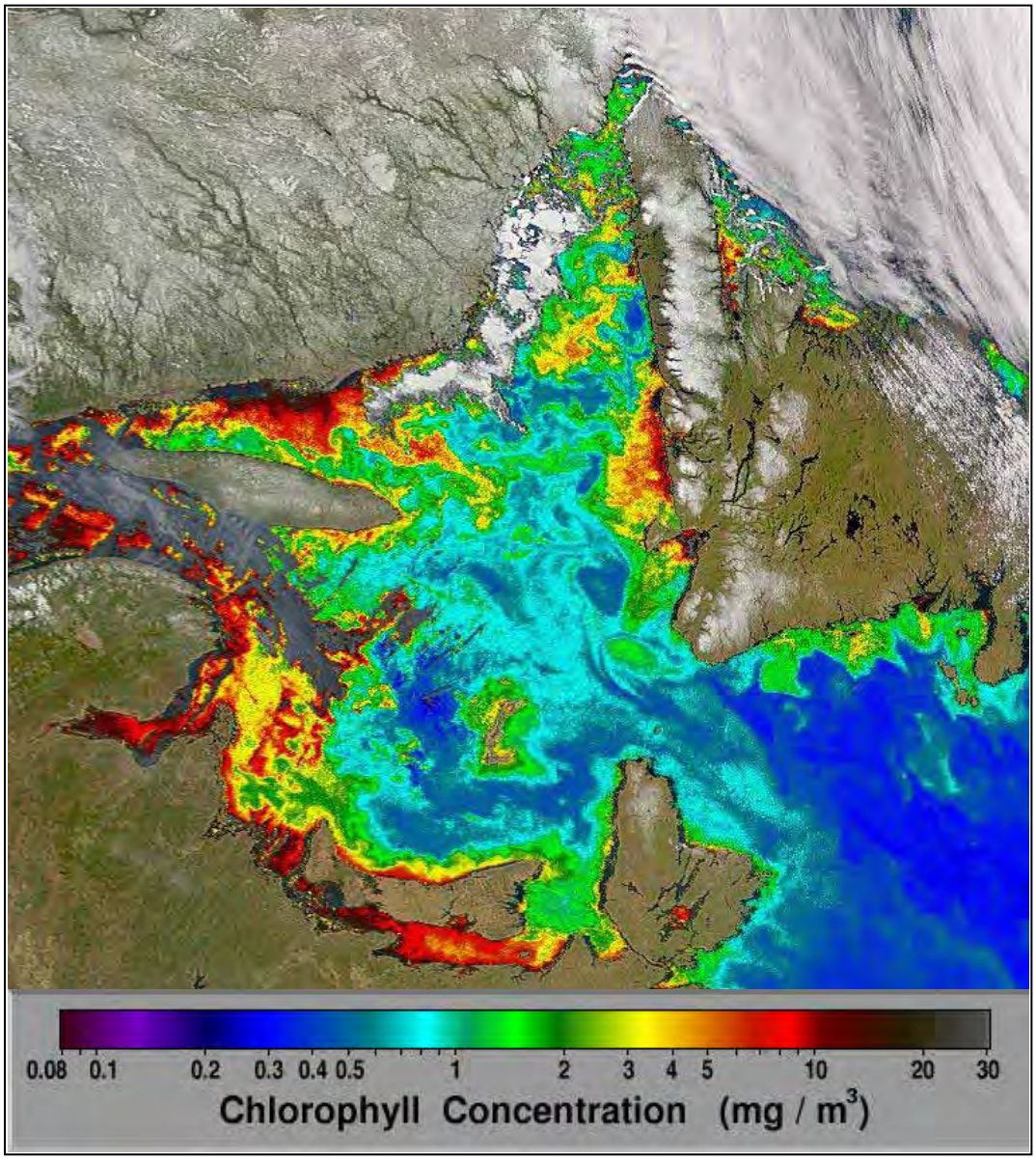
Spring blooms are caused when sunlight interacts with nutrient-rich north Atlantic waters that upwell to the surface. During the spring bloom in the Gulf, large phytoplanktonare abundant and mesozooplankton are largely herbivourous (Rivkin et al 1996). The spring bloom in the lower Saint Lawrence Estuary typically occurs in early summer, usually late June-July, although this can occur earlier if the spring freshwater runoff is low (Zakardjian et al 2000). The spring bloom is dissipated by the secondary producers (zooplankton) that graze on the phytoplankton resulting in a mid-summer phytoplankton low. Post bloom, large phytoplankton are reduced and mesozooplankton are largely omnivorous and prey on flagellates and ciliates (Rivkin et al 1996). A second upwelling event occurs in autumn, which again triggers a bloom. Primary production plays a key role in the Gulf as a conduit to transport nutrients and biogenic carbon from the euphotic zone to the benthos (Rivkin et al 1996, Tian et al 2001).

An illustrative satellite image of the distribution of chlorophyll concentrations in the Gulf of St. Lawrence is provided in Figure 4.28, based on data from the SeaWiFS program from May of 2003. The maximum primary production spring bloom values were between 1.4 and 2.2 g C/m2/d (Le Fouest et al 2005). Sporadic blooms of toxic algae are also known to occur in the lower Gulf of St. Lawrence Estuary (Zakardjian et al 2000).

The St. Lawrence Global Observatory conducts annual surveys of seawater chlorophyll content along eight transects within the Gulf, one of which runs perpendicular to the shoreline from Bonne Bay on the west coast of Newfoundland to the southeast coast of Québec. The results of their most recently available chlorophyll profiles for the spring and fall surveys (2011) indicate values in the surface waters of between 1 and 3 mg/m^3 for the last three survey years (SLGO 2012).

Areas of relatively high production across the entire Gulf of St. Lawrence include the lower estuary, the northwestern Gulf, the southern and western end of Anticosti Island, and along Québec's north shore. The western shore of Newfoundland has relatively low values along the northern peninsula and the Port aux Basques area (Dufour and Ouellet 2007) but areas of relatively higher productivity occur along other parts of the coast.

Figure 4.28 Chlorophyll Concentrations for the Gulf of St. Lawrence (May 18, 2003) (from SeaWIFS)



Zooplankton (Secondary Production)

The marine zooplankton for the St. Lawrence Marine System has 318 identified species from eight phyla (Archambault et al 2010). The zooplankton distributions in the Gulf often follow a salinity gradient from the rivers mouths to the marine zone (Archambault et al 2010). Copepods dominate the Gulf of St. Lawrence zooplankton and comprise about 75 percent of the zooplankton species richness. These taxa are also important prey for larval fish. Copepods are followed by larvaceans, cladocerans, and euphausiids (Lafontaine et al 1991). Euphausiids (krill) are also an important food item for large marine mammals (Plourde and McQuinn 2009). Zooplankton populations follow that of phytoplankton populations spatially and temporally in that they peak after the spring bloom, die off as they deplete this food source and are consumed by predators, and ultimately increase again following the fall bloom.

Harvey and Devine (2009) provided an overview of the temporal variability of zooplankton biomass, abundance, interannual variability, and species composition based on the Atlantic Zone Monitoring Program (AZMP) network of fixed point stations, sections, and multi-species surveys. Table 4.32 lists the top ten zooplankton taxa from the section that overlaps the SEA Update Area (Bonne Bay Line), nine of which are copepod species. Other authors have identified the Gulf of St. Lawrence is an important conduit of Arctic *Calanus* copepod species, transporting them from the Arctic to the Scotian Shelf (Herman et al 1991, Head and Pepin 2010). Two major trends in the AZMP data set is the changes in the krill and amphipod populations (Harvey and Devine 2009). There were fluctuations in the krill populations (*Meganyctiphanes norvegica, Thysanoessa raschii*) with the lower values in the most recent data assessed (2008) for the lower St. Lawrence Estuary and the northwest Gulf of St. Lawrence. Another trend is the presence of the arctic amphipod, *Themisto libellula*, which was rare or virtually absent in the Gulf before the 1990s and is now an abundant full time resident (Marion et al 2008). This may have important implications for the trophic dynamics and zooplankton community of the Gulf as *T. libellula* is a predator of many species of copepods, euphausiids and chaetognaths (Marion et al 2008).

Recent studies have also found that microplankton (heterotrophic protists including ciliates and tintinnids) and the microbial food web also play an important role in aquaculture production in some areas of the Gulf (Trottet et al 2007).

Table 4.32 Percentages and Averages of the 10 Top Zooplankton Taxa along the Bonne Bay Line of the Atlantic Zone Monitoring Program (2008 Surveys)

Rank	Taxa/Taxon	Group	% Total zooplankton	Average (N/m^2 10^2)
1	*Oithona* spp.	Copepod	45	914
2	*Pseudocalanus* spp.	Copepod	17	337
3	*Calanus finmarchicus*	Copepod	16	323
4	Copepod naulii (N3-N6)	Copepod	5	109
5	Copepod eggs	Copepod	4	71
6	*Appendicularia*	tunicate	2	44
7	*Calanus hyperboreus*	Copepod	2	42
8	*Temora* spp.	Copepod	2	37
9	*Microcalanus* spp.	Copepod	1	19
10	*Calanus glacialis*	Copepod	1	18
Total			95	1913
Total ZP				2019
Source: Modified from Harvey and Devine (2008)				

Ichthyoplankton

Ichthyoplankton in the Gulf of St. Lawrence is composed of fish larvae and eggs from 50 species and has considerable importance to the fisheries of the region. Ichthyoplankton assemblages in the Gulf vary depending on season and location. For the northern Gulf, sand lance larvae, redfish larvae, and cod or witch flounder eggs dominate early in the season. In the southern Gulf, sand lance and radiated shanny dominate in the spring and mackerel dominate in the summer (Dufour and Ouellet 2007). Surveys have been conducted along the west coast of Newfoundland from Port au Port Bay to Bonne Bay over the past decade (Gregoire and Faucher 2006; 2006; Gregoire et al 2009). Of the 20 larval species caught, the five most abundant were capelin, cunner, Atlantic herring, flounder, and Atlantic cod (Gregoire and Faucher 2006). Atlantic mackerel eggs and larvae were

also caught in the ichthyoplankton survey, which is somewhat surprising as it was generally recognized that the species' main spawning ground is the southern Gulf (Gregoire et al 2009).

Importance of the Plankton Community

The plankton community serves as the foundation of the marine food web, which is relied on directly or indirectly by all higher trophic levels. For example, the Gaspé Jet current, and Anticosti Gyre in the northwestern Gulf causes a permanent front of nutrients that supplies large diatoms, which in turn triggers a large accumulation of copepods that ultimately leads to a high production of larval capelin (Fortier 1992). This is similar to the front at the St. Lawrence Estuary that also has high production of capelin (Marchand et al 1999) and is part of the baleen whale feeding grounds. It has been argued that the changes in the cod stock were influenced by changes in plankton dynamics (Rothschild 2007). Krill are also an important component of zooplankton as it is a food source for large marine mammals. Plourde and McQuinn (2009) presented acoustic data that showed potential for high krill biomass along the eastern Equiman Channel.

Other studies have, however, suggested that the northern Gulf is not heavily influenced by bottom-up control, namely, that changes in primary productivity values do not directly affect productivity in higher trophic levels (Savenkoff et al 2007a, see Frank et al 2006 for exception). The Gulf has important hydrographic conditions that change the nutrient dynamics of the whole North Atlantic and cause spatio-temporal "pockets" of high plankton abundances that many other species depend on (Dufour and Ouellet 2007). Many important commercial species also have their larval stage as plankton, including snow crab, American lobster, northern cod, witch flounder, American plaice and others (Locke 2002).

The EBSA for the *West Coast of Newfoundland* (#10) was identified in part based on its planktonic community. The significance of this area for fish is reflected through its meroplankton component (maximum uniqueness, average to maximum concentration and adaptive value). In spring, there is a high concentration of Atlantic cod eggs. Since 1993, the area offshore from St. George's Bay has been regarded as the Atlantic cod's principal area for early spawning (northern Gulf stock entering the Gulf from wintering areas). There are also capelin and Atlantic herring larvae in abundance in this area, especially in the coastal area north of the Port au Port Peninsula.

Although not situated within the SEA Update Area or the Gulf itself, the Laurentian Channel has also been identified as an EBSA (Templeman 2007), and is located to the immediate southeast of the region. Enhanced primary and secondary production in the area from upwelling along the offshore slopes leads to aggregations of prey and consumers and both direct and indirect impacts on local ecosystem function.

Other EBSAs within the Gulf of St. Lawrence that are within general proximity to the SEA Update Area (within 100 km) that have also been identified in part based on their planktonic community include the South Fringe of the Laurentian Channel and Western Cape Breton. A summary of those areas is provided in Table 4.33.

Additional EBSAs in the Gulf of St. Lawrence that have been identified for their planktonic community but which are not in close proximity to the SEA Update Area include the St. George's Bay Area, Northumberland Strait, the Southwestern Coast, the Lower Estuary, and the Western and Northern Anticosti Island areas, a summary of which is provided in Table 4.34.

Table 4.33 Plankton Characteristics of EBSAs in the Gulf in Proximity (100 km) of the SEA Update Area

EBSA Name	Description as it Relates to Plankton	#
Southern Fringe of the Laurentian Channel (NS, PE, QC)	• Phytoplankton and zooplankton gather sometimes in large numbers within this region. This area also may be significant as a wintering area for zooplankton.	4
Western Cape Breton (NS, PE, QC)	• This area has been identified as significant due to its meroplankton, phytoplankton, and zooplankton populations. • It has the largest observed array of meroplanktonic species (witch flounder exclusively north of the area, Atlantic cod, winter flounder, American plaice, yellowtail flounder, decapod crustaceans, etc) and the highest meroplankton abundance (eggs and larvae) among all the identified areas in the Gulf. • A small part of the area in the north is under the influence of the Gaspé current and it is sometimes possible to observe significant biomass and a strong phytoplankton production. In the deeper valley waters in the northern section of this area, there is a likely potential for the accumulation of strong biomasses of mesozooplankton (>1 mm), biomasses identified as "sources" for high trophic level species that feed there. • The southern part is located in an area (southern Gulf) where there are large concentrations of mesozooplankton (<1mm). • Throughout the Gulf, there is no greater area for small mesozooplankton production.	1
Modified from DFO (2007)		

Table 4.34 Plankton Characteristics of EBSAs in the Gulf not in Proximity (>100 km) of the SEA Update Area

EBSA Name	Description as it Relates to Plankton	#
St. George's Bay (NS)	• This area is part of the southern section of the Gulf where the largest array and abundance of meroplanktonic species in the Gulf are observed and is hypothesized to have similar rates of secondary production with high concentrations of small mesozooplankton (<1 mm).	2
Northumberland Strait (PE, NB)	• As in the rest of the Southern Gulf, this area has particularly favourable conditions for diversity and abundance of meroplankton.	3
South-Western Coast of the Gulf (NB, PE)	• With the influence of the Gaspé current, which carries nutrients and phytoplankton cells, high phytoplankton concentrations can be observed in the area. • Zooplankton production and accumulation is considerable in the area, with high concentrations of prey items (*Calanus*, euphausids) that are important for higher trophic levels. • As for meroplankton, the EBSA is located in the area south of the Gulf where the widest array of species is found (Atlantic cod, winter flounder, American plaice, yellowtail flounder, decapod crustaceans, etc) as well as the greatest abundances among all the identified areas in the Gulf (maximum uniqueness, concentration and adaptive values).	5
Lower Estuary (NB, QC)	• The exceptional hydrographical conditions at the head of the channel provide a considerable nutrient input that support local production as well as higher	6

EBSA Name	Description as it Relates to Plankton	#
	production to the northwest and southern part of the Gulf through nutrient export. • The area is characterized by the remarkable intensity of its primary production and secondary production. This intense production provides for the accumulation of high phytoplankton and zooplankton biomasses (mesozooplankton > 1mm and macrozooplankton). • A very high secondary production (production and recruitment) and the accumulation of mesozooplankton and possibly macrozooplankton also occur over winter in deeper waters.	
Western Anticosti Island (QC, NB)	• The area is characterized by high primary production. In spring (April-May), there are heavy phytoplankton accumulations and production. The deep water resurgence associated with the Anticosti gyre, south of Anticosti Island and on the north shore, can spontaneously support a high phytoplankton biomass in the area. • The area is also characterized by its great significance for secondary production. Various studies indicate that this area could be very significant for production (reproduction and recruitment) and for maintaining (retention) mesozooplankton in the north-west of the Gulf and in the lower estuary. • There are very high zooplankton concentrations and production (macrozooplankton and mesozooplankton > 1 mm). In this area, in fall, the highest macrozooplankton biomass levels of the entire eastern Gulf are recorded. • The entire periphery around Anticosti Island represents an exceptional area for meroplankton in terms of maximum uniqueness, concentration, and adaptive values.	7
The Northern Anticosti Island (QC)	• Heavy concentrations of phytoplankton and zooplankton have been observed in the area (macro- and mesozooplankton >1mm).	8
Modified from DFO (2007)		

4.2.1.3 Coastal Habitats and Benthos

Coastal / Intertidal and Subtidal Communities

Coastal ocean habitats are some of the most productive in the ocean. In coastal areas of western Newfoundland, gradients of ice and wave disturbance, water depth, light availability, temperature and salinity, as well as varying substrate types create a diversity of habitat that is populated by a variety of organisms that include plants, mammals, birds, fish and invertebrates.

Intertidal Community

The composition of intertidal benthic invertebrate communities in the SEA Update Area is dependent on a combination of physical factors and biological factors including predation, grazing and those mentioned above. Catto et al (1999) provide descriptions of various typical coastal habitat types in the region (Table 4.35).

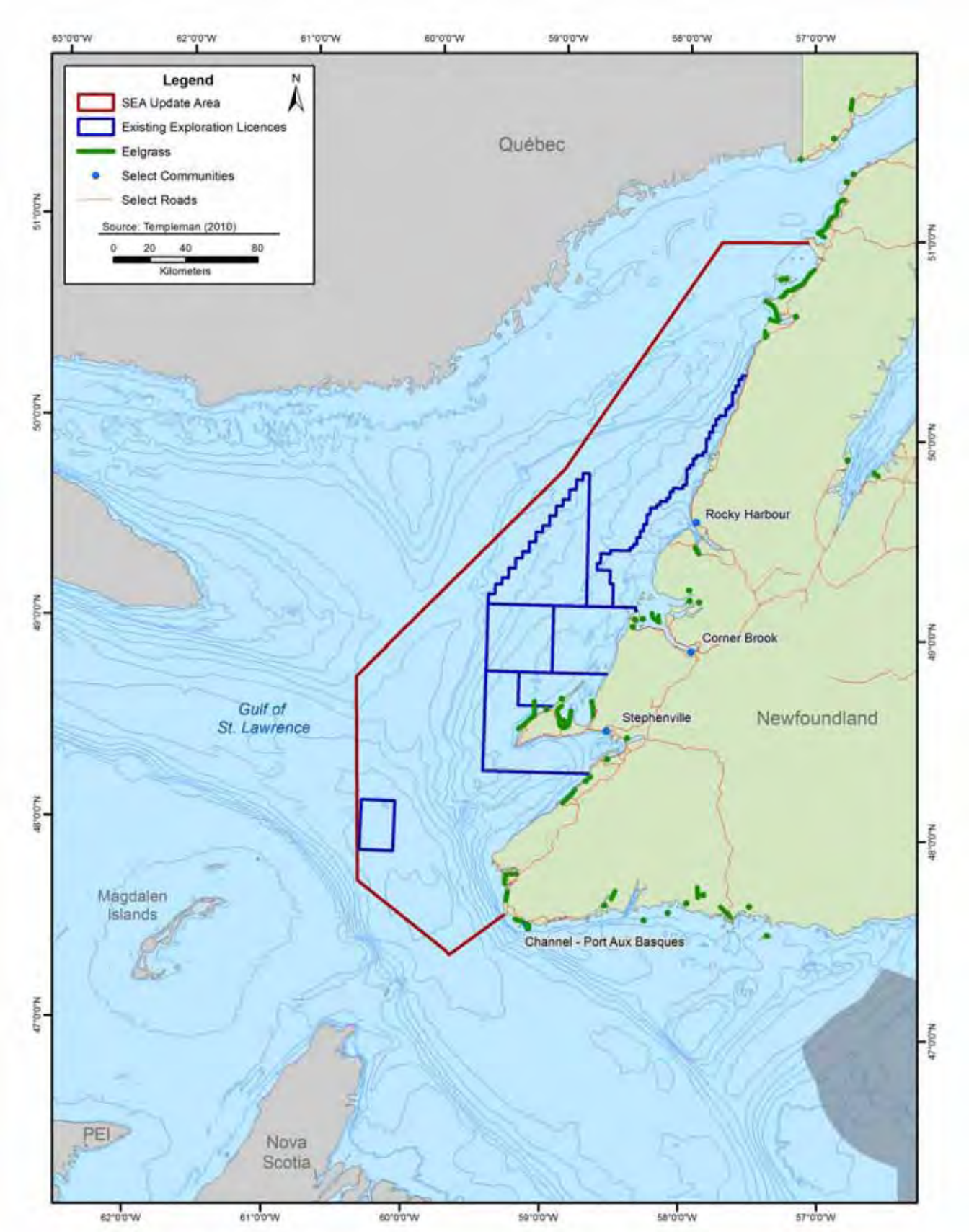
Table 4.35 General Coastal Habitat Types Occurring Along the West Coast of Newfoundland

Coarse Substrate	Typical Species	Fine Substrate	Typical Species
Fucus Anceps Surf Zone	Fucus seaweeds, barnacles	Saltmarsh	Grasses and sedges snails, amphipods
Seabird-dominated shores	Epiphytes, lichens	*Zostera* Eelgrass marsh	*Zostera*, softshell clams, lugworms, sand shrimp, hydroids, bryozoans, serpulids
Ascophyllum Rockweed Shores	Fucoid seaweeds, periwinkles, polychaetes, hydroids, bryozoans	Barachois Estuaries	Trout, salmon
Capelin Spawning Beaches	Capelin, nematodes, burrowing crustaceans		
Temporary Intertidal Communities	Copepods, amphipods		
Vertical Biological Zones	Periwinkles, mussels		
Rockweed Platforms	Periwinkles, mussels, barnacles		
Periwinkle Shores	Periwinkles, green sea urchins, Polychaetes, nemertean worms, amphipods, oligochaetes, nematodes		
Source: Catto et al (1999)			

In the recent consultation activities for the SEA Update, it was noted that some areas along the Québec Lower North Shore near the Strait of Belle Isle (such as the St. Augustine area, just north of the SEA Update Area) have large kelp beds, which may become economically important.

Eelgrass beds (*Zostera marina*), for example, are an important component of nearshore marine environments in the Gulf as they play an important structural role by filtering the water column, stabilizing the sediment, and buffering the shorelines. In addition eelgrass beds have high levels of primary productivity, add spatial complexity to the habitat and are utilized as nursery and spawning grounds for fish (DFO 2009, Cote et al 2013). These important ecological features have led to eelgrass being classified as an Ecologically Significant Species (DFO 2009). These habitats are widely spread across coastal areas of the SEA Update Area (Figure 4.29; ASCMA 2010, 2011).

Figure 4.29 Some Known Eelgrass Beds Along the West Coast of Newfoundland



Subtidal Community

The subtidal community consists of infralittoral (or shallow subtidal; < 30 m depth) and circalittoral (or shelf habitats; 30 to 200 m depth) communities. Much of the deep subtidal is composed of a series of banks separated by glacially deepened troughs. As the Gulf of St. Lawrence has both oceanic and estuarine components, the benthic community varies spatially throughout and correlated with physical factors such as depth, temperature, dissolved oxygen (DO), and sediment types.

For example, some recent studies have focused on the effect of DO in the deepwater channels in the Gulf (Belley et al 2010) as some of the bottom waters are hypoxic. In these areas deposit feeders (brittle stars, molluscs, cnidarians) dominate, while suspension feeders are more pervasive in the more oxygenated areas (burrowing anemones, shrimp). Characteristic deep subtidal invertebrate species in the more oceanic areas include lobster, snow crab, toad crab, rock crab, Iceland scallops, sea scallops, northern shrimps, Stimpson's surf clams, propeller clams, ocean quahogs and sea urchins.

Estuaries

Estuaries are coastal habitats that have marine waters diluted by riverine freshwater inputs. These habitats can vary in nature and size, and occur frequently along the coastline of the SEA Update Area. Estuaries are noted for extremely high levels of productivity (Greenlaw et al 2011) and serve as nursery areas for a variety of biota (Correll 1978). High levels of productivity are achieved when depleted marine nitrogen and phosphorus are renewed by freshwater inputs. These nutrients and plankton are pushed out to sea in fresh surface waters but much sinks into denser marine water below and is retained in the system (Correll 1978).

In addition to overall high productivity, estuaries can contain important habitats for aquatic plants (e.g. eelgrass), invertebrates, finfish and waterbirds. Fish species such as Atlantic cod use eelgrass habitats found in estuaries as nursery habitats (Gregory et al 2006), whereas other finfish use estuaries for feeding (e.g. Atlantic salmon, McCormick et al 1998; American eel, Velez-Espino and Koops 2010) or as staging areas for migration to and from rivers (e.g. Atlantic salmon; American eel, Dutil et al 1989). For anadromous species that exhibit population structuring at small scales (Bradbury et al 2008; COSEWIC 2011a), local disturbance could have implications for such fish species and populations

Recent studies have further classified estuaries based on physical (geomorphological, hydrographic) and biological features (diversity patterns, productivity) to further prioritize areas for protection (Greenlaw et al 2011).

Benthic Invertebrates

The greatest marine species diversity in the Gulf of St. Lawrence (over 1,500 species) is associated with the benthos (Dufour and Ouellet 2007), including several important commercial species such as American lobster, snow crab, Atlantic scallop, blue mussel and northern shrimp.

Benthic Diversity

A list of deep subtidal species is given in Table 4.36 based on Chabot et al (2007) that gathered available data from scientific surveys from the Maurice-Lamontagne Institute (MLI) and the Gulf Fisheries Centre (GFC) which

shows the contributions of benthic invertebrates to the marine diversity. It is important to note that this Table is based largely on surveys that were below 50 m, and so the data do not necessarily capture all the diversity in the shallower areas.

Table 4.36 Benthic Taxa from Shelf Habitats in the Gulf of St. Lawrence

General Group	Subgroup	Species or Taxon	SEA Update Area[1]	EBSA[2]
Soft coral		(Alcyoniidae)		•
Anemones		(Anthozoa)		•
Sponges		(Porifera)		•
Ascidians				•
Molluscs		Arctic surfclam (*Mactromeris polynyma*)		
		Atlantic surfclamn (*Spisula solidissima*)		
		Common softshell clam (*Mya arenaria*)		
		Shortfin squid (*Illex illecebrosus*)	•	•
		Spoonarm octopus (*Bathypolypus bairdii*)	•	•
		Lesser bobtail squid (*Semirossia tenera*)	•	•
		Whelk (*Buccinum sp*. and *Neptunea sp*. and others)		•
		Iceland scallop (*Chlamys islandica*)		•
		Sea scallop (*Placopecten magellanicus*)	•	•
Echinoderms		Starfish (*Asteroidea*)		•
		Basket stars (*Gorgonacea*)		•
		Brittle stars (*Ophiuridae*)	•	•
		Sea urchins		•
		Sea cucumbers (*Holothuroidea*)		•
Crustaceans	Mysids	*Boreomysis arctica*		•
	Shrimp	*Acanthephyra pelagica*		•
		Arctic argid (*Argis dentata*)	•	•
		Atlantopandalus propinquus	•	•
		Arctic eualid (*Eualus fabricii*)	•	•
		Circumpolar eualid (*E. gaimardi*)		•
		Greenland shrimp (*E. macilentus*)	•	•
		Doll eualid (*E. pusiolus*)		•
		Spiny lebbeid (*Lebbeus groenlandicus*)		•
		L. microceros		•
		Polar lebbeid (*L. polaris*)	•	•
		Northern shrimp (*Pandalus borealis*)		•
		Striped pink shrimp (*P. montagui*)		•
		Pink glass shrimp (*Pasiphaea multidentata*)	•	•
		Crimson pasiphaeid (*Pasiphaea tarda*)		•
		Norwegian shrimp (*Pontophilus norvegicus*)	•	•
		Sars shrimp (*Sabinea sarsi*)	•	•
		Sevenline shrimp (*S. septemcarinata*)	•	•
		Sculptured shrimp (*Sclerocrangon boreas*)	•	•
		Sergestes arcticus		•
		Friendly blade shrimp (*Spirontocaris lilljeborgii*)	•	•
		Punctate blade shrimp (*S. phippsii*)		•
		Parrot shrimp (*S. spinus*)		•
	Crabs	Atlantic rock crab (*Cancer irroratus*)	•	
		Snow crab (*Chionoecetes opilio*)		•

General Group	Subgroup	Species or Taxon	SEA Update Area[1]	EBSA[2]
		Toad crab (*Hyas sp*.)		•
		Arctic lyre crab (*H. coarctatus*)		•
		Lady crab (*Ovalipes ocelatus*)		•
		Hermit crab (*Pagurus sp*.)		•
		Spiny crab (*Lithodes maja*)	•	•
		Sand shrimp (*Crangon septemspinosa*)		
	Lobsters	American lobster (*Homarus americanus*)	•	
1These species were present or abundant within the SEA Update Area 2 These species were used in the determination of the EBSAs Source: Modified from Chabot et al (2007)				

Life Histories, Habitat, and Spawning (Benthic Invertebrates)

Table 4.37 provides an updated overview of some of the key marine invertebrate species in the region, including general (and summarized) information on their life histories, habitat preferences and reproduction patterns and practices. Although the Table clearly cannot include all species that could potentially occur in the region, it focuses on species that have been identified through the SEA Update as being of potential ecological and/or socioeconomic relevance.

Other sections of this report also discuss different and/or more specific aspects of benthic invertebrates. Important spawning times and locations for American lobster and information on aquatic invasive species, for example, are provided in Section 4.2.1.4.

Distribution maps of benthic invertebrate species that are known have a relatively high overlap with the SEA Update Area are provided in Section 4.2.1.5.

Table 4.37 Overview of Some Key Marine Invertebrate Species in the SEA Update Area

Species	Habitat and Distribution	Spawning	Commercial Significance
American lobster *(Homarus americanus)*	• Lobsters are among the biggest and longest-living marine crustaceans, some reaching ages of up to 50 years. • Distributed along the Atlantic Coast, specifically the area between Cape Hatteras in North Carolina and the Strait of Belle Isle. • In Canada, the biggest populations are close to southwest Nova Scotia and in the southern part of the Gulf of St. Lawrence. • Found in waters ranging between –1.5 and 24°C and are fished in waters up to 300 m deep depending on the region (DFO 2009b).	• Mating between male and female American lobsters usually occurs immediately following the female's molting (or ecdysis) during the summer months. • Reproductive cycle lasts about two years. A female lobster will produce between a few thousand and several tens of thousands of eggs depending on her size. • The survival rate of eggs is very low: 0.01-0.1 percent of young lobsters (larvae) will become adults (DFO 2009b).	Commercially significant shellfish species
Atlantic sea scallop (*Placopecten magellanicus*)	• Sea scallops are distributed in the northwest Atlantic Ocean from Labrador to Cape Hatteras, North Carolina. • In the northern part of their range, they tend to occur in shallow water at depths of less than 20 m. • In Newfoundland and Labrador, they are generally distributed throughout the shallow coastal region, occurring most often on sand-gravel or gravel-pebble substrates.	• Sea scallops are normally dioecious and their spawning times vary from July to early October, depending on location. • Spawning time tends to be later as one moves north within their distribution. In Newfoundland, spawning typically occurs in September and October, with specific timing being dependent on latitude and environmental conditions.	Commercially significant shellfish species
Blue mussels (*Mytilus spp.*)	• Blue mussels have a circumpolar distribution and occupy temperate waters. • In the northwestern Atlantic Ocean, its distribution extends from the Arctic to South Carolina. • This bivalve can be found in habitats ranging from slightly brackish, shallow estuaries to highly saline offshore environments.	• Spawning by this dioecious species and subsequent external fertilization generally occurs during the May to August period, peaking between mid-May and late June. • Spawning appears to occur in response to environmental triggers, including sufficiently high water temperatures (10 to 12°C), suitable planktonic food supply, spring tidal currents and sudden physical disturbance during storms. Salinity should be at least 15 ppt to ensure successful fertilization.	Commercially significant shellfish species (aquaculture)
Deep sea corals and sponges	• Corals have been found from 39 m to 200 m depths (Campbell and Simms 2009) along all areas in the Gulf (DFO 2010a). • Sponges occur from interidal to deep sea	• Sea pens likely spawn prior to spring (Campbell and Simms 2009).	Not commercially significant in the region

Species	Habitat and Distribution	Spawning	Commercial Significance
	(Campbell and Simms 2009) in all regions of the Gulf (DFO 2010a). • Aggregations of sea pens occur along the Laurentian Channel.		
Northern shrimp (*Pandalus borealis*)	• Most abundant north of 46° N. Water temperatures in areas of the northwest Atlantic Ocean, where the Northern shrimp are most abundant range from 1 to 6°C, sometimes restricting them to deep areas (i.e., > 180 m). • Northern shrimp appear to prefer areas with soft, mud and silt substrates but occasionally they will be found on sand and gravel/rock substrates. • These water temperature and substrate conditions occur throughout the Newfoundland-Labrador offshore area within a depth range of approximately 150 to 600 m, providing a vast area of suitable habitat.	• Northern shrimp spawn once a year, generally in autumn. • Fecundity has been shown to vary considerably according to individual size and area. In Atlantic Canada, the number of eggs per female usually ranges from 800 to 4,300. • At water temperatures of 3 to 5°C, Northern Shrimp females tend to be almost 100 percent ovigerous in autumn and spawn at least annually.	Commercially significant shellfish species
Snow crab (*Chionoecetes opilio*)	• Snow crab live on muddy bottoms in cold waters and occupy a broad depth range in the northwest Atlantic Ocean from Greenland to the Gulf of Maine. • The species typically occurs on soft bottoms at depths of 60 to 400 m where water temperatures remain primarily between 4-5 °C.	• Snow crab are sexually dimorphic, meaning males and females have two different forms, with obvious size differences between them. • Primiparous females mate after their terminal moult, sometime from February to mid-March. • A female can produce from 12,000 to 160,000 eggs depending on her size (DFO 2009b).	Commercially significant shellfish species
Source: From Christian et al (2010) unless otherwise noted			

Corals

Deep-sea corals are important component to the ecology of the marine environment. They provide structural complexity on the seafloor, and therefore provide shelter, food, or substrate for epifaunal growth for other organisms (Watanabe et al 2009) including commercial fish (Gilkinson and Edinger 2009). Recent studies have provided direct evidence of the utilization of cold-water corals by fish larvae, mainly those of redfish in the east coast of Canada (Baillon et al 2012); redfish larvae were observed tucked in among the polyps in deep-water sea pens. In addition, deep-sea corals and sponges have been shown to increase biodiversity and habitat heterogeneity in the deep sea system (Buhl-Mortensen et al 2010).

Deep sea corals have been classified into five functional groups: 1) large gorgonians or antipatharian corals, 2) small gorgonian corals, 3) cup corals, 4) sea pens, and 5) soft corals. The first two groups are considered to be the most sensitive to disturbance because their carbonate skeletons cannot reattach to substrate if dislodged (Gilkinson and Edinger 2009). Deep sea corals are known for their slow steady growth, and as such are vulnerable to anthropogenic disturbance such as fishing and oil and gas activities (Campbell and Simms 2009; Watanabe et al 2009). Six areas at locations throughout Canadian waters on the west and east coasts were identified as unique and/or rare for cold-water corals in the Canadian waters (as defined in DFO 2010a), with neither of these occurring within the Gulf of St. Lawrence.

There is, however, a known presence of corals and sponges within the Gulf (Colpron et al 2010), with sea pens, soft corals and stony corals known to occur within the SEA Update Area (Figures 4.30 and 4.31). Whereas corals and sponges are widely distributed throughout the SEA Update Area and the entire Gulf, there are also high aggregations of sea pens that are considered important (DFO 2010a).

DFO (2010a) used a cumulative threshold catch density of 97.5 percent for sea pens and small gorgonians and 90 percent for large gorgonian corals to determine key areas in the Gulf. Twenty-eight interviews were conducted with Northern Gulf fish harvesters (DFO 2010a) in November and December 2009 in three communities on the west coast of Newfoundland (Port au Choix, Norris Point and Port aux Basques). Fish harvesters were asked to draw polygons on nautical charts representing their fishing areas as well as areas where they recall having seen coral. During interviews, fish harvesters were shown pictures and specimens of different species of coral to help facilitate and confirm identification. The information from those surveys is also included in Figure 4.31.

Figure 4.30 Deep Sea Corals in the Northern Gulf of St. Lawrence

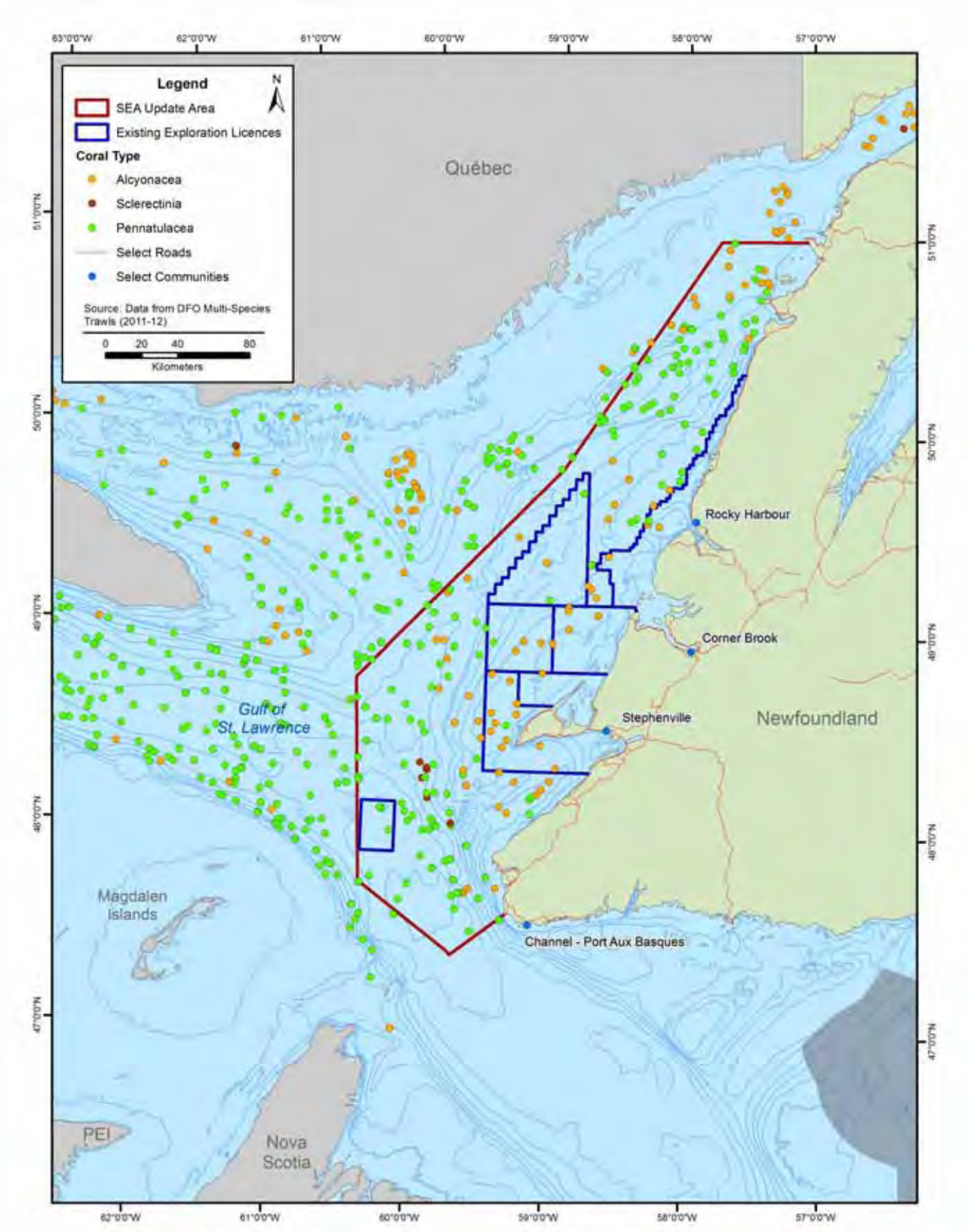
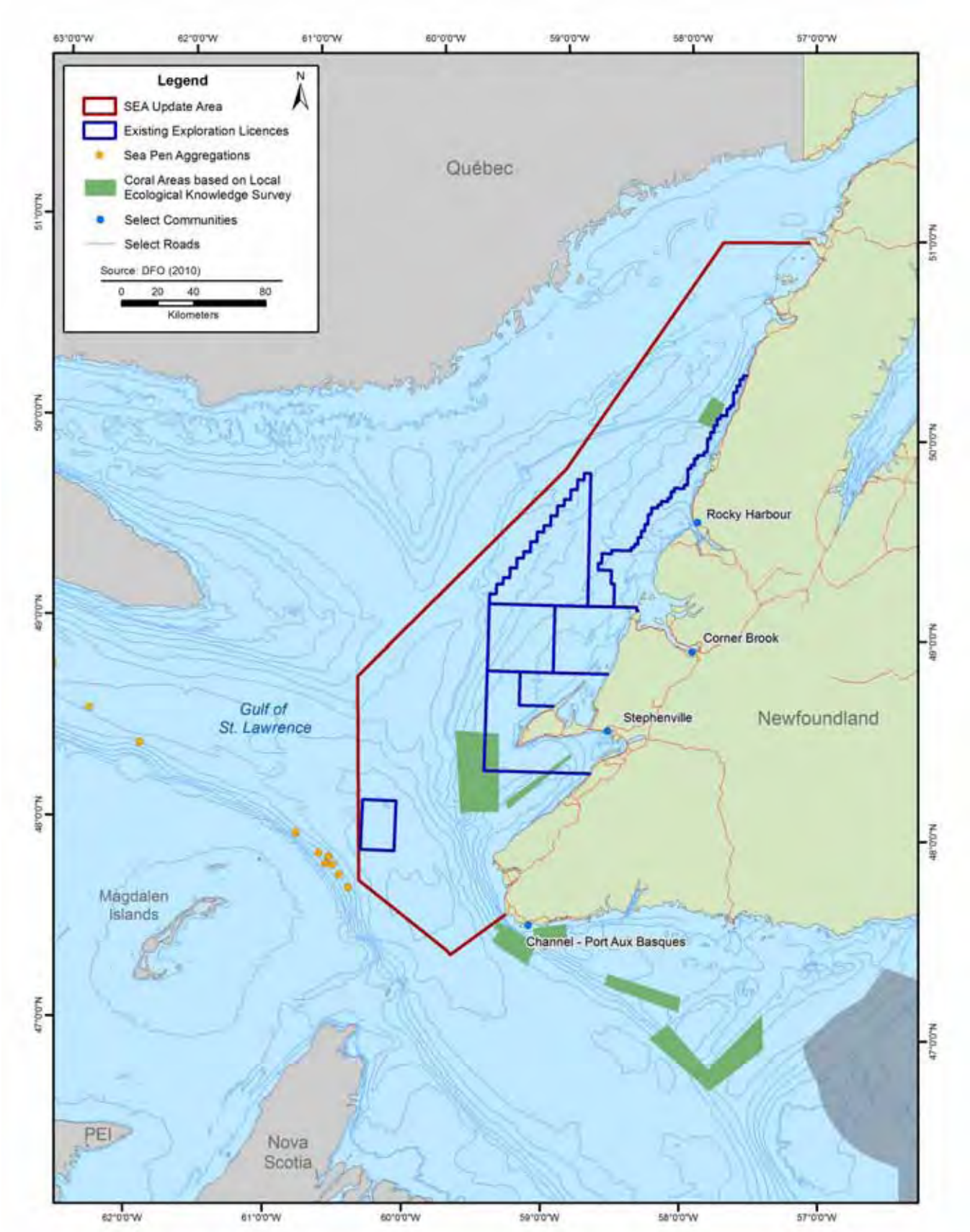


Figure 4.31 Aggregate Cold Water Coral Areas and Areas Identified from Local Knowledge



4.2.1.4 Marine Fish

A wide and varied range of marine fish species are known or are thought to occur within the SEA Update Area. The occurrence of these species reflects their physiological and life history requirements and their presence may vary according to habitat, environmental conditions and life history stage.

This section provides an updated overview of some of the key marine fish species in the region, including general (and summarized) information on their life histories, habitat preferences and reproduction patterns and practices. As with invertebrate species, the tables and text do not necessarily present an exhaustive list of every species that could occur in the Gulf. Further information and inventories can be found in other sources (such as Nozeres et al 2010; Bourdages and Ouellet 2011).

This is followed by information related to key aspects of marine fish presence and abundance, spatial and temporal distribution, and their movements to, through and within the region which are particularly relevant to their potential interactions with offshore petroleum activities in the area.

Life Histories, Habitat, and Spawning (Finfish)

Tables 4.38 to 4.39 list some of the marine fish species that are known or likely to occur in the SEA Update Area, as well as summarizing their preferred habitats, distribution, spawning behaviour, and identifying whether or not they have commercial significance in the SEA Update Area.

Additional and detailed information on marine fish spawning, migration and regional distributions that is specific to the SEA Update Area and other portions of the Gulf of St. Lawrence is provided in subsequent sections. Distribution maps of species that have a high degree of overlap with the SEA Update Area are presented in Section 4.2.1.5 and species at risk such as Atlantic wolffish are listed in this section but are discussed further in Section 4.2.1.6.

Table 4.38 Overview of Some Key Demersal Finfish Species in the SEA Update Area

Species	Habitat and Distribution	Spawning	Commercial Significance
Alligator fish *(Aspidophoroides monopterygius)*	• Found in high densities throughout the SEA Update Area (Bourdage and Ouellet 2011) • Mostly found in depths ranging from 41 to 195 m • Found over soft mud or pebbly bottoms	• Internal gametic association rather than broadcst spawning (Arbour et al 2010)	Not commercially significant in the region
Atlantic cod (*Gadus morhua*)	• Occurs on both sides of the North Atlantic. • Found in cool-temperature to subarctic waters from inshore regions to the edge of the continental shelf. • Depth of habitat is usually related to temperature; cool temperatures are preferred, in 0.5–10°C range. • Cod occur throughout the Canadian Atlantic Area, and each region has different identifiable stocks. • Gulf cod undertake winter migrations into the Laurentian Channel (Campana et al 1999). • Found throughout the SEA Update Area (Bourdage and Ouellet 2011)	• Over the whole Canadian Atlantic region, spawning begins in the north as early as February and ends in the south as late as December. • Due to the fact that cod spawn over such a large area, it is difficult to generalize about specific conditions. • The depth at which cod spawn varies according to the particular stock, locality, and temperature and can vary from 110 m to 182 m. • Gulf cod spawn in the Laurentian Channel just prior to inshore migrations in late spring (Campana et al 1999).	Commercially significant species
Atlantic halibut (*Hippoglossus hippoglossus*)	• The largest of the flat fishes, and typically found along the slopes of the continental shelf. • Atlantic halibut move seasonally between deep winter waters and the shallow waters of the Gulf where they feed. • This migration allows them to avoid temperatures below 2.5°C.	• Spawning grounds of the Atlantic halibut are not clearly defined. • Fertilized eggs are slightly positively buoyant so that they naturally disperse and only gradually float toward the ocean's surface. • Once hatched, the developing larvae live off their yolk for the next six to eight weeks while their digestive system develops so they can begin feeding on natural zooplankton.	Commercially significant species
Atlantic hagfish (*Myxine glutinosa*)	• Found in water depths of 30 m or more. • Require high salinity (approx. 30 ppt or more) and low-temperature (below 12°C). • Widely distributed in Arctic seas southward along both coasts of the North Atlantic. • Throughout the Canadian area, distributed off all	• Spawning occurs throughout the year. • Hagfish eggs are seldom found in the wild but have been taken in the Bay of Fundy, on Georges Bank, and off the south coast of Newfoundland.	Not commercially significant in the region

Species	Habitat and Distribution	Spawning	Commercial Significance
	coasts and in the Gulf of the St. Lawrence, over soft bottom. • Highest densities in the SEA Update Area are in the southern half (Bourdage and Ouellet 2011)		
Atlantic softpout (*Melanostigma atlanticum*)	• A bottom living species, the Atlantic softpout has been taken from relatively shallow water from the Gulf of St. Lawrence, but is generally found in waters at 276–366 m in collections off Canada. • Bottom temperatures at presumed depths were in the range of 3.0 to 5.18°C, and salinities were about 33.4 to 34.7 ppt. • Highest densities in the SEA Update Area are in the southern tip (Bourdage and Ouellet 2011). • Found mostly in depths ranging from 228 to 402 m	• Spawning occurs from July to September, time to hatching is not known.	Not commercially significant in the region
American plaice *(Hippoglossoides platessoides)*	• Usually considered a coldwater species, with a preference for temperatures from just below 0 to 1.5°C and a depth range of 90–250 m. • Occurs on both sides of the Atlantic, can tolerate lowered salinities and have been reported in salinities as low as 20 – 22 ppt. • Found throughout most of the SEA Update Area (Bourdage and Ouellet 2011). • Depths usually range from 85 to 244 m.	• For Gulf stocks, spawning occurs in spring, beginning early April and continues through June when near-bottom temperatures were in the range of 3-6°C (Walsh 1994). • Time to hatching depends on water temperature in the surface layers, but at 5°C hatching occurs in 11 – 14 days.	Occur primarily in the southern Gulf of St. Lawrence but some taken as bycatch in the 4R fisheries
Atlantic wolffish[1] (*Anarhichas lupus*)	• Occurs on both sides of the North Atlantic Ocean. • Commonly an inhabitant of deep water along the shelves (Dutil et al 2011). • In the Newfoundland area, it occurs over hard clay bottom in depths of 101 – 350 m and bottom temperatures of 0.4 to 4°C. • In the Gulf, they are distributed along the slopes of the Laurentian, Esquiman, and Anticosti Channels.	• Information available shows a wide variability in time and place of spawning.	Not commercially significant in the region
Black dogfish (*Centroscyllium fabricii*)	• Small, deepwater shark occurring off bottom, at times forming schools. • Throughout its range usually occurring at depths from 275 m to 1600 m; in Canadian waters at depths of 460 m and deeper. • Bottom temperatures where most captures have occurred were 3.5 – 4.5°C.	• Ovoviviparous, the fertilized eggs develop within the brood chamber of the female.	Not commercially significant in the region

Species	Habitat and Distribution	Spawning	Commercial Significance
	• Highest densities in the SEA Update Area are on the southern tip (Bourdage and Ouellet 2011)		
Cusk (*Brosme brosme*)	• Lives on hard, rough or rocky bottom, preferring relatively warm water and intermediate depths. • Found in moderately deep water on both sides of the North Atlantic. In the Canadian region more common on southwestern Scotian Shelf and Slope and Fundian Channel that elsewhere.	• Reproductive biology not widely known for the northwest Atlantic.	Not commercially significant in the region
Fourbeard rockling (*Enchelyopus cimbrius*)	• Occurs at depths of 55 – 550 m. • Underwater observations in Newfoundland waters using SCUBA gear revealed rocklings sought shelter in partially concealed burrows in bottom mud. • Widely distributed in shore waters of the eastern and western North Atlantic. • Highest densities in the SEA Update Area are in the offshore areas (Bourdage and Ouellet 2011).	• Spawning period is prolonged. Research indicates that the period runs from late May or early June until August, September, or even October depending on the water temperature. • Spawning reached a peak when ocean temperature reached 9 to 10°C.	Not commercially significant in the region
Goosefish (*Lophius americanus*)	• Also known as a Monkfish, this is a bottom-dwelling sluggish fish living over a variety of substrates, from tideline down to 668 m. • Tolerates a wide variety of temperature, 0 to 21°C • Research shows that they invade shallow waters of the banks in summer and migrate to deeper waters in winter. • Highest densities in the SEA Update Area are in the offshore areas from the southern tip to north of the Port Au Port (Bourdage and Ouellet 2011).	• Spawning occurs from June to September in Canadian waters.	Not commercially significant in the region
Greater eelpout (*Lycodes esmarki*)	• A subarctic species found on mud bottoms at depths of 151 – 500 m in temperatures of -0.4 to 5°C. • Depths of 251 – 350 m and temperatures of -0.4 to 3.5°C were considered optimal in Labrador and Newfoundland waters. • Highest densities in the SEA Update Area are in the southwest corner (Bourdage and Ouellet 2011). • Found in depths from 307 to 450 m.	• Information on biology is extremely limited.	Not commercially significant in the region
Greenland halibut (*Reinhardtius hippoglossoides)*	• A deepwater flatfish species that occurs in water temperatures ranging from -0.5 to 6°C but appears to have a preference for temperatures of 0 to	• These halibut are believed to spawn in Davis Strait during the winter and early spring at depths ranging from 650 to 1,000	Commercially significant species

Species	Habitat and Distribution	Spawning	Commercial Significance
	4.5°C. • Unlike many flatfishes, the Greenland halibut spends considerable time in the pelagic zone. • Highest densities in the SEA Update Area occur offshore (Bourdage and Ouellet 2011).	m. They are also thought to spawn in the Laurentian Channel and the Gulf of St. Lawrence during the winter (Bowering 1982). • The large fertilized eggs are benthic but the hatched young move upwards in the water column and remain at about 30 m below surface until they attain an approximate length of 70 mm. • As they grow, the young fish move downward in the water column and are transported by the currents in the Davis Strait southward to the continental shelf and slopes of Labrador and Newfoundland.	
Haddock (*Melanogrammus aeglefinus*)	• Found in southwest Newfoundland and St. Pierre Bank. • Found in water depths of 27 to 366 m. • Prefers temperatures of 1 to 13°C. • Occurs in a variety of habitats; juveniles have higher survival rates when they settle on sand or gravel bottoms. • Highest densities in the SEA Update Area are offshore from Corner Brook (Bourdage and Ouellet 2011)	• Generally, haddock spawning on the Grand Banks begins in March and continues through to August or September. • Spawning peak appears to occur in March. • The early 3P spawning peak was also reported by Templeman and Bishop (1979) but recent surveys have shown lack of spawning in the region (Ollerhead at al 2004).	Commercially significant species
Longfin hake (*Urophycis chesteri*)	• A deepwater, demersal species occurring at depths of 160 – 1,290 m off Virginia. In Canadian waters it has been found most abundant at depths of 300 – 450 m, in temperatures of 1.6 to 9.7°C. • Adults have been caught in a deep fjord off southern Newfoundland, indicating local populations may survive near shore in cool, deep water. • Highest densities in the SEA Update Area are in the bottom third of the area (Bourdage and Ouellet 2011).	• Spawning occurs from September to April off Virginia, and during October and peaking during the winter off the southern Grand Bank and Flemish Cap.	Not commercially significant in the region
Lumpfish (*Cyclopterus lumpus*)	• Primarily a bottom fish of cold to temperate waters, living on a stony or rocky bottom. • Highest densities in the SEA Update Area are in areas off Port au Port, Cow Head and Port au Choix	• Spawning takes place along the coast in shallow water, occasionally in deeper water, in early spring and may continue over a lengthy period.	Not commercially significant in the region

Species	Habitat and Distribution	Spawning	Commercial Significance
	(Bourdage and Ouellet 2011). • Found mostly in depths ranging from 70 to 351 m.	• Individuals may deposit several egg masses during a spawning period.	
Marlin-spike (*Nezumia bairdi*)	• A benthic species, usually living on the mud bottom. • It has been caught at depths of 16 – 2285 m but was found to me most abundant off Newfoundland in 183 – 732 m. • Its distribution in the western Atlantic occurs in deeper parts of the Gulf of St. Lawrence; in the Bay of Fundy; from the southwestern Grand Bank; banks of the Scotian shelf; and southward along the continental slope of the West Indies. • Bottom temperatures where marlin-spike has been found range from 3 and 8°C. • Highest densities in the SEA Update Area are between Port aux Basques and the Port au Port Peninsula (Bourdage and Ouellet 2011).	• Information on reproduction is sparse, the species most likely spawns in summer and autumn.	Not commercially significant in the region
Moustached sculpin *(Triglops murrayi)*	• Found throughout most of the SEA Update Area (Bourdage and Ouellet 2011). • Depth range is usually between 48 and 150m	• Presumed to have sinking eggs • Prolonged spawning period (summer into fall)	Not commercially significant in the region
Northern wolffish[1] (*Anarhichas denticulatus*)	• Occurs in arctic seas on both sides of the North Atlantic Ocean. The preferred temperature of wolffish was found to be less than 5°C. • In the Gulf of St. Lawrence they are found mainly in waters deeper than 150 m, off the south and west coast of Newfoundland.	• Information on reproduction is limited.	Not commercially significant in the region
Pollock (*Pollachius virens*)	• Juveniles are common in shallow inshore waters, while adults live in deeper inshore waters or on offshore banks. • Adults prefer a depth range of 110 to 181 m. • Can withstand a range of temperatures, from 0 to 18°C, but prefer a range of 7.2 to 8.6°C. • Distribution s mainly restricted to the slope waters of the Burgeo and St. Pierre Banks. • Found at low densities in the SEA Update Area (Bourdage and Ouellet 2011).	• Pollock of various stages of maturity are encountered during surveys indicating spawning on Burgeo and St. Pierre Banks.	Not commercially significant in the region
Redfish (*Sebastes mentella,*	• Redfish typically occur in cool waters (3.0 to 8.0ºC) along the slopes of fishing banks and deep	• Ovoviviparous, the fertilized eggs develop within the brood chamber of the female.	Commercially significant species

Species	Habitat and Distribution	Spawning	Commercial Significance
Sebastes fasciatus)	channels in depths of 100 to 700 m. • In the western Atlantic, redfish species range from Baffin Island in the north to the waters off New Jersey in the south. • The three redfish species that occur in the Northwest Atlantic include *Sebastes mentella*, *S. fasciatus*, and *S. marinus*. The latter species is relatively uncommon except in the area of the Flemish Cap. • *S. mentella* is typically distributed deeper than *S. fasciatus* (Gascon 2003). • Relatively high densities throughout most of SEA Update Area (Bourdage and Ouellet 2011).	• Mating occurs in the fall months and the larvae subsequently hatch from the eggs inside the female. • The larvae feed exclusively on energy stored in the yolk, develop inside the female and eventually are released as young fish sometime between April and July (Gascon 2003; Ollerhead et al 2004). • Redfish spawn in the Gulf of St. Lawrence (St. Pierre and de Lafontaine 1995)	
Roughnose grenadier (*Trachyrhynchus murrayi*)	• Uncommon but not rare in multispecies Research Vessel (RV) surveys in DFO NL Region Subarea 2+3.	• Not available.	Not commercially significant in the region
Sea raven (*Hemitripterus americanus*)	• Most occur in waters deeper than 2 m but their usual range may extend only to about 91.1 m. • Preferred water temperatures may range from the upper limit of 14.4 to 15.6°C to near freezing point of salt water in the southern Gulf of St. Lawrence. • Highest densities in northern tip of SEA Update Area (Bourdage and Ouellet 2011).	• Research shows spawning to take place from late autumn to early winter.	Not commercially significant in the region
Silver hake (*Merluccius bilinearis*)	• Occurs at a wide range of depths, from shallows to depths of over 910 m. • Its distribution is determined largely by water temperature. • Preferred temperatures recorded off the Scotian Shelf were between 6 to 8°C. • Highest densities in the SEA Update Area are found sporadically in the offshore waters from Cape Anguille to Port au Choix (Bourdage and Ouellet 2011).	• Spawning occurs from June to September, peaking in July and August.	Not commercially significant in the region
Spotted wolffish[1] (*Anarhichas minor*)	• Occurs on both sides of the North Atlantic. • Inhabits deeps waters of 457 m or more and usually occurs at temperatures below 5°C • Tagging studies indicated that migrations are local and limited.	• Information on reproductive activities in western North Atlantic Ocean is minimal. Studies have shown that wolffish in the Newfoundland area appeared to spawn in late autumn or early winter.	Not commercially significant in the region

Species	Habitat and Distribution	Spawning	Commercial Significance
	• In the Gulf of St. Lawrence, they occur mainly at depths of 100-350 m in the Esquiman and Anticosti Channels, and the northern portion of the Laurentian Channel.		
Spiny dogfish (*Squalus acanthias*)	• Widely distributed in coastal waters of temperate seas throughout the world. • Small, schooling shark frequenting coastal and inshore waters in cold to warm temperate oceans. Usually found at temperatures of 6 – 15°C. Tolerant at low salinities and may ascend estuaries. • Dogfish occur seasonally in Canadian waters, usually appearing in the Gulf of St. Lawrence in July, off southwestern Newfoundland in June and spread around the island, moving into southern Labrador waters in late summer. They move out of Canadian region by late fall. • Highest desnities in the SEA Update Area are in the area off the Port au Port Peninsula (Bourdage and Ouellet 2011)	• Ovoviviparous, developing young are in the brood chamber of the female Gestation period is long, about 22 months, one of the longest for any vertebrate animal. • Spiny dogfish is slow-growing and long-lived.	Not commercially significant in the region
Thorny skate (*Amblyraja radiata*)	• A boreal to arctic species living offshore on hard and soft bottoms at depths of about 18 – 966 m and at temperatures of -1.4 to 14°C. • Occurs in eastern and western North Atlantic • Found throughout SEA Update Area (Bourdage and Ouellet 2011).	• Limited information is available.	Not commercially significant in the region
White hake (*Urophycis tenuis*)	• Prefer temperatures between 3 and 8 °C	• Spawning is thought to occur in spring and early summer. • Eggs are pelagic and remain close to the surface.	Not commercially significant in the region (were historically)
Windowpane (*Scophthalmus aquosus*)	• A shallow-water benthic species living on sand bottom; down to 55 – 73 m on Georges Bank, and 31 – 37 m in coastal waters off Maine. • Adults tolerate a wide range of temperature.	• Spawning takes place in late spring and early summer in the northern part of the range.	Not commercially significant in the region
Winter skate (*Leucoraja ocellata*)	• Restricted to the northwest Atlantic. • A benthic species living over sand or gravel bottoms usually in depths less than 111 m but has been caught at a depth of 371m in the Gulf of St. Lawrence.	• Mating most likely occurs throughout the year although details are lacking.	Not commercially significant in the region

Species	Habitat and Distribution	Spawning	Commercial Significance
	• Temperatures at which winter skate were found in the Gulf range from -1.2 to 4.8°C. • Highest densities in the SEA Update Area are in the area off Cape St. Gregory and southern tip (Bourdage and Ouellet 2011).		
Witch flounder (*Glyptocephalus cynoglossus*)	• Disperse throughout the Gulf after spawning. • High concentration around St, George's Bay during summer. • Found throughout most of the SEA Update Area (Bourdage and Ouellet 2011). • Depth range mostly from 146 to 424 m.	• Form dense pre-spawning concentrations in deepwater channels during winter (Esquiman and eastern Laurentian Channel) .	Not commercially significant in the region (moratorium)
Sources: Summarized from Scott and Scott (1988) unless otherwise noted [1]These species have been designated as protected under *SARA*			

Table 4.39 Overview of Some Key Pelagic Fish Species in the SEA Update Area

Species	Habitat and Distribution	Spawning	Commercial Significance
Atlantic argentine (*Argentina silus*)	• A deepwater fish concentrated mainly in warmer waters of continental shelves and in deepwater basins. • Highest densities in the SEA Update Area are offshore from the Port au Port Peninsula (Bourdage and Ouellet 2011).	• There is little information on the time of spawning on the North American side of the Atlantic Ocean. • Research has suggested that spawning takes place on the Scotian Shelf in March and April.	Not commercially significant in the region
Atlantic bluefin tuna (*Thunnus thynnus*)	• Moves northward into Canadian waters in summer and southward again in late fall. • They occur over the continental shelf, off Newfoundland, and in the Gulf of St. Lawrence, at depths of 27 – 183 m, often in schools of less than 50 fish. • Using a concurrent heat-exchange system, the bluefin can maintain muscle temperatures 10 – 15°C above the temperature of the surrounding water. • Bluefin tunas undertake extensive migrations, moving from the waters off Florida and the Gulf of Mexico as far as Newfoundland and the Gulf of St. Lawrence.	• Bluefin tuna do not reproduce in Canadian waters. Two major spawning areas in the western Atlantic are the Straits of Florida and the Gulf of Mexico. • Spawning occurs during April, May, and June in subsurface waters • At temperatures of 24.9 – 29.5°C in the Straits of Florida, hatching of eggs occurs in a few days.	Recreational fishing
American eel (*Anguilla rostrata*)	• Found in the western North Atlantic. • Abundant in many parts of Québec tributary to the St. Lawrence River and Gulf, southern Newfoundland, and the Maritime Provinces, where it occurs in estuaries, lakes and rivers (Jessop et al 2002) that have access to the sea. • During the freshwater phase of their life, eels move into streams, rivers, and muddy or silt-bottomed lakes.	• The eel is unique to other fish in that it breeds at sea and the young move into fresh water where they feed and grow. • After a number of years in freshwater they return to the sea to spawn, and presumably die.	Recreational and commercial significance
Atlantic herring *(Clupea harengus harengus)*	• Primarily pelagic, and often in schools, occurring in the shallow inshore waters, or offshore from surface to depths of 200 m. • Research has demonstrated that Atlantic Herring has annual migratory patterns, such as movements to spawning grounds and feeding and wintering areas.	• Atlantic herring are demersal spawners depositing their adhesive eggs on stable bottom substrates (Scott and Scott 1988; Reid et al 1999). • Spawning may occur in offshore waters (e.g., Georges Bank) at depths of 40 to 80 m; however, most Atlantic herring stocks,	Commercially significant species.

Species	Habitat and Distribution	Spawning	Commercial Significance
	• Spring and Fall spawners may migrate together in the SEA Update Area, separating only to spawn (McQuinn 1997). • Occurs on both sides of the North Atlantic. It occurs in commercial quantities along the coast of southern Labrador, around the coast of Newfoundland and offshore banks, in the Gulf of St. Lawrence, along the coast of Nova Scotia and offshore banks, and the Bay of Fundy. • Found throughout most of the SEA Update Area (Bourdage and Ouellet 2011)	including those in the SEA Update Area spawn in shallow (<20 m) coastal waters (e.g. St. Georges Bay; Lambert 1987 McQuinn 1997). • In the case of coastal spawning, spring spawning generally takes place in shallower waters than fall spawning.	
Atlantic mackerel *(Scomber scombrus)*	• A pelagic fish common to the temperate waters of the open sea and is one of the most active and migratory fishes. • During the winter they occupy moderately deep water, 70 – 200 m, usually in water temperatures above 7°C. In the spring there is a general inshore and north-eastward migration in to the Gulf. • Occurs on both sides of the Atlantic Ocean. Mackerel are seen in Canadian coastal and inshore waters only during summer and fall. • Highest densities in the SEA Update Area are north of the Port au Port Peninsula and the southwest edge of the area (Bourdage and Ouellet 2011).	• While mackerel winter outside of the Gulf of St. Lawrence, they migrate to the Gulf of St. Lawrence in spring to spawn in the Magdalen Shallows (outside of the SEA Update Area) and are found off Western Newfoundland from July to October. • Spawning in the Gulf typically occurs between mid-June and mid-July in open water, resulting in a concentration of fertilized eggs in the upper 10 m of the water column. • Larval hatching generally occurs within five to seven days at water temperatures of 11 to 14°C.	Commercially significant species.
Atlantic salmon (*Salmo salar*)	• Occurs on both sides of the North Atlantic Ocean, including rivers along the coast of the SEA Update Area. • An anadromous species, living in fresh water and estuaries for at least the first 2 to 3 years of life before migrating to sea. Cool rivers with extensive gravelly bottom headwaters are important habitat. • When about 15 cm long, young salmon migrate to sea, where they may live for 1, 2, or more years before returning to freshwater. • Salmon in the SEA Update Area migrate to the	• Atlantic salmon spawn in October and November in Canadian waters. • Eggs are buried in gravel by females and development continues over the winter. • The time required for the eggs to hatch varies with water temperature but is about 110 days at 3.9°C.	Renowned recreational fishing exists, however not fished commercially in the area.

Species	Habitat and Distribution	Spawning	Commercial Significance
	north Atlantic through the Strait of Belle Isle and the Cabot Strait (Reddin 2006). • The southern rivers of the SEA Update Area are one of the few areas in insular Newfoundland where prized Multi-Sea Winter salmon occur (COSEWIC 2011a).		
Atlantic sturgeon (*Acipenser oxyrinchus*)	• Restricted to the Atlantic coast of North America including the Gulf, the Atlantic sturgeon ranges from Hamilton Inlet, Labrador, or possible Ungava Bay to Florida. • An anadromous, bottom-living species, entering freshwater rivers and estuaries to spawn. • Most of its life is spent in salt water. Migrating mature sturgeon move in spring or early summer, arriving on breeding grounds in advance of spawning time.	• Little is known of the spawning grounds or breeding behaviour in Canadian waters. It is assumed that spawning takes place in deep pools below waterfalls in tributaries of the St. Lawrence River. • Hatching takes place in a 1 – 2 week period, depending on the water temperature. • Young sturgeon remain and develop in fresh water up to 3 – 4 years before migrating to sea.	Not commercially significant in the region
Banded killifish[1] (*Fundulus diaphanus*)	• Although salinity-tolerant to a degree, the banded killifish is considered a resident of freshwaters. • Reports have shown that the species is capable of surviving normal Gulf of St. Lawrence salinities since the nearest populations to those in Newfoundland occur in the Maritimes across the Gulf .	• Spawn in aquatic vegetation in freshwater. • Although widespread in the Canadian Maritimes, the banded killifish in Newfoundland are known to exist only in a few isolated populations.	Not commercially significant in the region
Blue shark (*Prionace glauca*)	• A wide-ranging pelagic species in temperate waters, often occurring near the surface, preferring temperatures of 7 to 16°C. • Occurs worldwide in both inshore and offshore waters. In the western Atlantic from Newfoundland and the Gulf of St. Lawrence southward to Argentina. Most occurrences in Canadian waters are during summer months.	• As with all sharks, fertilization is internal. After eggs are fertilized, gestation requires 9 – 12 mo., and birth usually occurs during March to July.	Not commercially significant in the region
Capelin (*Mallotus villosus*)	• A marine fish of cold, deep waters, found in the Atlantic Ocean on the offshore banks and in coastal areas. • Capelin is plentiful off the north shore of the Gulf of St. Lawrence but the largest concentrations in Canadian waters are found	• Spawning is marked by an intensive migration inshore in early spring to spawn on beaches throughout the spring-summer and return to offshore waters in autumn. • Where substrate conditions are suitable spawning beaches may be found in exposed,	Commercially significant species.

Species	Habitat and Distribution	Spawning	Commercial Significance
	off Newfoundland and the Labrador Coast. • Highest desnities in the SEA Update Area are in St. George's Bay and northern third of the region (Bourdage and Ouellet 2011).	moderately exposed, and sheltered locations throughout the region. • Beach spawning is demersal with the eggs being deposited in the intertidal zone.	
Porbeagle shark (*Lamna nasus*)	• A pelagic, epipelagic, or littoral shark usually more common on continental shelves but occurring sometimes well offshore. • Occurs in Atlantic, Pacific, and Indian Oceans. • More common in the Canadian region during spring, summer, and fall, usually found in temperatures below 16°C.	• Ovoviviparous, developing young are in the brood chamber of the female. • Little information on the rate of growth.	Not commercially significant in the region
Rainbow smelt (*Osmerus mordax*)	• The rainbow smelt is found in rivers and coastal areas of eastern North America from Labrador to New Jersey.	• Spawning usually occurs March, April, or May.	Not commercially significant in the region
Sea trout (*Salvelinus fontinalis*)	• An anadromous species, initially living in fresh water before migrating to sea. • Usually stay in sea for two months on average through the summer months (June – August) • Typically remain within estuary of freshwater while in sea (less than 1km range)	• Spawn in freshwater in the fall.	Recreational species
Shortfin mako shark (*Isurus oxyrinchus*)	• Extremely active, the shortfin mako shark is the fastest shark and one of the swiftest fishes. • The species is circumglobal in temperate and tropical waters. Individuals found in Atlantic Canada are considered part of a larger North Atlantic population. • Highly migratory with distribution apparently dependent on water temperatures (between 17 and 22°C). • They migrate to the Atlantic coast of Canada generally in the late summer and fall where they are usually associated with the warm waters of the Gulf Stream (DFO 2010b).	• Females mature at lengths of 2.7 to 3 m (corresponding to an age of about 17 years) and give birth to a litter size of 4 to 25 pups after a gestation period of approximately 15 to 18 months. • The minimum lifespan has been estimated at 24 years with a maximum life expectancy of up to 45 years (DFO 2010b).	n/a
Striped bass (*Marone saxatilis*)	• Distributed along the North American Atlantic coast from St. Lawrence River and south Gulf of St. Lawrence to the St. John's River in northern Florida.	• Spawning always occurs in spring in fresh water, in most cases relatively far upriver. • In the Gulf of St. Lawrence watersheds spawning occurs in May and June.	Not commercially significant in the region

Species	Habitat and Distribution	Spawning	Commercial Significance
	• An anadromous and coastal schooling species that inhabits mainly inshore waters.		
White shark[1] (*Carcharodon carcharias*)	• Occurs in coastal and offshore waters of continental shelves, from surface waters to depths of 1,280 m. • Widespread in warm and cool temperate seas of all oceans, antitropical in Atlantic and Pacific oceans and contiguous waters.	• Little information available.	Not commercially significant in the region
White barracudina (*Notolepsis rissoi*)	• Adults inhabit generally cold waters, mainly in depths of 200 – 1,000 m. • Distribution is found worldwide from Arctic to Antarctic. • The white barracudina is of significance importance as food for such commercial species as Atlantic cod, pollock, swordfish, and redfishes. • Highest desnities in the SEA Update Area are in the area offshore from Port aux Basques to Port au Choix (Bourdage and Ouellet 2011).	• Spawning is said to take place in temperate to subtropical areas. • Spawning season is assumed to extend from January or February to September, with height of spawning in May. Eggs have not been seen.	Not commercially significant in the region
Sources: Summarized from Scott and Scott (1988) unless otherwise noted; Used 2005-2009 surveys maps to assess relative densities in the SEA Update Area (Bourdage and Ouellet 2011) [1]These species have been designated as protected under *SARA*			

Summary of Some Key Spawning Times and Areas

A summary overview of some important spawning areas and times for key and select species in the Western NL Update Area and in the larger Gulf of St. Lawrence is provided in Table 4.40.

A number of important spawning locations are also illustrated in Figures 4.32 and 4.33, including some known spawning and nursery areas for Atlantic herring as well as capelin spawning beaches. Other spawning areas are discussed and illustrated in later sections.

Table 4.40 Summary of Known Spawning Times and Areas for Select Marine Fish Species

	Month														
Species	**J**	**F**	**M**	**A**	**M**	**J**	**J**	**A**	**S**	**O**	**N**	**D**	**Some Known Spawning Locations**	**Gulf**	**SEA Update Area**
Atlantic Cod [1] (Northern)													Cape St. George	•	•
Atlantic Mackerel [1]													Magdellan Shallows Green Point	•	
Atlantic Herring [1,2] (Spring Spawners)													St. George's Bay Green Point; Bay of Islands; Port au Port Bay; Sally's Cove	•	•
Atlantic Herring [2] (Fall Spawners)													St. John Bay, Ingornachoix Bay	•	•
Capelin [3]													Trout River, Beach south of Baker's Brook, Sandy Cove Bay, Port au Choix, Port Saunders, River of Ponds, Belburns, Meadows, John's Beach, Ship Cove	•	•
Redfish [4]													Central Laurentian Region		
Greenland Halibut													Laurentian Channel (130-150 m)	•	•
Wolffish [5]													Slope Region of Laurentian, Esquiman, and Anticosti Channels	•	•
American Lobster [6]													North Head, Trout River Bay Outer Port au Port to Shag Bay	•	•
White Hake													Southern Gulf of St. Lawrence	•	

[1] These areas were identified from the initial SEA (LGL Limited 2005, 2007) and recent SEA consultations
[2] Areas identified from McQuinn (1997)
[3] From Capelin Observer's Network Summary Report (DFO 2011b) and discussions with Parks Canada
[4] Redfish are known to have larval extrusion from April to July (darker shade of grey) and use the area identified (Savenkoff et al 2007)
[5] Little is known about wolffish spawning in the Gulf and this time frame is quite speculative (Jonssen 1982)
[6] Areas identified are those with concentration of egg-carrying females (females carry their eggs and do not lay their eggs on the substrate)

Figure 4.32 Some Known Spawning and Nursery Areas for Atlantic Herring

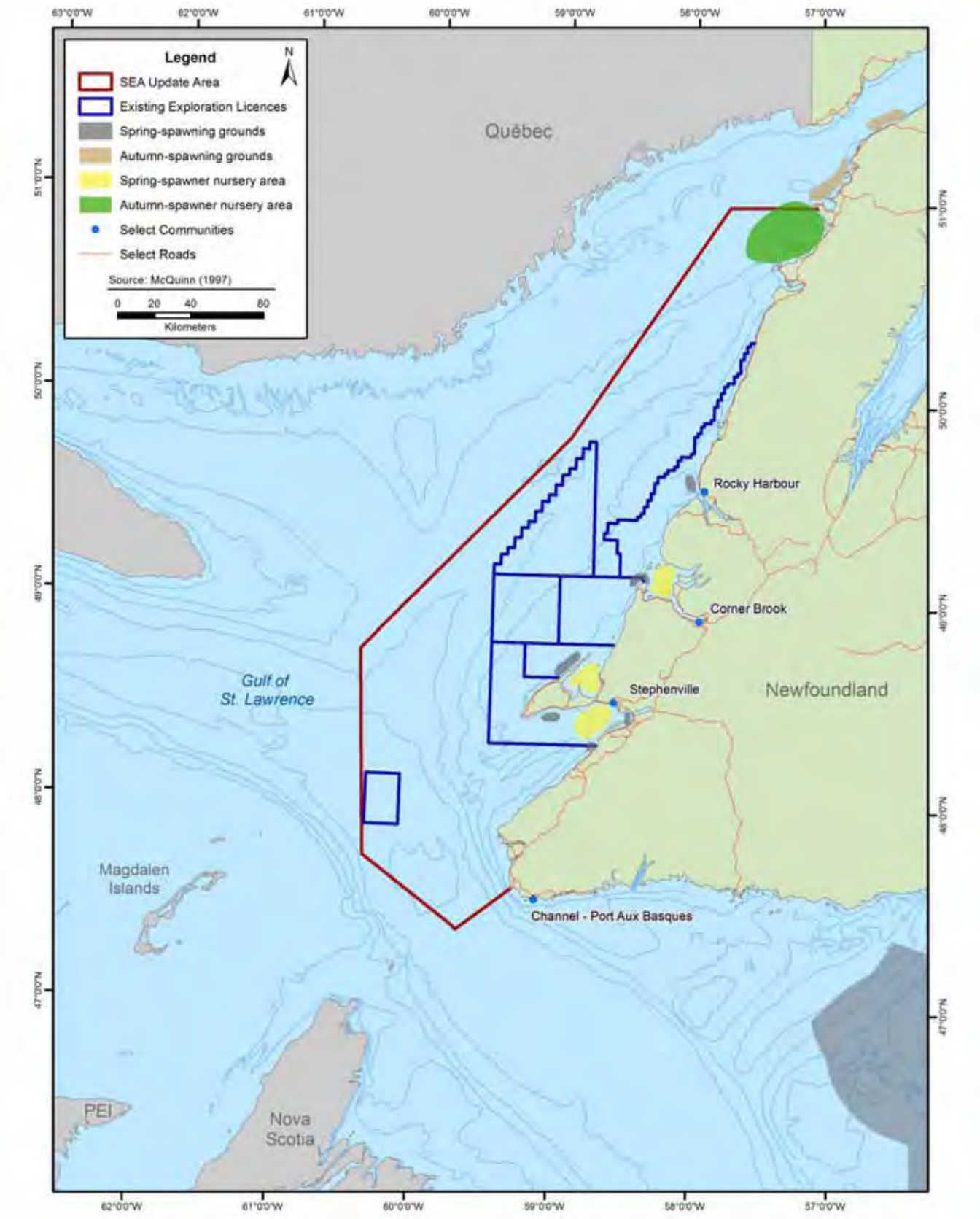
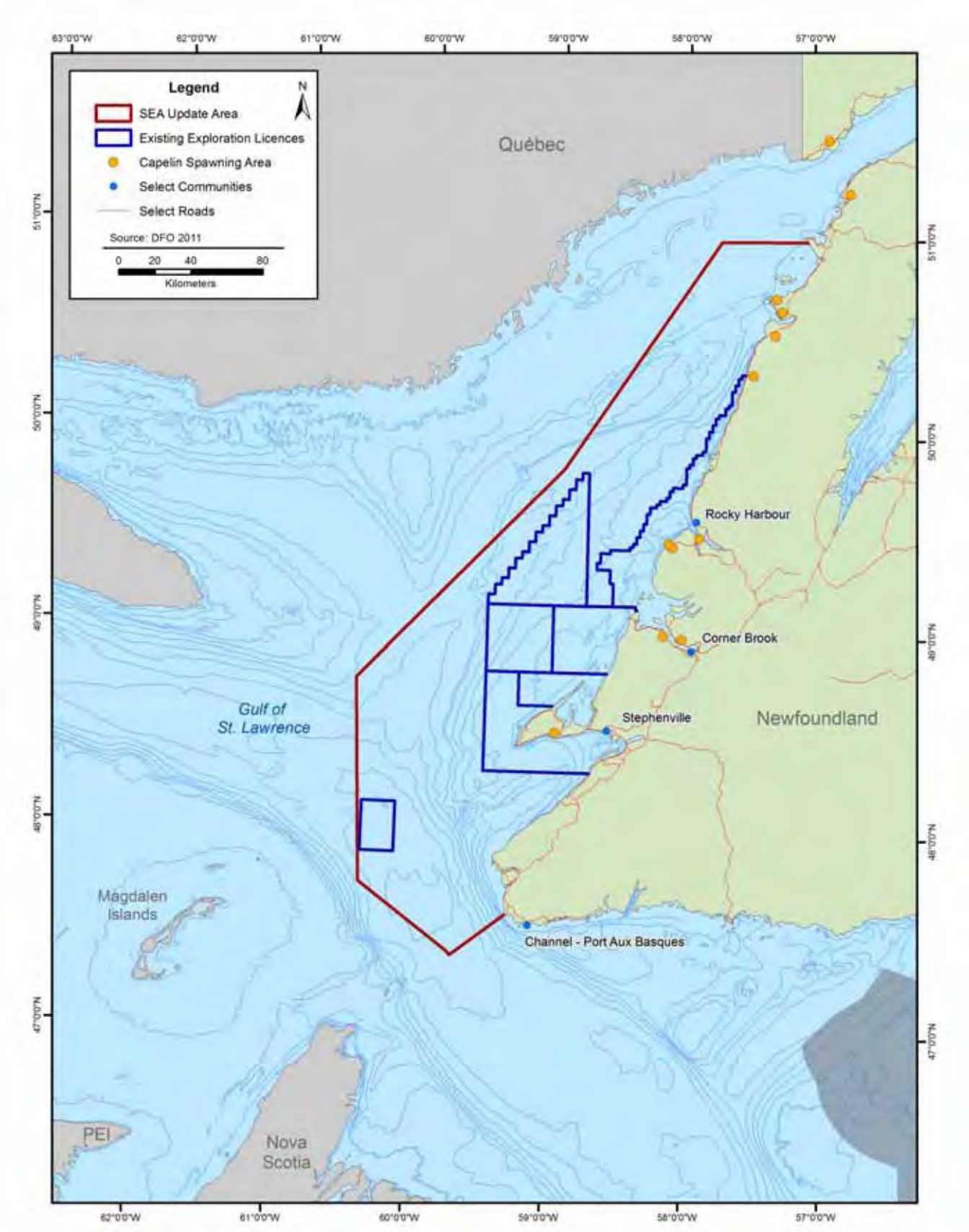


Figure 4.33 Capelin Spawning Beaches



Fish Migration Patterns

Dufours and Ouellet (2007) provide an overall and holistic description of fish migration in the Gulf of St. Lawrence. They indicate that the Gulf of St. Lawrence system can be considered two general fish habitats: 1) the shelf areas and 2) the deep channels, which support rather different, but seasonally intermingled communities. The shallows are characterized by warm surface waters and high productivity in summer. They are important spawning, nursery, and adult feeding grounds for large biomasses of both groundfish and pelagic fishes. The Magdalen Shallows also supports high densities of American plaice which, together with cod, constitute the dominant groundfish in the southern Gulf. In addition, the southern Gulf provides important feeding grounds for a number of highly migratory fishes that move into the area to feed in summer, notably bluefin tuna, spiny dogfish, and mackerel.

In winter, the Magdalen Shallows are typically ice–covered, with water temperatures near the freezing point of seawater (–1.5^{o}C) from surface to bottom. To avoid these harsh winter conditions, many of the large fishes migrate out of this area each winter. Some migrate far out of the Gulf to overwinter at more southerly latitudes (such as bluefin tuna, mackerel and spiny dogfish). Others overwinter in warmer deep waters of the Laurentian Channel within the Gulf, such as white hake, American plaice, witch flounder and Greenland halibut (Bowering 1982) and/or towards the entrance of the Laurentian Channel in the Cabot Strait area (including cod, herring and redfish). The main pathway for these fall migrations out of the Gulf and the return migrations each spring is along the west coast of Cape Breton Island, Nova Scotia.

In the northern Gulf, shallow shelf areas along the west coast of Newfoundland and along the Québec north shore represent important summer feeding grounds and nursery areas for both demersal and pelagic fishes (cod and herring). Herring along the west coast of Newfoundland move into the warm deep waters of the Esquiman Channel to overwinter. Like the southern Gulf population, cod in the northern Gulf are highly migratory (Figure 4.34), moving into warm deep waters in the Cabot Strait area in winter (Castonguay et al 1999). Information and local knowledge obtained through the recent SEA Update consultations also indicates the importance of the Strait of Belle Isle as a migratory corridor for cod, herring and mackerel. Another shelf resident in the Gulf of St. Lawrence, winter flounder, exhibits an alternate migratory pattern. This species migrates from relatively shallow summer coastal habitats (> 40 m) to take refuge from harsh winter conditions in brackish estuaries (Hanson and Courtenay 1996).

The relatively warm deep waters of the channels that dominate the northern Gulf constitute the feeding, spawning, and nursery grounds for a number of deepwater and slope species, notably the redfishes, Greenland halibut and witch flounder. Adults of some of these species (witch flounder) move up the slopes to feed in somewhat shallower water in summer. These deep channels also constitute the overwintering grounds for the adults of many of the large–bodied fishes whose spawning, nursery and/or feeding grounds occur in shallower shelf waters (cod, herring, plaice, white hake and thorny skate). Although the deepwater and slope species do not need to undertake major migrations to avoid harsh winter conditions, some exhibit seasonal movements.

The Cabot Strait and the Strait of Belle Isle are also important migratory corridors for diadromous fishes. On the basis of the timing of the commercial fisheries and tagging programs, the anadromous clupeids are assumed to enter and exit the Gulf through Cabot Strait, exclusively along the north of Cape Breton Island and disperse westward north of PEI and through Northumberland Strait (Rulifson and Dadswell 1987). The Cabot Strait area is a common migration pathway for seven of the ten diadromous species in the Gulf of St. Lawrence.

The Strait of Belle Isle is considered a more important migration corridor for Atlantic salmon, particularly for populations from the rivers along the northern portion of the Gulf of St. Lawrence including the northern portion of the SEA Update Area and the north shore of Québec (COSEWIC 2011a; Lefevre et al 2012; Figure 4.35). For other diadromous species (e.g. rainbow smelt), migrations out of the Gulf do not occur (Bradbury et al 2008). Migration into and out of the Gulf of St. Lawrence occurs predominantly during the months of May to November.

The timing of migration is relatively constant for some species (such as cod) and can occur simultaneously across the Gulf (such as herring, smelt). It can also be area-specific (e.g. alewife and Atlantic salmon (Chadwick and Claytor 1989) or is sporadic and dependent on environmental conditions (e.g. Atlantic saury) (Chaput and Hurlbut 2010). Alterations in the migration timing of at least some species (such as cod) are, however, among the widespread ecological changes noted in the Gulf of St. Lawrence in recent decades (Castonguay et al 1999; Comeau et al 2002).

The life history of anadromous fish (those that travel from marine environments to spawn in freshwater) typically results in more complex population structuring than marine spawning species. In the Gulf of St. Lawrence, Atlantic salmon are partitioned into seven Designatable (conservation) Units by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC 2011a), whereas cod are represented by two units (COSEWIC 2010a) and eels one (COSEWIC 2006a; Gagnaire et al 2012). Genetic studies on other species show similar characteristics for anadromous (rainbow smelt, Bradbury et al 2008) and marine species (e.g. white hake, Roy et al 2012).

Figure 4.34 Seasonal Migration Routes of Atlantic Cod

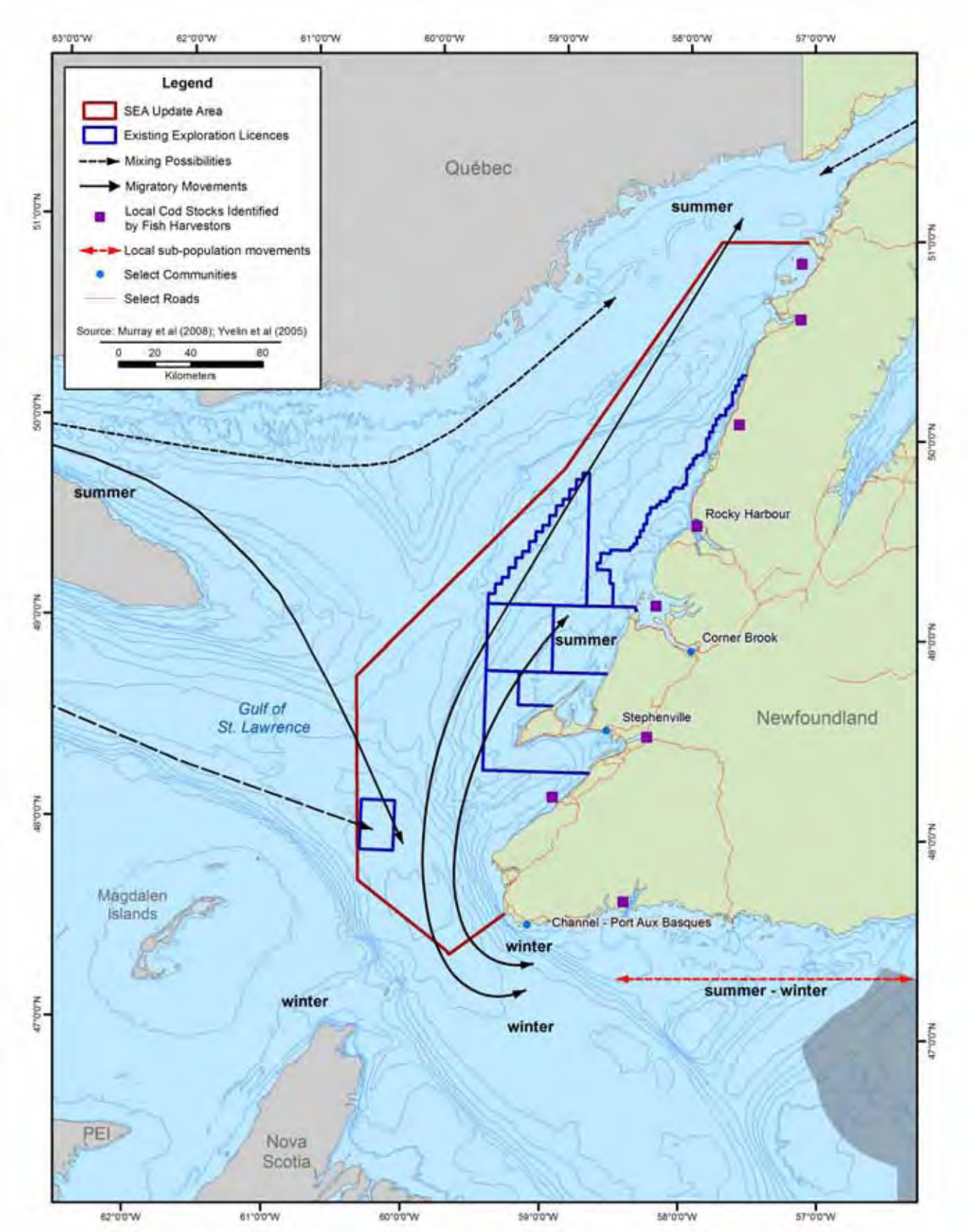
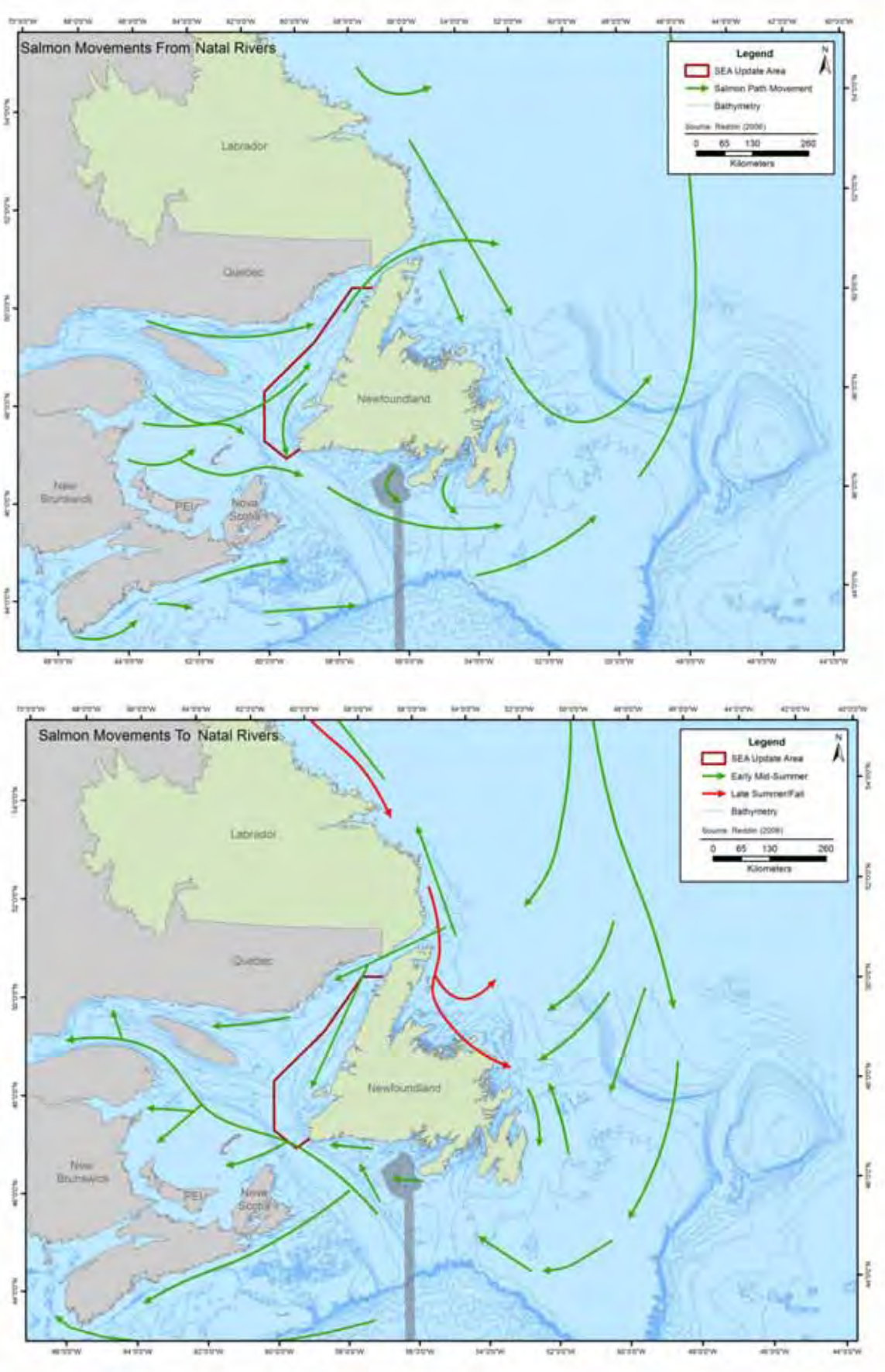


Figure 4.35 General Migration Routes of Atlantic Salmon from Natal Rivers (Top) and Back (Bottom)



Environmental Influences and Changes

Fish species' abundance and distributions can be influenced by environmental factors, interspecific interactions (predation, prey availability) or a mixture of these. Some species, such as redfish, have larvae that are regulated by environmental factors such as the thickness of the cold intermediate layer (Devine and Haedrich 2011), whereas shrimp populations have been shown to increase in abundance when large predators such as cod are in decline (Koeller 2000; Lilly et al 2000; Savenkoff et al 2007a). In the northern Gulf, for example, the shrimp biomass almost doubled from the mid-1980s to the early 2000s as large predators such as cod declined significantly (Savenkoff et al 2007a). Other species such as snow crab are regulated by environment and predation. Recent studies have found that snow crab abundance is largely influenced by temperature during early post-settlement and becomes increasingly regulated by cod-predation prior to being recruited into the fishery (Boudreau et al 2011).

In general, in the northern Gulf of St. Lawrence (NAFO 4R, 4S), the biomass of Atlantic cod, redfish, and other large demersals such as white hake, black dogfish, and Atlantic halibut decreased considerably as planktivorous pelagics and invertebrates increased (Savenkoff et al 2007a). Cod, the main predator of capelin and shrimp, was replaced by marine mammals and Greenland halibut, respectively (Savenkoff et al 2007a). This, in turn, is thought to have influenced the major expansion in the distribution of capelin throughout the Gulf in the 1990s. Most of these trends have been observed in the northern Gulf (NAFO 4R and 4T) but similar trends have been observed in the southern Gulf that includes NAFO 4T (Benoit and Swain 2008). Benoit and Swain (2008) suggest that the grey seal population maintains the southern Gulf cod population at low abundance.

Climate changes are now recognized as having a major influence over ecosystem changes in the Gulf with fishing pressure also being a strong forcing factor (Dawe et al 2012). Despite moratoria on Gulf cod fishing, abundance indices remain at similar levels indicating the absence of any rebuilding of the stock (DFO 2009d). This suggests that the environment had more of an effect on the cod collapse than previously thought (Lambert 2011) or at least plays a role in repressing population recovery. This may be due to particularly cold water inputs into the Gulf from the Labrador Shelf in the mid-1980s and 1990s (Bui et al 2010). Similar research on the redfish population in the Gulf has correlated population dynamics with oceanographic conditions. Survival of redfish in the region has been linked to a variety of factors including synchrony redfish larvae and prey availability (early stages of krill and *Calanus finmarchicus*), environmental conditions (thickness of the cold intermediate layer), and bottom temperature (Devine and Haedrich 2011).

Climate change has therefore also affected marine fish presence and distributions in the Gulf of St. Lawrence, including the SEA Update Area. Polar sculpin and Arctic sculpin, for example, suddenly appeared in the southern Gulf when the water unusually cooled in the mid-1990s and the species disappeared again when the temperatures increased (Benoit and Swain 2008). Stakeholders and the general public that participated in the recent SEA Update consultations also noticed changes in species presence and distributions that they believed were linked to environmental changes, including changes in the timing and water depths at which some species occur and spawn, as well as the presence of marine fish species that had not been previously observed.

Aquatic Invasive Species

Aquatic invasive species (AIS) can threaten aquatic ecosystems, occupying habitats or out-competing native species. These species may show rapid population growth in the absence of natural predators and may soon become established to the point where eradication is impossible. Local and international marine transport in general is implicated in many of the accidental introductions of marine AIS, as ship hulls and bilge water serve as vectors for AIS range expansion (Mckenzie et al 2011). In addition to industry-related shipping, oil and gas development can also increase spread of AIS propagules when offshore drilling units and other installations are moved about the globe (Benoit et al 2012).

There are at least 20 aquatic invasive species that are established in the Gulf (Table 4.41), at least six of which are known to have affected the ecosystem and/or the economy of the region (Benoit et al 2012).

Table 4.41 Some Invasive Marine Species Known to be Present in the Gulf of St. Lawrence

Taxa	Species	Taxonomic Name	Year First Reported in Gulf
Green Algae	Oyster thief[1]	*Codium fragile fragile*	1996
Brown Algae		*Fucus serratus*	1869
		Stictyosiphonsoriferus	1976
Red Algae		*Furcellaria lumbricalis*	1931
Fungus	European oyster disease	*Ostracoblabe sp.*	1969
Mollusc	Common periwinkle	*Littorina littorea*	1840
	Bay scallop	*Argopecten irradians*	1982
Crustacean	European green crab[1]	*Carcinas maenas*	1994
	Japanese skeleton shrimp	*Caprella mutica*	1998
Tunicate	Golden star tunicate[1]	*Botryllus schlosseri*	2001
	Clubbed tunicate[1]	*Styela clava*	1998
	Violet tunicate[1]	*Botrylloides violaceus*	2002
	Vase tunicate[1]	*Ciona intestinalis*	2004
	Compound sea squirt	*Diplosoma listerianum*	2009
Bryozoan	Coffin box bryozoan	*Membranipora membranacea*	2002
Fish	Brown trout	*Salmo trutta*	1930s
	Rainbow trout	*Onchorhynchus mykiss*	1924

Taxa	Species	Taxonomic Name	Year First Reported in Gulf
Unidentified disease agent	Malpeque disease		1915
Source: Modified from Benoit et al (2012) [1] Known to have affected the ecosystem and/or the economy of the region			

4.2.1.5 Regional Marine Fish Distributions

As indicated previously, the Gulf of St. Lawrence is composed of two general marine habitats, the shelf areas and the deep channels with diversity decreasing from south (Cabot Strait) to the northwest (Estuary) and northeast (Strait of Belle Isle) for each habitat type (Dufour and Ouellet 2007). As also stated earlier, the shallows are highly productive in the summer and serve as important spawning, nursery, and adult feeding grounds for both groundfish and pelagic fishes. The channels are occupied by deepwater species (e.g. redfish) and also serve as winter habitat for many species that occupy the shelf areas in summer (e.g. cod) (Dufour and Ouellet 2007).

Invertebrate Species

Table 4.42 presents the three most abundant invertebrate species for trawls that had a high degree of overlap with the SEA Update Area, based on the DFO RV survey data (2004-2011). Density distributions based of individuals per tow for these invertebrates has also been mapped in the Figures that follow. Two other invertebrate species of commercial significance (American lobster and snow crab) are also described below.

Table 4.42 Most Abundant Invertebrate Species from RV Survey Trawls that Overlap the SEA Update Area

Common Name	Scientific name	# Caught	# Caught per tow	% of total catch	Commercial Use
Northern Shrimp	*Pandalus borealis*	192,469	141.73	6.06	•
Striped Pink Shrimp, Aesop Shrimp	*Pandalus montagui*	19,244	14.17	0.61	
Sea Urchins	*Strongylocentrotus sp.*	17,306	12.74	0.54	

Northern Shrimp: This species is found throughout the northern Gulf at depths of 150 m to 350 m (DFO 2012b). This trend is generally consistent with Figure 4.36, with the highest densities occurring along and within the slope of the Esquiman Channel and the shore south of Port au Choix as the channel is closer to the coast.

Striped Pink Shrimp, Aesop Shrimp: The highest densities of striped pink shrimp are found closer to shore than northern shrimp with a high density along shore from St. George's Bay to north of Rocky Harbour (Figure 4.37).

Sea Urchins: These are usually associated with kelp beds and subsequently form urchin barrens in the Gulf (Dumont et al 2006). Based on DFO's multi-species survey, there are relatively high densities of sea urchins in much of the SEA Update Area. Areas of high density extend from south of Stephenville (St. George's Bay) to Port au Choix (Figure 4.38).

American Lobster: Lobsters have a preference for rocky structurally complex habitats (Geraldi et al 2009) which is a dominant subtidal habitat along the western coast of Newfoundland (Catto et al 1999). Using lobster landings as a general indication of their distribution, the highest distributions of lobster in the SEA Update Area are found along the shoreline from the Port au Port Peninsula to north of Port au Choix (Pezzack 1992).

Snow Crab: This species is generally found at depths ranging from 45 to 380 m in the Gulf of St. Lawrence with a large drop in frequency below 250 m (Sainte-Marie et al 2005). Their locations are largely controlled by substrate type (muddy and/or sandy bottoms) and temperature (Dufour and Ouellet 2007). As discussed above, there has been a general increase in their abundance Gulf wide since the 1990s (Boudreau et al 2011) although most distribution information has focused on areas outside the SEA Update Area and NAFO 4R in general (Dawe et al 2010, DFO 2012c,d). Research on cod stomachs in the Gulf has, however, shown a major snow crab nursery above 200 m in the SEA Update Area (Chabot et al 2007).

Figure 4.36 Distribution and Abundance of Northern Shrimp (2004-2011 Surveys)

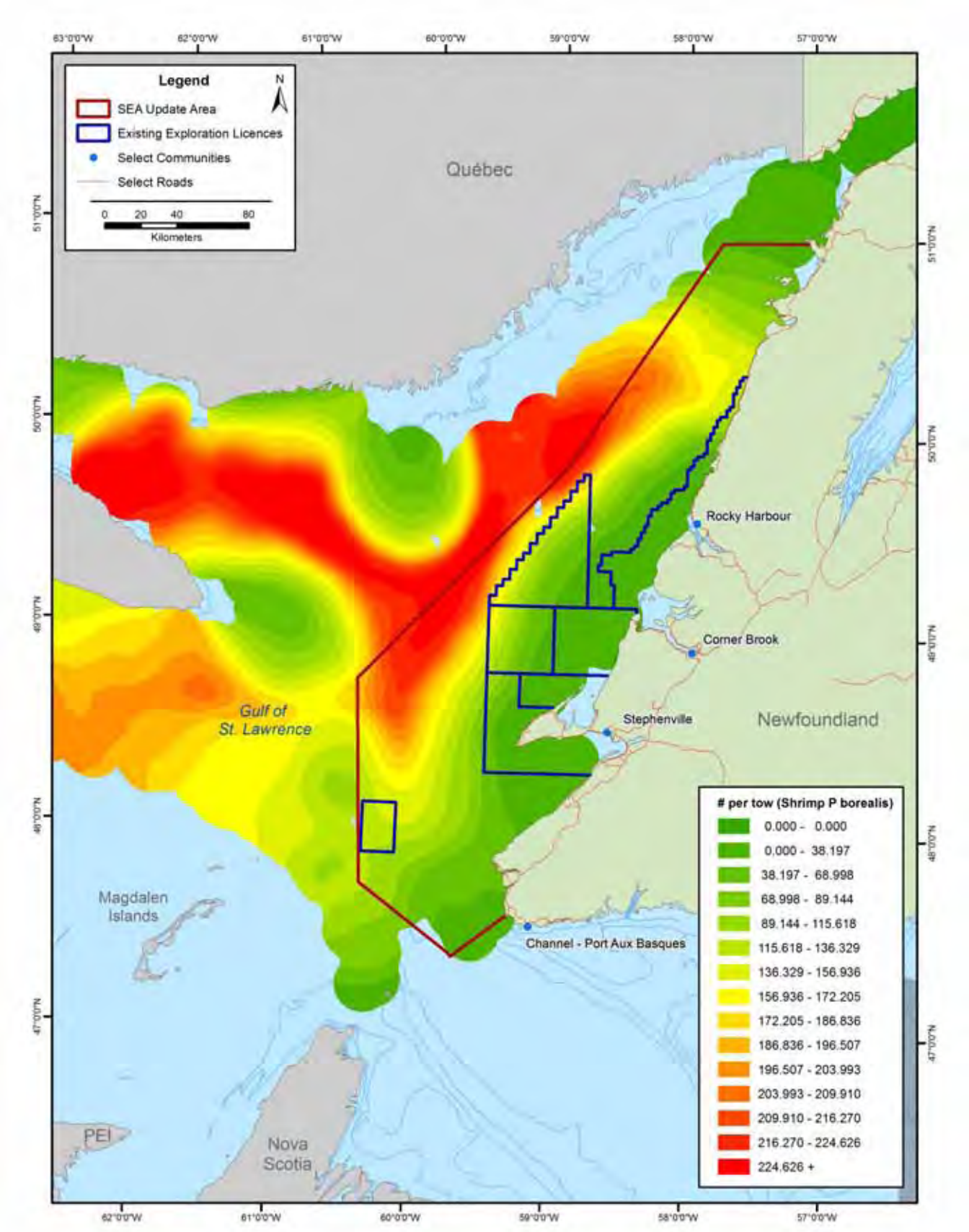


Figure 4.37 Distribution and Abundance of Striped Pink Shrimp (2004-2011 Surveys)

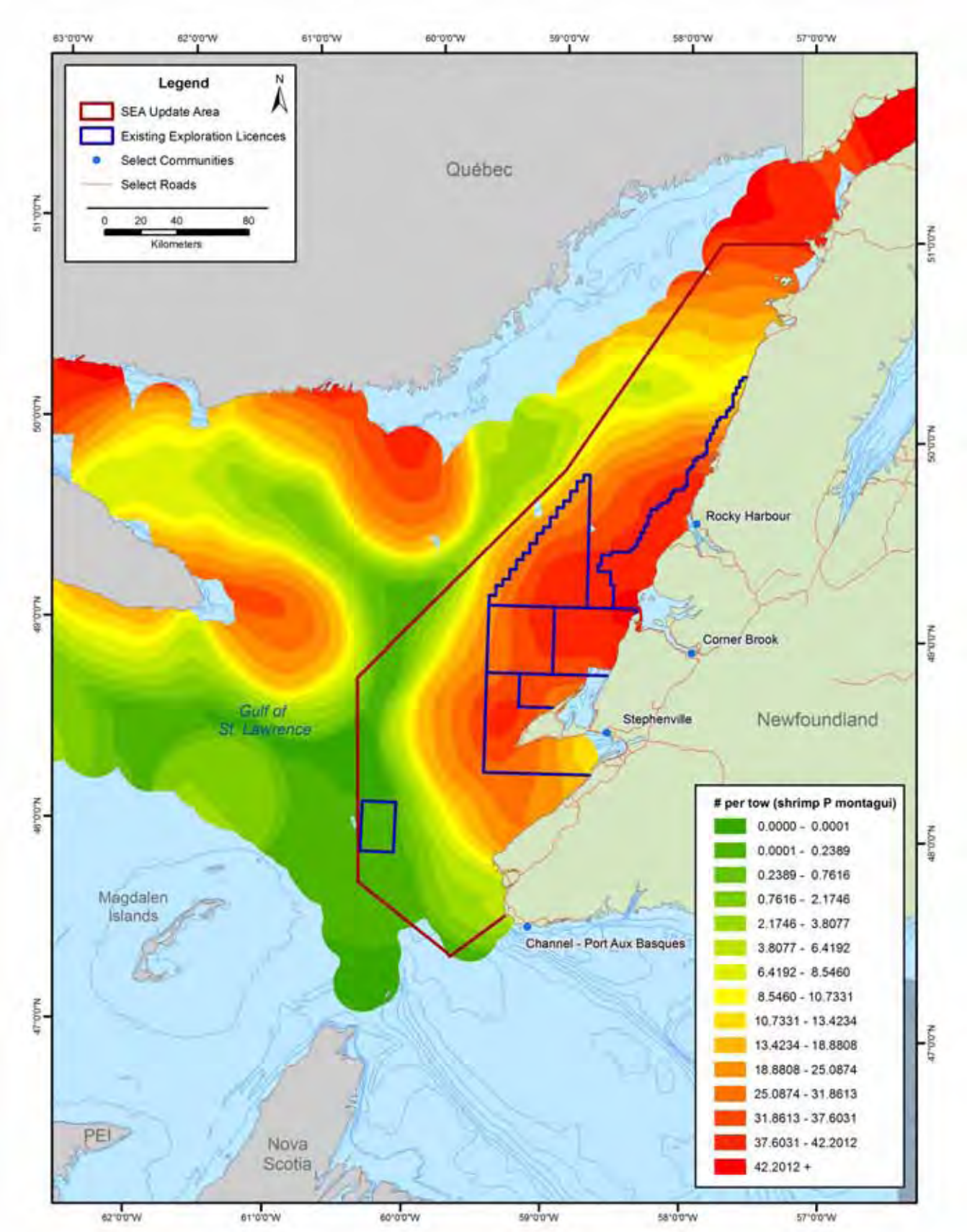
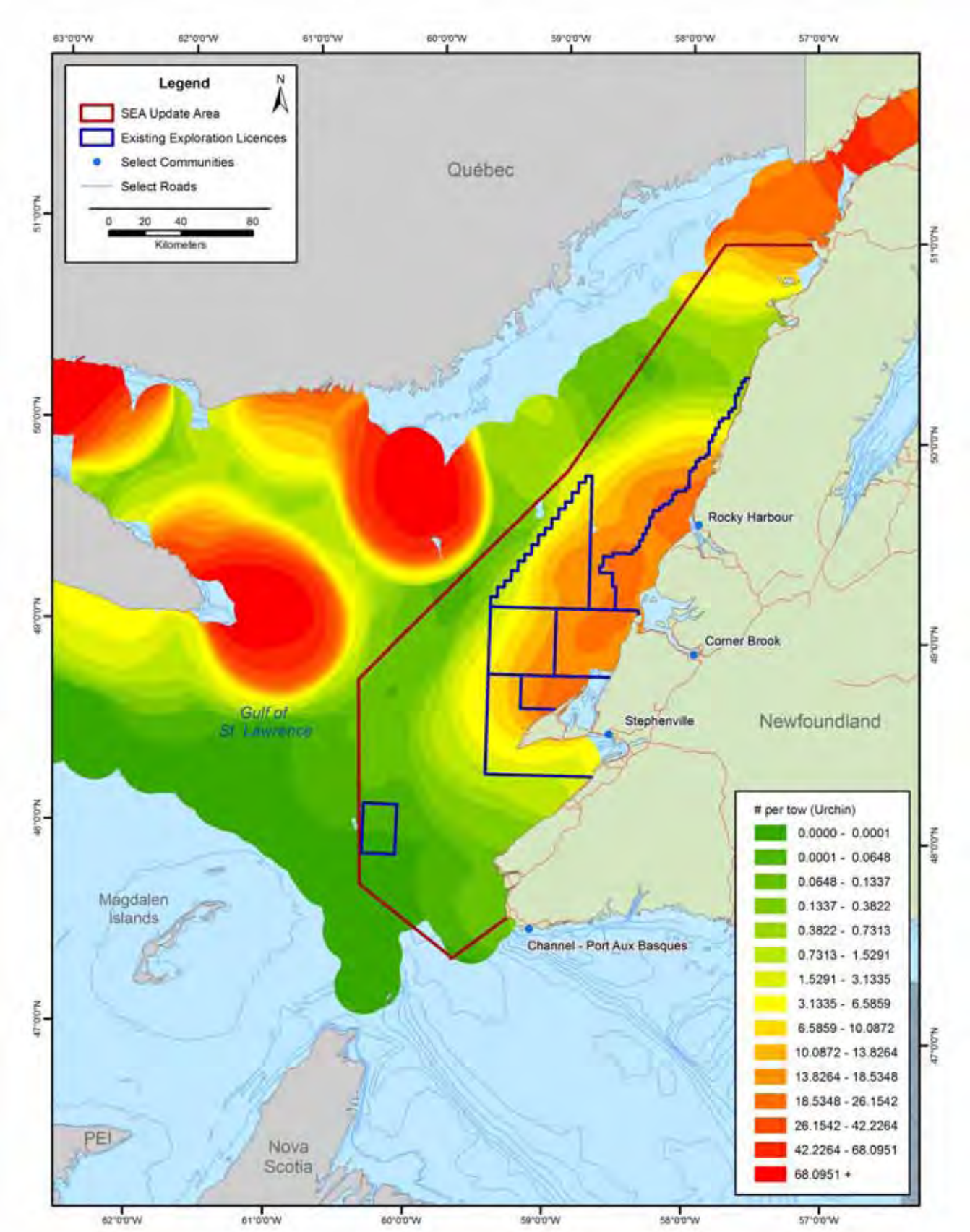


Figure 4.38 Distribution and Abundance of Sea Urchin (2004-2011 Surveys)



Finfish Species

Table 4.43 presents the 11 most abundant finfish species observed for 2004-2011 DFO RV Survey trawls that had a high degree of overlap with the SEA Update Area. Density distributions based on number of fish per tow for a selection of demersal finfish have been mapped in the Figures that follow, based on the DFO RV survey data.

Four other species (Greenland halibut, capelin, mackerel, and salmon) did not have a high degree of overlap with the SEA Update Area (based on the multi-species trawl surveys) but as they are important commercial and/or recreational species these are also discussed.

Table 4.43 Most Abundant Finfish Species in the SEA Update Area from 2004-2011 DFO RV Surveys

Common Name	Scientific name	# Caught	# Caught per tow	% of total catch	Commercial Use
Redfish	*Sebastes sp.*	289,471	213.16	9.11	•
American Plaice	*Hippoglossoides platessoides*	82,652	60.86	2.60	•
Atlantic Cod	*Gadus morhua*	43,945	32.36	1.38	•
Moustache Sculpin	*Triglops murrayi*	24,842	18.29	0.78	•
Atlantic Herring	*Clupea harengus*	13,513	9.95	0.43	•
Longfin Hake	*Phycis chesteri*	5,606	4.13	0.18	
Alligatorfish	*Aspidophoroides monopterygius*	3,042	2.24	0.10	
Atlantic Wolffish	*Anarhichas lupus*	1,634	1.20	0.05	
Spotted Wolffish	*Anarhichas minor*	113	0.08	0.00	
Atlantic Halibut	*Hippoglossus hippoglossus*	487	0.36	0.02	•
Silver Hake	*Merluccius bilinearis*	440	0.32	0.01	•

Redfish are deep water residents in the Gulf, although *S. fasciatus* is typically captured in shallower water (200-250 m) than *S. mentella* (300-500 m) (Campana et al 2007). In the SEA Update Area, redfish migrate from the Esquiman Channel (DFO 2007) to the Laurentian Channel (Campana et al 2007). Unlike many Gulf fish species which migrate to avoid harsh environmental conditions, redfish appear to do so primarily for feeding or reproductive reasons (Campana et al 2007). Redfish are among the most important predators in the northern Gulf, second to only Atlantic cod for vertebrate prey and behind cod and capelin for invertebrate prey (Morissette et al 2006). High densities of redfish were found by the summer RV survey to occur in the southern half of the SEA Update Area from Port aux Basques to areas offshore of Rocky Harbour. The northern end of SEA near Port au Choix had the lowest densities, while the extreme offshore areas off the southern end of the region had moderate densities (Figure 4.39).

American Plaice, along with cod, are the dominant groundfish species in the Gulf of St. Lawrence (Dufour and Ouellet 2007). Like many other shallow water species, high densities of plaice occur in the Magdelan shallows in the summer. These fish migrate to deeper water along the slopes of the Laurentian Channel to overwinter when the shallows are typically ice-covered (Dufour and Ouellet 2007). High densities of American plaice were found by the summer RV survey in the southern end of the SEA Update Area in St. George Bay's to the northern end of the SEA near Port au Choix (Figure 4.40). The lowest density areas were in the offshore section in the southwest corner of the SEA Update Area.

Atlantic Cod are the dominant groundfish species in the Gulf of St. Lawrence (Dufour and Ouellet 2007), and accordingly, they are the most important predator for vertebrate prey and follow only capelin for all prey types (Morissette et al 2006). In the SEA Update Area, shallow shelf zones provide important spawning (Tamdrari et al 2012b), feeding and nursery areas (Dufour and Ouellet 2007). Since the collapse of the northern Gulf Atlantic cod stock, relatively few cod are found along the north shore of Québec and now are primarily concentrated along the west coast of Newfoundland (Tamdrari et al 2012b). These areas are vacated in late autumn or early winter (Tamdrari et al 2012b) when northern Gulf cod migrate through the Esquiman Channel (DFO 2007a) into relatively warm deep waters in the Laurentian Channel and along the north side of the Cabot Strait (Campana et al 1999; Dufour and Ouellet 2007; Tamdrari et al 2012b). Summer feeding grounds are known to vary with temperature (with cod preferring temperatures between 3 and 7°C) and food availability (Tamdrari et al 2012b). During the past five years, high densities of Atlantic cod were located along most of the western seaboard from the Port au Port Peninsula to areas just north of Rocky Harbour (Figure 4.41). The lowest density areas were in the offshore section in the southwest corner of the SEA Update Area. Data from the Sentinel Fishery Surveys have also shown relatively high abundances of cod in the inshore areas of the SEA Update Area (Fréchet et al 2009).

Moustache Sculpin are a poorly studied demersal species found in relatively shallow areas of the Gulf (typically less than 110 m; Scott and Scott 1988) and along the southern slope of the Laurentian Channel (Swain and Benoit 2007). The highest densities of moustache sculpin occur from southern end of the SEA Update Area from St. George's Bay to Rocky Harbour (Figure 4.42). The area from southwest of Port au Choix to the northern edge of the SEA Update Area also has relatively high densities, and it has also been found in St. Paul's Inlet near Rocky Harbour (Melanson and Campbell 2012).

Atlantic Herring are a pelagic schooling species that occurs throughout the Gulf. In the SEA Update Area they spawn in shallow (< 20 m) coastal waters (Lambert 1987; Melanson and Campbell 2012) in spring and autumn (McQuinn 1997). Along with many other pelagic species, Atlantic herring use the head of the Esquiman Channel (DFO 2007a) and shallow shelf areas (Dufour and Ouellet 2007) for feeding. In the northern Gulf, a large portion of the population overwinters in the Esquiman Channel (DFO 2007a) while in the southern Gulf herring undertake a winter migration to the entrance of the Laurentian Channel in the Cabot Strait (Dufour and Ouellet 2007). Atlantic herring have been a beneficiary of the recent regime shift (Savenkoff et al 2007a) in the Gulf and currently occur at higher abundances than in previous years. The highest densities of Atlantic herring are on the northern edge of the SEA Update Area in the vicinity of Port au Choix with less dense pockets around and offshore from St. George's Bay and nearshore close to Corner Brook (Figure 4.43).

Longfin Hake spawning occurs from fall through winter for this very fecund species (Scott and Scott 1988). It is generally considered to associate with deep water habitats (Scott and Scott 1988; Swain and Benoit 2007) and is known to occur in the SEA Update Area in the Laurentian Channel (Harvey et al 2012). Nonetheless, RV surveys also capture this fish in coastal areas in the region. Two areas stand out as having high densities of longfin hake; the entire southwest quadrant of the SEA Update Area and the coastal area in the vicinity of Rocky Harbour (Figure 4.44)

Alligatorfish are a species for which very little is known about their ecology, including the population that is found within the SEA Update Area. In the southern Gulf, alligatorfish have been documented to feed on invertebrates (amphipods and euphasiids primarily) and spawn in mid to late autumn (Arbour et al 2010). They are a deep water species (Scott and Scott 1988) and in the southern Gulf they occupied waters that ranged from 50-200 m depth (Arbour et al 2010). In the northern Gulf however, RV surveys indicate a more coastal

distribution. The highest densities of alligatorfish occur from the southern portion of the SEA Update Area from St. George's Bay to Rocky Harbour. The area north of Port au Choix also had higher densities (Figure 4.45).

Atlantic Wolffish are more widespread than the other two species in the Gulf but clearly avoid the bottom of the deep channels (Dutil et al 2011). Although in general their relative occurrence is low in the southern Gulf, they are present along the 200-m isobaths on the sloped south of the Laurentian Channel (Dutil et al 2011). Based on the trawl surveys (Figure 4.46) the highest densities of Atlantic wolffish are located within the SEA Update Area from Port aux Basques to Rocky Harbour.

Spotted Wolffish are known to occur in the northeast area of the Gulf, particularly in the Esquiman Channel (Dutil et al 2011). Based on the DFO trawl surveys (Figure 4.47), the highest densities of spotted wolffish within the SEA Update Area are around Rocky Harbour and off the Port au Port Peninsula.

Atlantic Halibut migrate seasonally between shallow (summer) and deep (winter) water habitats of the Laurentian Channel (Bowering 1982). Tagging studies indicate that these migrations are relatively small scale compared to many Gulf migrants (such as cod) (Scott and Scott 1988). In the northern Gulf, Atlantic halibut have experienced a four-fold decrease in abundance in the years following the fishery collapse (Savenkoff et al 2007a). More recently, the highest densities of Atlantic halibut occur in coastal areas off Port au Choix (Figure 4.48), with other portions of the SEA Update Area having relatively low or moderate abundances.

Silver Hake were found in higher densities near the southern shoreward end of the SEA Update Area near Port aux Basques as well as mid-latitude offshore areas (adjacent to Stephenville and Rocky Harbour). Low density areas occurred near shore (except in the vicinity of Port aux Basques) and in the northern third of the SEA Update Area (Figure 4.49).

Greenland Halibut are a deep water species that are an important stock component in the northern Gulf (Morissette et al 2009). It occupies the deep water channels where it feeds and spawns (Dufour and Ouellet 2007). Since the collapse of the fishery, it has become an increasingly important predator of fish and replaced cod as the dominant shrimp predator (Savenkoff et al 2007a). Based on the trawl survey data (Figure 4.50) the highest densities of Greenland halibut within the region are in the offshore area in the northwest corner.

Capelin is a key ecological component in the Gulf of St. Lawrence food web, given its role as an important invertebrate predator (Morissette et al 2006) and a key prey item for piscivorous fish and marine mammals (Morissette et al 2006; Morissette et al 2009). Capelin spawn in the intertidal zone on beaches or subtidally (Scott and Scott 1988) from May to July (Frank and Leggett 1981). This species, along with many other pelagic species, feed in summer habitats at the head of Esquiman Channel (DFO 2007a). In winter, the Gulf's capelin population overwinter in the deeper water of the Esquiman Channel (DFO 2007a). In the SEA Update Area, high densities of capelin larvae have been documented north of the Port au Port Peninsula (DFO 2007a). This is in general agreement with the DFO survey data (Figure 4.51) with the highest densities of capelin within the SEA Update Area in the northern section from Corner Brook to north of Port au Choix.

Atlantic Mackerel are a schooling, migratory species that are important dietary components of large demersal fish (such as cod) and cetaceans (Gregoire and Savenkoff 2005). Mackerel arrive from overwintering grounds outside the Gulf (Stobo and Fowler 2009) in June (Ware and Lambert 1985) and spread across the Magdelan Shallows, into Northumberland Strait and Baie-des-Chaleurs and along the west Coast of Newfoundland (Gregoire and Savenkoff 2005). Mackerel spawn in coastal areas in early summer. In St. Georges Bay, peak

spawning occurs at the end of June and continues into August (Ware and Lambert 1985). While in the Gulf, mackerel feed on zooplankton primarily but sometimes include capelin in their diet (Gregoire and Savenkoff 2005). In November, mackerel leave the Gulf to avoid harsh winter conditions (Dufour and Ouellet 2007).

Atlantic Salmon exhibit a wide diversity of life histories but most commonly are anadromous (spawn in fresh water and migrate to sea) (COSEWIC 2011a). Salmon spend 2-7 years rearing in freshwater as parr before they transform into smolt and migrate to sea. Seaward migrations typically occur in spring. In the southern portions of the SEA Update Area, salmon migrate from the Gulf through the Cabot Strait, whereas salmon from rivers in the northern portion of the SEA migrate through the Strait of Belle Isle (Reddin 2006). Salmon from this area can spend 1-2 years at sea and travel as far away as Greenland. Adults typically return to natal rivers in summer to spawn and are capable of spawning in multiple years (Scott and Scott 1988). Salmon rivers in the southern part of the SEA (e.g. the Humber River) produce multi-sea winter fish, which are uncommon in other areas of insular Newfoundland and prized by recreational fishermen (COSEWIC 2011a).

Figure 4.52 illustrates the locations of the various scheduled salmon rivers that are located along the west coast of Newfoundland, within the SEA Update Area.

Figure 4.39 Distribution and Abundance of Redfish (2004-2011 Surveys)

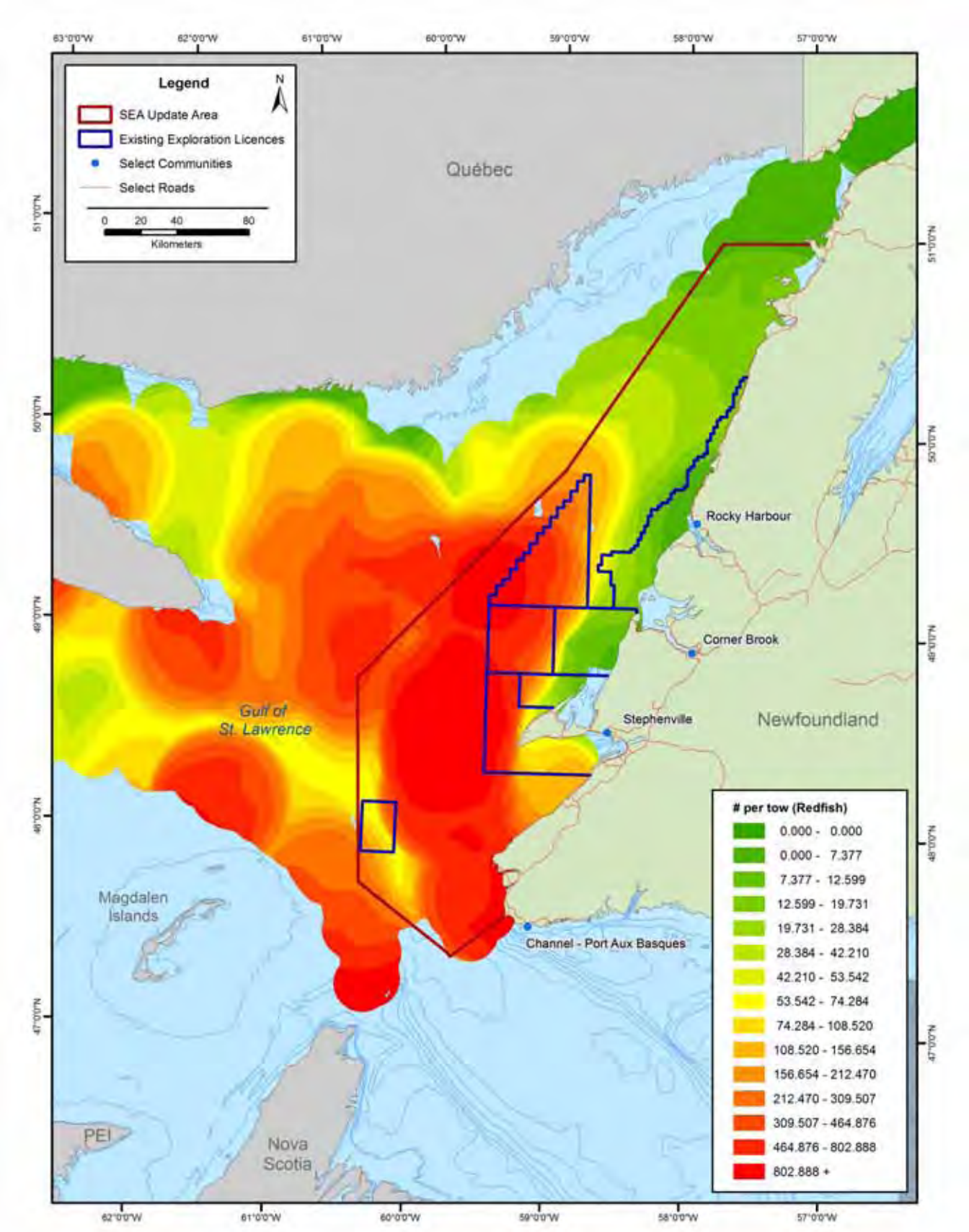


Figure 4.40 Distribution and Abundance of American Plaice (2004-2011 Surveys)

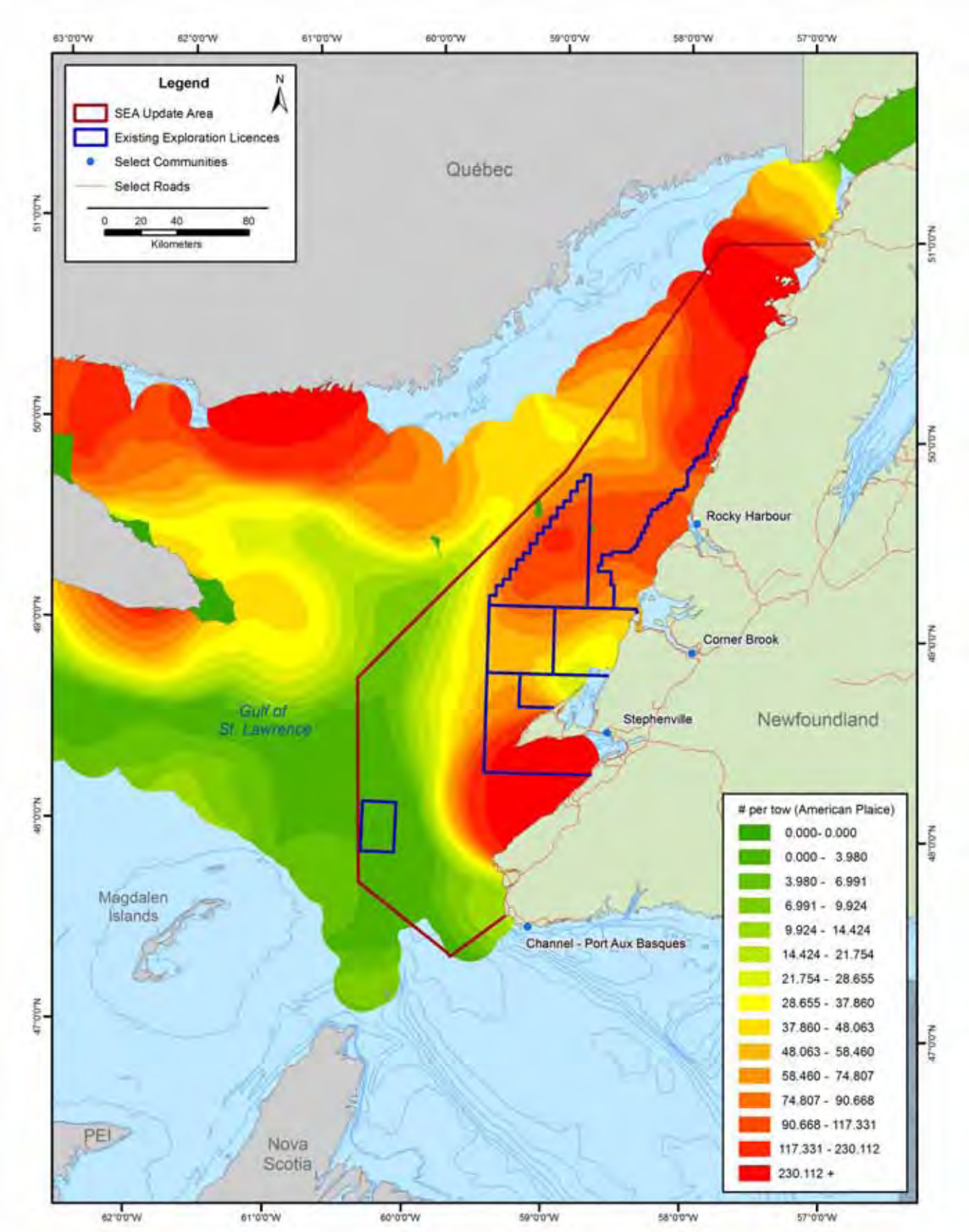


Figure 4.41 Distribution and Abundance of Atlantic Cod (2004-2011 Surveys)

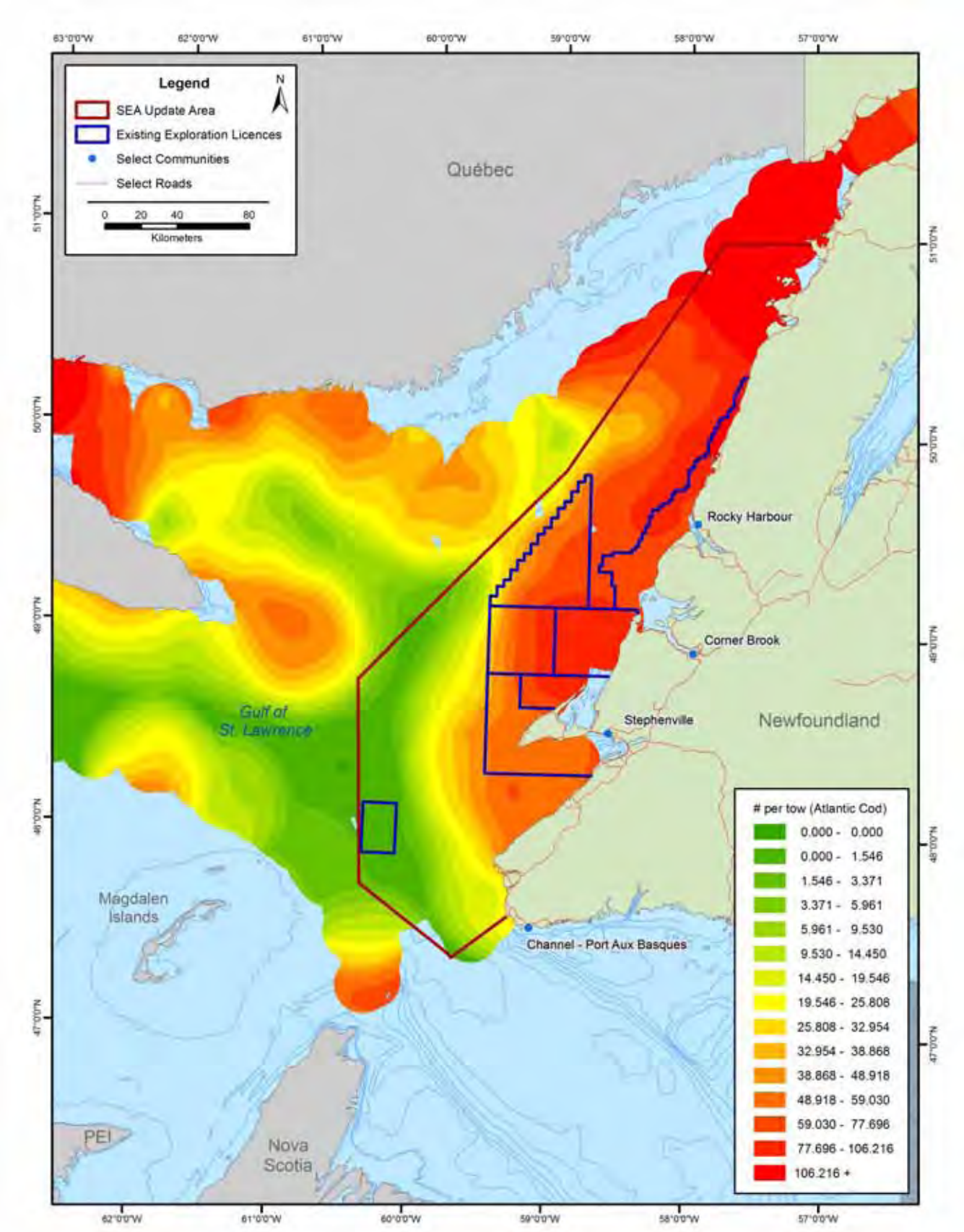


Figure 4.42 Distribution and Abundance of Moustache Sculpin (2004-2011 Surveys)

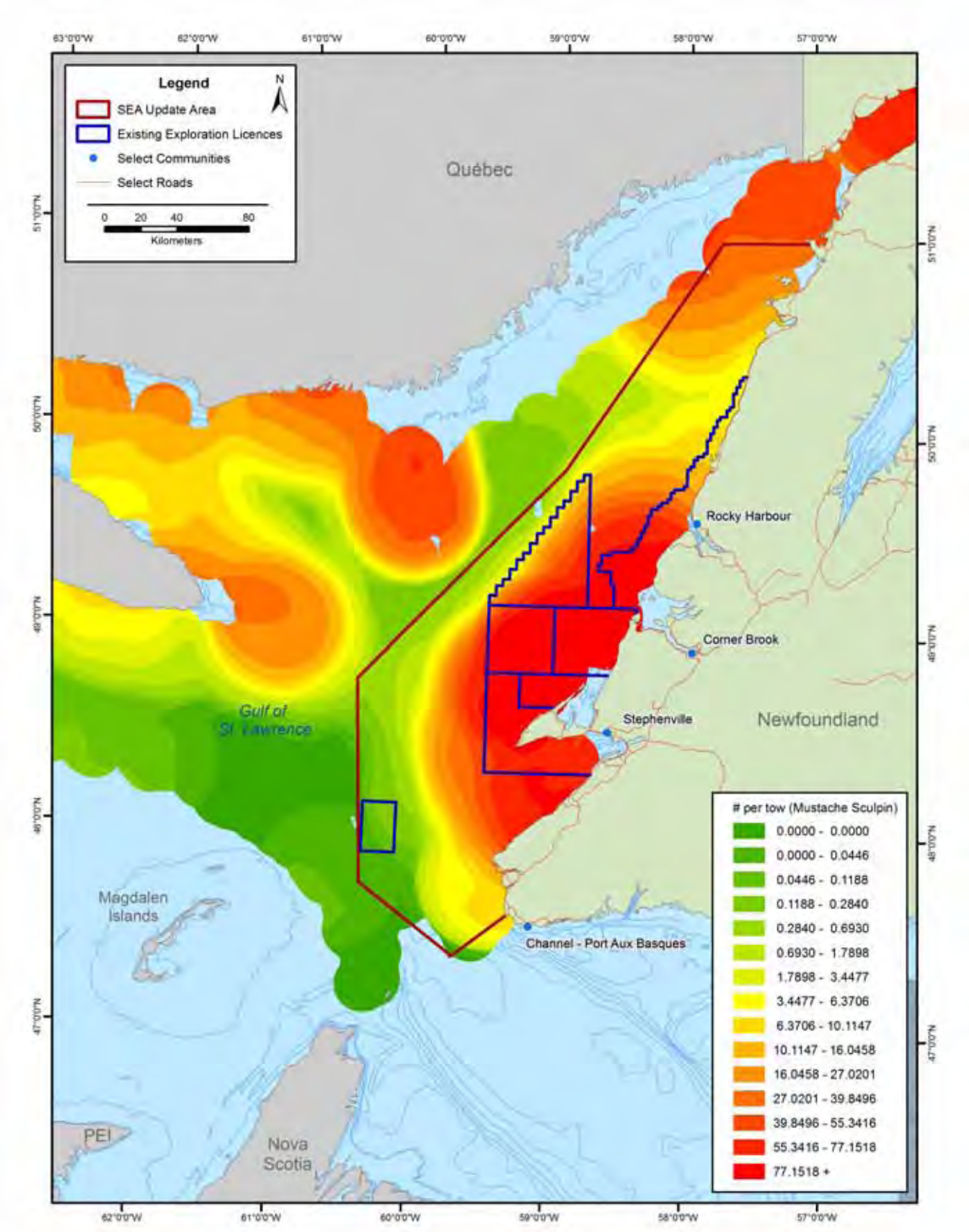


Figure 4.43 Distribution and Abundance of Atlantic Herring (2004-2011 Surveys)

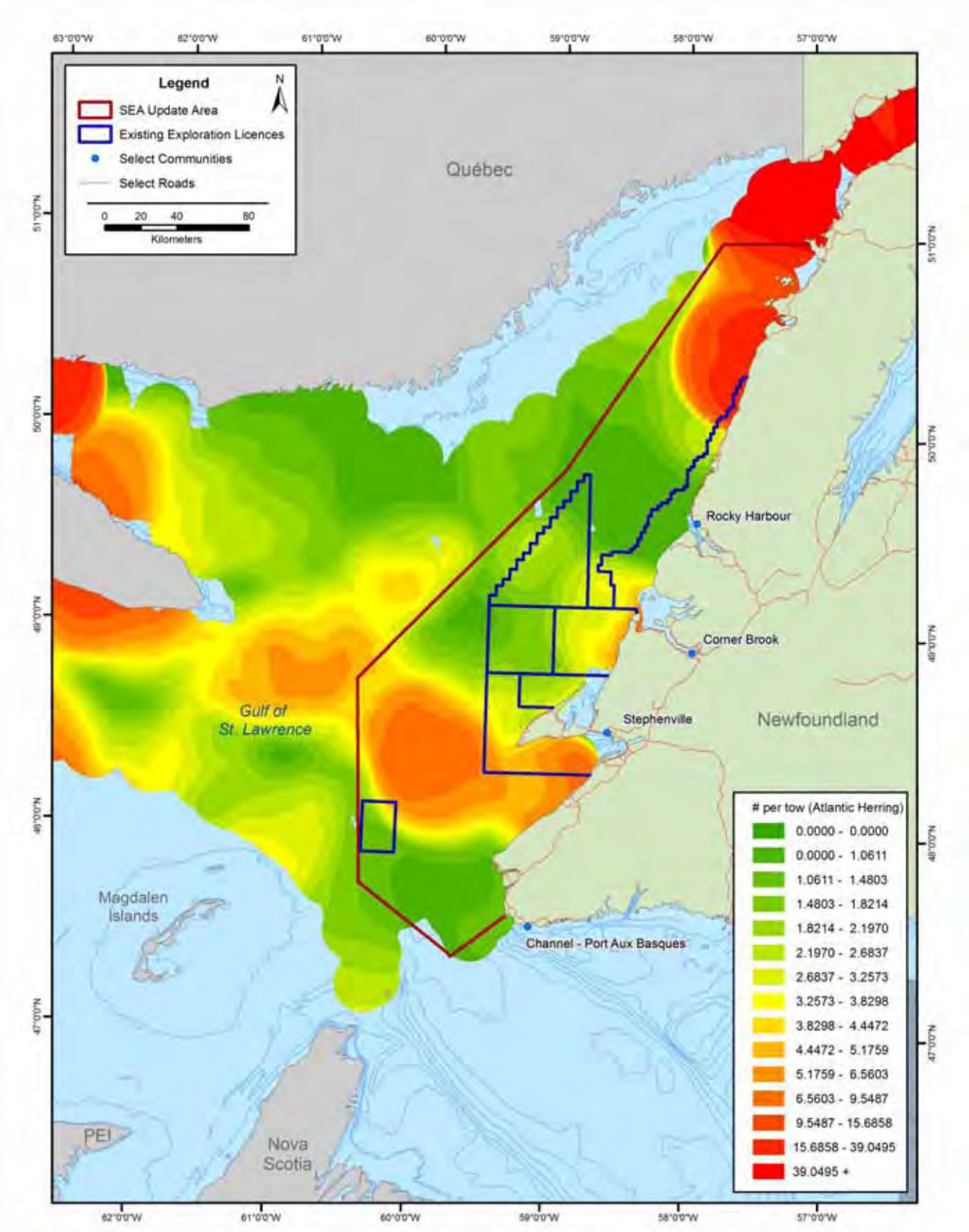


Figure 4.44 Distribution and Abundance of Longfin Hake (2004-2011 Surveys)

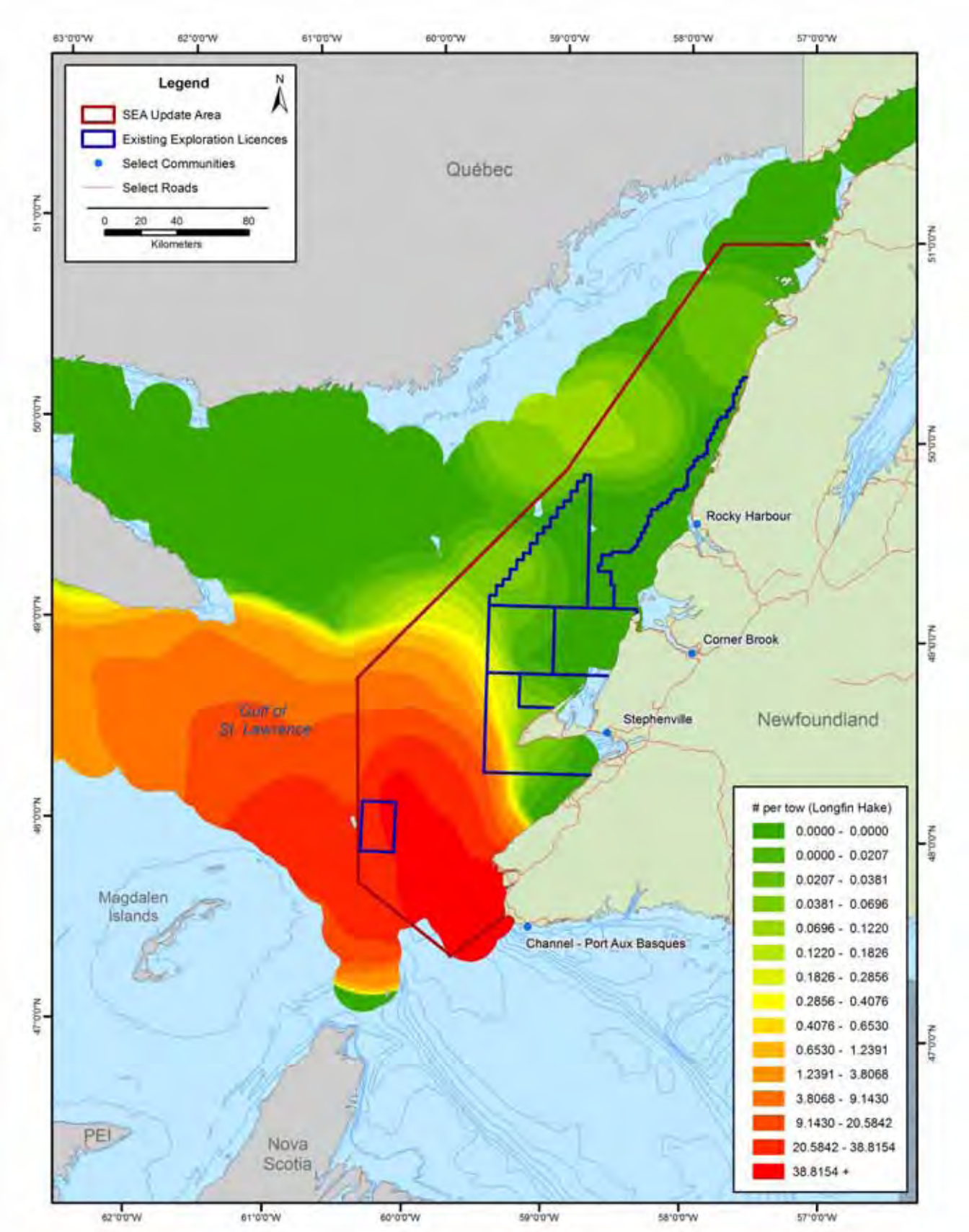


Figure 4.45 Distribution and Abundance of Alligator Fish (2004-2011 Surveys)

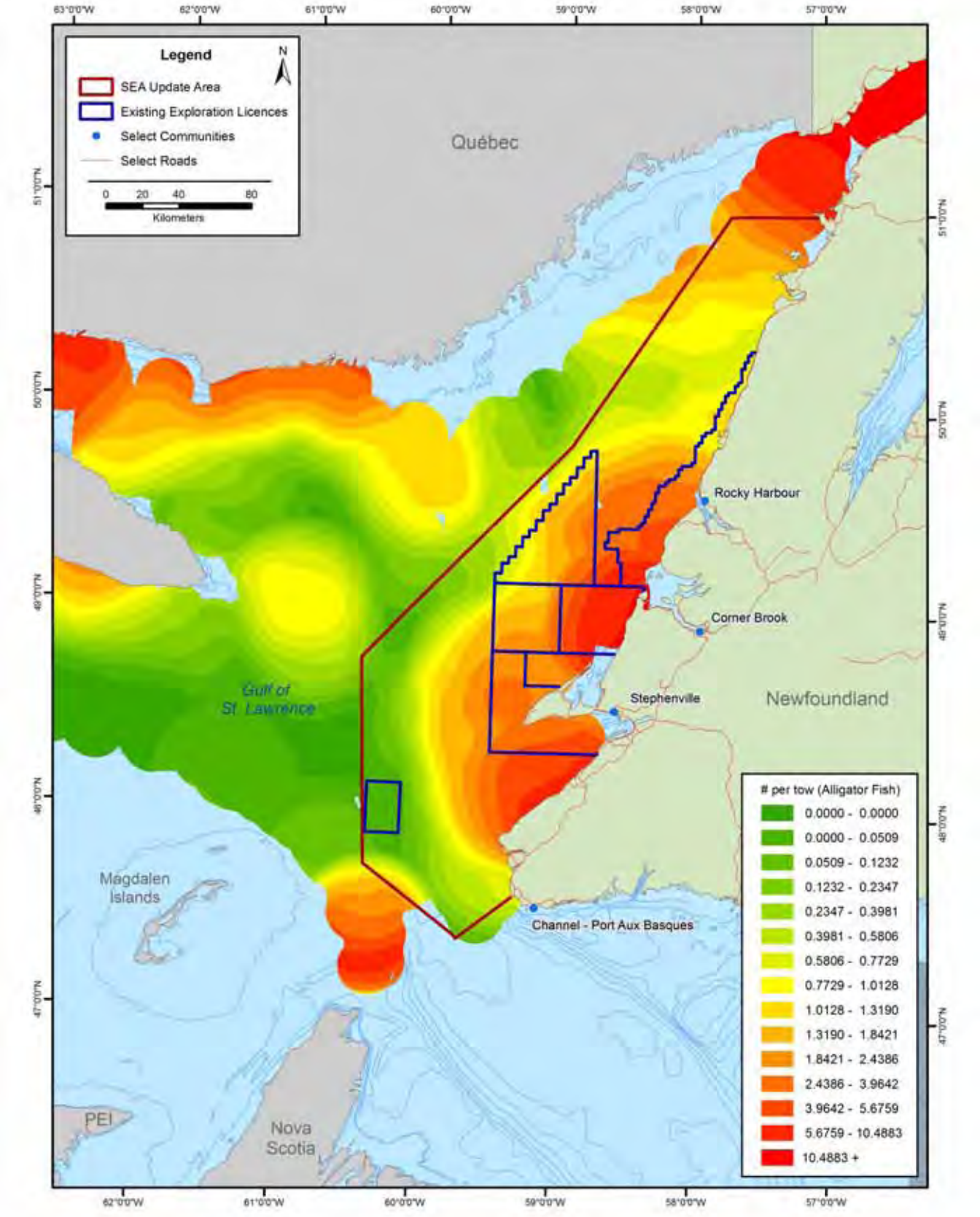


Figure 4.46 Distribution and Abundance of Atlantic Wolffish (2004-2011 Surveys)

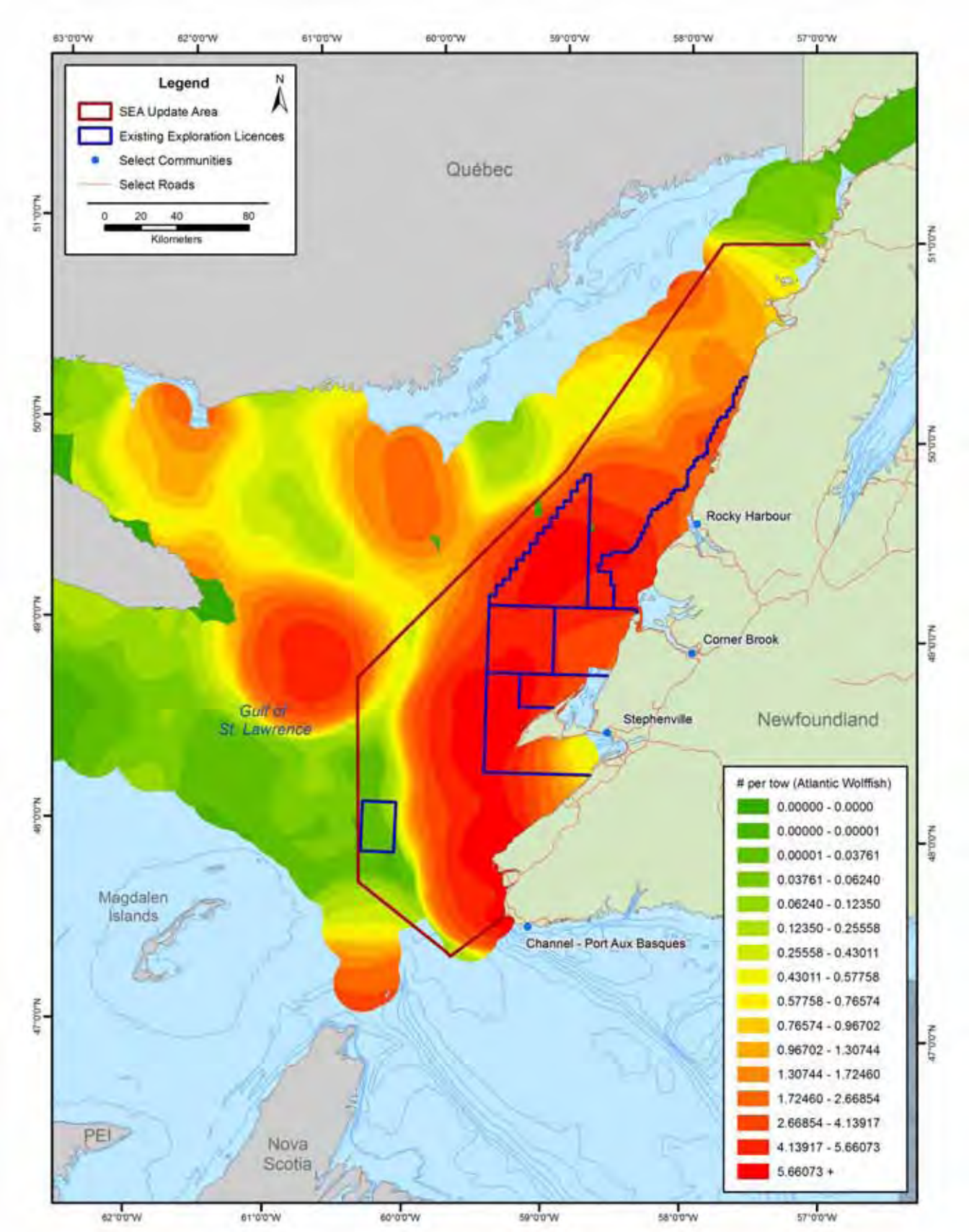


Figure 4.47 Distribution and Abundance of Spotted Wolffish (2004-2011 Surveys)

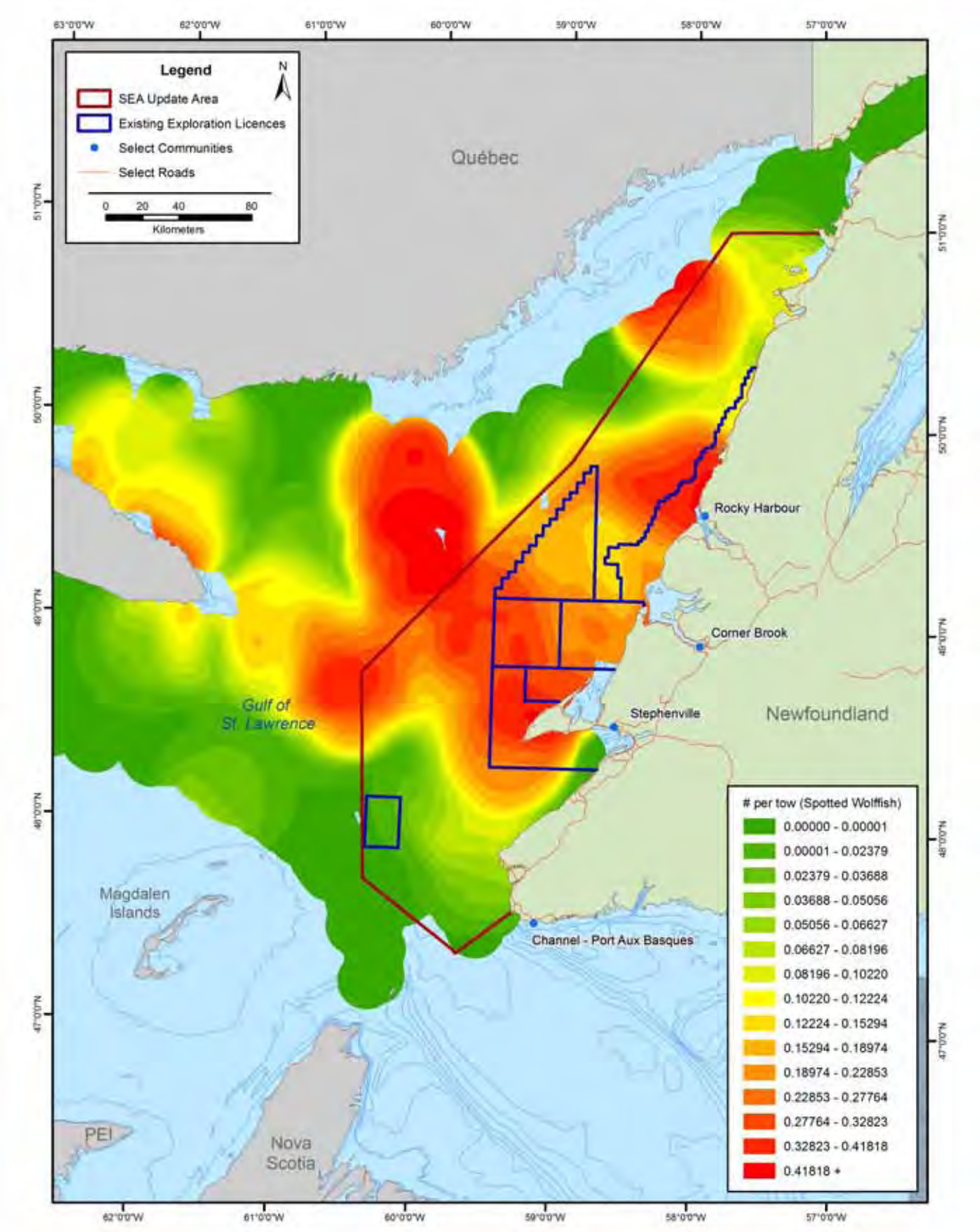


Figure 4.48 Distribution and Abundance of Atlantic Halibut (2004-2011 Surveys)

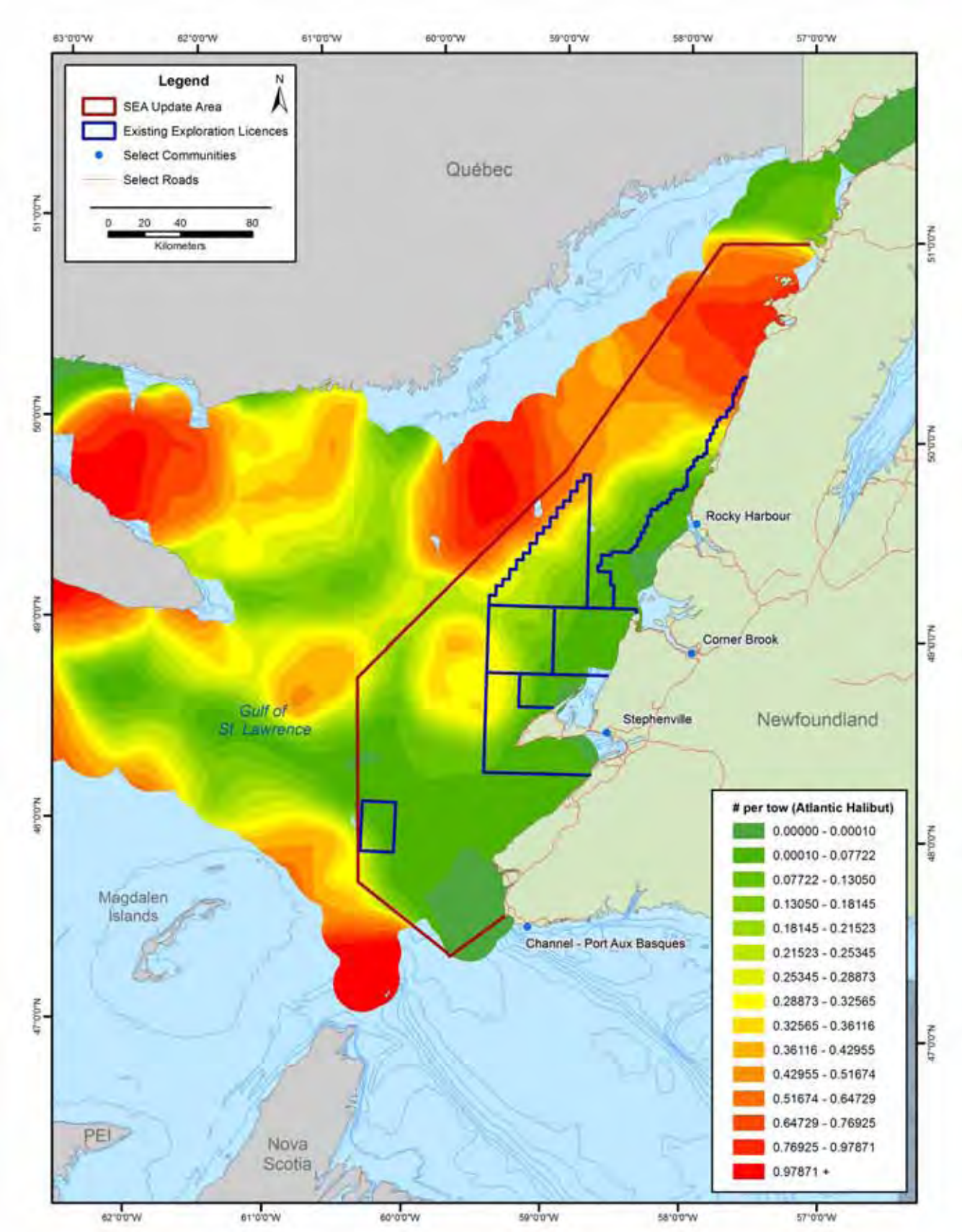


Figure 4.49 Distribution and Abundance of Silver Hake (2004-2011 Surveys)

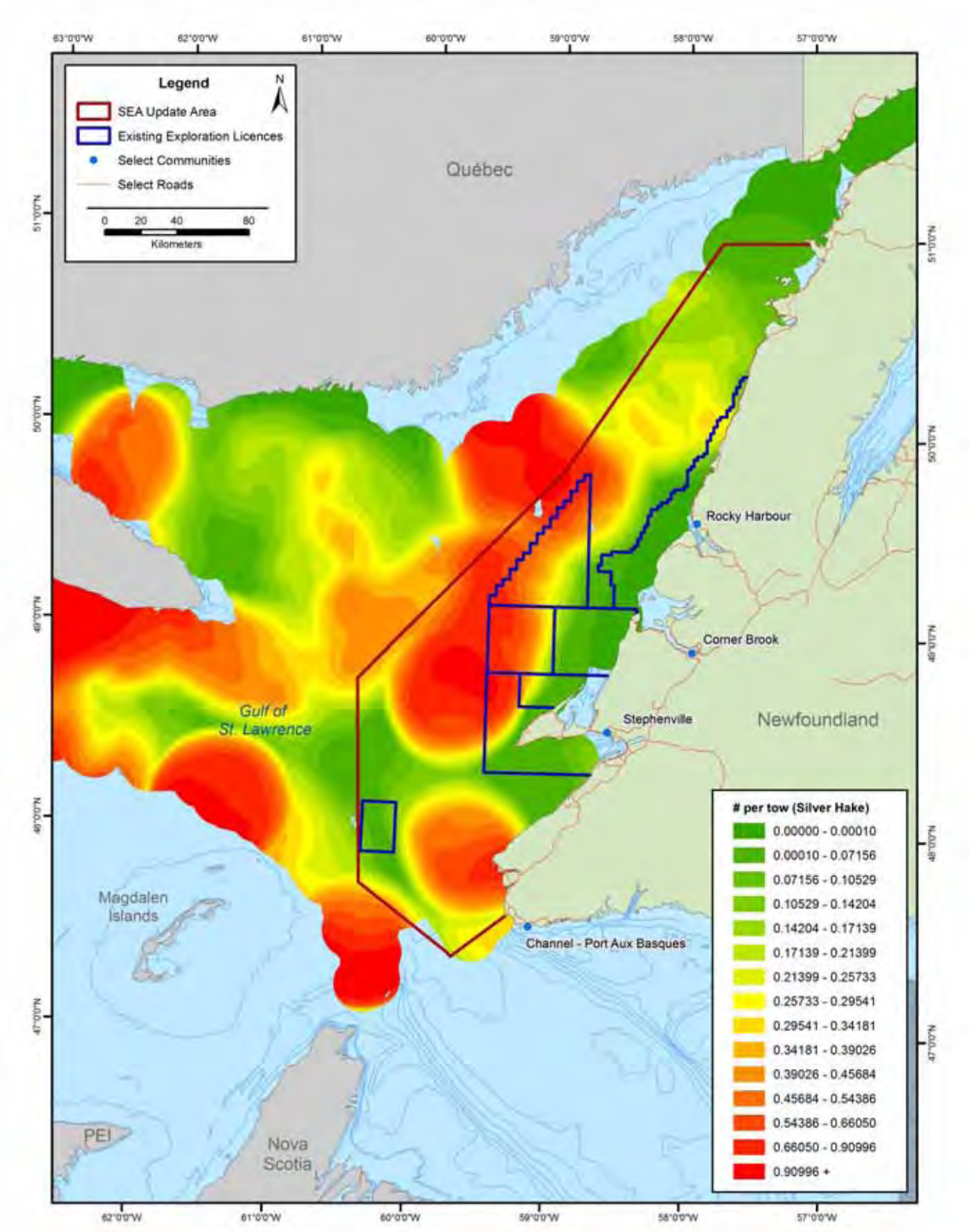


Figure 4.50 Distribution and Abundance of Greenland Halibut (2004-2011 Surveys)

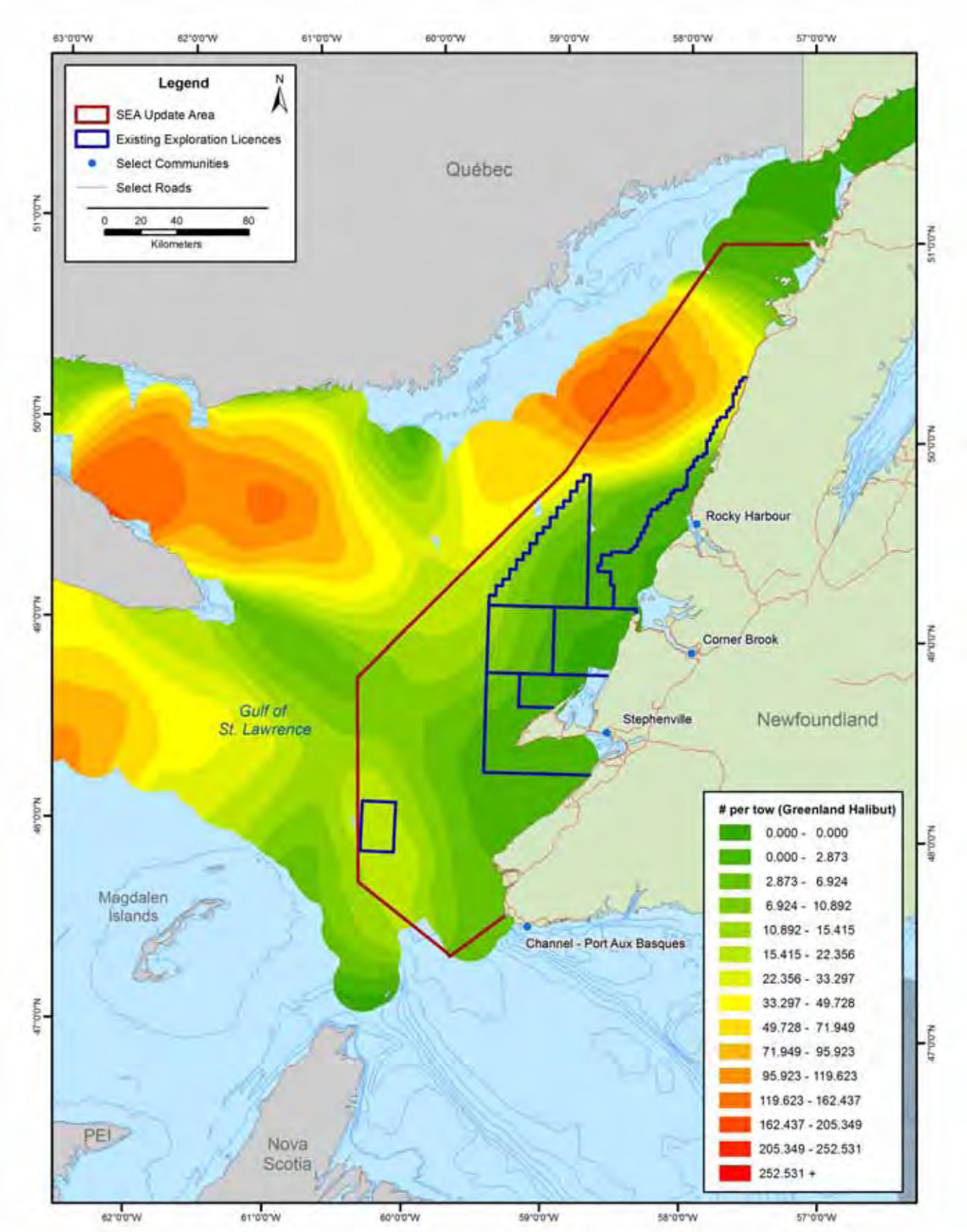


Figure 4.51 Distribution and Abundance of Capelin (2004-2011 Surveys)

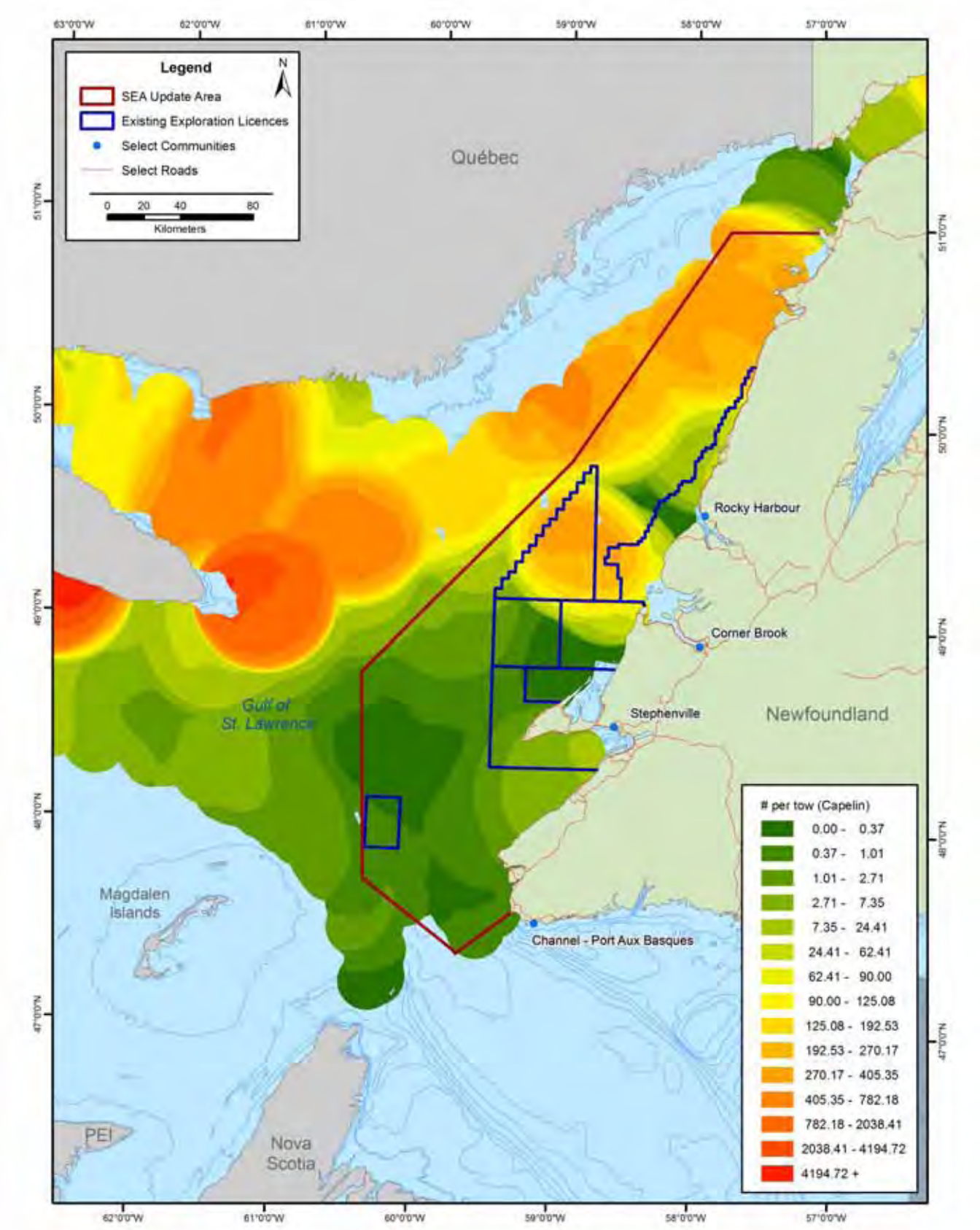
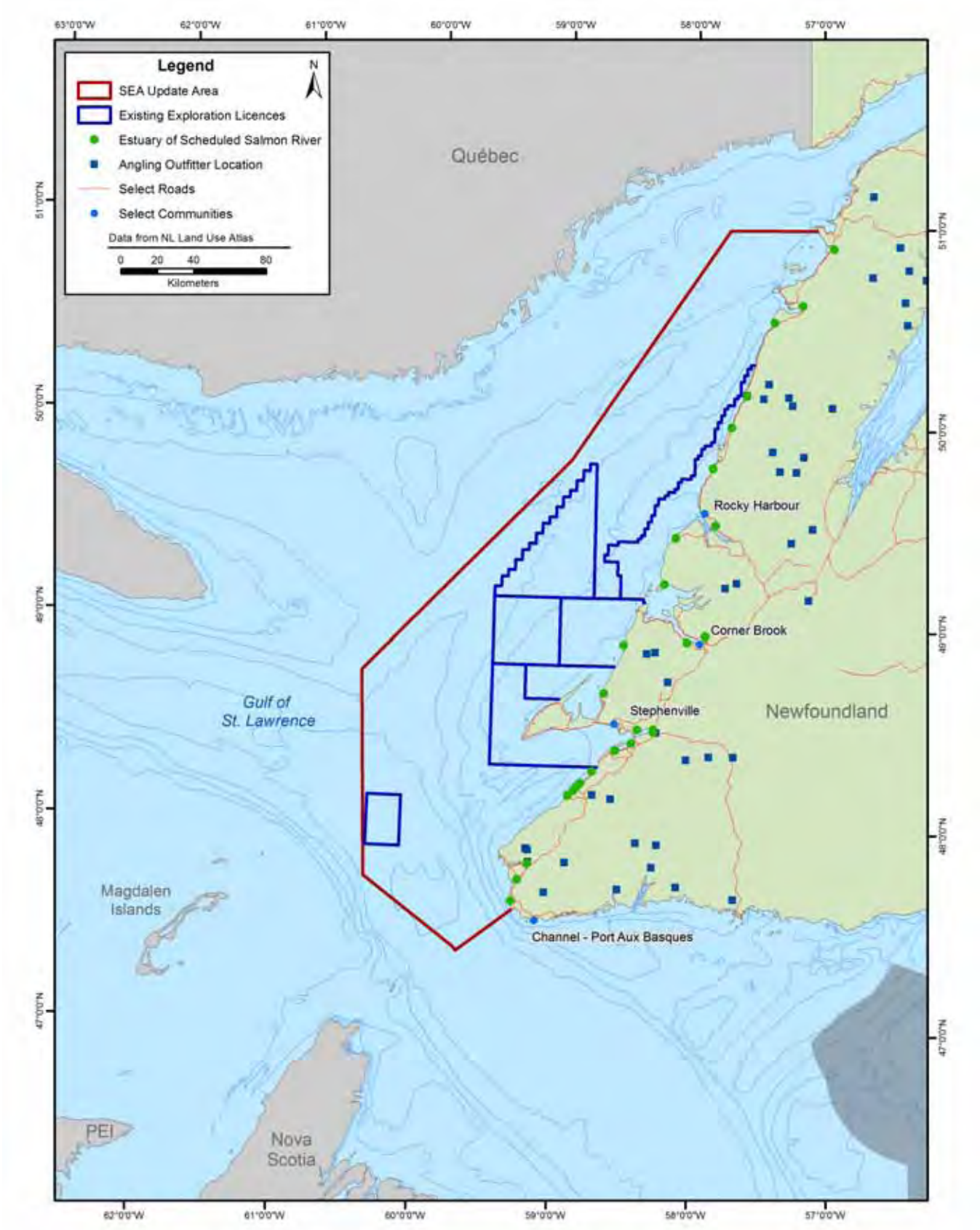


Figure 4.52 Salmon Rivers and their Estuaries in the SEA Update Area



4.2.1.6 Fish Species at Risk

A number of species of special conservation concern occur in the SEA Update Area and/or elsewhere in the Gulf of St. Lawrence. These include marine fish species that have varying degrees of formal protection under provincial and/or federal legislation, as well as various others which have been otherwise identified as potentially being of conservation concern and/or regionally rare.

The Newfoundland and Labrador *Endangered Species Act* (NL ESA) provides protection for indigenous species, sub-species and populations considered to be endangered, threatened, or vulnerable within the province. These potential designations under the legislation are defined as follows:

- *Endangered*: A species that is facing imminent extirpation or extinction;
- *Threatened*: A species that is likely to become endangered if nothing is done to reverse the factors leading to its extirpation or extinction; and
- *Vulnerable*: A species that has characteristics which make it particularly sensitive to human activities or natural events.

There are currently 32 species, subspecies, and populations designated under the *NL ESA*. Ten of these species are listed as endangered, nine as threatened, and 13 as vulnerable. Designations are based on recommendations from the national Committee on the Status of Endangered Wildlife in Canada (COSEWIC) and/or the provincial Species Status Advisory Committee (SSAC). Both COSEWIC and SSAC are independent committees that consist of government and non-government scientists who determine the status of species, subspecies and significant populations considered to be at risk of extinction or extirpation. The evaluation processes of both are independent, open and transparent, and based on the best available information on the biological status of species including scientific, community and traditional knowledge. Habitat that is important to the recovery and survival of endangered or threatened species can also be designated as critical habitat or recovery habitat, and protected under the *NL ESA*.

The Canadian *Species at Risk Act* (*SARA*) provides protection to species at the national level to prevent extinction and extirpation, facilitate the recovery of endangered and threatened species, and to promote the management of other species to prevent them from becoming at risk in the future. Designations under the Act follow the recommendations and advice provided by the COSEWIC.

There are currently various schedules associated with the SARA. Species that have formal protection are listed on Schedule 1, which includes the following potential designations:

- *Extirpated*: A species that no longer exists in the wild in Canada, but exists elsewhere;
- *Endangered*: A species that is facing imminent extirpation or extinction;
- *Threatened*: A species that is likely to become endangered if nothing is done to reverse the factors leading to its extirpation or extinction; and
- *Special Concern*: A species that may become threatened or endangered because of a combination of biological characteristics and identified threats.

Schedule 1 of *SARA* is the official federal list of species at risk in Canada. Once a species is listed, measures to protect and recover a listed species are established and implemented, including the development of a Recovery Strategy. These are detailed plans that define conservation goals and objectives, identify critical habitat, and describe the research and management activities required for the species in question, by:

- describing the particular species and its needs;
- identifying threats to survival;
- identifying and classifying the species' critical habitat (namely, that which is required for the species' survival or recovery), where possible;
- providing examples of activities that are likely to result in destruction of the critical habitat;
- setting goals, objectives and approaches for species recovery;
- identifying information gaps that should be addressed; and
- stating when one or more action plans relating to the strategy will be completed.

Once a species is added to the list and protected officially under *SARA*, a Recovery Strategy must be developed. For endangered species, this strategy must be developed within a year of the listing; for threatened or extirpated (extinct in Canada) species, it must be developed within two years.

Action Plans summarize the projects and activities required to meet recovery strategy objectives and goals. They include information on habitat, details of protection measures, and evaluation of socioeconomic costs and benefits. Action plans are the second element of the Act's two-part recovery planning process, and are used to implement projects and activities to improve species status.

Management Plans set goals and objectives for maintaining sustainable population levels of one or more species that are particularly sensitive to environmental factors, but which are not yet considered in danger of becoming extinct. Where possible, these plans are prepared for multiple species on an ecosystem or landscape level.

Although the information presented in this SEA Update is considered current as of the time of writing, it should be noted that the provisions of and associated requirements under SARA can change over the time (for example, there may be new species added to Schedule 1, new recovery strategies, action plans or management plans, identification of critical habitat, etc). It is therefore important to refer to the SARA Public Registry (*www.sararegistry.gc.ca*) to get the most up-to-date information and requirements for species at risk in Canada.

In addition to species that are listed under the provincial and/or federal legislation, there is also often a degree of interest around species that are considered to be regionally rare, even though these are not necessarily provided with formal, legal protection. Although the designation of a species by COSEWIC or other such organizations, for example, does not in itself constitute such legal protection, they do provide a general indication of species that may be considered rare, and thus, of some degree of potential conservation interest.

There are currently four marine fish species that are known to occur in the SEA Update Area that have formal designation and protection under *SARA*, including three species of wolffish (family *Anarhichadidae*) and the white shark (Table 4.44). It should be noted that the banded killifish, designated as being of special concern, is considered a freshwater species that tolerates high salinity waters and for completeness it has been included in the Table.

The Northern wolffish was designated as threatened as numbers of this large, slow-growing, long-lived, solitary, nest-building fish have declined over 95 percent in three generations, and the number of locations where the fish is found has decreased. Spotted wolffish were designated for similar reasons as the populations have declined over 90 percent in three generations, and the number of locations where the fish is found has decreased. Although Atlantic wolffish is at a lower designation, it also underwent a decline as great as that observed for the two threatened species. Specific threats identified by COSEWIC included bycatch mortality in commercial fisheries and habitat alteration by trawling gear. Another species, *A. lupus*, was assessed by COSEWIC as being of special concern, suggesting that it is particularly sensitive to human activities or natural events, but is not formally designated or protected at this time. All three wolffish species were reassessed by COSEWIC in 2012 and their recommended statuses have not changed. There is, however, a recovery strategy and management plan outlined in Kulka et al (2007) to increase the population levels and distributions of the three wolffish species. This includes the identification and protection of critical habitats under *SARA*.

The previous sections present the results of recent DFO surveys that overlap with the SEA Update Area and which found two wolffish species (Atlantic and Spotted) in the region. Spotted wolffish had relatively high densities throughout most of the SEA Update Area with the highest distributions from St. George's Bay to North of Rock Harbour and another high density area offshore from Port au Choix. The Atlantic wolffish had an even wider range of high density areas covering most of the SEA Update Area with the only low density areas being at the northern tip and south-western edge. Although Northern wolffish are rarely seen in the Gulf, most of their known occurrences in the region have occurred within the SEA Update Area (Dutil et al 2011)

Although the range of the white shark extends to the Canadian waters of the North Atlantic, it is considered to be quite rare (only 32 records over 132 years for Atlantic Canada; COSEWIC 2006b). Its numbers have been estimated to have declined by about 80 percent over 14 years (less than one generation) in areas of the northwest Atlantic Ocean outside of Canadian waters. This species was assessed in 2006 as being endangered under Schedule 1 of *SARA* with no update since that time.

Table 4.44 Marine Fish Species at Risk that are Known to or May Occur within the SEA Update Area

Common Name	Scientific Name	Population/Occurrence	Provincial Designation		SARA Status			COSEWIC Designation
			Province	Status	Endangered	Threatened	Special Concern	
Acadian redfish	*Sebastes fasciatus*	Bonne Bay population						Special Concern
Acadian redfish	*Sebastes fasciatus*	Atlantic population						Threatened
American eel	*Anguilla rostrata*	Québec, New Brunswick, Prince Edward Island, Nova Scotia, Newfoundland and Labrador, Atlantic Ocean	NL	Vulnerable				Threatened
American plaice	*Hippoglossoides platessoides*	Maritimes population & Newfoundland and Labrador population						Threatened
Atlantic bluefin tuna	*Thunnus thynnus*	Atlantic Ocean						Endangered
Atlantic cod	*Gadus morhua*	Newfoundland and Labrador population						Endangered
Atlantic cod	*Gadus morhua*	Laurentian North population						Endangered
Atlantic salmon	*Salmo salar*	Québec Eastern North Shore population						Special Concern
Atlantic salmon	*Salmo salar*	Gaspé-Southern Gulf of St. Lawrence population						Special Concern
Atlantic sturgeon	*Acipenser oxyrinchus*	Maritimes populations						Threatened
Atlantic sturgeon	*Acipenser oxyrinchus*	St. Lawrence population						Threatened
Atlantic wolffish	*Anarhichas lupus*	Atlantic Ocean					Schedule 1	Special Concern
Banded killifish	*Fundulus diaphanus*	Newfoundland population	NL	Vulnerable			Schedule 1	Special Concern
Blue shark	*Prionace glauca*	Atlantic population						Special Concern
Cusk	*Brosme brosme*	Atlantic Ocean						Endangered

Common Name	Scientific Name	Population/Occurrence	Provincial Designation		SARA Status			COSEWIC Designation
			Province	Status	Endangered	Threatened	Special Concern	
Deepwater redfish	*Sebastes mentella*	Gulf of St. Lawrence-Laurentian Channel population						Endangered
Northern wolffish	*Anarhichas denticulatus*	Atlantic Ocean				Schedule 1		Threatened
Porbeagle shark	*Lamna nasus*	Atlantic Ocean						Endangered
Shortfin mako shark	*Isurus oxyrinchus*	Atlantic population						Threatened
Spotted wolffish	*Anarhichas minor*	Atlantic Ocean				Schedule 1		Threatened
Striped bass	*Marone saxatilis*	Southern Gulf of St. Lawrence population						Special Concern
Spiny dogfish	*Squalus acanthias*	Atlantic population						Special Concern
Thorny skate	*Amblyraja radiata*	Québec, New Brunswick, Prince Edward Island, Nova Scotia, Newfoundland and Labrador, Atlantic Ocean						Special Concern
Winter skate	*Leucoraja ocellata*	Southern Gulf of St. Lawrence population						Endangered
White shark	*Carcharodon carcharias*	Atlantic population			Schedule 1			Endangered

4.2.1.7 Ecologically and Biologically Significant Areas (EBSAs) for Fish

As indicated previously, DFO has identified various EBSAs in and near the Gulf of St. Lawrence (see Figure 4.25), several of which have been selected in part due to their marine fish components and characteristics.

The *West Coast of Newfoundland* EBSA falls within the SEA Update Area. The area is primarily identified for the role it plays for groundfish (maximum uniqueness, concentration and adaptive values). Sections that are partially covered by the EBSA are somewhat unique and essential in that the entire populations concentrate there. Whether in the Esquiman Channel or in shallower waters, Western Newfoundland remains a main concentration area for juvenile Atlantic cod, redfish, American plaice, juvenile skate and Atlantic wolffish (Savenkoff et al 2007b). In addition, entire populations (Atlantic cod, redfish and others) use the Esquiman Channel (overall including the Cabot Strait escarpment) as their principal migration corridor in the Gulf. These populations have very dense concentrations during certain periods in spring and fall (DFO 2007a).

The area is also significant for pelagic fish (low to average uniqueness, average to maximum concentration and adaptive values). The channel in Cabot Strait represents a migration corridor and refuge for several species. In winter, the head of Esquiman Channel is the refuge for the Gulf's capelin population and the entire Esquiman Channel is the refuge for a large portion of the northern Gulf Atlantic herring population. These critical refuges are the only ones known for these populations. Many pelagic fish species (Atlantic herring, capelin, spiny dogfish, silver hake and pollock) concurrently use the area as a summer feeding area (head of the Esquiman Channel in the vicinity of the strait offshore from Port au Port). There can be large aggregations of these pelagics, especially in the southern half of the area. For most of the pelagic fish species in the northern Gulf, these feeding areas are among the rare locations with such significance (DFO 2007a). Portions of this area were identified in the initial SEA for the Western NL Offshore Area (LGL 2005, 2007) to be a cod spawning area, a redfish spawning, and a potential Greenland halibut and wolffish spawning area.

Although not situated within the SEA Update Area or the Gulf itself, the Laurentian Channel Slope has also been identified as an EBSA (Templeman 2007), and is located to the immediate southeast of the region. This area has been identified due to its importance in the juvenile live stages of finfish, as feeding grounds and its role as a migration corridor. This area is the sole pupping grounds for the black dogfish and has the highest black dogfish populations of Canada. It is also an important juvenile/nursery area from smooth skate and a feeding ground for monkfish, pollock and white hake. A noteworthy percentage of several species are known to use the area on a seasonal basis for movement to and from the Gulf (Templeman 2007).

Other EBSAs that are within proximity to the SEA Update Area (within 100 km) that have been identified for their fish and invertebrate communities and characterises include the Strait of Belle Isle, the South Fringe of the Laurentian Channel and Western Cape Breton. Some of the key relevant characteristics of these EBSAs are highlighted in Table 4.45.

Additional EBSAs that have been identified for the fish and invertebrate related reasons but which are not located in close proximity to the SEA Update Area include the St. George's Bay Area, Northumberland Strait, the Southwestern Coast, the Lower Estuary, and the Western and Northern Anticosti Island areas, summaries of which are provided in Table 4.46.

Table 4.45 Fish Characteristics of EBSAs within Proximity (100 km) of the SEA Update Area

EBSA Name (province)	Description as it relates to Benthic Invertebrates and Finfish	#
Strait of Belle Isle (QC, NL)	*Benthic Invertebrates:* The area, in particular the Strait of Belle Isle, has certain significance for benthic invertebrates (maximum concentration and adaptive values). They have a very high concentration index (ascidians, sponges, stars, basket stars, lesser bobtail squid, S*clerocrangon boreas, Eualus fabricii, E. macilentus, Spirontocaris spinus, Lebbeus polaris, Pandalus montagui, Sabinea septemcarinata, Argis dentata*, arctic lyre crab). Also in the Strait, the highest concentrations of shrimp are found, which are only marginally present in the rest of the eastern Gulf (*Eualus gaimardii gaimardii, E. gaimardii belcheri, Lebbeus groenlandicus, Spirontocaris phippsi, Lebbeus microceros*). There are also Icelandic scallop beds around the Mecatina trough. *Finfish:* For most pelagic fish in the northern Gulf, the Strait of Belle Isle represents one of the rare areas with such significance (maximum concentration, average uniqueness and adaptive values). Several species (such as spiny dogfish, Atlantic herring, sand lance and capelin) feed there in large aggregations. This area is also the main spawning ground for Atlantic herring (fall spawning). For groundfish such Atlantic cod, the Mecatina trough could be highly significant. It is a production and concentration area for juvenile Atlantic cod (4S sub-stock) and the significance is difficult to assess.	9
Southern Fringe of the Laurentian Channel (NS, PE, QC)	*Benthic Invertebrates*: Benthos have high use of the area compared with the northern part or middle of the channel (concentration index from low to high with species such as soft coral, anemones, Icelandic scallop, shortfin squid, lesser bobtail squid, northern Atlantic octopus, *Pasiphaea multidentata* shrimp, friendly blade shrimp and deep sea king crab). *Finfish*: This EBSA is characterized by its great significance for pelagic fish (average to maximum uniqueness, average concentration and adaptive values), and on a larger scale, for groundfish (low to average uniqueness and average concentration and adaptive values). Atlantic cod are especially vulnerable to disturbance because their entire population gathers there at that time of the year, their energy balance is negative (their food intake does not compensate for energy losses). Around the area towards the middle of the channel are located the only wintering areas in the Gulf for many other groundfish species whose entire populations aggregate there in large numbers. On the fringe of the EBSA, the Cape Breton Channel serves as a migration corridor (spring and fall) to the Atlantic for Atlantic cod (southern Gulf stock), for white hake (coastal component of the stock) as well as for other groundfish species. It is also the principal summer feeding area for witch flounder and white hake (deep water component). For many resident pelagic species in the southern Gulf, the EBSA is unique in that it remains their only corridor to the Atlantic. For most of these species (Atlantic herring, capelin, spiny dogfish, pollock and silver hake), the EBSA is a rare and significant area that serves multiple purposes (feeding ground, refuge).	4
Western Cape Breton (NS, PE, QC)	*Benthic Invertebrates*: This area has significant concentrations of macroinvertebrate species such as brittle stars, starfish, basket stars, hermit crabs, whelks, and squid. *Finfish*: As for groundfish, the northern part of the area has important biodiversity and high biomass. The Cape Breton Channel serves as a migration corridor (spring and fall) towards the Atlantic for Atlantic cod and for the white hake (coastal component of the stock) as well as for other groundfish species. It is also a significant summer feeding area for witch flounder (adults) and white hake (deep water components of the stock), where, in this area, are recorded the largest concentration in the southern Gulf. Ecosystem disturbance in the area, and in the surrounding area in some cases, (e.g. migration corridor), could have severe	1

EBSA Name (province)	Description as it relates to Benthic Invertebrates and Finfish	#
	consequences especially with the large proportions of various groundfish species populations that are concentrated there seasonally. The southern part of the area is a spawning and nursery area for Atlantic herring and a wintering area for juveniles. It is also a very significant feeding area where most pelagic fish species in the southern Gulf concentrate (alewife, spiny dogfish, adult and juvenile Atlantic herring, Atlantic mackerel, capelin, rainbow smelt and silver hake). Because of this preference, this area probably has a high adaptive value for pelagic fish.	
Modified from DFO (2007a)		

Table 4.46 Fish Characteristics of EBSAs not within Proximity (>100 km) of the SEA Update Area

EBSA	Description as it relates to Benthic Invertebrates and Finfish	#
St. George's Bay (NS)	*Benthic Invertebrates*: This area is important for its high concentrations of benthic invertebrates (DFO 2007). *Illex coindetti*, the shortfin squid, is found in large concentrations in this area. In addition, the area only has a few giant scallop beds left.	2
Northumberland Strait (PE, NB)	*Benthic Invertebrates*: An isolated calico crab population (endemic subspecies) persists in this area where they spend their life cycle. There are also giant scallop beds in this area. *Finfish*: For winter skate, the largest aggregation, i.e. half of the total population is concentrated in this area (including the southernmost part of adjacent area 5) in summer and early fall. The area is very significant for this species because their numbers have been dropping for twenty years (endangered according to the COSEWIC). Several other groundfish species with limited range can be found in large quantities in the area, such as white hake and windowpane.	3
South-Western Coast of the Gulf (NB, PE)	*Benthic Invertebrates*: Invertebrates are very high in numbers north of the area (ascidians, brittle stars, basket stars, *Pandalus montagui, Eualus macilentus, Spirontocaris spinus, Lebbeus polaris, Argis dentata,* snow crab, arctic lyre crab). Also in the area there are Icelandic scallop beds as well as shrimp whose ranges are limited (*Eualus fabricii, Sclerocrangon boreas, Lebbeus groenlandicus*). *Finfish*: This EBSA, in particular the entire southern part of the area starting at Bay-des-Chaleurs, is characterized by its rare significance for several pelagic fish species (maximum reaching uniqueness, concentration and adaptive values). Significant pelagic fish such as Atlantic herring (adult and juvenile), capelin, Atlantic mackerel and American smelt feed in the area on high concentrations of prey (*Calanus*, euphausids). The area also includes several spawning sites for Atlantic herring. For juvenile Atlantic herring, Chaleur Bay represents their principal wintering area. The area also serves multiple purposes (spawning, refuge, feeding) for many other species (large concentrations of alewife, spiny dogfish, capelin, Atlantic mackerel and American smelt. For groundfish, the Shediac Valley area is a summer feeding area and a significant rearing area for several species (Atlantic cod, winter flounder, yellowtail flounder). Species with limited range can also be found in large quantities in the area, in particular white hake and windowpane. In addition, the southernmost part of the area is unique for the winter skate (distinct and endangered population in the southern Gulf). Half the population is concentrated, in summer and early fall, along the southern margin of the EBSA and in the adjacent Northumberland Strait EBSA.	5
Lower Estuary (NB,QC)	*Benthic Invertebrates*: The lower estuary is a significant area for benthic invertebrate; Icelandic scallop beds can be found along with heavy concentrations of anemones, starfish, basket stars, brittle stars, sea urchins, northern Atlantic octopus, snow crab and arctic lyre crab. The area is also one of three areas in the eastern Gulf where the deepwater mysid	6

EBSA	Description as it relates to Benthic Invertebrates and Finfish	#
	species *Boreomysis arctica*, a prey item for fish, was observed. *Finfish*: The lower estuary EBSA also plays a very significant role for groundfish. According to perennial and multispecies surveys conducted in late summer, the largest concentrations of juvenile Greenland halibut, witch flounder and thorny skate in the entire eastern Gulf are found there. This high accumulation of juvenile flat fish is probably related to the estuarine water circulation in this area.	
Western Anticosti Island (QC, NB)	*Benthic Invertebrates*: The area is home to benthic invertebrates including anemones, sponges, sea urchins, *Pasiphaea multidentata*, *Lebbeus polaris*, *Pandalus borealis*, *Pandalus montagui*, snow crab and hermit crab. There is also a significant area for soft coral (partly covered by the area) and for *Boreomysis arctica*, two marginally represented taxons in the eastern Gulf. *Finfish*: The area captures a portion of this area rich in exceptional species for the abundance of fish and decapod crustacean eggs and larvae (abundant fish egg concentrations and more specifically Atlantic cod and winter flounder, high concentrations of Arctic shanny as well as several shrimp species and snow crab). These observations show the significance of the area for the emergence and development of northern shrimp in the north-western Gulf, for spawning and reproduction as well as for many biological components of the ecosystem.	7
The Northern Anticosti Island (QC)	*Benthic Invertebrates*: In shallower water (<200 m), west of the area, there are dense benthic invertebrate communities (maximum concentration for this area - brittle stars, sea urchins, sea cucumbers, *Pandalus montagui, Argis dentata, Eualus fabricii, E. macilentus, Spirontocaris spinus, Lebbeus polaris*, Arctic lyre crab, hermit crab). There are also several important Icelandic scallop beds as well as species not frequently found elsewhere (ascidians, *Lebbeus groelandicus, L. microceros, Eualus gaimardii belcheri, Sclerocrangon boreas*). *Finfish*: The periphery of Anticosti Island, especially the Jacques-Cartier Strait area west of the area, is remarkable for its abundance of meroplankton species as well as fish and decapod crustacean eggs and larvae (Atlantic cod and winter flounder eggs, sand lance, capelin, Arctic shanny and crab larvae). These observations show the significance of the area (maximum uniqueness and adaptive values) for spawning and reproduction as well as for several biological components in the ecosystem. The area, particularly around the Anticosti Channel, is a concentration and reproduction area for Greenland halibut (likely a distinct sub-population) and a feeding area for several other pelagic fish species (capelin, Atlantic herring).	8
Modified from DFO (2007a)		

4.2.1.8 Other Identified Important Areas for Fish and Fish Habitat

The Bonne Bay Biological Field Station was established as a research and teaching facility in 1979 and since that time, has contributed significantly to the knowledge of the marine flora and fauna of Bonne Bay and the surrounding area. Some of their key findings that would make it an important area include the following:

- Bonne Bay has an incredible diversity of seaweeds, invertebrates, fish and other marine life;
- Many species reported off northeastern North America reside in or visit the waters off Gros Morne;
- Local biodiversity is especially high in the Bonne Bay Narrows and in Outer Bonne Bay;
- The East Arm of Bonne Bay is inhabited by isolated populations of numerous arctic seaweeds, invertebrates and fish; and
- Since the establishment of the Bonne Bay Biological Field Station over 30 years ago, many formerly abundant marine species in Bonne Bay have become rare, coinciding with use of gill nets, seines and bottom trawls.

Eelgrass beds (*Zostera marina*) are an important component of nearshore marine environments in the SEA Update Area (see Figure 4.29) as they have high levels of primary productivity add spatial complexity to the habitat and are utilized as nursery and spawning grounds for fish such as Atlantic cod (DFO 2009a; Cote et al 2013).

There are areas of upwelling that bring cold deep nutrient rich waters to the surface and produce productive fishing grounds for various life stages of numerous species including cod, capelin, and shrimp. Two such areas have been identified within the SEA Update Area (LGL Limited 2005);

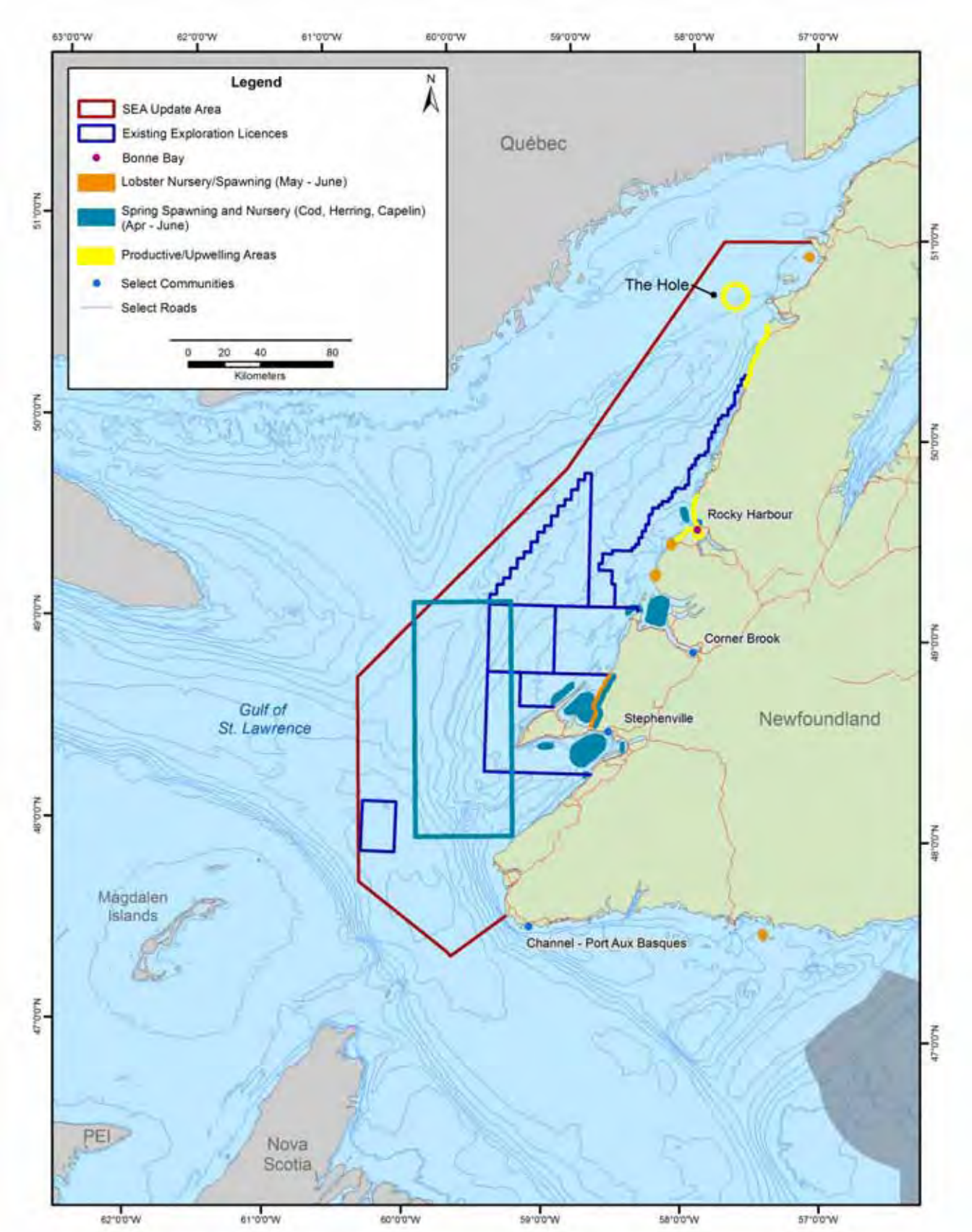
1) A steep slope area at the northern end of the Esquiman Channel known locally as the “Hole”, and
2) A slope area close to shore between Bellburns and River of Ponds.

A number of other important or sensitive marine areas (lobster areas, krill, and other food sources) were also identified in the initial SEA Report (LGL 2005) as well as the 2012 SEA Update public consultations (a full description of the public consultation sessions is available in Appendix A):

1) A cod spawning area, referred to as the Cape St. George Spawning Area (off the Port au Port Peninsula) was identified for northern Gulf cod in April and May;
2) Important lobster areas in the region including Ramea, Port aux Basques and east, north to St. George’s Bay;
3) A lobster spawning area was identified from Outer Port au Port to Shag Bay;
4) There were also two lobster nursery areas identified; Shoal Point, Outer Bay of Islands (just above North Head), and Trout River Bay; and
5) A shallow inshore area between Trout River and Sally’s Cove, known locally as Green Point Banks, was also identified in the 2012 SEA public consultations as a particularly important area for mackerel and lobster (by local fishers) as well as being a herring spawning area (identified by Parks Canada).

This information is summarized in Figure 4.53, and is further complemented by the A*tlases of Significant Coastal and Marine Areas* which cover the SEA Update Area (see Figure 4.27, ASCMA 2010, 2011), as described earlier.

Figure 4.53 Some Other Identified Important Areas for Fish and Fish Habitat



4.2.2 Water Birds

This section describes the presence, distribution and seasonal abundance of bird species found in the SEA Update Area. For the purposes of this discussion, these avifauna are grouped into four categories: 1) seabirds, 2) waterfowl (including loons and grebes), 3) shorebirds, and 4) other bird species, including passerines. Seabirds, coastal waterfowl and shorebirds are considered to be the most vulnerable to perturbation from offshore petroleum activity as they spend much of their life in the marine environment, and therefore, are given a relatively higher degree of focus in this section.

4.2.2.1 Seabirds

Although the Gulf of St. Lawrence is used by a variety of bird species throughout the year, the coast and waters of Western Newfoundland have relatively lower abundances of seabirds compared with other marine areas of Newfoundland and Labrador. It is believed that this is likely because this area is less influenced by major oceanic currents, although it may also be in part due to a lack of breeding habitat and relatively low productivity of the adjacent waters compared to the east coast and the nutrient-rich Grand Banks off southern Newfoundland (Lock et al 1994; Fifield et al 2009a).

Previous survey coverage of the area has been relatively low (Lock et al 1994). The Canadian Wildlife Service (CWS) recently reinvigorated its efforts to monitor seabird species at sea, and in 2006 they initiated the Eastern Canadian Seabirds at Sea (ECSAS) program (Gjerdrum et al 2008; Fifield et al 2009b). As of the most recent available project summary report, survey coverage within most of the SEA Update Area is limited to the summer months of May to August (Fifield et al 2009b). The ECSAS monitoring program is ongoing, and the Working Group is in the process of developing a publically available interactive online atlas of seabird density and distribution that will provide up-to-date information on the status of seabirds in the region (C. Gjerdrum, pers. comm.).

According to data from Lock et al (1994), the largest concentration of seabirds in the SEA Update Area is in late winter (January to March), and geographically, the southern part of the area supports the greatest seabird abundance during this period (Figures 4.54 to 4.57).

Seabirds are least abundant in the SEA Update Area in the fall. As many as 10 - 99 seabirds per linear kilometre are present and therefore vulnerable to perturbation in parts of the coastal areas near southwestern Newfoundland from January to September, while no more than 10 birds per kilometre are present from October to December. Recent data also show the greatest concentration of seabirds occurring in the northern part of the SEA Update Area between May and August (Figure 4.58; the numbers in the ovals represent the total seabird density within the 1 degree survey block (top) +/- standard error (bottom). One degree blocks without a coloured oval were not surveyed). Most seabird nesting in the area takes place on islands off the coast, although some species nest on inaccessible mainland cliffs or on sandy beaches and peninsulas. Generally speaking, seabirds occurring in the SEA Update Area are long-lived with low fecundity, delayed recruitment and low rates of population growth. Egg-laying commences in mid to late May and into June, and most species are fledged by July to August, though as late as November for Northern Gannets.

Seabirds that occur in the marine waters off Western Newfoundland include cormorants, gannets, phalaropes, gulls, terns, alcids (auks), jaegers and skuas, and tubenoses (fulmars, petrels and shearwaters). Each of these avifauna groups is discussed in turn below.

Figure 4.54 Distribution and Seasonal Abundance of Seabirds (January – March)

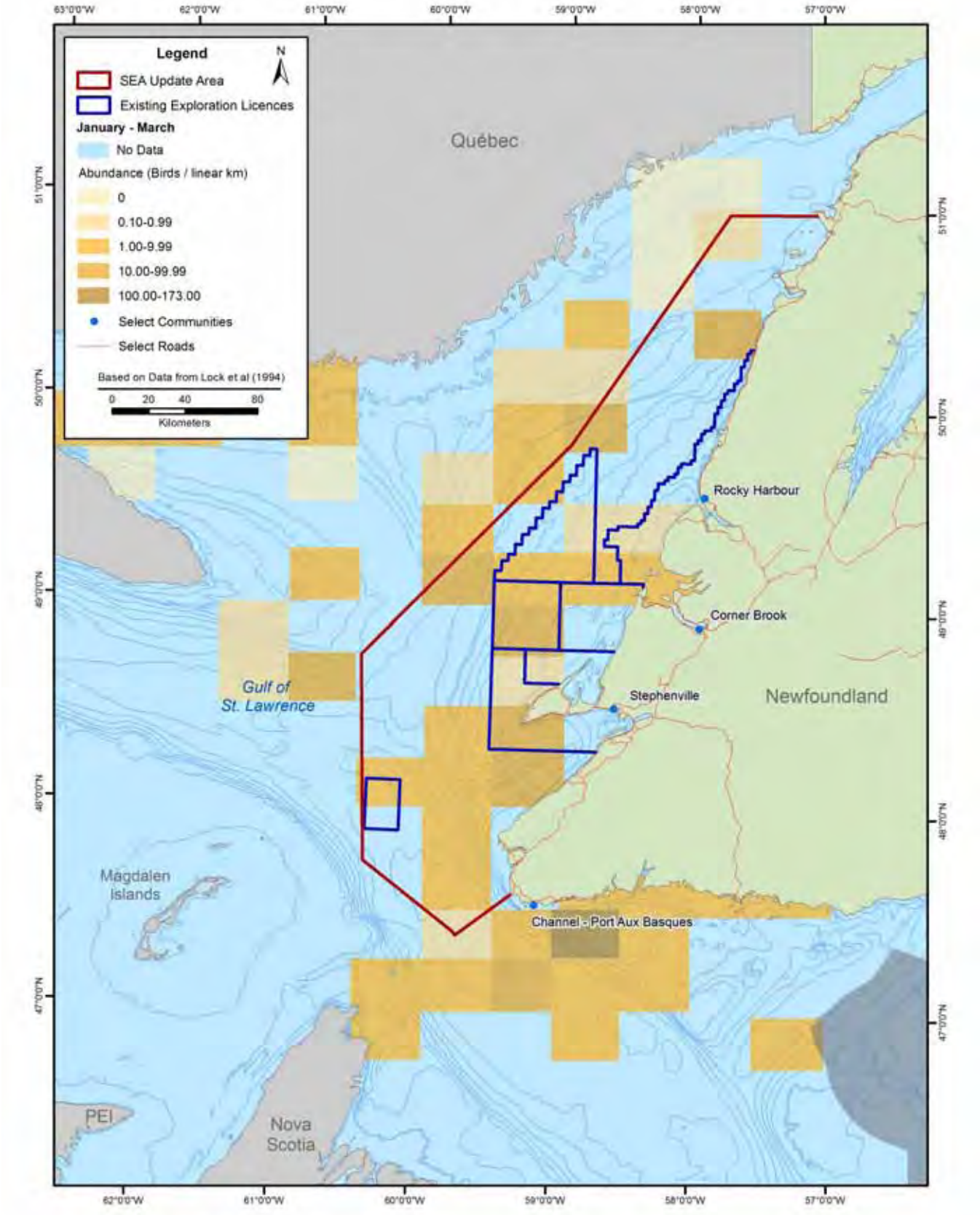


Figure 4.55 Distribution and Seasonal Abundance of Seabirds (April - June)

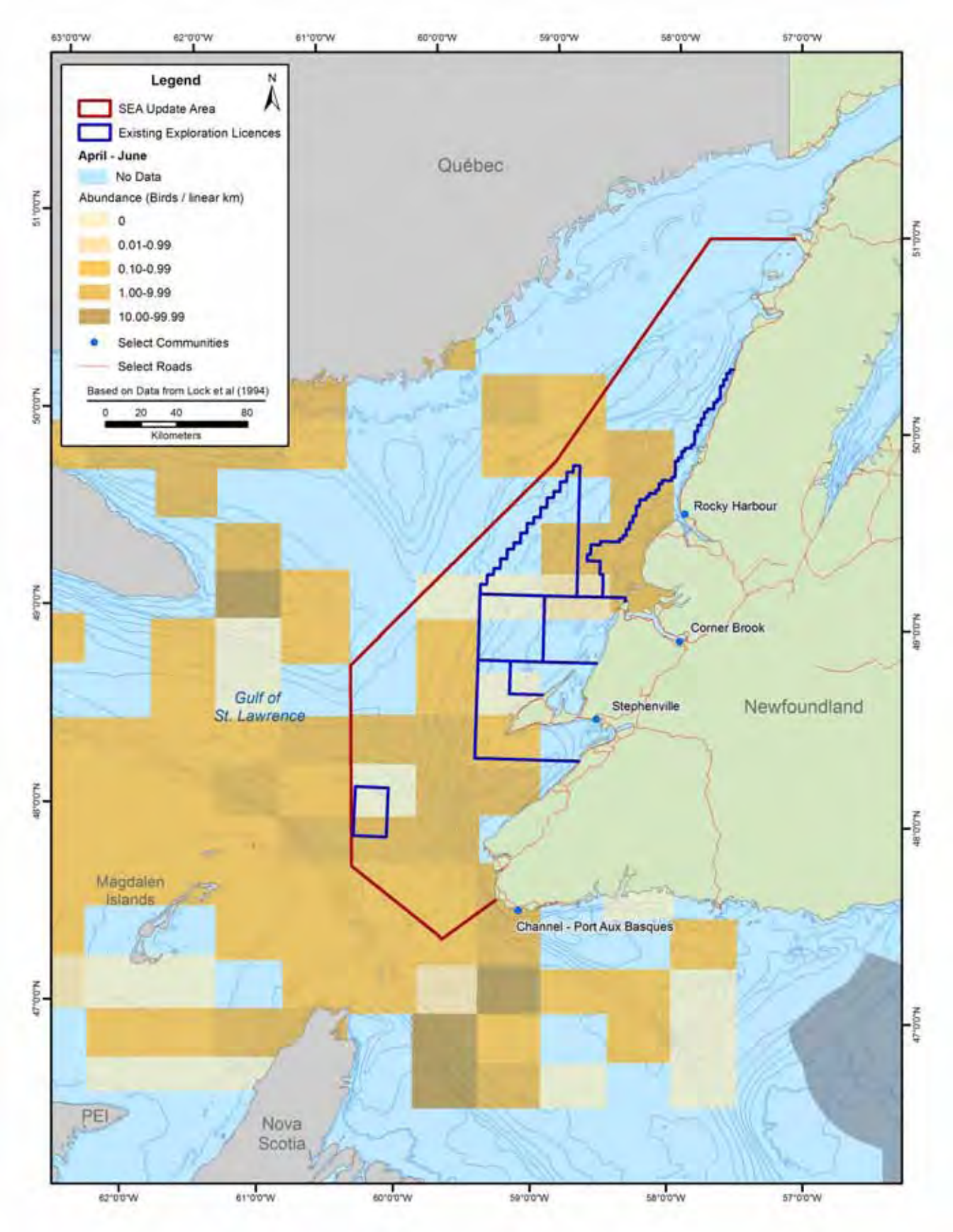


Figure 4.56 Distribution and Seasonal Abundance of Seabirds (July - September)

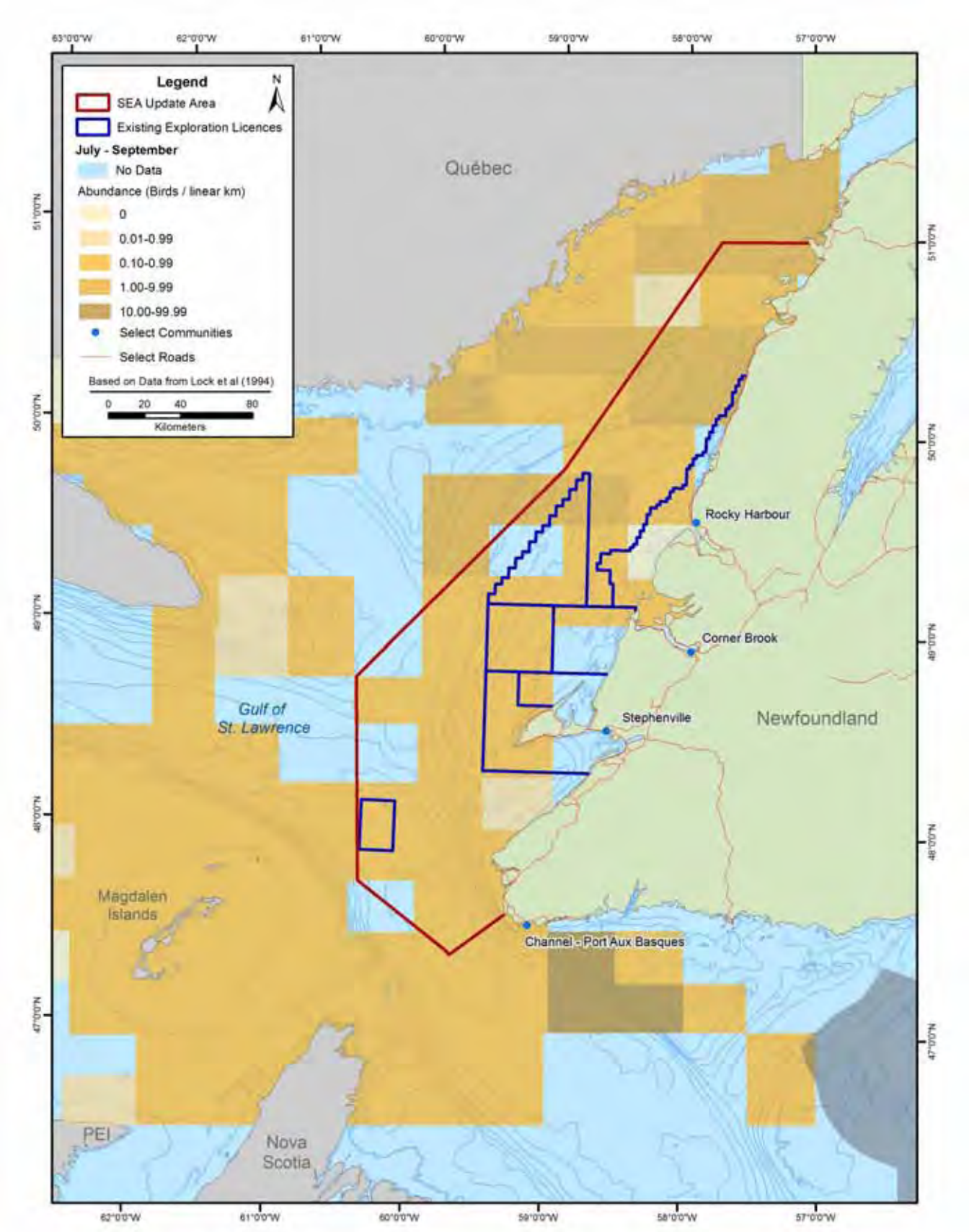


Figure 4.57 Distribution and Seasonal Abundance of Seabirds (October-December)

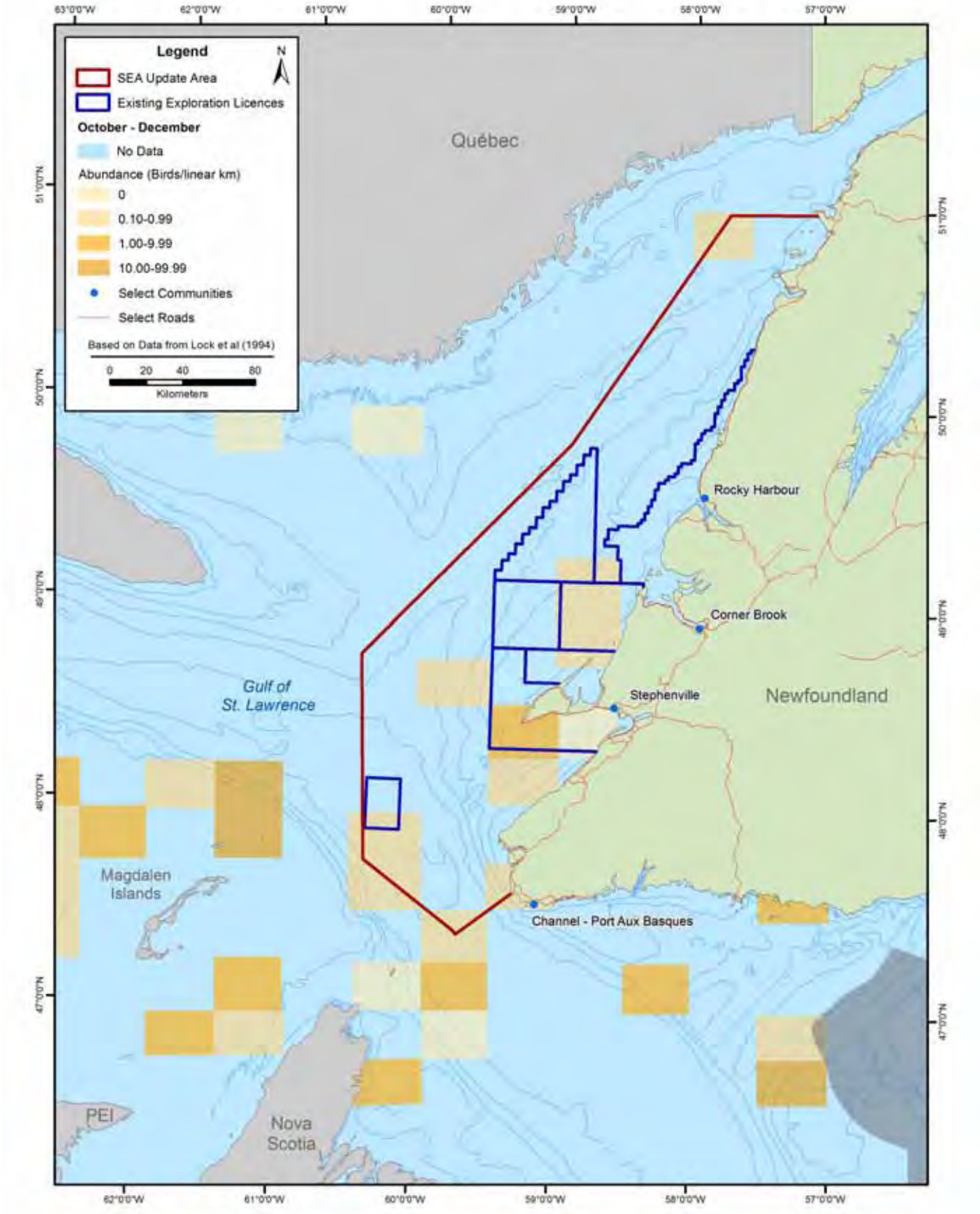
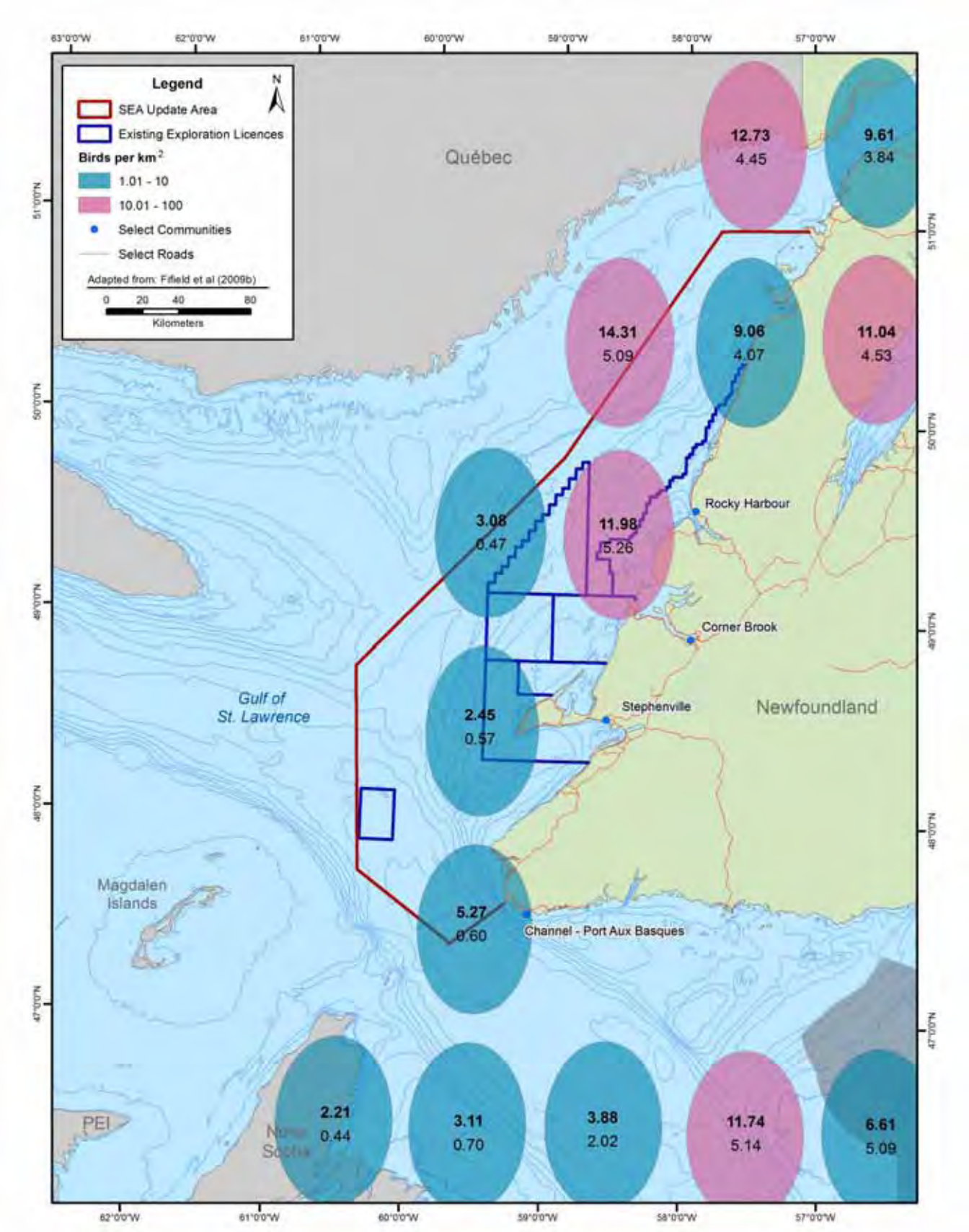


Figure 4.58 CWS May to August Eastern Canada Seabird at Sea Surveys in the SEA Update Area



Cormorants

Cormorants are represented by two species in the SEA Update Area. Table 4.47 summarizes the habits, habitats and key life history characteristics of these cormorant species.

Table 4.47 Overview of Cormorant Species Occurring in the SEA Update Area

Cormorants (*Phalacrocoracidae*)	Summary	Reference(s)
Description	• Large-bodied, long-necked black seabirds with colourful bare facial patches. • Long-lived colonial seabirds. • Two species found in SEA Update Area: Double-crested Cormorant and Great Cormorant. • Great Cormorant is widespread along the eastern coast of North America, while Double-crested is found on east and west coasts as well as inland. • Both species are secure in Canada. Double-crested Cormorant populations have increased significantly since 1970.	Hatch and Weseloh (1999); Hatch et al (2000); Environment Canada (2011)
Habitats and Movements	• Coastal species; typically found in shallow (< 8 m) waters. • Arrive at breeding territory in early spring • North Atlantic populations of Double-crested Cormorants migrate south in late fall • Great Cormorants are partial migrants, with some individuals remaining within the breeding range year round.	Hatch and Weseloh (1999); Hatch et al (2000)
Reproduction	• Nests may be constructed on cliffs, artificial platforms, rocky ground, shrubs or trees. • Begin to breed at 3 (sometimes 2) years of age. • Mean clutch size: 4 eggs (range 1-7). • Great Cormorant: Egg-laying begins in mid-April. Chick rearing takes place from mid-May until mid-August. • Double-crested Cormorant: Egg-laying begins in early May. Chick rearing is from early June until late August. • Number of fledglings per breeding pair for populations in eastern Canada range from 0.98 - 2.35 (Double-crested) and 1.2 - 1.97 (Great).	Hatch and Weseloh (1999); Hatch et al (2000)
Foraging Strategy and Food Sources	• Feed by pursuit diving to depths of up to 35 m, though typically 10 m or shallower • Prey on a wide variety of small fish (typically < 20 cm) and invertebrates, predominantly marine bottom species	Hatch and Weseloh (1999); Hatch et al (2000)

Great and Double-crested Cormorant breed in a few locations along the west coast of Newfoundland. As with all seabird species, breeding colonies are particularly sensitive areas for populations. Within the SEA Update Area, small colonies of both species are found at Bay of Islands, the northern portion of Gros Morne National Park, Guernsey Island and Woods Island (Lock et al 1994). From aerial surveys of Western Newfoundland (CWS, unpublished data) and ground surveys within Gros Morne National Park (S. Gerrow, Parks Canada, unpubl. data), two colonies of up to 100 breeding pairs and three colonies of up to 500 breeding pairs of cormorants are known to occur within the SEA Update Area. Although Double-crested Cormorants have a wide distribution in Newfoundland, the breeding range of Great Cormorants is restricted to the south and southwest coast of the island (Cairns et al 1989).

Both cormorant species are abundant in the SEA Update Area in spring, summer and autumn, while Double-crested are absent and Greats are uncommon in the SEA Update Area in winter (Husky Energy 2000).

Gannets

A single gannet species, the Northern Gannet, is found in the SEA Update Area. Table 4.48 summarizes the habits, habitats and key life history characteristics of the Northern Gannet.

Table 4.48 Overview of Gannet Species Occurring in the SEA Update Area

Gannets (*Sulidae*)	Summary	Reference(s)
Description	• Northern Gannet is a large-bodied seabird with long neck and large, bluish bill. Adult plumage is white with yellowish-buff wash on head and neck, black wing tips. Long-lived colonial seabird. • Entire Northwest Atlantic breeding population is confined to six colonies in eastern Newfoundland and Québec. Winter range extends along the eastern coast of the United States, as far as northern Mexico. • Gannets are secure in Canada, with a steadily increasing population of between 200,000 and 300,000 breeding adults.	Mowbray (2002); Environment Canada (2011)
Habitats and Movements	• Gannets typically inhabit continental shelf waters at all times of the year. • Adults arrive at breeding territory in mid-April, followed a few weeks later by subadults. • Juvenile gannets begin a southward migration in September. Adults and older immatures may travel north from the breeding colonies in order to feed along the Labrador Coast before beginning southward migration.	Mowbray (2002)
Reproduction	• Nests in dense colonies on cliff ledges, typically on islands, but occasionally inaccessible mainland areas. • Age at first breeding between 4 and 7 years. • Clutch size: 1 egg. • Egg-laying begins in mid-May. Chick rearing takes place from late June until early October. • Number of fledglings per year per breeding pair: 0.81.	Montevecchi and Porter (1980); Mowbray (2002)
Foraging Strategy and	• Feeds by deep plunge diving from a height of 10 - 40 metres above the surface.	Montevecchi and Porter (1980);

Gannets (*Sulidae*)	Summary	Reference(s)
Food Sources	• Large flocks (up to 1000 birds) may congregate over shoals of food fish. • Descends to depths of up to 15 m. • During breeding season, may travel up to 180 km from breeding colony to forage. • Preys on shoaling fish, predominantly herring, mackerel and capelin, as well as invertebrates such as squid.	Mowbray (2002)

Although Northern Gannets do not breed in the SEA Update Area, individuals from the large colonies in the north shore of Québec frequent the region in the summer months (Fifield et al 2009b). Gannets are uncommon off western Newfoundland in the spring and fall, and absent in winter (Husky Energy 2000). In the summer months, areas of high prey density where individuals may forage in groups of more than 1,000 are particularly sensitive for Northern Gannets; two such feeding areas have been identified near Gros Morne and at Pointe Riche, near the Port au Choix National Historic Site (Parks Canada 2012d). The largest concentrations of gannets observed during the 2006 - 2009 ECSAS summer surveys were in the central and northern portions of the SEA Update Area (Fifield et al 2009b).

Phalaropes

The Red Phalarope and Red-necked Phalarope are occasionally encountered in the SEA Update Area. While taxonomically aligned with shorebirds such as sandpipers and plovers (Family: *Scolopacidae*), the phalaropes that occur in the region are pelagic outside of the breeding season (Table 4.49).

Table 4.49 Overview of Phalarope Species Occurring in the SEA Update Area

Phalaropes (*Scolopacidae*)	Summary	Reference(s)
Description	• Two species occur offshore in the SEA Update Area, the Red Phalarope and the Red-necked Phalarope. • Among the smallest seabirds, phalaropes are unusual in that they display reverse sexual dimorphism, females being larger and more brightly coloured than males. • Both species breed throughout the Arctic and winter in offshore waters, mostly in tropical and sub-tropical regions. • Red-necked Phalarope populations have decreased slightly, while insufficient data exists to determine population trends for Red Phalaropes. Both species are estimated to have a population of over 1,000,000 adults in Canada.	Rubega et al (2000); Tracy et al (2002); Environment Canada (2011)
Habitats and Movements	• Phalaropes spend most of the year offshore, coming on land only during the summer months to breed. • Found in Arctic tundra during breeding season. • Typically spend winter along offshore ocean fronts, where upwellings are associated with higher prey densities.	Rubega et al (2000); Tracy et al (2002)
Reproduction	• Ground nester, lays eggs in short vegetation (e.g. sedges, mossy hummocks) typically close to fresh water. • Male is sole provider; female leaves shortly after egg laying. • Typically breed in first year.	Rubega et al (2000); Tracy et al (2002)

Phalaropes (*Scolopacidae*)	Summary	Reference(s)
	• Clutch size: typically 4. • Egg-laying begins in late May to early June. Chick rearing takes place from mid-July until early September. • Number of fledglings per year highly variable depending on predator populations; average believed to be approximately 10 percent in Canada for the Red Phalarope.	
Foraging Strategy and Food Sources	• Phalaropes employ a unique surface feeding strategy whereby they spin in tight circles on the water surface, churning prey upwards to within reach. • Feed on zooplankton and small aquatic invertebrates.	Rubega et al (2000); Tracy et al (2002)

Both phalarope species are absent from the region in winter, and scarce in all other seasons (Husky Energy 2000). Individuals that are present are likely to congregate in areas where prey items are most readily available, such as along ocean fronts and around upwellings, and it is in these areas where phalaropes are most vulnerable to disturbance.

Gulls

Several species of gulls occur in the SEA Update Area throughout the year, including five species that are known to breed in Western Newfoundland (Table 4.50).

Table 4.50 Overview of Gull Species Occurring in the SEA Update Area

Gulls (*Laridae*)	Summary	Reference(s)
Description	• Nine species occur in the SEA Update Area: Herring Gull, Iceland Gull, Glaucous Gull, Great Black-backed Gull, Ring-billed Gull , Black-headed Gull, Sabine's Gull, Ivory Gull and Black-legged Kittiwake. • One species, the Ivory Gull, is considered at risk at the federal and provincial level. This species has suffered a large decrease in numbers since 1970, with an estimated population of 500 - 1000 pairs in Canada. • There are insufficient data to estimate Sabine 's Gull population trends. Glaucous gulls are in global decline and are known to occur in the SEA Update Area. Regional data concerning Glaucous Gulls are sparse, but it is likely that this species is in decline in the area as well. Further research is required. However, all other species are considered secure.	Gilchrist (2001); Good (1998); Pierrotti and Good (1994); Snell (2002); Mallory et al (2008); Pollet et al (2012); Day et al (2001); Fifield et al (2009b); Environment Canada (2011)
Habitats and Movements	• Iceland, Glaucous, Ivory and Sabine's breed in the Arctic; Iceland and Glaucous occur in offshore and coastal areas outside the breeding season, while Ivory and Sabine's are restricted to offshore waters the rest of the year. • Herring, Great Black-backed, Ring-billed and Black-headed Gulls, as well as Black-legged Kittiwakes, are found in temperate areas year-round.	Fifield et al (2009b); Gilchrist (2001); Good (1998); Pierrotti and Good (1994); Snell (2002); Mallory et al (2008); Pollet et al (2012); Day et al (2001)

Gulls (*Laridae*)	Summary	Reference(s)
Reproduction	• Most species are ground nesters, although Black-legged Kittiwake breeds on cliffs. • Typically begin to breed at between 3 and 7 years of age • Clutch size: typically 2-3. • Egg-laying begins in late May to early June. Chick rearing takes place from mid-June to early August.	Gilchrist (2001); Good (1998); Pierrotti and Good (1994); Snell (2002); Mallory et al (2008); Pollet et al (2012); Day et al (2001)
Foraging Strategy and Food Sources	• Surface feeders. • Feed on invertebrates (cephalopods and crustaceans) and fish, as well as offal. • Large gulls including Herring and Great Black-backed also prey on eggs, young, and occasionally adults of other seabird species.	Gilchrist (2001); Good (1998); Pierrotti and Good (1994); Snell (2002); Mallory et al (2008); Pollet et al (2012); Day et al (2001)

Herring and Great Black-backed Gulls breed in many locations, individually or in colonies, along the coastal reaches of the SEA Update Area. Ring-billed Gulls, Black-legged Kittiwakes and Black-headed Gulls nest in several locations on the coast of Western Newfoundland. The Black-headed Gull is a European species considered to be locally rare, as it nests in very few places in North America. Its breeding areas in Stephenville Crossing and Flat Bay Island/Sandy Point are considered important.

Herring, Iceland and Great Black-backed Gulls are considered common in the SEA Update Area over much of the year, while Glaucous Gulls are absent in summer and otherwise uncommon (Husky Energy 2000). Collectively, large gulls (including Herring, Iceland, Glaucous and Great Black-backed) are found in large concentrations in coastal and offshore waters throughout the entire SEA Update Area in the summer months (Fifield et al 2009b). Ivory Gull and Sabine's Gull are high Arctic species which are occasionally found in offshore waters of the SEA Update Area. The former is absent off the coast of western Newfoundland in the summer and occurs only rarely in other seasons, while the latter is a rare Autumn visitor (Husky Energy 2000).

Terns

Three tern species occur in Western Newfoundland. Table 4.51 presents information on the habits, habitats and key life history characteristics of tern species in the SEA Update Area.

Table 4.51 Overview of Tern Species Occurring in the SEA Update Area

Terns (*Sternidae*)	Summary	Reference(s)
Description	• Three species occur in the SEA Update Area: Common Tern, Arctic Tern and Caspian Tern. • Widely distributed throughout North America, although the Caspian Tern is locally uncommon. • Populations are considered stable in Canada, with little change since the 1970s, at between 100,000 and 200,000 individuals for Common and Arctic Terns. Caspian Tern populations are somewhat smaller.	Hatch (2002); Nisbet (2002); Cuthbert and Wires (1999); Environment Canada (2011)
Habitats and Movements	• Breed in northern North America, often on islands and typically in areas with sand or low vegetation. • Found in coastal and offshore waters.	Hatch (2002); Nisbet (2002); Cuthbert and Wires (1999)

Terns (*Sternidae*)	Summary	Reference(s)
	• Arctic Terns undertake long migrations to the waters off of Antarctica, while Common and Caspian Terns winter in Central and South America.	
Reproduction	• Ground nester. • Begin to breed at 2 to 4 years of age. • Clutch size: 1 - 3 eggs. • Egg-laying begins in early June. Chick rearing takes place from mid-July until early August. • Chicks fledged per pair varies between 0.59 and 2.0 in different studies.	Hatch (2002); Nisbet (2002); Cuthbert and Wires (1999)
Foraging Strategy and Food Sources	• Surface feeding and pursuit plunging. • Feed on fish and small crustaceans.	Hatch (2002); Nisbet (2002); Cuthbert and Wires (1999)

Terns are most vulnerable to perturbation during the breeding season, and near their colonies; the islands near Cow Head and in St. Paul's Inlet support over 1000 pairs of Common and Arctic Terns, and is believed to be the largest breeding population in Newfoundland (Parks Canada 2012d). They are common in the waters off Western Newfoundland in spring and summer, but generally scarce in fall and absent in winter (Husky Energy 2000), although they are considered abundant in the Gros Morne area through to mid-October (Parks Canada 2012d). Caspian Terns are a locally uncommon species, and within the SEA Update Area, believed to breed only at Stephenville Crossing and at Little Island (St. Paul's Inlet) in Gros Morne National Park.

Alcids

Six alcid species utilize the waters off of Western Newfoundland during at least part of the year. Only one is known to breed in the SEA Update Area (Table 4.52).

Table 4.52 Overview of Alcid Species Occurring in the SEA Update Area

Alcids (*Alcidae*)	Summary	Reference(s)
Description	• Six species occur in the SEA Update Area: Dovekie, Razorbill, Common Murre, Thick-billed Murre, Atlantic Puffin and Black Guillemot. • Alcids are heavy-bodied and proportionately small winged black-and-white birds of the northern hemisphere. • Distribution of alcids in eastern North America is from the high arctic to north of the Carolinas. • Alcid populations are considered secure, with many species showing slight increases in number in recent years.	Ainley et al (2002); Gaston and Hipfner (2000); Butler and Buckley (2002); Lowther et al (2002); Lavers et al (2009); Fifield et al (2009b); Environment Canada (2011)
Habitats and Movements	• Breed on offshore islands or inaccessible cliffs, away from terrestrial predators. • Typically found in offshore waters outside the breeding season; however, Black Guillemot tends to prefer more coastal environments, often close to breeding colonies. • Thick-billed Murre and Dovekie are largely arctic species that	Ainley et al (2002); Gaston and Hipfner (2000); Butler and Buckley (2002); Lowther et al (2002); Lavers et al (2009)

Alcids (*Alcidae*)	Summary	Reference(s)
	range into offshore eastern Canada only in winter.	
Reproduction	• Cliff nesters and cavity nesters in inaccessible (typically island) colonies. • Typically breed at 2 years or older. • Clutch size: 1 for most species; 2 for Black Guillemot • Egg-laying begins in May to early June. Chick rearing takes place from mid-June until late August. • Number of fledglings per pair varies from 0.26 - 0.72 for Black Guillemot (the only species breeding in the SEA Update Area).	Ainley et al (2002); Gaston and Hipfner (2000); Butler and Buckley (2002); Lowther et al (2002); Lavers et al (2009)
Foraging Strategy and Food Sources	• Feed by pursuit diving. • Primary food source in Newfoundland is small fish such as capelin and sandlance, also take some invertebrates.	Ainley et al (2002); Gaston and Hipfner (2000); Butler and Buckley (2002); Lowther et al (2002); Lavers et al (2009)

Among seabirds, alcids (particularly murres) are considered to be particularly vulnerable to the effects of oil spills, because they spend a large proportion of their time on the water relative to more aerial species (Fifield et al 2009a). During the breeding season, Razorbills, Common Murres and Atlantic Puffins breeding in Québec occur offshore in the SEA Update Area; however, alcids are not considered abundant there at any time of year (Husky Energy 2000). In recent surveys conducted in the SEA Update Area during the summer months, Dovekies were not reported, while murres and other alcid species were found in moderate numbers (0.11 - 4.62 birds/km^2) in all but the southern part of the SEA Update Area (Fifield et al 2009b).

Jaegers and Skuas

Jaegers and skuas are occasional visitors to the SEA Update Area; four species occur with some regularity in Western Newfoundland (Table 4.53).

Table 4.53 Overview of Jaeger and Skua Species Occurring in the SEA Update Area

Jaegers and Skuas (*Stercorariidae*)	Summary	Reference(s)
Description	• Four species occur in SEA Update Area: Pomarine Jaeger, Parasitic Jaeger, Long-tailed Jaeger and Great Skua. • High arctic breeders which are found in offshore waters the rest of the year. • Great Skuas do not breed in Canada, but are occasionally seen in offshore waters of the northwest Atlantic. • Insufficient data exist to determine population trends for jaegers. All three species are estimated to have a population of over 100,000 – 200,000 adults in Canada.	Wiley and Lee (1998, 1999, 2000); Environment Canada (2011)
Habitats and Movements	• Jaegers and skuas spend most of the year offshore, coming on land only during the summer months to breed. • Breed in Arctic tundra.	Wiley and Lee (1998, 1999, 2000)

Jaegers and Skuas (*Stercorariidae*)	Summary	Reference(s)
Reproduction	• Breeds in high Arctic tundra • Age at first breeding believed to be typically 4 years. • Clutch size: typically 2. • Egg-laying begins in late May to early June. Chick rearing takes place from mid-July until early September. • Number of fledglings per pair varies with factors such as parental experience and prey density; range is between approximately 0.5 - 1.5.	Wiley and Lee (1998, 1999, 2000)
Foraging Strategy and Food Sources	• Frequently engage in kleptoparisitism, stealing food items from other seabirds, especially in winter; Long-tailed and Pomarine Jaegers largely predatory during breeding, feeding on lemmings and voles.	Wiley and Lee (1998, 1999, 2000)

Jaegers and skuas are scarce in the waters off Western Newfoundland, and absent in winter (Husky Energy 2000). They are not known to breed in the SEA Update Area, and therefore, their populations are not considered highly vulnerable.

Fulmars and Shearwaters

Four members of the shearwater family occur in the SEA Update Area. Table 4.54 presents information on the habits, habitats and key life history characteristics of fulmars and shearwaters in the SEA Update Area.

Table 4.54 Overview of Fulmar and Shearwater Species Occurring in the SEA Update Area

Fulmars and Shearwaters (*Procellariidae*)	Summary	Reference(s)
Description	• Northern Fulmar and three shearwater species, Greater Shearwater, Sooty Shearwater and Manx Shearwater, occur in the SEA Update Area. • Wide-ranging at sea outside of the breeding season. • Only the Northern Fulmar and Manx Shearwater nest in Canada; the other two shearwater species breed in the Southern hemisphere. • Fulmar populations have shown little change in recent years, with a stable population of 300,000 – 400,000 individuals. • Manx Shearwaters breed in one small colony of less than 100 birds in southern Newfoundland which has shown a recent slight decline.	Lee and Haney (1996); Fifield et al 2009b; Environment Canada (2011); Mallory et al (2012)
Habitats and Movements	• Spend most of the year in coastal and offshore waters, primarily along the continental shelf in temperate to cold water environments. • Breed on islands, often on cliffs.	Lee and Haney (1996); Mallory et al (2012);
Reproduction	• Most shearwaters are burrow nesters, while fulmars nest on cliffs. • Typically start to breed at 5-8 years, female fulmars generally older at first breeding.	Lee and Haney (1996); Mallory et al (2012);

Fulmars and Shearwaters (*Procellariidae*)	Summary	Reference(s)
	• Clutch size: 1. • Number of fledglings per pair per season ranges from 0.28 - 0.62	
Foraging Strategy and Food Sources	• Shearwaters feed by pursuit plunging, while fulmars are typically surface feeders. • Feed on fish, offal, squid.	Lee and Haney (1996); Mallory et al (2012);

Members of the shearwater family are uncommon to scarce in the waters off of Western Newfoundland, and (except for the fulmar) are entirely absent in winter (Husky Energy 2000). In recent surveys in the Gulf of St. Lawrence, fulmars were found in low to moderate numbers (0.14 - 4.19 birds / km^2) off the west coast of Newfoundland, while shearwaters were almost entirely absent (Fifield et al 2009b). These species are not known to breed in the SEA Update Area. Because they are locally relatively sparse, their populations are also not considered particularly vulnerable to the effects of offshore activity in the SEA Update Area, although shearwaters are known to be strongly attracted to artificial light sources including flaring (Wiese et al 2001).

Storm-petrels

Two species of storm-petrel, which are small relatives of shearwaters, are found in the SEA Update Area (Table 4.55).

Table 4.55 Overview of Storm-petrels Occurring in the SEA Update Area

Storm-petrels (*Hydrobatidae*)	Summary	Reference(s)
Description	• Two species in SEA Update Area, Leach's Storm-petrel and Wilson's Storm-petrel. • Among the smallest of seabirds, both species are dark in colour with a white rump and with a decidedly bat-like flight. • Only Leach's breeds in Canada; Wilson's is an Antarctic breeder. • While there are insufficient data to assess population trends, there are over 10 million breeding Leach's Storm-petrels in Canada.	Huntington et al (1996); Fifield et al (2009b); Environment Canada (2011)
Habitats and Movements	• Breed on offshore islands • Highly pelagic; even during breeding season returns to land only at night.	Huntington et al (1996)
Reproduction	• Nests in burrows in offshore islands. • Age at first breeding typically breed in fifth year. • Clutch size: 1. • Egg-laying begins in early June. Chick rearing takes place from mid-July until late October. • Fledging success in Newfoundland estimated at 48 percent.	Huntington et al (1996)

Storm-petrels (*Hydrobatidae*)	Summary	Reference(s)
Foraging Strategy and Food Sources	• Surface feeders, hovering over the surface while gleaning prey items. • Often follow ships and fishing boats (particularly Wilson's) • Feed on zooplankton, small crustaceans.	Huntington et al (1996)

Wilson's Storm-petrels are rare summer visitors to western Newfoundland, and absent in all other seasons, while Leach's Storm-petrels are absent in winter and uncommon the rest of the year (Husky Energy 2000). In recent surveys, storm-petrels were absent close to the western coast of Newfoundland, and reported in low numbers (0.10 - 0.21 birds/km^2) further offshore (Fifield et al 2009b). These species are not known to breed in the SEA Update Area.

4.2.2.2 Waterfowl, Loons and Grebes

Waterfowl, loons, and grebes spend much of their time on the water's surface. Although loons and grebes are not waterfowl, they have fairly similar life histories and therefore similar vulnerabilities to development. Accordingly they have been combined in this section (Table 4.56).

Broadly, waterfowl may be categorized as dabbling ducks (primarily inland breeders) and diving ducks (most of which are considered "sea ducks" as they spend much of the non-breeding season at sea).

Table 4.56 Overview of Coastal Waterfowl, Loons and Grebes Occurring in the SEA Update Area

Waterfowl (Anatidae), Loons (Gaviidae), Grebes (Podicipedidae)	Summary	Reference(s)
Description	• The Common Loon, Pied-billed Grebe and at least 14 species of waterfowl breed in Newfoundland, and over 20 occur in the SEA Update Area during at least part of the year. • Populations of inland-breeding duck species surveyed by CWS (American Black Duck, Mallard, Green-winged Teal and Ring-necked Duck) are considered stable throughout Eastern Canada. • Available information indicates that sea duck populations are stable; however, because most sea ducks breed in remote areas, population trends are relatively poorly known. • The Common Eider is the most abundant waterfowl species in all seasons in coastal Newfoundland.	Lock et al (1994); CWS Waterfowl Committee (2012); Warkentin and Newton (2009); IBA 2012
Habitats and Movements	• Most nest inland on freshwater lakes and rivers; some (e.g. American Wigeon, Blue-winged Teal, Northern Shoveler, Pied-billed Grebe) nest in estuaries. Common Eider breeds in colonies on coastal islands. • In the fall, many species aggregate at staging areas. • Many species spend winter months offshore in the study area (e.g. scoters, mergansers, Common Goldeneye, Long-tailed Duck, Common Eider).	IBA (2012); Lock et al (1994)

Waterfowl (Anatidae), Loons (Gaviidae), Grebes (Podicipedidae)	Summary	Reference(s)
Reproduction	• Loons, grebes and sea ducks typically have lower reproductive rates compared with inland duck species.	CWS Waterfowl Committee (2012); Warkentin and Newton (2009)
Foraging Strategy and Food Sources	• The main foraging strategies of this group are diving and dabbling (surface-feeding).	Warkentin and Newton (2009)

The Codroy River estuary supports particularly large concentrations of breeding waterfowl, including American Wigeon, Blue-winged Teal, Northern Shoveler and Pied-billed Grebe (IBA 2012). A major eider colony is found at St. John Bay in the SEA Update Area, and there are some smaller colony sites.

Significant late summer-early fall staging areas for waterfowl within the SEA Update Area include the Codroy River estuary where at least 20 waterfowl species have been recorded, including significant aggregations of Canada Geese (IBA 2012). Flat Bay Island/Sandy Point, Stephenville Crossing, St. Paul's Inlet and Parsons Pond all support staging Canada Geese and American Black Duck.

Scoters, Long-tailed Ducks and Common Eiders can occur in large flocks ("rafts") in coastal waters from autumn to spring (Lock et al 1994). Common Goldeneye, Common Merganser and Red-breasted Merganser winter in large numbers in coastal areas along Western Newfoundland. Barrow's Goldeneye moults and winters in Western Newfoundland at Stephenville Crossing and at the mouth of the Humber River (Schmelzer 2006), regularly winters in Rocky Harbour, and has also been observed in small numbers at Portland Creek, Shallow Bay / Cow Head, St. Paul's Bay, Western Brook Beach, Norris Point and Corner Brook (Parks Canada 2012d).

Harlequin Duck breed in several streams in Gros Morne National Park (Stassinu Stantec 2010), and occur in coastal waters at the mouths of nesting streams in the SEA Update Area during both spring and fall staging. In late summer to fall, a small moulting concentration congregates at Stearin Island, one of just three such sites in Newfoundland. In the winter, Harlequin Ducks are found along rocky coastline, subtidal ledges, and exposed headlands (NLDEC 2012a).

4.2.2.3 Shorebirds

Shorebirds in the SEA Update Area are most abundant during migration, particularly from July to September, when Arctic-nesting species migrate through the area to their wintering areas. Many species utilize coastal habitats such as sandy mudflats, and have foraging strategies that can bring them into contact with marine oil spills, such as foraging at the water's edge, on flats exposed at low tide, or while wading in shallow water (Table 4.57).

Table 4.57 Overview of Shorebird Species Occurring in the SEA Update Area

Shorebirds (Scolopacidae, Charadriidae)	Summary	Reference(s)
Description	• At least 28 species of shorebirds pass through Western Newfoundland during fall migration. • Commonly seen migrants include Semipalmated Sandpiper, White-rumped Sandpiper, Greater Yellowlegs, Semipalmated Plover and Black-bellied Plover. • Other species reported less frequently in the area include Ruddy Turnstone, Least Sandpiper, Sanderling, Buff-breasted Sandpiper and the endangered *rufa* subspecies of Red Knot. • Small numbers of shorebirds breed on the coast of Western Newfoundland, including the endangered Piping Plover, Willet, Least Sandpiper, Greater Yellowlegs, Semipalmated Plover and Killdeer.	Warkentin and Newton (2009); Parks Canada (2012d); Elphick and Tibbitts (1998); Nebel and Cooper (2008)
Habitats and Movements	• Shorebirds are generally long distance migrants, and most species that occur in the study area nest in the far north. • Spring and fall migration routes differ; in Atlantic Canada, greater numbers of most species are seen during fall migration.	Morrison (2001)
Reproduction	• Most species typically lay four eggs. Incubation lasts approximately three weeks. • Chicks are relatively precocious, leaving the nest within 24 hours of hatching, although they are unable to fully thermoregulate for the first few days.	Warkentin and Newton (2009); Morrison (2001)
Foraging Strategy and Food Sources	• Most shorebirds feed in tidal mudflats, probing the sand with their long bills. • Some species (e.g. Whimbrel) feed on berries in coastal barrens. The Purple Sandpiper feeds on small invertebrates (e.g. mollusks) along rocky shorelines and offshore ledges and islands.	Warkentin and Newton (2009)

Although Newfoundland does not host a high proportion of all fall migrating shorebirds along the Atlantic Flyway, the west coast of Newfoundland hosts the greatest proportion of migrating shorebirds within the province, including a particularly high proportion of migrating White-rumped Sandpipers and Semipalmated Sandpipers in the province. Flat Bay Island / Sandy Point supports the greatest numbers and diversity of fall shorebird migrants; other important stopovers for shorebirds in and near Western Newfoundland include Eddies Cove East, Parson's Pond, the Gros Morne National Park IBA (particularly at St. Paul's Bay and St. Paul's Inlet, Shallow Bay and Western Brook Beach), Point au Mal, Piccadilly Lagoon, West Bay, Black Duck Brook, Stephenville Crossing, and the Grand Bay West to Cheeseman Provincial Park IBA. A significant percentage of Newfoundland's Piping Plovers nest in the Grand Bay West to Cheeseman Provincial Park IBA (IBA 2012).

In the winter months, from November to April, Purple Sandpipers are present along rocky shorelines and offshore ledges and islands along the coast.

4.2.2.4 Other Birds (Including Passerines)

Western Newfoundland is home to many breeding landbirds, most of which are migratory (Warkentin and Newton, 2009). While most of these species do not occur in the marine environment for most of the year, during migration many species fly long distances over water. In particular, passerines are primarily nocturnal migrants that are known to be attracted to artificial light sources, particularly in inclement weather conditions (e.g. fog). Certain species of landbirds also occasionally feed in coastal habitats (e.g. Bank Swallow, Savannah Sparrow, some raptor species).

Areas of particular importance to landbirds in Western Newfoundland in terms of both abundance and diversity include Gros Morne National Park and the Codroy Valley, with the latter supporting populations of two landbird species at risk (Red Crossbill *percna* subspecies and Bobolink), as well as locally uncommon species such as Ruby-throated Hummingbird, Gray Catbird, Red-eyed Vireo and Rose-breasted Grosbeak (IBA 2012).

4.2.2.5 Bird Species at Risk

A number of bird species that are currently or soon likely to be designated as being at risk (and are therefore protected) under the Canadian *Species at Risk Act* (*SARA*) and/or the Newfoundland and Labrador *Endangered Species Act* (*NL ESA*) are known or likely to occur in the SEA Update Area. These include the: 1) Piping Plover, 2) Harlequin Duck, 3) Barrow's Goldeneye, 4) Ivory Gull, 5) Red Knot (*rufa* subspecies), 6) Buff-breasted Sandpiper, 7) Peregrine Falcon, 8) Short-eared Owl and 9) Bank Swallow. Four of these avifauna species, the Piping Plover, Harlequin Duck, Short-eared Owl and Bank Swallow, are known to breed in coastal habitats in Western Newfoundland.

- *Piping Plover*: Designated as endangered under *SARA* and the *NL ESA*, the recovery plan for this species identifies a number of critical habitat beaches, including sites in the southern and southwestern part of the SEA Update Area, notably the Grand Bay West to Cheeseman Provincial Park IBA and Shallow Bay and Western Brook Beach in the Gros Morne IBA (Parks Canada 2012d; Environment Canada 2012b). The Piping Plover is present in the breeding grounds from April to September. As well, the Piping Plover nests on the Îles-de-la-Madeleine, where approximately 40 pairs are present each year. Québec provincial authorities have identified critical habitats for this species which will be legally protected under the provincial *Conservation et mise en valeur de la faune act* in the near future.

- *Harlequin Duck*: The eastern population of this species is designated as a species of special concern under *SARA*, and is considered vulnerable under the *NL ESA*. The Harlequin Duck breeds in fast-flowing streams, including several streams in Gros Morne National Park (Stassinu Stantec 2010), and occurs in coastal waters during both spring and fall staging at the mouths of nesting streams in the SEA Update Area. In late summer to fall, a moulting concentration of approximately 30 individuals congregates at Stearin Island, the largest of only three such sites in Newfoundland (Parks Canada 2012d). In the winter, they are found along rocky coastline, subtidal ledges, and exposed headlands (NLDEC 2012a).

- *Barrow's Goldeneye*: Designated as being of special concern and vulnerable under the *SARA* and *NL ESA*, respectively, the species moults and winters in small numbers, often in groups with Common Goldeneye, off the coast of Eastern Canada. It has been reported in Western Newfoundland at Stephenville Crossing and at the mouth of the Humber River (Schmelzer 2006), regularly winters in

Rocky Harbour, and has also been observed in small numbers at Portland Creek, Shallow Bay / Cow Head, St. Paul's Bay, Western Brook Beach, Norris Point and Corner Brook (Parks Canada 2012d). These birds are known to congregate in relatively small geographic areas in important shipping corridors, and therefore the population is considered to be particularly vulnerable to being affected by oil spills and the bioacculmulation of environmental contaminants (NLDEC 2012a).

- *Ivory Gull*: This species is currently designated as endangered under the federal and provincial legislation. It winters offshore, occurring in small numbers in the Strait of Belle Isle and northern Gulf of St. Lawrence. They are found most often among the pack ice, and are more rarely seen on the coast of the Northern Peninsula and ashore (Stenhouse 2004; NLDEC 2012a).

- *Red Knot (rufa subspecies):* This species is currently listed as endangered under *SARA* and *NL ESA*, and has been sighted in several coastal Newfoundland locations. On the west coast of the Island, the majority of sightings have been at Stephenville Crossing, Shallow Bay (Belldowns Point), Sandy Point and St. Paul's Inlet (Garland and Thomas 2009; Parks Canada 2012d), although they have also been observed in small numbers at Western Brook Beach and in Rocky Harbour (Parks Canada 2012d). During fall migration, from mid-August through late September, they frequent open sandy inlets, coastal mudflats, sand flats, salt marshes, sandy estuaries and areas with rotting kelp deposits (Garland and Thomas 2009; NLDEC 2012a). Newfoundland is not considered to be a major stopover location, so within the province threats to the species are considered unlikely to be severe (Garland and Thomas 2009).

- *Buff-breasted Sandpiper:* This species was recently designated as a species of special concern by COSEWIC (2012), and is not yet listed on Schedule 1. During fall migration surveys, small numbers of this species were observed by Parks Canada personnel in salt marshes at Tickle Point in St. Paul's Bay in 1994, 2010 and 2012 (Parks Canada 2012d).

- *Peregrine Falcon:* Designated as a species of Special Concern under *SARA* (both *anatum* and *tundrius* subspecies) and vulnerable under *NL ESA*, this species migrates along the west coast of Newfoundland during the fall and preys on concentrations of migrating shorebirds, including in the Gros Morne area at St. Paul's Bay and Western Brook Beach (Parks Canada 2012d).

- *Short-eared Owl:* This species, designated as being of special concern under *SARA* and vulnerable under *NL ESA*, occurs in low numbers on the west coast of Newfoundland where it typically nests in coastal barrens and grasslands, including in the Gros Morne area at Cow Head. Short-eared Owls have been observed hunting in dunegrass at Shallow Bay, Tickle Point (St. Paul's Bay) and Western Brook Beach (Parks Canada 2012d).

- *Bank Swallow:* This species, currently under assessment by COSEWIC (report expected in 2013), nests on the west coast of Newfoundland in burrows constructed in steep banks. Colonies are found near Tickle Point and Parson's Pond (Parks Canada 2012d).

The *Bald Eagle* designated in Québec as vulnerable, is common along coastal Newfoundland. They feed primarily on fish, often catching large fish from the near surface with their strong talons.

A summary overview of these species is provided in Table 4.58.

Two additional bird species at risk in Eastern Canada, the Roseate Tern and Eskimo Curlew, are not considered likely to occur in the SEA Update Area. Within North America, the Roseate Tern breeds in southern Nova Scotia and northeastern United States, and winters further south (Gochfeld et al 1998). The Eskimo Curlew once bred in large numbers in the Arctic and passed through Newfoundland and Labrador on its migration to the South American wintering grounds in the fall; however, the species numbers have declined sharply. There have been no confirmed sightings of the Eskimo Curlew since 1963, and the species is considered to possibly be extinct (COSEWIC 2009).

Table 4.58 Water Bird Species at Risk that are Known to or May Occur within the SEA Update Area

Common Name	Scientific Name	Population/Occurrence	Provincial Designation		SARA Status			COSEWIC Designation
			Province	Status	Endangered	Threatened	Special Concern	
Bald Eagle	*Haliaeetus leucocephalus*	Québec	QC	Vulnerable				
Barrow's Goldeneye	*Bucephala islandica*	Québec, New Brunswick, Prince Edward Island, Nova Scotia, Newfoundland and Labrador	NL	Vulnerable			Schedule 1	Special Concern
Harlequin Duck	*Histrionicus histrionicus*	Québec, New Brunswick, Nova Scotia, Newfoundland and Labrador	NL	Vulnerable			Schedule 1	Special Concern
			NS	Endangered				
Ivory Gull	*Pagophila eburnea*	Newfoundland and Labrador	NL	Endangered	Schedule 1			Endangered
Piping Plover (*Melodus* subspecies)	*Charadrius melodus melodus*	Québec, New Brunswick, Prince Edward Island, Nova Scotia, Newfoundland and Labrador	NL	Endangered	Schedule 1			Endangered
			QC	Threatened				
			NS	Endangered				
Red Knot (*Rufa* subspecies)	*Calidris canutus rufa*	Québec, New Brunswick, Prince Edward Island, Nova Scotia, Newfoundland and Labrador	NL	Endangered	Schedule 1			Endangered
			NS	Endangered				
Buff-breasted Sandpiper	*Tryngites subruficollis*	Yukon, Northwest Territories, Nunavut, British Columbia, Alberta, Saskatchewan, Manitoba, Ontario, Quebec, Nova Scotia, Newfoundland and Labrador						Special Concern
Peregrine Falcon	*Falco peregrinus anatum* and *tundrius*	Yukon, Northwest Territories, Nunavut, British Columbia, Alberta, Saskatchewan, Manitoba, Ontario, Québec, New Brunswick, Nova Scotia, Newfoundland and Labrador	NL	Vulnerable			Schedule 1	Special Concern
			QC	Vulnerable				
			NS	Vulnerable				
Short-eared Owl	*Asio flammeus*	Yukon, Northwest Territories, Nunavut, British Columbia, Alberta, Saskatchewan, Manitoba, Ontario, Québec, New Brunswick, Prince Edward Island, Nova Scotia, Newfoundland and Labrador	NL	Vulnerable			Schedule 1	Special Concern
Bank Swallow	*Riparia riparia*	Yukon, Northwest Territories, British Columbia, Alberta, Saskatchewan, Manitoba, Ontario, Québec, Prince Edward						Under assessment

Common Name	Scientific Name	Population/Occurrence	Provincial Designation		SARA Status			COSEWIC Designation
			Province	Status	Endangered	Threatened	Special Concern	
		Island, New Brunswick, Nova Scotia, Newfoundland and Labrador						

4.2.2.6 Locally Rare Species

In terms of other regionally rare species, the Black-headed Gull, previously a strictly European species, has only recently started to expand its breeding range into North America. Small breeding colonies at Flat Bay Island/Sandy Point and at Stephenville Crossing are, therefore, quite significant to the North American population of the species. Black-legged Kittiwakes, while abundant in eastern and northeastern Newfoundland, are restricted to just five colonies in western Newfoundland, all in the Port au Port area. The enriched coastal marshes of Flat Bay Island / Sandy Point and Stephenville Crossing also provide the only known nesting areas in Newfoundland for Willet, Sora and Great Blue Heron. Caspian Terns are believed to nest at Stephenville Crossing and in Gros Morne National Park (IBA 2012; Parks Canada 2012d).

4.2.2.7 Significant Bird Habitat Areas Including IBAs

Areas of particular importance to the survival of bird species may be given the designation of Important Bird Area (IBA). The IBA program is coordinated by BirdLife International, and administered in Canada by the Canadian Nature Federation and Bird Studies Canada (IBA 2012). The criteria used to identify important habitat are internationally standardized, and are based on the presence of species at risk, species with restricted range, habitats holding representative species assemblages, or a congregation of a significant proportion of a species' population during one or more season. These criteria are used to identify sites of national and international importance.

There are four IBA sites in the SEA Update Area (IBA 2012): 1) Codroy Valley (NF040); 2) Codroy Valley Estuary (NF041); 3) Grand Bay West to Cheeseman Provincial Park (NF038); and 4) Gros Morne National Park (NF045). In addition, locations of colonial and rare species nesting sites as well as select areas of regional importance are also considered in this section.

Codroy Valley IBA

The Codroy Valley IBA, on the southwestern tip of Newfoundland, encompasses a large triangular parcel of land between the Little Codroy River and the Grand Codroy River. This IBA is home to a number of forest bird species, including two species of restricted range, the Ovenbird and the Red Crossbill. The IBA is rich in woodland warbler species, and several species that are uncommon or absent elsewhere in Newfoundland are found here, including Ruby-throated Hummingbird, Gray Catbird, Red-eyed Vireo and Rose-breasted Grosbeak. Bobolink also breed in this IBA.

Codroy Valley Estuary IBA

Located immediately north of the Codroy Valley IBA at the mouth of the Grand Codroy River, this IBA is an important breeding and staging site for waterfowl. A continentally significant number of Canada Geese use this estuary as a staging area, and at least 20 waterfowl species are known to occur in the estuary including American Wigeon, American Black Duck, Wood Duck, Green-winged Teal, Northern Pintail, Gadwall, Lesser Scaup, Greater Scaup and Common and Red-breasted Mergansers. Rare ducks such as Eurasian Wigeon and Tufted Duck have also been seen in this IBA. The first Newfoundland breeding record for Northern Shoveler was at this estuary, and there are provincially significant numbers of breeding American Wigeon and Blue-winged Teal. The Piping Plover, globally vulnerable and listed as endangered on Schedule 1 of *SARA*, nests on Grand Codroy beach. A single pair nested on the beach at the mouth of the estuary from 1992 to 1998, successfully

fledging young. As well, this site is a wetland of international importance according to the 1971 Ramsar Convention.

Grand Bay West to Cheeseman Provincial Park IBA

This IBA, located near Port aux Basques, consists of an eight kilometre stretch of sand beach and small sections of rocky coastline between J.T. Cheeseman Provincial Park and Grand Bay West. The site provides important nesting habitat for the Piping Plover, with an average of 17 adults between 1995 and 1998 (approximately 30 percent of the Newfoundland population), and is an important fall migration stopover for shorebirds.

Gros Morne National Park IBA

This IBA, located on the west coast of the island, features a diversity of habitats supporting a large variety of bird species; over 200 species have been recorded in the park. Common and Arctic Terns nest on two offshore islands in the park, namely, Stearin Island and Belldowns Island (Lock et al 1994). These islands are also important breeding areas for Common Eider, Black-legged Kittiwake, large gulls and cormorants. Small numbers of the eastern Canadian population of the Harlequin Duck breed in rivers in the park. After the nesting season, some broods congregate where the breeding streams drain into coastal waters, and a concentration of less than 100 individuals moults at Stearin Island (Lock et al 1994; IBA 2012). Relatively large aggregations of shorebirds and waterfowl occur during migration in St. Paul's Inlet; shorebird aggregations also occur at Shallow Bay and Western Brook Beach during the fall migration. Piping Plovers were reported breeding in the park, for the first time in over 30 years, in 2009 (NLDEC 2012a); there is currently one designated Piping Plover Critical Habitat beach in the park (Shallow Bay), and a second (Western Brook Beach) will soon be designated. In the winter, the waters off Gros Morne National Park are important to winter waterfowl, particularly the Common Goldeneye and American Black Duck.

Other Important Habitat Areas

Breeding sites for colonial species and species at risk also constitute particularly important areas and habitats for Water Birds. Figure 4.59 shows the locations of known seabird colonies in the SEA Update Area. St. John Bay supports a significant nesting population of Common Eiders, among the largest in coastal Newfoundland (see also Table 4.59).

Critical habitat for breeding Piping Plovers in Newfoundland has been identified, and recommendations for conservation and management of this habitat have been made to the federal Piping Plover Recovery Team as well as to the provincial government. Amirault (2005) identified various sites in or near the SEA Update Area that meet the criteria for critical Piping Plover, including Stephenville Crossing, Sandy Point / Flat Bay Island, Flat Bay Peninsula, Searston, Codroy, East of Windsor Point, J.T. Cheeseman Provincial Park, Jerret Point-Windsor Point, Big Barachois, Bottle's Barachois and Rocky Barachois Bight. The federal recovery strategy for the Piping Plover (Environment Canada 2012b) identifies several critical habitat beaches in Western Newfoundland and elsewhere in the Gulf; these beaches are shown on Figure 4.60.

The Sandy Point and Flat Bay Islands area has been considered for special protection for its importance to birds, notably providing habitat for several breeding pairs of Piping Plovers comprising approximately a third of the Newfoundland population. A notable abundance and diversity of shorebirds has been recorded in this area. Indeed, in 2005, four hectares on Sandy Point were acquired by the Nature Conservancy of Canada. The area is

an important migration stopover for a number of waterfowl species, including American Wigeon, American Black Duck, Green-winged Teal, Red-breasted Merganser, Northern Pintail, Greater Scaup, White-winged Scoter and Common Goldeneye. Sandy Point is one of only two known colonies of breeding Willets in Newfoundland.

Stephenville Crossing is home to breeding Piping Plovers, Willets and Black-headed Gulls, and it is believed that small numbers of Caspian Terns also nest there. Other species nesting in this area that are not known to do so elsewhere in Newfoundland include Sora and Great Blue Heron. Rare birds are frequently reported at Stephenville Crossing, including a 2005 sighting of a Western Reef Heron, native to West Africa. Stephenville Crossing supports a rich series of intertidal flats and marshes that are considered unique within insular Newfoundland, and the area supports some of the largest concentrations of migrating shorebirds.

In December 2011, Parks Canada announced that the area around the Îles-de-la-Madeleine was being considered as a National Marine Protected Area, in part due to its significance as feeding and nesting habitat for a number of bird species. Some of the largest seabird colonies in the Gulf are found in the area, including Rocher aux Oiseaux, which supports over 20 percent of Canada's Northern Gannet population. Lagoons and inland bodies of water located along the edges of the marine area provide critical habitat for ducks and shorebirds, as well as the Piping Plover and Roseate Tern. As well, several provincially designated wildlife habitats have been designated on the Îles-de-la-Madeleine, many of which are important to birds; these habitats are designated under the *Conservation et mise en valeur de la faune* act:

- Aire de concentration d'oiseaux aquatiques de l'Île de l'Est
- Refuge faunique de la Pointe-de-l'Est
- Colonie d'oiseaux sur une île ou une presqu'île de l'étang de l'Est # 2,# 3
- Colonie d'oiseaux sur une île ou une presqu'île de l'Île Shag (Havre-aux-Maisons)
- Colonie d'oiseaux sur une île ou une presqu'île de l'Île Rouge, Havre-Aux-Maisons
- Colonie d'oiseaux en falaise de l'Île aux Goélands, Étang-du-Nord
- Aire de concentration d'oiseaux aquatiques de la Plage de l'ouest #2 20-12-04
- Aire de concentration d'oiseaux aquatiques de la Plage de l'Ouest # 1 20-12-03
- Colonie d'oiseaux en falaise du Sud du Havre-Aux-Basques # 3-Colonie 2D
- Colonie d'oiseaux sur une île ou une presqu'île du Sud du Havre-Aux-Basques # 1,# 2

Figure 4.59 Important Bird Areas and Known Nesting Locations in the SEA Update Area

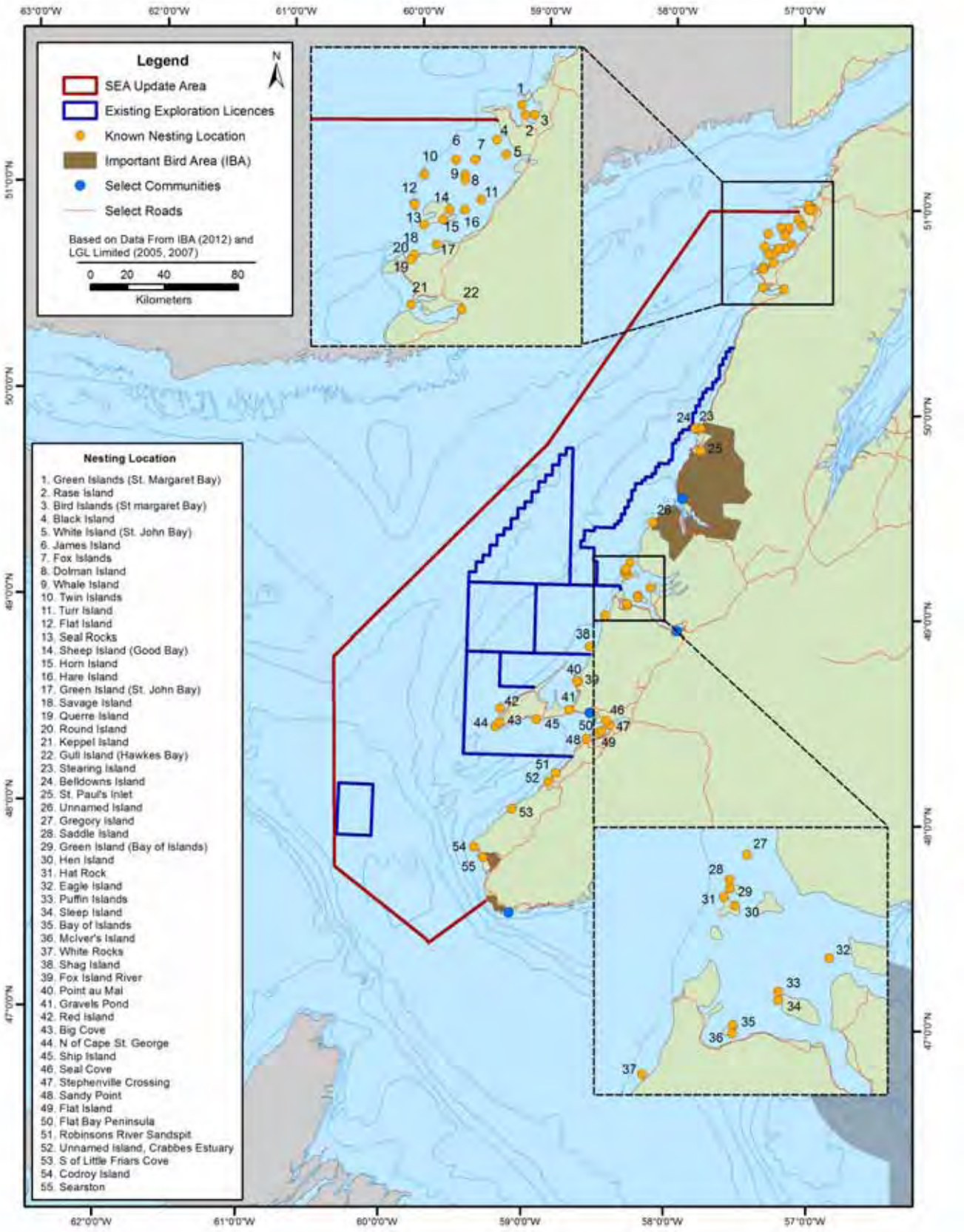
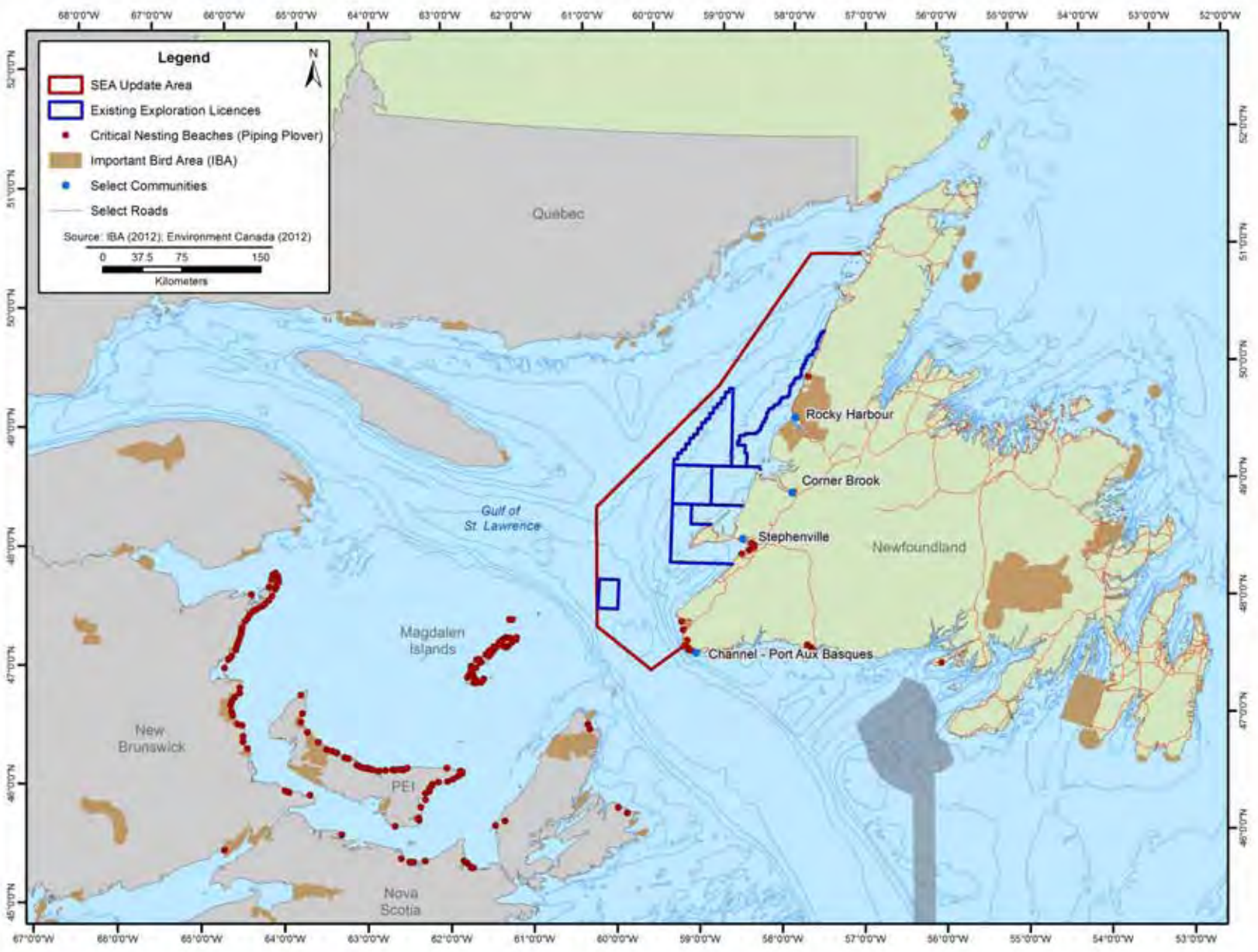


Figure 4.60 Piping Plover Beaches



4.2.2.8 Seasonal Considerations for Water Birds

Overall, the greatest concentration of pelagic seabirds in the SEA Update Area occurs during the winter months and through the breeding season (Lock et al 1994). During the winter, Arctic-nesting species including Northern Fulmar, Glaucous Gull, Black-legged Kittiwake, Thick-billed Murre, and Dovekie move southward into Newfoundland waters (Lock et al 1994), while many summer residents move offshore, but stay relatively close to their breeding grounds.

During the summer breeding season, the greatest abundance of seabirds is concentrated around nesting colonies (Lock et al 1994). Seabirds are relatively long-lived, and in many species, individuals do not breed until four or five years of age. Large groups of non-breeding immature birds will tend to congregate in waters close to the breeding grounds and offshore. Large aggregations of alcids may include individuals from both Québec North Shore and Newfoundland colonies. In addition to resident breeders, Southern Hemisphere seabirds such as Greater Shearwater, Sooty Shearwater, and Wilson's Storm-Petrel spend their winter in waters of the Northern Hemisphere, although only a small proportion of these populations occur in the SEA Update Area.

Waterfowl breeding in coastal and estuarine environments, particularly the colonial Common Eider, are vulnerable in the summer months. In the fall staging period and in the winter, species such as eiders, scoters and mergansers can be found in large numbers in coastal waters. The endangered Harlequin Duck and small numbers of Barrow's Goldeneye may be found in coastal waters outside of the breeding season. Nationally significant concentrations of Canada Geese utilize parts of the Codroy Valley Estuary as staging grounds.

Many species of shorebirds, including the endangered Red Knot, utilize a variety of coastal habitats including sandy mudflats, saltmarshes and river outlets in Western Newfoundland during their southward migration, along with various high tide roost sites; peak abundance occurs in July to October. In the breeding season, a small number of shorebird species, including the endangered Piping Plover, nest on sandy beaches and estuaries in the SEA Update Area. During the winter months, Purple Sandpipers feed on rocky shorelines and offshore ledges and islands; a flock of 200 individuals was recently observed in Gros Morne National Park.

Table 4.59 Nesting Areas for Birds in the SEA Update Area

Nesting Areas and Important Bird Areas	Cormorants		Gulls						Terns			Alcids (Auks)	Waterfowl	Shore-birds
	Double-crested Cormorant	Unidentified Cormorant	Black-headed Gull	Ring-billed Gull	Herring Gull	Great Black-blacked Gull	Large Gull Sp.	Black-legged Kittiwake	Arctic Tern	Unidentified Small Tern	Caspian Tern	Black Guillemot	Common Eider	Piping Plover
Total # of Nesting Sites	**2**	**8**	**1**	**12**	**35**	**37**	**3**	**6**	**24**	**19**	**1**	**1**	**11**	**4**
Grand Bay West to Cheeseman Provincial Park IBA														(7 +)
Little Codroy IBA														(1 +)
Green Island						**1-100**								
Duck Island						**101-500**								
Durands Island				**101-500**	**101-500**	**101-500**								
Bard Island						**1-100**								
Shag Island					**101-500**	**1-100**								
Bay behind Shoal Point						**1-100**								
Codroy Island					**1-100** (11-100)	**1-100** (11-100)				**2**				
Grebes Head		**1-100**												
Wreck Cove		**1-100**												
Ship Cove		**1-100**												
S of Little Friars Cove		(11-100)												
Unnamed island, Crabbes Estuary				**101-500** (11-100)		**1-100** (11-100)			(25)	**50**				
Robinsons River sandspit										(9)				
Sandy Point / Flat Island				(101-500)		(11-100)			(50)					(1 +)
N of Cape St. George								**501-1000** (501-1000)						

Nesting Areas and Important Bird Areas	Cormorants		Gulls						Terns			Alcids (Auks)	Waterfowl	Shore-birds
	Double-crested Cormorant	Unidentified Cormorant	Black-headed Gull	Ring-billed Gull	Herring Gull	Great Black-blacked Gull	Large Gull Sp.	Black-legged Kittiwake	Arctic Tern	Unidentified Small Tern	Caspian Tern	Black Guillemot	Common Eider	Piping Plover
Big Cove (Port au Port Bay)								**> 1000** (> 1000)						
St. Georges River				**101-500**						**183**				
Sandbar in St. Georges River										**35**				
Stephenville Crossing			(10 +)							(225)				(1 +)
Ship Island (Port au Port Bay)					(11-100)	**101-500** (11-100)								
Cape Cormorant						**101-500**								
Gravels Pond, Unnamed island										**240** (210)				
Red Island (Port au Port Bay)					**101-500** (101-500)	**101-500** (11-100)								
Point au Mal										**80** (50)				
Fox Island River					**1-100**					**37** (10)				
Fox Island					**1-100**									
Shag Island (N of Port au Port Bay)		**101-500** (101-500)			**101-500** (101-500)	**1-100** (101-500)		**1-100** (1-100)				(11-100)	(12)	
White Rocks						**1-100** (11-100)								
McIver's Island									(435)					
Governors Island (Bay of Islands)					(501-1000)	(11-100)								
Seal Island (Bay of					**101-500** (101-	**1-100** (11-100)								

Nesting Areas and Important Bird Areas	Cormorants		Gulls						Terns			Alcids (Auks)	Waterfowl	Shore-birds
	Double-crested Cormorant	Unidentified Cormorant	Black-headed Gull	Ring-billed Gull	Herring Gull	Great Black-blacked Gull	Large Gull Sp.	Black-legged Kittiwake	Arctic Tern	Unidentified Small Tern	Caspian Tern	Black Guillemot	Common Eider	Piping Plover
Islands)					500)									
Sleep Island					(101-500)	(11-100)								
Puffin Islands, SE					(11-100)	(11-100)								
Puffin Islands					(11-100)	(11-100)								
Eagle Island				(101-500)	(11-100)	(11-100)								
Hat Rock					(11-100)	(11-100)								
Hen Island					(11-100)	(11-100)							(50)	
Green Island (Bay of Islands)					(11-100)									
Saddle Island		(101-500)			(11-100)	(11-100)		(501-1000)						
Unnamed island SW of Gregory Island	(11-100)													
Gregory Island	(101-500)	(101-500)			(202-1000)	(11-100)								
Unnamed island SW of Trout River Bay					(11-100)	(11-100)								
Western Island (St. Paul's Inlet)									(155)	404 **55**				
Middle Island (St. Paul's Inlet)							6		(460)	314 **340**				
Little Island (St. Paul's Inlet)				1094 **1-100** (11-100)					(2375)	1068 **175**	2			
Sandbar in St. Pauls Bay									(9)	**4**				

Nesting Areas and Important Bird Areas	Cormorants		Gulls						Terns			Alcids (Auks)	Waterfowl	Shore-birds
	Double-crested Cormorant	Unidentified Cormorant	Black-headed Gull	Ring-billed Gull	Herring Gull	Great Black-blacked Gull	Large Gull Sp.	Black-legged Kittiwake	Arctic Tern	Unidentified Small Tern	Caspian Tern	Black Guillemot	Common Eider	Piping Plover
Stearin Island		138		(11-100)	**1-100** (12-700)	**1-100** (11-100)	714	114		16			402	
Belldowns Islands					(11-100)	**1-100** (11-100)	188	50 (11-100)		228			122	
Gull Island (Hawkes Bay)									(95)					
Keppel Island									(6)					
Querre Island				**101-500** (202-1000)					(700)	**675**				
Round Island														
Savage Island				**101-500** (101-500)	**1-100** (22-200)	**101-500** (202-1000)								
Green Island (St. John Bay)					(11-100)	**1-100** (11-100)								
S of Green Island (St. John Bay)													(20)	
Seal Rocks									(30)					
Horn Island									(1200)	**400**				
Sheep Island (Good Bay)									(270)	**235**				
Hare Island					(11-100)									
Off of Hare Island													(6)	
Flat Island					**1-100** (11-100)	**1-100** (11-100)								
Turr Island (west)				(101-500)	**1-100** (112-600)									
Turr Island (east)					**1-100** (11-100)	(101-500)								
Flat Island, NE tip of													(22)	

Nesting Areas and Important Bird Areas	Cormorants		Gulls						Terns			Alcids (Auks)	Waterfowl	Shore-birds
	Double-crested Cormorant	Unidentified Cormorant	Black-headed Gull	Ring-billed Gull	Herring Gull	Great Black-blacked Gull	Large Gull Sp.	Black-legged Kittiwake	Arctic Tern	Unidentified Small Tern	Caspian Tern	Black Guillemot	Common Eider	Piping Plover
Whale Island (west)					**101-500** (101-500)	**1-100** (11-100)			(145)					
Dolman Island					(101-500)									
Twin Islands (south)					**1-100** (11-100)	**1-100** (11-100)			(30)	**50**			(20)	
Twin Islands (north)					**1-100** (213-1100)	**1-100** (22-200)								
SW of Fox Islands													(10)	
Fox Islands (south)									(155)					
Fox Island (east)					**101-500** (202-1000)	**1-100** (11-100)			(55)					
E of Fox Islands													(24)	
James Island					**1-100** (112-600)	**1-100** (213-1100)								
White Island (St. John Bay)									(160)					
Black Island									(285)					
Rase Island				(11-100)					(50)					
Rock SE of Bird Islands (St Margaret Bay)									(85)					
Bird Islands, middle (St. Margaret Bay)				(11-100)										
Bird Islands, E of (St. Margaret Bay)													(60)	

Nesting Areas and Important Bird Areas	Cormorants		Gulls						Terns			Alcids (Auks)	Waterfowl	Shore-birds
	Double-crested Cormorant	Unidentified Cormorant	Black-headed Gull	Ring-billed Gull	Herring Gull	Great Black-blacked Gull	Large Gull Sp.	Black-legged Kittiwake	Arctic Tern	Unidentified Small Tern	Caspian Tern	Black Guillemot	Common Eider	Piping Plover
Green Islands (east)									(35)					
Green Islands, large (St. Margaret Bay)									(50)					
Green Islands, west (St. Margaret Bay)						**1-100** (22-200)								
Rock NW of Wooded Island									(105)					

Note: Values in **bold** are from 2006-2007 CWS survey data, while underlined values are 5-year averages (2008 to 2012; numbers of individuals were estimated by doubling nest counts) from Parks Canada 2012d. Values in parentheses are from LGL Limited (2007), based primarily on 2002 CWS survey data.

4.2.3 Marine Mammals and Sea Turtles

Over 20 marine mammal and sea turtle species are known to occur with some degree of frequency in the waters off Western Newfoundland. Many of these marine mammals and reptiles are considered to be of special conservation concern. The western shelf of Newfoundland and the entrance to St. George's Bay in southwestern Newfoundland have both been identified as ecologically significant areas for marine mammals within the Gulf of St. Lawrence due to their importance to a number of species (Lesage et al 2007).

4.2.3.1 Mysticetes

Six species of the cetacean suborder Mysticetes (the baleen whales), have been reported in the waters off Western Newfoundland. These large whales are characterized by having plates of baleen, which filter food items from seawater, instead of teeth. They are typically solitary or clustered in small groups called pods. The Tables in the next sections summarize key life history and habitat information for the six species of baleen whales that do or may occur in the SEA Update Area.

Table 4.60 Overview of the North Atlantic Right Whale

North Atlantic Right Whale	Summary	Reference(s)
Description	• Adult North Atlantic right whales average 13-16 m in length and 40,000 to 70,000 kg in weight. • Concentrated in the western North Atlantic, but may occur further east to Europe. • Considered to be the most endangered large whale in the world with approximately 300-350 individuals remaining. • Endangered (*SARA* Schedule 1).	COSEWIC (2003); Kraus et al (2001)
Habitats and Movements	• Generally found in waters with surface temperatures ranging from 8-15^{o}C, in areas that are 100-200 m deep. • Shifts in the distribution and abundance of their primary prey items can dramatically affect right whale distribution within their range.	COSEWIC (2003); Kenney (2001)
Reproduction	• Mean age at first reproduction is 10 years for females and is likely similar for males. • Gestation period is unknown; may be >12 months. • Interval between births typically 3 - 5 years (mean: 3.7).	COSEWIC (2003)
Foraging Strategy and Food Sources	• Plankton feeders. The primary prey item of the North Atlantic Right whale is the copepod *Calanus finmarchicus*, which they capture by filtering seawater through their baleen plates in their mouths.	Kenney (2001)

North Atlantic Right Whales are known to aggregate in five seasonal habitat areas along the east coast of North America, all south of Newfoundland (COSEWIC 2003). In Canada, they can be found in the Bay of Fundy from June-November, with peak abundance in August to early October, and in the Roseway Basin south of Nova Scotia from July to November. Right Whales are only occasionally sighted in the Gulf of St. Lawrence, mostly in the area offshore Gaspé (Lien et al 1989; Lesage et al 2007). Sightings are likely to be extremely rare in the SEA Update Area.

Table 4.61 Overview of the Humpback Whale

Humpback Whale	Summary	Reference(s)
Description	• Adult Humpback Whales average 13-16 m in length with females growing larger than the males. • It has unusually long pectoral flippers. • Known for its surface displays and breaching acrobatics. • Designated as being of special concern under *SARA.*	COSEWIC (2011b); IWC (2002)
Habitats and Movements	• Highly migratory, with seasonal movements between temperate to arctic feeding areas and low-latitude breeding areas. • In the North Atlantic, six distinct feeding areas: Gulf of Maine, Gulf of St Lawrence, Newfoundland and Labrador, West Greenland, Iceland and North Norway. • One common breeding area located in the West Indies. • Often sighted singly or in groups of two or three, except during breeding and feeding times, where groups can be as large as 15 individuals.	IWC (2002); Lesage et al (2007)
Reproduction	• Average age at sexual maturity is 9 years. • Calving occurs between January and April after a gestation of approximately 12 months. • Inter-calving interval of 2 years.	COSEWIC (2011b)
Foraging Strategy and Food Sources	• Humpback Whales feed on small schooling fishes and krill. • They often feed cooperatively in groups and have been observed using specialized feeding techniques such as bubble net feeding.	COSEWIC (2011b)

Humpback Whales aggregate in the Gulf of St. Lawrence in the summer to feed (Katona and Beard 1990). Most humpback sightings occurred in the Gulf were the northeast, including the Strait of Belle Isle, Western Newfoundland and St. Georges Bay (Lesage et al 2007).

Table 4.62 Overview of the Blue Whale

Blue Whale	Summary	Reference(s)
Description	• The largest animal ever known to live, an adult Blue Whale can reach up to 30 m in length. • All populations have been exploited commercially. It is estimated the western North Atlantic population to be on the order of a few hundred individuals. • Widely distributed throughout the world's oceans and occurs in coastal, shelf and oceanic waters. • Endangered (*SARA* Schedule 1).	COSEWIC (2002)
Habitats and Movements	• In the western North Atlantic, Blue Whales occur in the Gulf of St. Lawrence and east of Nova Scotia in spring, summer and fall and off southern Newfoundland in winter. • Usually occur alone or in small groups. • Distribution during feeding seasons is largely dependent on the areas of high concentrations of their primary food item.	Waring et al (2002); Leatherwood and Reeves (1983)

Blue Whale	Summary	Reference(s)
Reproduction	• Mate and calve from late fall to mid-winter in Northern hemisphere. • Age at sexual maturity: 5 - 15 years for both sexes. • Gestation period 10 - 11 months. • Interval between births is 2 - 3 years.	COSEWIC (2002)
Foraging Strategy and Food Sources	• The primary prey item of the blue whale is euphausiids.	Yochem and Leatherwood (1985)

The western North Atlantic population of Blue Whales was severely depleted by whaling, and sightings of this species anywhere within its range, including off Western Newfoundland, are uncommon. Blue Whales can be found in the Gulf of St. Lawrence year-round, including the western shelf of Newfoundland and in the St. Georges Bay area, but they are most abundant from August to October (Sears et al 1990; Lesage et al 2007). Sightings occur predominantly along the north shore between Saguenay River and the Strait of Belle Isle, and along the southwest and eastern coasts of Newfoundland during winter and early spring (Sears et al 1990; Lesage et al 2007).

Table 4.63 Overview of the Fin Whale

Fin Whale	Summary	Reference(s)
Description	• Adult Fin Whales average 18-20 m in length. • Lower jaw is white on the right side while the left side is gray or black. • One of the fastest whales on earth and nicknamed “the greyhound of the sea”, the Fin Whale can sustain speeds of up to 37km/h and burst speeds of over 40km/h. • Atlantic population designated as a species of Special Concern by *SARA* (Schedule 1) and COSEWIC.	COSEWIC (2005)
Habitats and Movements	• Widely distributed in all the world’s oceans but typically occur in temperate and polar regions. • Appear to have complex seasonal movements and are likely seasonal migrants. • Mate and calve in temperate waters during winter but migrate to northern latitudes during the summer to feed. • Occur in coastal and shelf waters, as well as in oceanic waters. • Observed alone or in pairs but groups of up to 20 individuals are often seen on feeding grounds.	Gambell (1985); COSEWIC (2005)
Reproduction	• Average age of sexual maturity: 6-7 years for males 7-8 years for females. • Conception and calving typically in winter. • Average 2.7 years between births.	COSEWIC (2005)
Foraging Strategy and Food Sources	• The primary prey of the Fin Whale is small schooling fishes and krill.	Kenney (2001)

Surveys of the Gulf of St. Lawrence show that Fin Whales are most common in the north and northeastern parts of the Gulf, particularly in the Strait of Belle Isle and in Western Newfoundland at St. George's Bay. Anecdotal reports indicate that Fin Whales are present in Northwestern Newfoundland as well. Reports of ice entrapments show that Fin Whales are present year round off Western Newfoundland (Lesage et al 2007).

Table 4.64 Overview of the Sei Whale

Sei Whale	Summary	Reference(s)
Description	• Adult Sei Whales can reach up to 18 m in length. • A relatively tall sickle shaped dorsal fin that may appear simultaneously as the blow, as seen from the surface. • Atlantic population considered Data Deficient by COSEWIC.	COSEWIC (2003)
Habitats and Movements	• Migrate between tropical to subtropical latitudes in winter and temperate and subpolar latitudes in summer, staying mainly in water temperatures of 8 - 18°C. • Winter distribution seems to be widely dispersed and is not fully mapped; summer distribution is highly variable, but in the western North Atlantic, generally north of southern Nova Scotia. • Typically occur in offshore, pelagic habitats; appear to be associated with the continental shelf edge in the northwest Atlantic. • Highly mobile and are known to make unpredictable movements. • Not considered deep divers.	Reilly et al (2008a); COSEWIC (2003)
Reproduction	• Reach sexual maturity at 5 to 15 years of age; mean age at first reproduction has apparently decreased since the 1930s. • Gestation period 10.5 - 12 months. Conception and birth typically occur in winter months. • Calving interval of 2 - 3 years.	COSEWIC (2003)
Foraging Strategy and Food Sources	• Diet includes copepods, euphasids and small fish.	COSEWIC (2003)

This species is considered uncommon in the SEA Update Area. An assessment of stocks in the northwest Atlantic indicated two main concentrations, one off southern Nova Scotia and one in the Labrador Sea (Mitchell and Chapman 1977).

Table 4.65 Overview of the Minke Whale

Minke Whale	Summary	Reference(s)
Description	• Adult Minke Whales average 7-10 m in length, the smallest of the baleen whales. • Like most whale species, females are larger. • White band on each flipper is diagnostic. • Designated Not at Risk by COSEWIC; populations are considered to be more secure than other baleen whales.	ACS (2006); COSEWIC (2006c)
Habitats and Movements	• Cosmopolitan distribution that spans ice-free latitudes. Prefer colder waters. • Very little information on winter distribution; have been reported along the western North Atlantic south of 40 degrees latitude. • Migrate northward from calving grounds during spring and summer. • Appear to prefer shallow water (less than 200 m). • Relatively solitary; usually seen individually or in small groups of two or three. • Larger groups have been observed in areas of concentrated feeding.	Stewart and Leatherwood (1985); Reilly et al (2008b); ACS (2006)
Reproduction	• Both sexes reach sexual maturity at about 7 to 8 years • Gestational period of 10-11 months • Produce calves every 2 years on average	ACS (2006)
Foraging Strategy and Food Sources	• The preferred prey items of the Minke Whale are sand lance and capelin, although other small schooling fishes likely make up a large part of their diet as well. • Copepods and krill are also taken.	Naud et al (2003); ACS (2006)

Minke Whales are widespread throughout the Gulf of St. Lawrence, but are encountered more frequently in northern parts of the Gulf (Kingsley and Reeves 1998; Lesage et al 2007). As with the other baleen whale species, Minke Whales are less common off the west and southwest coasts of Newfoundland than elsewhere off Newfoundland (Kingsley and Reeves 1998).

4.2.3.2 Odontocetes

The cetacean suborder Odontoceti includes toothed whales, dolphins and porpoises. Five species of larger toothed whales, three dolphin species and one porpoise have been reported in the waters off Western Newfoundland. The following Tables summarize key life history and habitat information for toothed whales, dolphins and porpoises that may occur in the SEA Update Area.

Table 4.66 Overview of the Sperm Whale

Sperm Whale	Summary	Reference(s)
Description	• Largest of the toothed whales, growing to a length of approximately 20.5 m with a worldwide distribution. • Routinely dive to depths of hundreds of meters and may occasionally dive as deep as 3000 m. • Considered to be Not At Risk by COSEWIC.	Rice (1989)

Sperm Whale	Summary	Reference(s)
Habitats and Movements	• Range as far north and south as the edges of the polar pack ice, although they are most abundant in tropical and temperate waters where temperatures are higher than 15°C. • Distribution is linked to social structure; adult females and juveniles generally occur in tropical and subtropical waters, whereas adult males are commonly alone often occurring in higher latitudes outside of the breeding season. • Generally distributed over large areas that have high secondary productivity and steep underwater topography.	Rice (1989); Best (1979); Watkins and Moore (1982); Arnbom and Whitehead (1989); Whitehead and Waters (1990)
Reproduction	• Females reach reproductive maturity at 7 to 13 years, males somewhat later. • Gestation is 14 to 16 months. • Interval between births is typically 3 to 6 years.	Shirihai and Jarrett (2006)
Foraging Strategy and Food Sources	• The primary prey item of the Sperm Whale is squid.	Shirihai and Jarrett (2006)

Sperm Whales are known to occur in the Gulf of St. Lawrence, including the Western Newfoundland region; while they are seen only occasionally in the Gulf of St. Lawrence, a few individuals occur there regularly (Reeves and Whitehead 1997; Lesage et al 2007). Sperm Whale sightings are regular in the deep waters off the shelf edge of the Western Newfoundland region, and based on the preference for deep waters, it is likely that they occur in the Cabot Strait and St. Georges Bay (Lesage et al 2007). However, researchers from DFO and Memorial University of Newfoundland have reportedly sighted Sperm Whales frequently in shallow water and close to the coastline in southern Newfoundland and occasionally along the southwest and west coasts of Newfoundland.

Table 4.67 Overview of the Northern Bottlenose Whale

Northern Bottlenose Whale	Summary	Reference(s)
Description	• Adult Northern Bottlenose Whales grow to approximately 10 m in length. • Pronounced beak that is white on males and grey on females. • Davis Strait-Baffin Bay-Labrador Sea population listed by COSEWIC as a species of Special Concern, while localized Scotian Shelf population considered endangered by *SARA* (Schedule 1) and COSEWIC. • Scotian Shelf population is believed to be non-migratory, while the Labrador population migrates north to south seasonally.	COSEWIC (2011c)
Habitats and Movements	• Live in deep water areas of the North Atlantic and are rarely found in waters less than 800 m deep. • Capable of remaining submerged for over an hour. • Can be found in groups ranging in size from one to 20 individuals. • Two areas of abundance in the western North Atlantic: off northern Labrador and “the Gully” on the Scotian Shelf.	Gowans (2002)

Northern Bottlenose Whale	Summary	Reference(s)
Reproduction	• Mate and give birth in April in the Labrador population. • Females reach reproductive age at 8 - 13 years, males somewhat earlier. • Single offspring produced every two years.	COSEWIC (2011c)
Foraging Strategy and Food Sources	• The primary prey item of the Northern Bottlenose Whale is deep water squid.	Gowans (2002)

Northern Bottlenose Whales are known to occur in the Gulf of St. Lawrence, including the SEA Update Area. They are likely to be extremely uncommon in the area, as it is not within the known areas of concentration of this relatively sedentary species (Lesage et al 2007). Individuals of this species found in the SEA Update Area are likely to be of the Labrador population, as the Scotian Shelf population are non-migratory (COSEWIC 2011c). Reeves et al (1993) reported that there were only two known occurrences of this species in the Gulf of St. Lawrence, while Wimmer and Whitehead (2004) show four stranding records from the region.

Table 4.68 Overview of the Beluga Whale

Beluga Whale	Summary	Reference(s)
Description	• Adult Beluga Whales can reach a length of approximately 5.5m. • Distinct from other whales in that they are white or cream coloured. • The Beluga Whale does not have a dorsal fin. • Seven distinct populations identified in Canada; four are considered at risk, including the St. Lawrence Estuary population (*SARA* and COSEWIC: Threatened).	COSEWIC (2004)
Habitats and Movements	• Generally limited to seasonally ice-covered Arctic and sub-Arctic waters. • The endangered St. Lawrence population represents the southern limit of its distribution worldwide.	Lesage and Kingsley (1998)
Reproduction	• Reach sexual maturity at 4 - 7 years (females) and 6 - 7 years (males). • Gestation approximately 13 - 14.5 months. • Mating occurs from late winter to early spring. • Average interval between calving is 3.25 years.	COSEWIC (2004)
Foraging Strategy and Food Sources	• Diet consists primarily of fish and invertebrates.	COSEWIC (2004)

Beluga Whales could potentially occur in the SEA Update Area, although their presence is likely to be rare. The St. Lawrence Estuary population is thought to be confined, for the most part, to the St. Lawrence Estuary and Saguenay Fjord within the St. Lawrence region; however, they occasionally range much further (COSEWIC 2004). Curren and Lien (1998) report only three sightings of live Beluga Whales, including one mother and calf pair, and two beluga whale strandings off Western Newfoundland from 1979-1992. However, a group of more than 100

was recently recorded swimming southwards near the coast of Port au Port, and so it is considered possible that they could be seen in this area during any time of year.

Table 4.69 Overview of the Killer Whale (Orca)

Orca	Summary	Reference(s)
Description	• Killer Whales (also known as Orcas), are large members of the dolphin family, black with distinct white patches on the chest, sides and above the eye. • Adult males can reach a length of 6-8 m while females can reach a length of 5-7 m. • Have tall dorsal fins that can reach a height of 2 m. • Northwest Atlantic / Eastern Arctic population designated as Special Concern by COSEWIC.	COSEWIC (2008)
Habitats and Movements	• Cosmopolitan and globally fairly abundant; have been observed in all oceans of the world. • Prefer warm waters but have been reported in cold waters as well. Not known to be reliably migratory. • The greatest abundance of Killer Whales is found within 800 km of major continents. • Often travel in close-knit matrilineal groups of a few to tens of individuals.	Ford (2002); COSEWIC (2008)
Reproduction	• Males reach sexual maturity at about 13 years, females at 14 - 15 years. • Calving peaks from fall to spring. • Average period between calving is approximately 5 years.	COSEWIC (2008)
Foraging Strategy and Food Sources	• Prey on a diverse variety of items including marine mammals, fish and squid.	COSEWIC (2008)

Killer Whales are known to occur throughout the Gulf of St. Lawrence, including the SEA Update Area, although they are less common in the Gulf than they had historically been (COSEWIC 2008). Their occurrence is somewhat regular near the Mingan Islands and at the western end of the Strait of Belle Isle (Baird 2001; COSEWIC 2008). Occasional sightings are reported along the Western Newfoundland shelf and St. Georges Bay, including an instance of ice entrapment in the latter location (Lien et al 1988; Lesage et al 2007). Based on the available information, this species is likely to be uncommon overall in the SEA Update Area.

Table 4.70 Overview of the Long-finned Pilot Whale

Long-finned Pilot Whale	Summary	Reference(s)
Description	• Members of the dolphin family. • Adult Long-Finned Pilot Whales reach a length of approximately 3.5 - 4.5 m, with males somewhat larger than females. • Bulbous forehead and sickle shaped dorsal fin. • Population considered Not at Risk by COSEWIC.	ACS (2006)
Habitats and Movements	• Widely distributed throughout the world's oceans, and abundant throughout the North Atlantic as far north as 70°N. • No evidence for marked north-south migration, but may	Bernard and Reilly (1999); Olson and Reilly (2002); Lesage et al

Long-finned Pilot Whale	Summary	Reference(s)
	migrate inshore-offshore seasonally in response to prey availability. • Pods are known to strand frequently en masse. • Typically only found cold waters.	(2007)
Reproduction	• Gestation period is 12 - 15 months. • Age at first breeding: 6 to 7 years. • Calving occurs every 3 to 5 years. • Calving may occur year round, but typically in summer.	ACS (2006)
Foraging Strategy and Food Sources	• Long-Finned Pilot Whales feed primarily on squid but known to consume octopus, cuttlefish and some fish species as well.	ACS (2006)

During an aerial survey conducted in late August to early September of 1995, Long-Finned Pilot Whales were observed in the southeastern portion of the Gulf of St. Lawrence, near Cape Breton Island and southwestern Newfoundland at St. Georges Bay (Kingsley and Reeves 1998; Lesage et al 2007). Pilot Whales occur regularly in the SEA Update Area and are considered relatively common there (Lesage et al 2007). Sightings in the region typically occur in deep water with steep bottom topography (Kingsley and Reeves 1998).

Table 4.71 Overview of Small Dolphin Species

Dolphins	Summary	Reference(s)
Description	• In addition to Killer Whales and Long-Finned Pilot Whales, three dolphin species found in SEA Update Area: Atlantic White-Sided Dolphin, White-Beaked Dolphin and Short-Beaked Common Dolphin. • All three species have been assessed by COSEWIC and populations were considered Not at Risk. Atlantic White-Sided is considered abundant throughout its range.	Reeves et al (1999); Hammond et al (2008a,b)
Habitats and Movements	• All species occur in temperate waters in the North Atlantic. The Atlantic White-Sided Dolphin and White-Beaked Dolphin also inhabit sub-Arctic portions of the North Atlantic. The Short-Beaked Dolphin also inhabits southern waters off the coast of Venezuela and the Gulf of Mexico. • Seasonal migration patterns for these species are poorly understood. • Most commonly found in groups of 30 to 70 individuals; however, larger groups numbering several hundred individuals are also observed. • All three species often associate and feed with large baleen whales, and are known to form mixed dolphin species groups.	Reeves et al (1999); Kinze (2002); ACS (2006) Hammond et al (2008a,b)
Reproduction	• Reach sexual maturity at 3 to 4 years. • Gestation lasts from 10 - 14 months.	ACS (2006)

Dolphins	Summary	Reference(s)
Foraging Strategy and Food Sources	• Diet for all three species consists of a variety of small schooling fishes and squids.	ACS (2006); Hammond et al (2008 a,b)

Atlantic White-Sided Dolphins have been sighted throughout the Gulf of St. Lawrence, although most sightings have occurred in areas with steep bottom topography along the margins (Hammond et al 2008a; Reeves et al 1999). White-Beaked Dolphins are less abundant in the western North Atlantic than in the eastern portion of their range; however, within the Gulf of St. Lawrence these dolphins are seen almost exclusively in shallow waters (< 100m deep), and are reported fairly regularly in the Strait of Belle Isle (Lesage et al 2007). Although most of the Northwest Atlantic population of Short-Beaked Common Dolphins is found south of Georges Bank (Reeves et al 1999), within the Gulf of St. Lawrence, the species is most often found off of Western Newfoundland, from the Strait of Belle Isle south to St. Georges Bay (Lesage et al 2007).

Table 4.72 Overview of Harbour Porpoise

Harbour Porpoise	Summary	Reference(s)
Description	• The Harbour Porpoise is a small compared to other cetaceans, growing to a length of 1.2 to 1.4 m. • Most commonly observed near the coast and will enter small bays and estuaries. • Harbour Porpoises in the western North Atlantic have been divided into three different subpopulations: the Bay of Fundy / Gulf of Maine, the Gulf of St. Lawrence and the Newfoundland populations. The boundaries between these populations are not well defined as there is some genetic overlap. • The Northwest Atlantic Harbour Porpoise is listed under *SARA* as a threatened species.	COSEWIC (2006d); Wang et al (1996)
Habitats and Movements	• Found in shelf waters throughout the northern hemisphere, usually in waters colder than 17^{o}C. • Usually seen in small groups of one to three animals often including at least one calf. Occasionally they from larger groups. • Present in northern coastal waters only during the summer months.	COSEWIC (2006d)
Reproduction	• Most mature females become pregnant each year. Gestational period is 10 - 11 months. • Mean age at sexual maturation is 3.5 years.	COSEWIC (2006d)
Foraging Strategy and Food Sources	• Feed on small schooling fishes.	COSEWIC (2006d)

Harbour Porpoises were widely distributed throughout the Gulf of St. Lawrence during aerial surveys from late August to early September of 1995 and from late July to early August of 1996 (Kingsley and Reeves 1998). They are considered moderately abundant in the Gulf during the ice-free months (Lesage et al 2007). They were most

numerous in the northern portion of the Gulf but were also widely distributed in the southern and central Gulf. Harbour Porpoise was seen frequently during surveys in waters off western and southwestern Newfoundland (Lesage et al 2007), and is considered likely to be relatively common in the SEA Update Area.

4.2.3.3 Pinnipeds

Four seal species are known to occur regularly in the SEA Update Area, and a further two are considered occasional visitors.

Table 4.73 Overview of Pinnipeds (Seals)

Seals	Summary	Reference(s)
Description	• Four species of seals commonly occur in the SEA Update Area: Harbour Seal , Harp Seal , Hooded Seal and Grey Seal. • Two additional pinniped species, Ringed Seal and the Bearded Seal , are typically Arctic dwellers but may occasionally be found in the SEA Update Area. • Adult Harbor Seals can grow to a length of approximately 1.85 m; harp seals may reach a length of approximately 1.7-2.0 m, hooded seals approximately 2.0 m for females and 2.6 m for males, and Grey Seals can grow to a length of approximately 1.6-2.0 m for females and 2.5-3.3 m for males. • Populations of the four common pinniped species are all considered secure in the region; Grey, Harbour and Hooded Seals have all been assessed by COSEWIC as Not At Risk. • Harbour Seals are the least abundant pinnipeds in the Gulf of St. Lawrence, with an estimated 4,000 – 5,000 individuals. • Harp Seals, the most abundant species, number more than a million in the region.	DFO (2000); Kovacs (2002)
Habitats and Movements	• All species inhabit most coastal waters of the North Atlantic. • Harbour seals are found in coastal waters in temperate and Arctic regions which are typically relatively sedentary, staying within a few kilometres of their haul-out sites. • Harp and Hooded Seals summer in the Canadian Arctic and Greenland, migrating to the Gulf of St. Lawrence in December and January and leaving the area in April to May. • Hooded Seals are highly pelagic, and it is not uncommon to see them outside of their normal range. • Grey Seals are primarily summer residents in the Gulf, although some remain in the area year round.	DFO (2000); Kovacs (2002); Hall (2002); Burns (2002); Lesage et al (2007)
Reproduction	• Harbour Seals mate shortly after giving birth in June or early July. Pups are born on secluded sections of shoreline or on rocky outcroppings. • Harp Seal pups are born on the ice and females will nurse their pups for approximately 12 days, then mate and disperse. • Hooded Seals congregate to breed in spring in the Gulf of St. Lawrence. After breeding, they move to moulting areas off Greenland. • The largest colony of Grey Seals is found off Nova Scotia. They	DFO (2000); Kovacs (2002); Hall (2002); Burns (2002)

Seals	Summary	Reference(s)
	give birth between September and March, with peak pupping occurring in January.	
Foraging Strategy and Food Sources	• Diets for all species include a variety of fish species, including cod, haddock, herring and mackerel.	Hammill and Stenson (2000)

Harp, Harbour, Hooded and Grey Seals are all likely to be common in the Newfoundland offshore region for at least part of the year, with Grey Seals occurring primarily in the summer months, Harp and Hooded Seals in the winter, and Harbour Seals throughout the year (Lesage et al 2007). Harbour Seals are thought to use parts of Western Newfoundland during the ice-free period (Robillard et al 2005). Harp Seals are found in particularly high numbers around the Strait of Belle Isle during the winter months, and Hooded Seals are likely to use the Western Newfoundland shelf from December to May (Lesage et al 2007). Grey Seals, while fairly common in the Gulf, are not considered likely to be abundant in the western shelf of Newfoundland (Lesage et al 2007).

4.2.3.4 Marine-Associated Species

The North American River Otter, although largely a freshwater species, often frequents the coastal waters of Western Newfoundland and so is considered here as a "marine-associated" mammal species.

Table 4.74 Overview of River Otter

River Otter	Summary	Reference(s)
Description	• Large semi-aquatic member of the mustelid (weasel) family • Adults range in size from 5 to 14 kg. • Newfoundland population considered by some to be a distinct subspecies. • Population is considered secure, although oil spills are said to present a potential threat to coastal populations.	Sefass and Polechla (2008); Parks Canada (2012a)
Habitats and Movements	• Utilize a diversity of aquatic habitats, but prefer areas with banked shores for burrows and lakes with beaver lodges, as well as rugged coastal areas with irregular shorelines that have short intertidal lengths. • Avoid water bodies with gradually sloping shorelines of sand or gravel. • Highly mobile in summer, where they can travel several kilometres in a day, but far less mobile in winter.	Sefass and Polechla (2008); Melquist et al (2003); Lariviere and Walton (1998)
Reproduction	• Males are sexually mature at 2 years of age; females usually 2 years as well, although yearling females occasionally produce young. • Usually breed from December to April, with young born between February and April. • Litter size usually one to three; occasionally up to five.	Sefass and Polechla (2008)
Foraging Strategy and Food Sources	• In coastal Newfoundland, diet consists largely of slow-swimming fish species such as sculpin, flounder, rock gunnel and ocean pout.	Cote et al (2008)

River Otters are widespread along the coastal regions of Newfoundland, including the west coast.

4.2.3.5 Sea Turtles

Sea turtles are marine reptiles that are found in all but the polar regions of the world's oceans. All seven species of sea turtles are considered endangered by the IUCN, with fisheries bycatch, hunting, contamination and beach development all considered major threats. Three species of sea turtles, summarized in Table 4.75, are or may be found in the waters of the SEA Update Area.

Table 4.75 Overview of Sea Turtle Species

Sea Turtles	Summary	Reference(s)
Description	• There are three species of sea turtles that do or may occur within the SEA Update Area; Leatherback Turtle, Loggerhead Turtle and Kemp's Ridley Turtle. • The Leatherback is the largest living turtle, measuring up to 2.19 m in length. • The Loggerhead is the largest hard-shelled turtle in the world, typically reaching 0.85-1.0 m in length. • Kemp's Ridley is the smallest sea turtle, at 0.6 - 0.7 m in length. • Leatherback is listed as Endangered under Schedule 1 of *SARA*, while the Loggerhead is considered Endangered by COSEWIC. • Kemp's Ridley is only rarely found in Canadian waters (considered an accidental visitor), but is considered critically endangered by IUCN.	Ernst et al (1994); Marine Turtle Specialist Group (1996); COSEWIC (2010b)
Habitats and Movements	• Leatherbacks range throughout the Atlantic Pacific and Indian oceans. Predominantly pelagic. • Loggerhead is the most abundant sea turtle in North American waters. Wander widely in their range from coastal areas to more than 200 km from shore. • Adult Kemp's Ridley Turtles rarely range beyond the Gulf of Mexico, but juveniles can be found as far north as Newfoundland.	Ernst et al (1994); Marine Turtle Specialist Group (1996)
Reproduction	• Leatherbacks nest on open beaches in the tropics; females lay an average of 6 clutches per season. • Loggerheads nest in the southern United States and in tropical areas; they lay 4 clutches per season, and will go 2 - 3 years between breeding seasons. • Kemp's Ridley Turtles nest exclusively in the Gulf of Mexico where they lay an average of 2.5 clutches per season. • Sex determination of marine turtle hatchlings is temperature dependent.	COSEWIC (2001); National Marine Fisheries Service (2010)
Foraging Strategy and Food Sources	• The preferred prey for Leatherbacks is jellyfish. • Loggerheads and Ridley's consume crustaceans, mollusks and some jellyfish.	Ernst et al (1994); Marine Turtle Specialist Group (1996)

There are no estimates of the population size in Canada; however, adult Leatherbacks are thought to be a regular part of the Newfoundland marine fauna in the summer and fall (Goff and Lien 1988). Leatherback Turtles are reported to use the area east of Cape Breton heavily during the summer months, including the Laurentian Channel (COSEWIC 2012). It is therefore possible that they also occur in southwestern Newfoundland and within the SEA Update Area. As well, Leatherbacks are known to frequent areas along the tip of the Gaspé Peninsula, near the Îles-de-la-Madeleine and along the north shore of the Gulf of St. Lawrence. Although there are no estimates available for the density of Loggerhead Turtles in the SEA Update Area, they are likely to be rare; Loggerheads are less common than Leatherbacks elsewhere in eastern Canadian waters (Breeze et al 2002). The number of Kemp's Ridley Turtles that visit the SEA Update Area is unknown, but this species is likely to be extremely rare in the SEA Update Area.

4.2.3.6 Marine Mammal and Sea Turtle Species at Risk

A total of six federally listed marine mammal species at risk are known or likely to occur in the SEA Update Area (Table 4.76): 1) Blue Whale - Atlantic Population; 2) North Atlantic Right Whale; 3) Northern Bottlenose Whale - Scotian Shelf Population; 4) Beluga Whale - St. Lawrence Estuary Population; 5) Fin Whale - Atlantic Population; and 6) Harbour Porpoise - Northwest Atlantic Population, as well as one listed sea turtle (Leatherback - Atlantic population). Two additional species that may occur in the SEA Update Area, the Killer Whale (Northwest Atlantic and Eastern Arctic Populations) and Loggerhead Sea Turtle (Atlantic Ocean Population), are listed by COSEWIC (Table 4.76). A third sea turtle species, the Kemp's Ridley, is not federally listed but is considered by the IUCN to be critically endangered.

One additional toothed whale species, Sowerby's Beaked Whale, is known to occur in the Northwest Atlantic, but is typically found further offshore. There are no records of sightings or strandings off Western Newfoundland, and just one possible stranding record in the entire Gulf of St. Lawrence (identification was uncertain; COSEWIC 2006e). As a result, this species is not considered likely to occur in the SEA Update Area.

Figure 4.61 provides information on important areas to marine mammals and sea turtles, as well as previous marine mammal sightings off Western Newfoundland based on information contained in DFO's sightings database (as of April 2013).

Figure 4.61 Marine Mammal and Sea Turtle Sightings off Western Newfoundland and Identified Marine Mammal Significant Areas

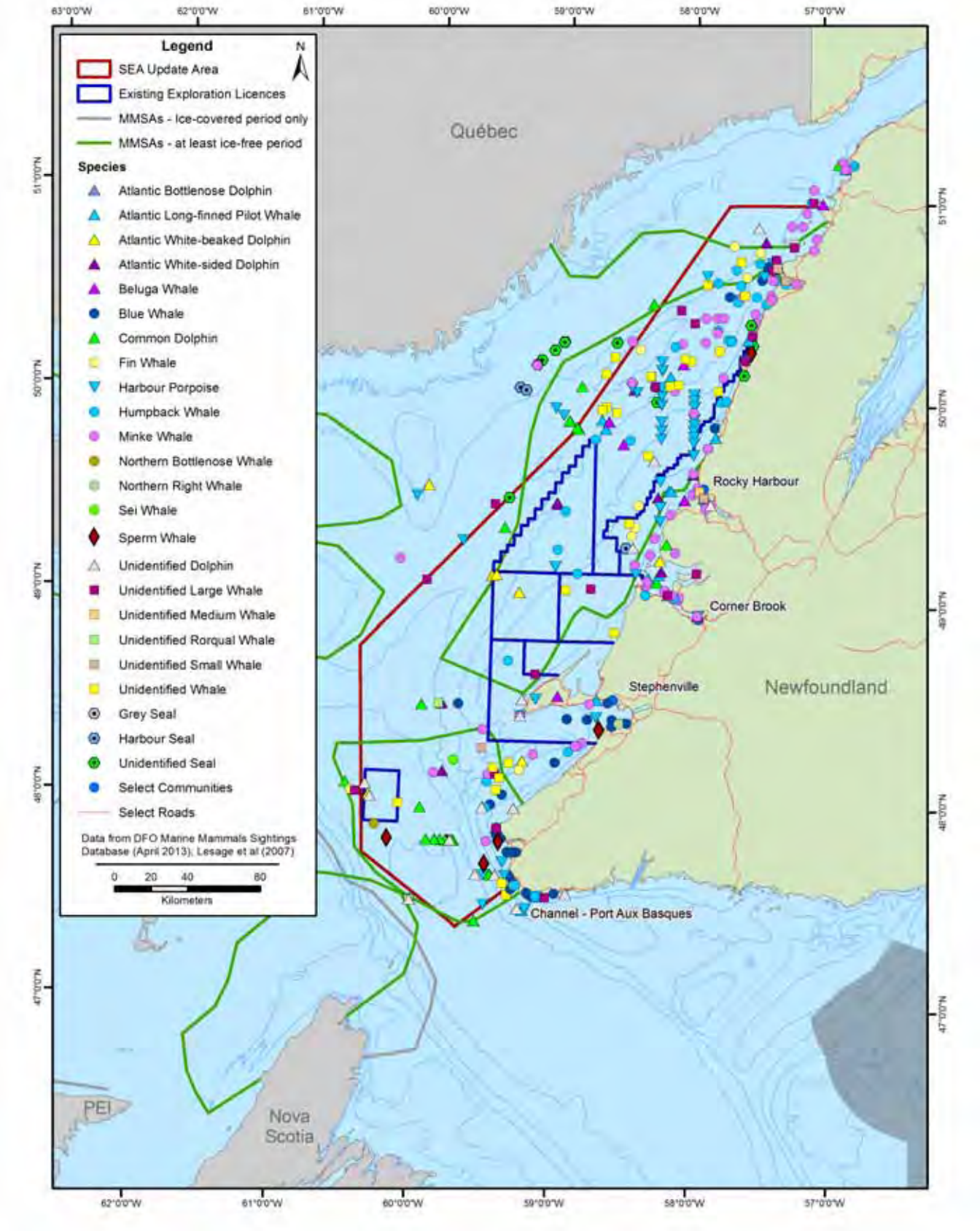


Table 4.76 Marine Mammal and Sea Turtles Species at Risk that are Known to or May Occur within the SEA Update Area

Common Name	Scientific Name	Population/Occurrence	Provincial Designation		SARA Status			COSEWIC Designation
			Province	Status	Endangered	Threatened	Special Concern	
Marine Mammals								
Blue Whale	*Balaenoptera musculus*	Atlantic population			Schedule 1			Endangered
North Atlantic Right Whale	*Eubalaena glacialis*				Schedule 1			Endangered
Northern Bottlenose Whale	*Hyperoodon ampullatus*	Scotian Shelf population			Schedule 1			Endangered
Beluga Whale	*Delphinapterus leucas*	St. Lawrence Estuary population	QC	Threatened		Schedule 1		Threatened
Fin Whale	*Balaenoptera physalus*	Atlantic population					Schedule 1	Special Concern
Sowerby's Beaked Whale	*Mesoplodon bidens*	Atlantic Ocean					Schedule 1	Special Concern
Killer Whale	*Orcinus orca*	Northwest Atlantic population, Eastern Arctic population						Special Concern
Harbour Porpoise	*Phocoena phocoena*	Northwest Atlantic population				Schedule 2		Special Concern
Sea Turtles								
Leatherback Turtle	*Dermochelys coriacea*	Atlantic population			Schedule 1			Endangered
Loggerhead Turtle	*Caretta caretta*	Atlantic Ocean						Endangered

4.2.3.7 Identified Important Areas for Marine Mammals and Sea Turtles

As part of an effort by DFO to define the ecologically and biologically significant areas (EBSAs) within the Gulf of St. Lawrence (as discussed in Section 4.2.1.7), areas of importance to marine mammals within the Gulf were identified by Lesage et al (2007). These "Marine Mammal Significant Areas" (MMSAs) are also illustrated on Figure 4.61.

Three of these areas lie at least partly within the SEA Update Area: the Strait of Belle Isle / Mecatina Plateau (MMSA #4); the Western Shelf of Newfoundland (MMSA #5); and the Entrance to St. Georges Bay (MMSA #6). Other MMSAs located in proximity of the SEA Update Area include the Jacques-Cartier Strait (MMSA #3), the Cape Breton Trough (MMSA #7), the North Margin of the Laurentian Channel to the south of Anticosti Island (MMSA #9) and the Southern Gulf Shelf (MMSA #10). Some of the key relevant characteristics of these seven MMSAs are highlighted in Table 4.77.

Three additional MMSAs have been identified for the Gulf of St. Lawrence not located in close proximity to the SEA Update Area: Pointe-des-Monts to Sept-Iles (MMSA #1); West of Anticosti Island (MMSA #2); and the area offshore Gaspé including the channel of Baie des Chaleurs (MMSA #8). A summary of these is provided in Table 4.78.

Table 4.77 Marine Mammal Significant Areas In or Within Proximity of the SEA Update Area

MMSA Name	Importance to Marine Mammals	#
Strait of Belle Isle / Mecatina Plateau	• The abundance of marine mammals in the Strait of Belle Isle has long been recognized. However, information on abundance of marine mammals in the area is relatively anecdotal, since little systematic effort has been conducted to survey there. • The available information is sufficient to indicate that the Strait of Belle Isle / Mecatina Plateau supports, at times, large biomasses of at least 14 marine mammal species. Specifically, between May and December, at least 13 species likely occur with more or less regularity in this area, including Grey, Harbour and Harp Seals, Fin, Minke, and Humpback Whales, Harbour Porpoises, Atlantic White-Sided, Whitebeaked and Common Dolphins, Pilot Whales, and occasionally, Blue Whales. Between December and May, Harp Seals, Hooded Seals and possibly Fin Whales occur regularly here. Harp Seals whelp in the area, and it is an important area for moulting for Gulf Harp Seals during the spring. • The occurrence of large concentrations of opportunistic feeders and fish consumers drawn by persistent aggregations of deep-dwelling zooplankton suggests that the sector serves a feeding function throughout the year, a migration function and in a reproduction function for some pinnipeds during winter time. The area is considered unique because 1) the local bathymetry results in the retention of large biomasses of zooplankton, and areas with large and predictable food resources are scarce; 2) large biomasses of opportunistic consumers and marine mammals in general are observed in this area, and only a few others in the Estuary or Gulf; 3) it is one of the rare areas where the endangered Blue Whale may congregate in large numbers, but the use of the area varies between years; 4) it supports an exceptionally diverse marine megafauna (at least 13 species); 5) it supports the largest known biomasses of Humpback Whales for the entire Estuary and Gulf of St. Lawrence; and 6) it represents the sole area known to still be frequented by Killer Whales in the Gulf of St. Lawrence.	4

MMSA Name	Importance to Marine Mammals	#
	• This area is considered particularly important for aggregation, considering the very high diversity and large biomasses of species using the area. Fitness consequences of a loss of access to this area would probably be important as it would likely result in a dramatic increase in the exploitation pressure on the few alternate feeding sites in the St. Lawrence system or the Northwest Atlantic.	
Western Shelf of Newfoundland	• This area is used by at least nine different species during the ice-free period (including Harbour Porpoise, White-Sided Dolphin, Harp Seal, Humpback Whale, Minke Whale, Pilot Whale, Blue Whale, Fin Whale and Sperm Whale), although the degree of seasonal use of this area by these species and their relative densities remain largely undocumented. The head and slope of the Esquiman Channel is of possible importance as an area of aggregation for foraging marine mammals, as deep-dwelling zooplankton appear particularly persistent at the head of the channel. • This sector serves primarily a feeding function, and is considered moderately unique because 1) it allows the persistent aggregation of zooplankton; 2) other regions of similar or higher value exist in the St. Lawrence system; 3) biomasses of fish and opportunistic consumers appear to be low to moderate and so, sectors attracting higher biomasses of marine mammals exist elsewhere in the St. Lawrence system; 4) it supports a moderately diverse megafauna (at least nine species). • This area is considered moderately important for aggregation, considering the moderate diversity and moderate to low biomasses of species using the area. Fitness consequences of a loss of access to this area would probably be of little to moderate importance for these species, since alternate habitats with similar characteristics exist elsewhere in the St. Lawrence system.	5
Entrance to St. Georges Bay	• During the ice-free period, a minimum of nine species appear to use the sector, including Minke, Fin, and Humpback Whales, Pilot and Killer Whales, Harbour Porpoises, White-Sided and Shortbeaked Common Dolphins, Harbour and Grey Seals. During winter, ice-entrapments suggest that Blue Whales and possibly Killer Whales may be present in the area, at least sporadically. • This area serves mainly a feeding function for all of the species described here. It is considered moderately unique because 1) the sector is characterised by physical and oceanographic features that favour biological productivity; 2) the sector supports what is suspected to be moderate biomasses of marine mammal species, which all have alternate habitats in the Estuary or Gulf; 3) it is one of the rare known areas where the endangered Blue Whales congregate during winter, although the use of the area may vary between years. • This area is considered moderately important for aggregation, considering the high diversity of species (at least 11 species), the moderate biomasses of species using the area, and the occurrence at times of moderate to large biomasses of the endangered Blue Whale. Fitness consequences of a loss of access to this area would probably be moderate, particularly for Blue Whales and the larger species as alternate habitats may be limited, particularly during winter.	6
Jacques-Cartier Strait	• Based on the available information, seven species of marine mammals likely occur in this area with some regularity during the ice-free period: Grey and Harbour Seals, Minke and Fin Whales, White-Sided and Whitebeaked Dolphins, and Harbour Porpoises, and occasionally Killer Whales. Between December and May, data on marine mammal	3

MMSA Name	Importance to Marine Mammals	#
	abundance is nearly nonexistent for this area, although Harp Seals, Blue Whales and some larger rorquals are known or believed to use the area. • The ability to define the use of this area by marine mammals is limited because the available information is scant and temporally limited. The sector of the Jacques Cartier Strait is characterised by the presence of wind-driven upwellings and likely has high biological productivity; based on this information and on the seasonal occupancy and identity of species, it is believed that the area serves a feeding function for the above species. The Strait is not considered particularly unique because 1) it is characterised by physical and oceanographic features that favour biological productivity; 2) the sector supports what is suspected to be low to moderate biomasses of marine mammal species, which all have alternate habitats in the Estuary or Gulf. • This area was considered moderately important for aggregation, considering the moderate diversity (at least eight species) and biomasses of marine mammals, and relatively large number of small cetaceans and pinnipeds. Fitness consequences of a loss of access to this area would probably be low to moderate, as alternative habitats exist in the Estuary and Gulf of St. Lawrence.	
Cape Breton Trough	• This area is important during both the ice free and ice-covered period, as three of the four seal species (Grey, Harbour and Harp) frequent the Cape Breton Trough during winter, and at least ten species of marine mammals occur in this sector during the ice-free period (including Harbour Porpoise, White-Sided Dolphin, Striped Dolphin, White-Beaked Dolphin, Pilot Whale, Humpback Whale, Fin Whale and Minke Whale). • The sector is characterised by a deep channel running along the west coast of Cape Breton, where food resources are likely to aggregate. Based on seasonal occupancy and identity of species, it is concluded that the area serves mainly a feeding function during the ice-free period, whereas it has reproductive and possibly moulting functions for pinnipeds during the winter and early spring. The area is considered unique because 1) the sector is characterised by physical and oceanographic features that favour biological productivity; 2) the sector supports what is suspected to be moderate biomasses of marine mammals, some of which have few alternate habitats in the Gulf (e.g., Pilot Whales); 3) it supports a diverse megafauna (at least 12 species) and newborns from three species of seals following whelping, which have very few alternative habitats in the Gulf or the Northwest Atlantic. • This area is considered moderately important for aggregation due to the high diversity of species and the moderate biomasses of species using the area. Fitness consequences of a loss of access to this area would probably be moderate to high, particularly for pinnipeds during winter, which rely specifically on this general sector to support the production of the year.	7
North Margin of the Laurentian Channel to the South of Anticosti Island	• This area appears to be used regularly during the ice-free period by at least four species: Minke and Fin Whales, Harbour Porpoises and White-Sided Dolphins. Other dolphin species and rorqual species may also be present. There is no information as to the importance of this sector during winter. • The north and south margins of the Laurentian Channel to the south of Anticosti, and particularly the margin of the plateau to the east of Anticosti, are characterized by important accumulations of zooplankton biomasses during most of the year, and the occurrence of fish consumers in this sector suggests an accumulation of fish prey. It is	9

MMSA Name	Importance to Marine Mammals	#
	believed that this area serves mainly a feeding function for the species listed above. The area is considered moderately unique because 1) the sector is characterised by physical and oceanographic features that favour biological productivity; 2) the sector supports what is suspected to be moderate biomasses of marine mammal species, which all have alternate habitats in the Estuary or Gulf; and 3) it supports a megafauna which is not diverse (as few as four species). • This area was considered of little to moderate importance for aggregation, considering the low diversity but moderate biomasses of marine mammals. Fitness consequences of a loss of access to this area would probably be low to moderate, as alternative habitats exist in the Estuary and Gulf of St. Lawrence.	
Southern Gulf Shelf (ice-covered months)	• This area is important during the ice-covered period, and includes the southern Northumberland Strait, St Georges Bay, western Cape Breton, and the waters surrounding the Îles-de-la-Madeleine. It provides an important whelping and breeding area for three species of pinnipeds: Harp, Hooded and Grey Seal. The ecological and biological significance of the shelf of the southern Gulf for these three pinniped species is intimately linked to ice quality. The stability of the ice is important for females to successfully rear their young, since suckling occurs only on the ice, but it is also important for pups, which remain on the ice for a further two to three weeks. Without access to stable ice to rest, the pups quickly tire and often drown or die. • This area serves mainly a reproductive function for the three seal species listed above. It is considered unique because 1) the sector is characterised by ice conditions and water masses that are favourable to whelping; 2) these environmental conditions are found only there in the Gulf or in only one or two other places in the Northwest Atlantic; 3) in the case of Hooded Seals and Grey Seals, a lack of access to this area may not be balanced by a displacement toward other whelping areas. • This area was considered highly important for aggregation as it supports for each of the three species, many thousands of individuals, and in some cases (e.g., possibly Hooded Seal), a totally independent population. Fitness consequences of a reduction in ice quality or a complete loss of access to the pack ice would probably be moderate to high depending on species, because whelping on thin ice or on land where humans or other hazards are present may reduce the survival of pups.	10
Modified from Lesage et al (2007)		

Table 4.78 Gulf of St. Lawrence Marine Mammal Significant Areas Not Within Proximity of the SEA Update Area

MMSA	Importance to Marine Mammals	#
Pointe-des-Monts to Sept-Îles	• This area is frequented relatively regularly by a high diversity of species (at least 11 species), and at some times of the year, including winter time, by large biomasses of marine mammals, including some endangered and threatened species (e.g., Blue and Beluga Whales). Between May and December, at least eight species likely occur with more or less regularity in this area, with another three species occurring less frequently: Grey and Harbour Seals, Blue, Fin, Minke, and Humpback Whales, Harbour Porpoises and White-Sided Dolphins, with sporadic presence of Beluga and Hooded Seals and occasional presence of Right Whales. Between December and May, Harp Seals, Hooded Seals and Beluga, as well as some larger rorqual whales (possibly Blue and Fin Whales) occur regularly in this sector.	1

MMSA	Importance to Marine Mammals	#
	• The sector to the east of Pointe-des-Monts is characterised by a large, nearly permanent cyclonic gyre, which is favourable to the persistent aggregation of zooplankton such as krill. Regular occurrences of several species of fish consumers suggest that fish aggregations probably also persist in the sector. The sector serves mainly a feeding function for the species listed above. The area is considered unique because 1) a gyre system such as the one characterizing this area does not exist elsewhere in the Gulf; 2) large biomasses of krill consumers and marine mammals in general are observed in only a few other areas of the Estuary or Gulf; 3) it is one of the rare areas where the endangered Blue Whales congregate in large numbers; and 4) it represents one of the very few known wintering grounds for the Beluga outside of the Estuary. • This area is also considered particularly important for aggregation, considering the diversity and biomasses of species using the area (at least 11 species), and the occurrence at times of large biomasses of the endangered Blue Whale. Fitness consequences of a loss of access to this area would probably be important for the larger species, particularly the Blue Whales, which appear to have access to few alternate feeding sites in the St. Lawrence system. Major feeding sites for the Blue Whale population of the Northwest Atlantic outside of the Gulf of St. Lawrence have not yet been determined. Fitness consequences might also be moderate to high for St. Lawrence beluga, as it represents the sole wintering grounds currently used by this species in the Gulf of St. Lawrence.	
West of Anticosti Island	• A high diversity of species uses the area, particularly during the ice-free period. A minimum of eleven species appear to use the sector on a relatively regular basis between May and December, i.e., Minke, Fin, Humpback, and Blue Whales, Harbour Porpoises, White-Sided and Whitebeaked Dolphins, Grey, Harbour and Harp Seals, and Killer Whales. Pilot Whales are also present occasionally during this period. Between December and May, the data are limited, but at least Harp and Hooded Seals are present. • The sector is characterised by the presence of wind-driven upwellings, intense tidal mixing and high biological productivity; it is concluded that this area serves mainly a feeding function for the species listed above. It is considered a moderately unique area because 1) the sector is characterised by physical and oceanographic features that favour biological productivity; 2) the sector supports what is suspected to be moderate to large biomasses of marine mammal species, which all have alternate habitats in the Estuary or Gulf; and 3) it is one of the rare areas where the endangered Blue Whales may congregate in large numbers, although the use of the area varies considerably between years. • This area is considered highly important for aggregation considering the high diversity of species and the moderate to high biomasses of species using the area, and the occurrence at times of large biomasses of the endangered Blue Whale. Fitness consequences of a loss of access to this area would probably be moderate for most species, but could be higher for some of the larger species if their displacement towards other habitats reduced food availability per capita.	2
Area Offshore Gaspé, including the channel of	• This area is important during both the ice-free and ice-covered periods; it is frequented regularly by at least nine species of marine mammals (Harbour Porpoises, White-Sided Dolphins, Minke, Fin, Humpback, Right and Blue Whales, Harbour Seals and Grey Seals)	8

MMSA	Importance to Marine Mammals	#
Baie-des-Chaleurs	and more occasionally by one other species (Pilot Whales) during the ice-free period, and is regularly frequented by at least five different species during winter. • The sector likely represents an area of aggregation of food, and remains relatively free of ice during most of the winter. Based on seasonal occupancy and identity of species, and on the physical and biological oceanography of the area, the area serves mainly a feeding function during both the ice-free and ice-covered periods. It is considered unique because 1) the sector is characterised by physical and oceanographic features that favour the aggregation of food resources throughout the year; 2) the sector remains relatively ice-free during winter, allowing animals to benefit from the locally abundant food resources throughout the year; 3) it supports what is suspected to be moderate biomasses of marine mammal species, some of which have few alternate habitats in the Gulf or even the northwest Atlantic (e.g., Blue Whales and North Atlantic Right Whales); and 4) it supports a diverse megafauna throughout the year. • This area is considered moderately important for aggregation, considering the high diversity of species and the moderate biomasses of species using the area. Fitness consequences of a loss of access to this area would probably be moderate to high, particularly for cetaceans during winter, which have a limited number of alternate feeding habitats, where food abundance is predictable and which remains relatively free of ice throughout winter. Fitness consequences might also be high for the right whales, which use this area but do not use the Bay of Fundy summer feeding grounds.	
Modified from Lesage et al (2007)		

Critical habitat has been identified in the federal recovery strategies for three of the marine mammal species at risk that have been reported in the SEA Update Area: 1) the Northern Bottlenose Whale (Scotian Shelf Population); 2) North Atlantic Right Whale; and 3) the Beluga Whale. The Beluga Whale's identified critical habitat is within the St. Lawrence estuary west of Baie-Comeau, including the lower reaches of the Saguenay River (DFO 2012h). Critical habitat of the Northern Bottlenose Whale is located off the southern coast of Nova Scotia, along the Scotian Shelf (DFO 2010c). The North Atlantic Right Whale's critical habitat is located within the Bay of Fundy and off of southern Nova Scotia at Roseway Basin (Brown et al 2009). The recovery strategy for the Blue Whale (Northwest Atlantic Population) currently does not define the boundaries of critical habitat. However, the Gulf of St. Lawrence is recognized as being important to the species, as it provides a number of valuable feeding areas with high krill densities (Beauchamp et al 2009a, 2009b). It is anticipated that the identification and delineation of critical habitat for the Blue Whale will be completed in 2014 (Beauchamp et al 2009a, 2009b).

Recovery strategies are not currently available for the four other species at risk reported in the SEA Update Area, although information from the COSEWIC species assessments indicates that sightings of the Leatherback Turtle and Harbour Porpoise are widespread throughout the area (COSEWIC 2012; 2006d). Sightings of the Fin Whale off Western Newfoundland are mainly around the Strait of Belle Isle and off the Northern Peninsula, but the species' range is inferred to include the entire Gulf of St. Lawrence (COSEWIC 2005). The range of the Sowerby's Beaked Whale does not extend within the Gulf of St. Lawrence, and the species has not been reported in the SEA Update Area, although there is a single report of a possible stranding in the Gulf (COSEWIC 2006e).

4.2.4 Protected Areas

In Canada, unique or sensitive environments may be designated as protected through federal, territorial or provincial legislation, with areas also sometimes also protected and/or managed by municipal or Aboriginal governments. These special places may be set aside to protect important or sensitive species and habitats, as representative natural areas, for cultural or historical reasons, and/or for human use and enjoyment.

This section describes a number of types of existing and proposed protected and identified sensitive areas in the SEA Update Area and in the larger Gulf of St. Lawrence, based on data obtained from the Conservation Areas Reporting and Tracking System (CARTS), (Canadian Council on Ecological Areas 2013) and from available provincial government parks and protected areas datasets.

4.2.4.1 Protected Areas within the SEA Update Area

National Parks and National Historic Sites

Parks Canada establishes National Parks (under the *National Parks Act)* to protect representative examples of Canada's 39 terrestrial natural regions (Environment Canada 2012a).

Parks Canada establishes National Parks and National Historic Sites with a landbase under the *Canada National Parks Act*. National Parks are created to protect representative examples of Canada's 39 terrestrial natural regions, while national historic sites commemorate significant historical locations or themes. Oil and gas exploration and development are prohibited within National Parks and National Historic Sites administered by Parks Canada, which encompass both surface and subsurface resources. Most of Parks Canada's sites in Eastern Canada are located along the coast, including all of those within the Gulf of St. Lawrence (e.g., Gros Morne, Cape Breton Highlands, Prince Edward Island, Kouchibouguac, Forillon and Mingan Archipelago, see later Figure 4.64).

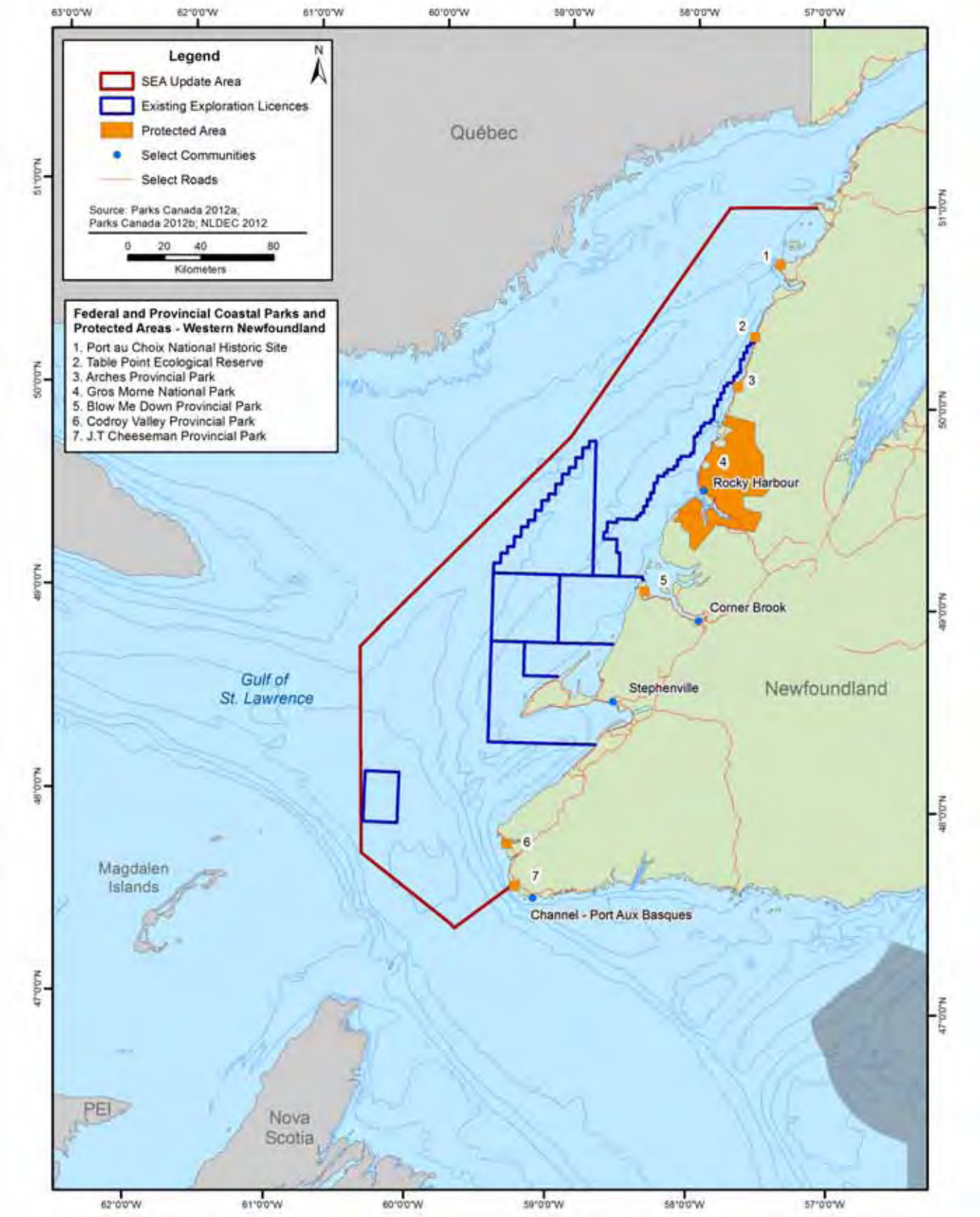
Gros Morne National Park is located in the SEA Update Area (Figure 4.62, Table 4.79), and is a UNESCO World Heritage Site that remains one of Newfoundland and Labrador's most important tourism destinations (Section 4.3.6.5). North of Gros Morne, the Port au Choix National Historic Site protects and interprets the history of several ancient peoples who inhabited this portion of the Island of Newfoundland. In addition to the terrestrial landbases included within these protected areas, the intertidal zones (extending to the normal low water mark) along the coasts of Gros Morne National Park and Port au Choix National Historic Site, as well as the inner portion of St. Paul's inlet in Gros Morne, are all marine habitats protected under the *Canada National Parks Act* and which fall within the SEA Update Area (Parks Canada 2012d).

Table 4.79 National Parks and National Historic Sites in the SEA Update Area

Park or Historic Site	Location	Key Characteristics and Features
Gros Morne National Park	Northern Peninsula of Newfoundland, including coastal areas from Shallow Bay to Trout River	• UNESCO World Heritage Site based on geological history (plate tectonics) • Protects a portion of the Western Newfoundland Highlands natural region • Coastal lowland bordering the Gulf of St. Lawrence and alpine plateau of the Long Range Mountains • Natural beauty with a rich variety of

Park or Historic Site	Location	Key Characteristics and Features
		scenery and wildlife including freshwater fjords waterfalls, marine inlets, sea stacks, sandy beaches • Provide opportunities for visitor appreciation and learning
Port au Choix National Historic Site	Northern Peninsula of Newfoundland	• Habitation sites of four ancient cultures
Source: Parks Canada (2012b; 2012c)		

Figure 4.62 Marine and Coastal Parks and Protected Areas in Western Newfoundland



Provincial Parks and Protected Areas

The Government of Newfoundland and Labrador (through the Department of Environment and Conservation) establishes and manages six types of provincial protected areas, each of which is designed to fulfill various conservation and/or cultural goals. The Parks and Natural Areas Division is responsible for wilderness and ecological reserves and provincial parks, while the Wildlife Division is responsible for wildlife reserves and an existing nature park. Crown reserves and special management areas are managed by Lands Branch and/or Parks and Natural Areas. The Province has also developed a Parks and Natural Areas Systems Plan which has not yet been publicly disclosed.

Existing provincial parks and protected areas in Western Newfoundland are listed and described briefly in Table 4.80. These include the marine and coastal parks and protected areas illustrated in Figure 4.62, as well as a number of other more inland parks and protected areas in the larger region.

Table 4.80 Provincial Parks and Protected Areas in Western Newfoundland

Park	Location	Purpose / Usage
Table Point Ecological Reserve	Coastal area near Belburn's	• Protect unique limestone formations and fossils
The Arches Provincial Park	Coastal area between Portland Creek and Parsons Pond	• Scenic attraction • Day use
Main River Waterway Provincial Park and National Heritage River	East side of the Northern Peninsula	• White water paddling, rafting, angling, hunting, snowmobiling and winter trekking
Sir Richard Squires Provincial Park	Humber River	• Day use and camping • Popular location for salmon angling
Blow Me Down Provincial Park	Humber Arm, Bay of Islands	• Scenic attraction • Day use and camping
Barachois Pond Provincial Park	Near Stephenville Crossing	• Day use and camping
The T'Railway Provincial Park	Former railbed from Port aux Basques to St. John's	• Hiking, bicycling, horseback riding, cross country skiing, ATV riding and snowmobiling
Codroy Valley Provincial Park	Codroy Valley	• Scenic attraction • Nature viewing • Day use
J.T. Cheeseman Provincial Park	Port aux Basques	• Scenic attraction • Nature viewing • Piping Plover breeding habitat • Day use and camping
Source: NLT (2012); NLDEC (2013)		

National Marine Conservation Areas

Parks Canada establishes National Marine Conservation Areas (NMCAs) under *the Canada National Marine Conservation Areas Act*. NMCAs are marine areas managed for ecologically sustainable use and containing smaller zones of protection. They include the seabed, the water column above it and they may also take in wetlands, estuaries, islands and other coastal lands (Parks Canada 2008). Oil and gas exploration and development is prohibited within NMCAs. No NMCAs have been established in the SEA Update Area.

The NCMA program has generally subdivided the Atlantic Canada region into various subregions for the purposes of evaluation and the potential designation of additional areas for designation. The Laurentian Channel marine region, for example, stretches from the St. Lawrence Estuary to the Strait of Belle Isle and to the Burin Peninsula of Newfoundland and thus borders on the SEA Update Area (Parks Canada 2009).

The South Coast Fjords NMCA study area off the southwest coast of Newfoundland is a potential candidate area for the Laurentian Channel marine region, but no establishment studies are currently being undertaken for this area (Parks Canada 2009).

Thus, there are currently no NMCAs located in the SEA Update Area but one may potentially be proposed in near proximity to it in the future.

Marine Protected Areas (MPAs) and Areas of Interest (AOI)

Canada's *Oceans Act* mandates the Minister of Fisheries and Oceans to lead and coordinate the development and implementation of a national network of marine protected areas on behalf of the Government of Canada. These areas are ecologically significant, with species and/or properties that require special consideration.

An *Oceans Act* Marine Protected Area (MPA) is a protective designation for an area that significantly contributes to the health of marine ecosystems and their resources. The first step in MPA establishment is the identification of Areas of Interest (AOI), which then undergo detailed evaluation and public consultation before a decision is made concerning whether to formally designate them as MPAs (Parks Canada 2006).

No MPAs or AOIs are located within the SEA Update Area (DFO 2012f). The Laurentian Channel off the southwest coast of Newfoundland has been identified as an AOI (Table 4.81; Figure 4.63).

Table 4.81 Marine Protected Areas of Interest in the SEA Update Area

Name / Location	Description / Special Features	Conservation Purpose / Status
Laurentian Channel Area of Interest is located off the southwest coast of Newfoundland	• A deep submarine valley over 1,200 km long and approximately 35,840 km^2 in size that extends from the intersection of the St. Lawrence and Saguenay Rivers to the edge of the continental shelf off southwest Newfoundland. • Contains the highest concentration of black dogfish in Canadian waters and is the only place where pupping occurs. • An important spawning, nursery and	• As the Laurentian Channel AOI is an estimated 17,950 km^2, if an MPA is established it will likely take in only a portion of this area. • DFO identified as a MPA area of interest in June 2010.

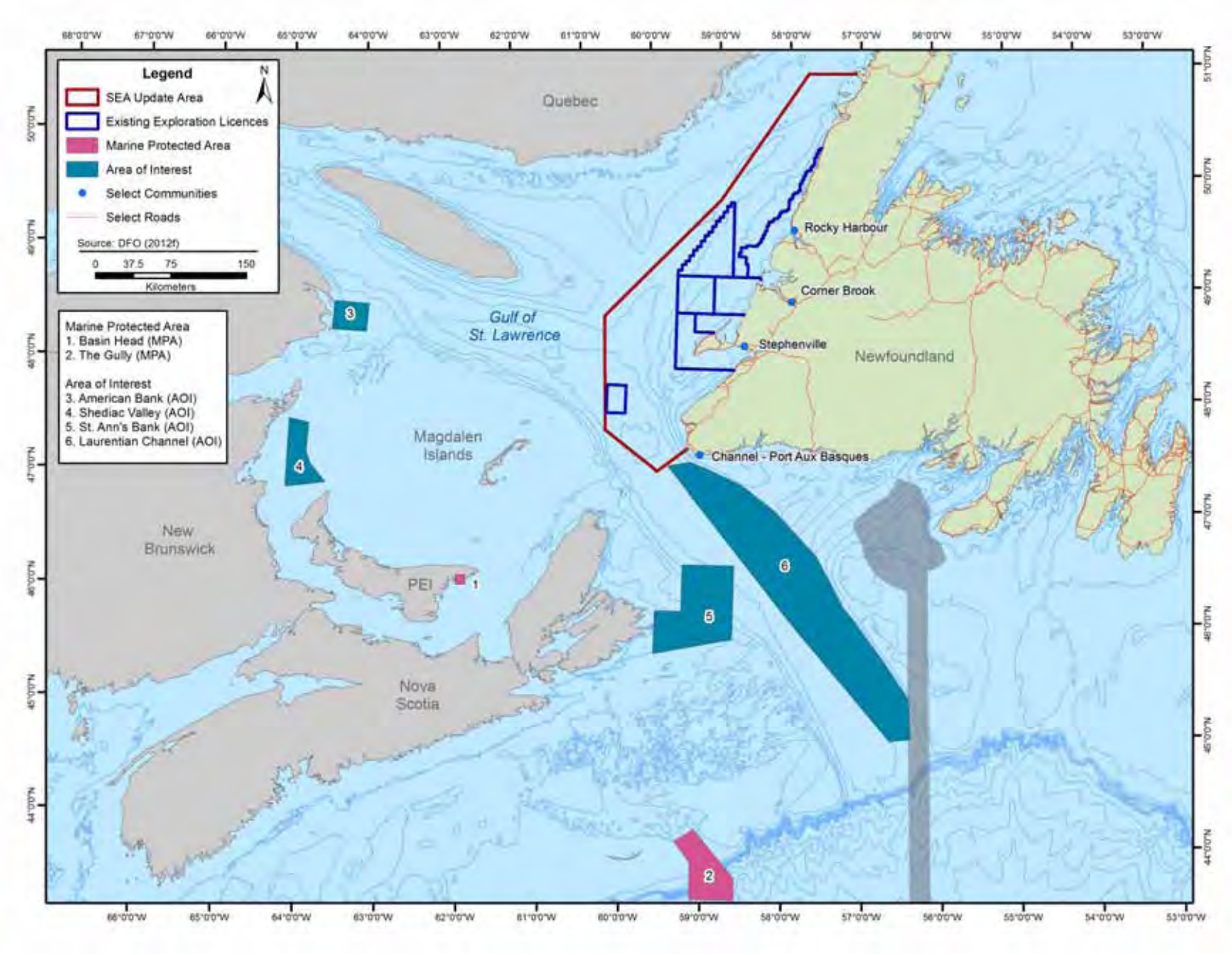
Name / Location	Description / Special Features	Conservation Purpose / Status
	feeding area for a variety of species including porbeagle shark and smooth skate. • Critical migration route for marine mammals moving in and out of the Gulf of St. Lawrence. • Several species at risk are found here, including the Northern wolffish, Blue Whales and Leatherback sea turtles	
Source: DFO (2012f)		

National Wildlife Areas and Migratory Bird Sanctuaries

Through the *Canada Wildlife Act*, the Government of Canada has established 54 National Wildlife Areas on federally owned lands for the purposes of wildlife conservation, research and interpretation. These areas, some of which are relatively undisturbed, protect approximately one million hectares of nationally significant plant and animal habitats, with nearly half of this total area protecting marine habitats. No such National Wildlife Areas are located in Newfoundland and Labrador, including the SEA Update Area (Environment Canada 2012a).

On the Island of Newfoundland, Migratory Bird Sanctuaries are located on the east coast of the Northern Peninsula and in Terra Nova National Park (Environment Canada 2012a). None are located in or near the SEA Update Area.

Figure 4.63 Marine Protected Areas and Areas of Interest in Atlantic Canada



4.2.4.2 Protected Areas Elsewhere in the Gulf of St. Lawrence

The Gulf of St. Lawrence has an extensive network of parks and protected areas that are federally designated and within the various provincial jurisdictions including Nova Scotia, Prince Edward Island, New Brunswick and Québec. A general overview of the number and distribution of these federally and provincially designated protected areas throughout the Gulf is provided in Figure 4.64 (based on data from the Canadian Council on Ecological Areas 2013 and other sources), and summarized in the following sections.

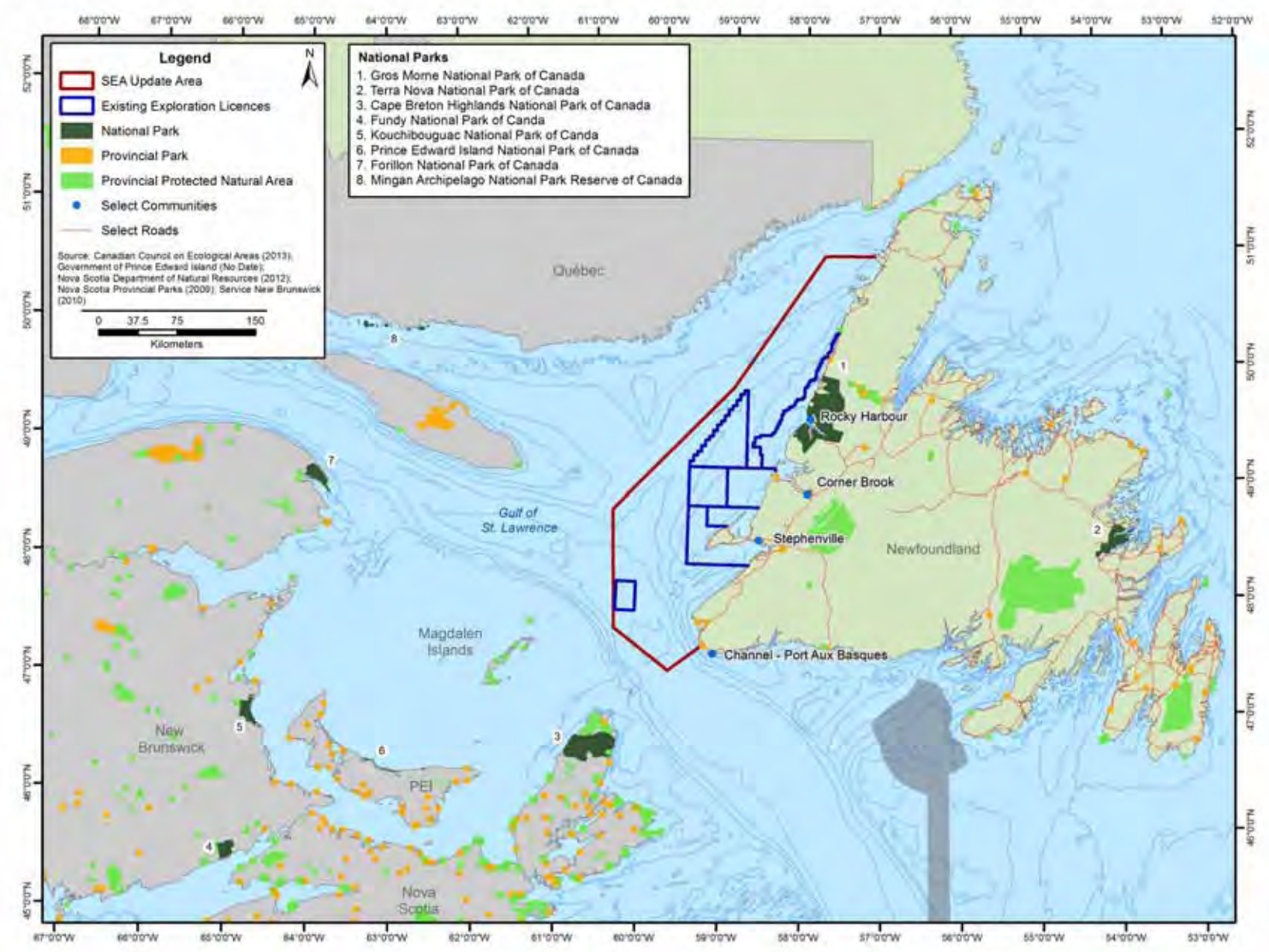
National Parks

Many of Parks Canada's sites in Eastern Canada are at least partially marine or coastal. Table 4.82 identifies and describes those that are located in the Gulf of St. Lawrence.

Table 4.82 National Parks in the Gulf of St. Lawrence

National Park or Historic Site	Location	Protected Features
Cape Breton Highlands National Park	Northern part of Cape Breton Island	• Protects part of the Maritime Acadian Highlands natural region • Unique blend of Acadian, Boreal and Taiga habitats, plants and animals not found anywhere else in Canada • Several dozen species of rare or threatened plants and animals, as well as old growth forests of international importance. Small populations of Arctic-alpine plants from the last ice age
Prince Edward Island National Park	Northern Prince Edward Island	• Protects a portion of the Maritime Plain natural region • Sand dunes, barrier islands and beaches, sandspits and associated wetlands • Habitats for a large variety of plants and animals including 300 species of birds
Kouchibouguac National Park	East Coast of New Brunswick	• Protects a portion of the Maritime Plain natural region • Bogs, salt marshes, tidal rivers, freshwater systems, sheltered lagoons, abandoned fields and tall forests • Second largest tern colony in North America • 25 km of sand dunes are home to endangered Piping Plover
Mingan Archipelago National Park Reserve	North Shore of the Gulf of St. Lawrence	• Protects part of the Eastern St. Lawrence Lowlands natural region • About 30 limestone islands and more than 1,000 granitic islets and reefs • Abundance of plants, seabirds colonies, seals, dolphins and whales
Forillon National Park	Extreme northeast end of the Gaspé Peninsula	• Representative sample of Notre-Dame and Mégantic mountain regions and elements of the Gulf of St. Lawrence marine natural region • Many seabirds including breeding colonies of black-legged kittiwake • Marine invertebrates (e.g. mussels, sea urchins, crabs and lobsters) and seals • Seven whale species including Blue Whale
Source: Parks Canada (2012a)		

Figure 4.64 National and Provincial Parks and Protected Areas in the Gulf of St. Lawrence



Provincial Parks and Protected Areas

Each of the provinces has its own protected areas systems, which include marine and coastal areas throughout the Gulf of St. Lawrence (Figure 4.64). Table 4.83 outlines a sample of the various types of parks and protected areas in each province, again based on data obtained from the Conservation Areas Reporting and Tracking System (CARTS 2013) and from provincial government parks and protected areas datasets and websites.

Protected areas are located in coastal and marine areas of Nova Scotia, Prince Edward Island, New Brunswick and Québec, along with numerous other inland protected areas that are not located in proximity to the coast.

Table 4.83 Provincial Parks and Protected Areas in the Gulf of St. Lawrence

Province	Protected Area Type	Purpose
Nova Scotia	Provincial Parks	• Outdoor recreational opportunities or to preserve rare or significant elements of the natural environment and historic resources
	Protected Natural Areas	• Wilderness Reserves • Nature Reserves • Protected Beaches • Game Sanctuaries • Wildlife Management Areas
Prince Edward Island	Provincial Parks	• Nature conservation and recreation including camping and day use
	Protected Natural Areas	• Protected Areas for a variety of habitats including water bodies, wetlands, forests, beaches and sand dunes • Wildlife Management Areas
New Brunswick	Provincial Parks	• Nature conservation and recreation including camping and day use
	Protected Natural Areas	• Natural Protected areas including ecologically sensitive areas or representative examples of natural ecosystems and landscapes • Bird Sanctuaries • Provincial Wildlife Management Areas
Québec	Parks	• Provincially designated areas for nature conservation and recreation including camping and day use
	Protected Natural Areas	• Threatened or Vulnerable Plant Species Habitats • Ecological Reserves • Biodiversity Reserves • Aquatic Reserves • Nature Reserves
Sources: Canadian Council on Ecological Areas (2013); Service NB (2010); Government of PEI (nd); Tourism PEI (2013); Nova Scotia DNR 2012; Nova Scotia Provincial Parks 2009		

National Marine Conservation Areas

The existing Saguenay-St. Lawrence Marine Park is the only designated NMCA in or near the Gulf of St. Lawrence and represents the St. Lawrence Estuary marine region. This NMCA but it is not located in or adjacent to the SEA Update Area.

Aside from the potential NMCA in the Laurentian Channel off the southwest coast of Newfoundland (as described earlier), there are a number of other potential NMCAs located in the Gulf of St. Lawrence.

Announced in 2010, a joint Canada / Québec feasibility assessment is presently underway for a marine protected area surrounding the îles de la Madeleine in the southern Gulf of St. Lawrence (Magdalen Shallows marine region). A potential candidate NMCA site has also been identified for the North Gulf Shelf region, in the Jacques Cartier Passage between the Mingan Islands and Anticosti Island, although no establishment studies are currently being undertaken for this area (Parks Canada 2006, 2012d).

Marine Protected Areas (MPAs) and Areas of Interest (AOI)

In addition to the Laurentian Channel off the southwest coast of Newfoundland, one other MPA and two AOIs are also located within the Gulf of St. Lawrence (Figure 4.63), with several others located in adjacent areas off Atlantic Canada (Table 4.84). These have been identified due to the presence of unique, rare or endangered species or their ability to support high productivity or habitat diversity.

Table 4.84 Marine Protected Areas and Areas of Interest Within or Near the Gulf of St. Lawrence

Name / Location	Description / Special Features	Conservation Purpose / Status
MPAs / AOIs Located in the Gulf of St. Lawrence		
Basin Head Marine Protected Area is located on the eastern tip of Prince Edward Island, near the town of Souris	• An approximately 5 km long shallow coastal lagoon. • Most notable species is a unique species of Irish moss.	• Conservation and protection of Irish moss and ecosystem, public awareness, education and research. • DFO designated as an MPA in October 2005.
American Bank Area of Interest is located off the eastern tip of the Gaspé Peninsula in the Gulf of St. Lawrence	• Submarine bank with a depth of at least 12 m includes two shelves separated by a sharp ridge. • Seasonal or year-round occurrence of many commercially important species, whales, species at risk and a high diversity of molluscs and crustaceans. • Significant potential as a feeding ground for various species of fish and marine mammals and as refuge habitat for declining groundfish populations, including the southern Gulf cod stock.	• An MPA designation would promote productivity and diversity of species (including those of commercial interest) and the recovery of species at risk. • DFO identified as a MPA area of interest in June 2011.
Shediac Valley Area of Interest is located in the southern Gulf of St. Lawrence east of New Brunswick and north-west of Prince Edward Island	• Highly productive 1,530 km² deep (24 to 51 m) water area with circular currents (gyres) located near the north and south borders. • Plays an important role in various biological functions (feeding, refuge, nursery and spawning) for a variety of fish species including many of	• An MPA designation would contribute to the survival and recovery of healthy and abundant aquatic resources by protecting them from a wide variety of human activities. • DFO identified as a MPA area of interest in June 2011.

Name / Location	Description / Special Features	Conservation Purpose / Status
	commercial interest. • Used by Atlantic cod particularly for summer feeding and as a nursery ground. • Other species of conservation interest include American plaice and winter skate.	
MPAs / AOIs Located in Atlantic Canada but not in the Gulf of St. Lawrence		
The Gully Marine Protected Area is located approximately 200 km off Nova Scotia, to the east of Sable Island on the edge of the Scotian Shelf	• Over 65 km long and 15 km wide, the Gully includes shallow sandy banks, a deep-water canyon and portions of the continental slope and abyssal plain. • Significant coral communities, diversity of shallow and deep-water fishes and a variety of whales and dolphins. • Resident population of Northern Bottlenose Whales found in the deep canyon.	• Legal protection for the natural biological diversity and ecosystem health of the Gully. • DFO designated as an MPA in May 2004.
St. Ann's Bank Area of Interest is located east of Cape Breton on the Eastern Scotian Shelf	• A variety of habitat types range from shallow waters of the Bank to deeper waters of the Laurentian Channel. • High diversity of fish species. • Important habitat for species at risk (e.g. Atlantic wolffish), depleted species (e.g. Atlantic cod) and several commercial species that are at low biomass levels (American plaice, white hake, redfish, witch flounder). • Sensitive ocean bottom habitats and species, such as corals and sponges • Summer foraging area for endangered Leatherback Turtle • Migration corridor for many fishes and marine mammals.	• While existing fisheries and other activities will be allowed to continue during the MPA designation process, St. Ann's Bank will receive some interim protection. • DFO will monitor activities in and around the site and work with other regulators to ensure any proposed new activities in other industry sectors consider the ecological importance of the area. • DFO identified as a MPA area of interest in June 2011.
Source: DFO (2012f)		

National Wildlife Areas and Migratory Bird Sanctuaries

There are no designated National Wildlife Areas in Newfoundland and Labrador. These sites do, however, exist in three other provinces that surround the Gulf of St. Lawrence (Figure 4.65, Table 4.85). Some of these National Wildlife Areas are also IBAs as described in Section 4.2.2.7.

Table 4.85 National Wildlife Areas in the Gulf of St. Lawrence

National Wildlife Area	Location	Most Significant Features
Sea Wolf Island	4 km off the coast of Cape Breton, Nova Scotia	• Sandstone bedrock island with high cliffs • Colonial breeding bird habitat • Over 40 species of birds recorded

National Wildlife Area	Location	Most Significant Features
		• Part of Margaree Island IBA
Wallace Bay	42km east of Amherst, Nova Scotia in the Northumberland Strait	• Marine and freshwater wetlands, forested uplands and fields • Habitat for many species of birds and other wildlife • Important for migrant and nesting waterfowl • 155 species of birds have been recorded
Cape Jourimain	Northumberland Strait 2 km from the Village of Cape Tormentine, New Brunswick	• Salt marshes, brackish marshes, freshwater wetlands, barrier beach, sand dune and uplands • Refuge for approximately 170 native and migratory bird species
Portage Island	Miramichi Bay 38km from the village of Chatham, New Brunswick	• Shallow waters and sheltered bay provide staging and migration habitat for waterfowl • Sandy flats and beaches used by migrating shorebirds
Pointe de l'Est	Northeastern tip of the Îles-de-la-Madeleine, Québec	• Habitats and staging areas for shorebirds and migratory birds • Breeding grounds for number species including species at risk • Also Île de l'Est IBA
Sources: Environment Canada (2012a)		

Canada has 92 Migratory Bird Sanctuaries that provide marine and terrestrial habitat for migratory birds. In the Gulf of St. Lawrence, one Migratory Bird Sanctuary exists along the Gulf coast in each of Nova Scotia, Prince Edward Island and New Brunswick, and 12 are located in Québec. Eleven out of the 15 Migratory Bird Sanctuaries are either an IBA or part of one (Environment Canada 2012a). Migratory Bird Sanctuaries in the Gulf are listed and briefly described in Table 4.86 and illustrated in Figure 4.65.

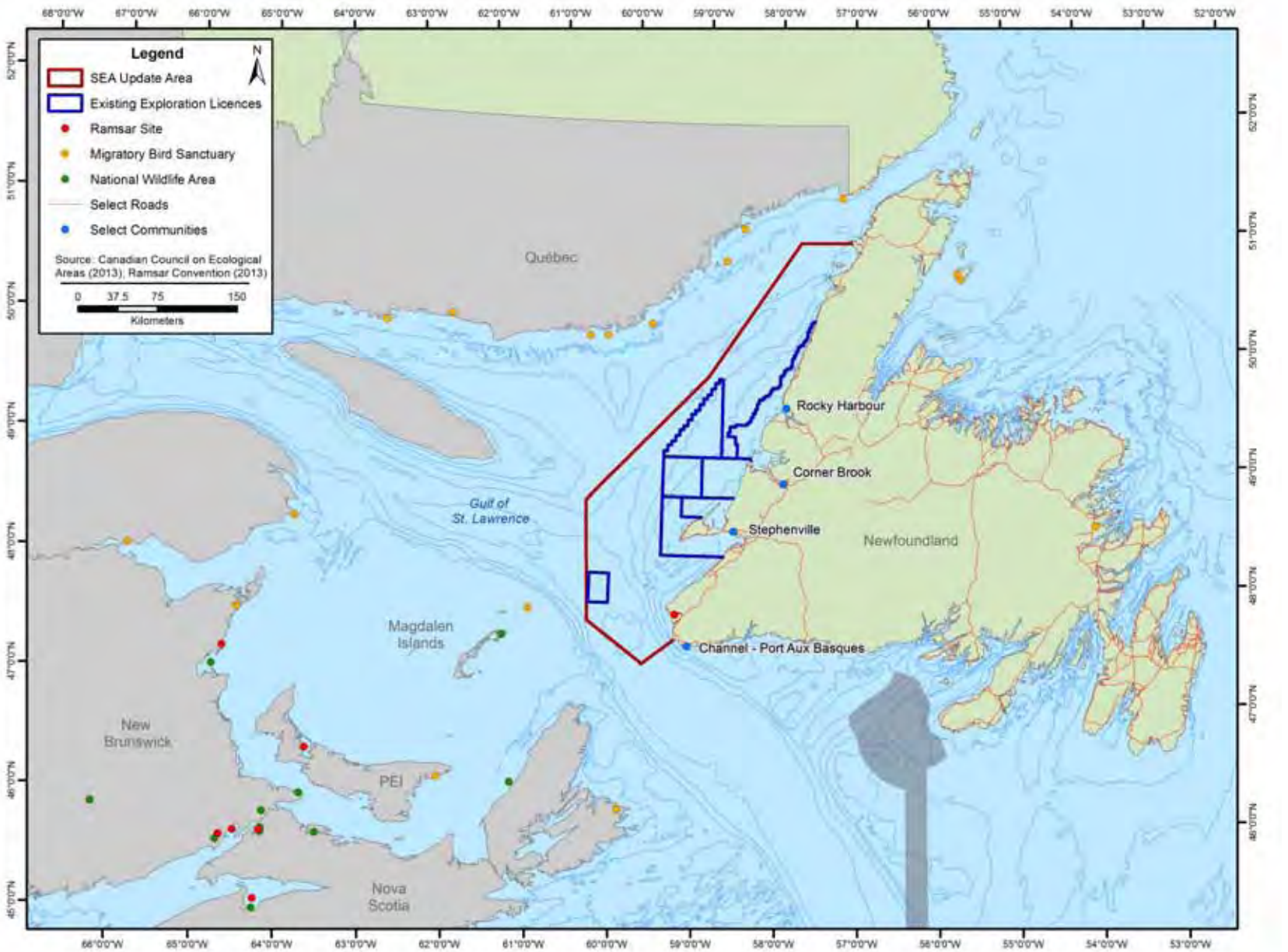
Table 4.86 Migratory Bird Sanctuaries in the Gulf of St. Lawrence Region

Migratory Bird Sanctuary	Location	Most Significant Features
Big Glace Bay Lake	Northeast shore of Cape Breton, Nova Scotia, near Glace Bay	• Part of Big Glace Bay Lake IBA • Coastal lagoon enclosed by a gravel and sand barrier beach with sparse vegetation. Low tide exposes mud and sand flats and intertidal beds of eel grass • Spring and fall migration area for Canada Geese (approximately 1,500 with a maximum count of 6,000 in spring)
Inkerman	East shore of northeast New Brunswick 20 km southeast of Caraquet	• Part of Pointe aux Rats Musques Heronry IBA • Pointe aux Rats Musqués contains a large colony of Black-crowned Night-Herons and several pairs of Great Blue Herons
Black Pond	Northeasterm tip of Prince Edward Island	• Migratory bird sanctuary
Brador Bay	North shore of the northeast part of the Gulf of St. Lawrence near Blanc-Sablon, Québec	• Also Baie de Brador IBA • Includes land, shoreline and marine area around Greenly and Perroquets Islands which is more than half covered by sand banks, rocky outcrops and water • Rocky surface of Greenly Island has a thin cover of herbaceous vegetation, and Perroquets Island has sparse herbaceous vegetation and low shrubs • Important colonies of Atlantic Puffin and Razorbill

Migratory Bird Sanctuary	Location	Most Significant Features
Baie des Loups	Northeastern part of the Gulf of St. Lawrence near Baie-des-Loups, Québec	• Also Baie des Loups IBA • 13 islands with stunted conifers, rock outcrops and freshwater ponds along with the marine waters of the archipelago • Great variety of seabird colonies in breeding season • Significant numbers of Atlantic Puffin
Betchouane	Approximately 1.5 km off the north shore of the Gulf of St. Lawrence, Québec	• Also Betchouane IBA • 3 three islands of the Mingan archipelago: Île Calculot des Betchouanes, Île Innu and a small unnamed island • Terrestrial portion consists mostly of rocky outcrops, woodlands, shrubs and herbaceous vegetation. Innu Island has a spruce-balsam fir forest and a peat bog. Île Calculot des Betchouanes has a herbaceous vegetation cover • Continentally significant numbers of breeding common eiders • High diversity of nesting seabirds
Gros Mécatina	East of the community of La Tabatière on the Lower North Shore of the Gulf of St. Lawrence, Québec	• Plate, Marmettes and Trois Collines islands • Atlantic Puffin, Razorbill, Black Guillemot, Great Black-Backed Gull, Herring Gull and Tern species form small colonies
Île à la Brume	East of the community of La Romaine on the Lower North Shore of the Gulf of St. Lawrence, Québec	• Common Eider, Ring-Billed Gull, Herring Gull and Great Black-Backed Gull nest here
Bonaventure Island and Percé Rock	Gulf of St Lawrence approximately 3.5 km off the shore of the Gaspé Peninsula, Québec	• Part of Bonaventure Island IBA • Balsam fir and spruce dominate. Cliffs and shorelines have limited vegetation except some Arctic / alpine species • Large Northern Gannet colony of nearly 60 000 breeding pairs with large populations of Black-Legged Kittiwakes and Common Murres • 11 species of breeding seabirds and waterbirds • In total, nearly 220 species of birds (including boreal forest birds) have been recorded
Corossol Island	Sept-Îles on the Lower North Shore of Québec	• Part of Corossol Island IBA • Seven islands form a natural barrier sheltering a bay that provides habitats such as supralittoral flats, salt marshes, mud flats and eelgrass beds. The islands have boreal forest, beaches, rocky cliffs and barren summits • More than 10,000 seabirds during breeding and/or during migration • Shorebirds found in great numbers throughout the year • Supports several species-at-risk • Approximately 20 raptor species have been recorded
Îles Sainte-Marie	North shore of the Gulf of St. Lawrence, near La Romaine, Québec	• Part of Îles Sainte-Marie IBA • 13 islands covered mostly by tundra and stunted conifers and marine area extending 1 km around the archipelago • One of the richest bird colonies in the Gulf of St. Lawrence
Bird Rocks	Rocher aux Oiseaux and the Rocher aux Margaulx	• Part of Les rochers aux Oiseaux IBA • Rocher aux Oiseaux is a flat topped island with 30 m high rock

Migratory Bird Sanctuary	Location	Most Significant Features
	are located about 32 km northeast of the Îles-de-la-Madeleine, Québec	cliffs on nearly all sides • The Rocher aux Oiseaux and Rocher aux Margaulx support one of six Northern Gannet colonies in North America • A number of other seabirds nest on the islands
Saint-Augustin	Group of islands and rocks along the south shore of Grande Passe Island, in the northeast section of the Gulf of St. Lawrence, Québec	• Also Saint-Augustin MBS IBA • Most of the site is composed of coastal marine areas with a sparse cover of shrubby and grassy vegetation • Sever Species of breeding birds
Saint-Omer	Outside of Gaspe, Québec on the New Brunswick border	• Migratory bird refuge in the Baie des Chaleurs
Watshishou	Coastal area on the north shore of the Gulf St. Lawrence, located partially within Mingan National Park Reserve, Québec	• Part of Watshishou IBA • Mostly marine, with rocky islets, islands and outcrops along the shoreline • Supports large numbers of nesting Common Eiders and nesting Terns, Gulls, and Cormorants
Source: Environment Canada (2012a); Lower North Shore Tourism (2013)		

Figure 4.65 National Wildlife Areas, Migratory Bird Sanctuaries and Ramsar Sites



4.2.4.3 Other Identified Areas in Western Newfoundland and the Gulf of St. Lawrence

Gulf of St. Lawrence Integrated Management Initiative

DFO has identified the Gulf of St. Lawrence one of five priority large ocean management areas requiring large-scale coordinated management. The Gulf of St. Lawrence Integrated Management (GOSLIM) initiative aims to plan and manage human activities among multiple user groups while conserving sustainable ocean resources (DFO 2013c).

DFO has also indentified smaller scale integrated Coastal Management Areas (CMAs) in the Gulf, with three of these being located in Western Newfoundland: Great Northern Peninsula; Bay St. George / Port au Port; and Bay of Islands. The Western Newfoundland CMAs are managed by the Great Northern Peninsula Integrated Coastal Zone Management Steering Committee, the Bay St. George / Port au Port Marine and Coastal Resources Steering Committee and the Atlantic Coastal Action Plan (ACAP) Humber Arm Environmental Association – Bay of Islands. The CMA committees, which include representatives of communities, businesses, local industries and other stakeholders, provide capacity for dealing with local and regional issues (NLDFA 2011).

Canadian Parks and Wilderness Society – Identified Special Marine Areas

The Canadian Parks and Wilderness Society (CPAWS) has also identified a number of special marine areas in Newfoundland and Labrador, and has prepared summary descriptions of these areas highlighting their locations, marine habitats, notable marine life, special features, existing protection, current or potential threats and recommendations for protection. CPAWS has no regulatory authority to designate protected areas and does not propose protection boundaries (CPAWS 2009). Several of these areas are located in or near the SEA Update Area, as outlined in Table 4.87.

Table 4.87 CPAWS Identified Special Marine Areas in Western Newfoundland

Area	Marine Habitat Importance / Conservation Status
J.T. Cheeseman Provincial Park	• On the flight path of many migratory species • Houses the largest variety of shorebirds in Newfoundland and Labrador • Coastal Provincial Park protects natural heritage and Piping Plover nesting habitat
Boswarlos	• Extensive eelgrass beds (important for fish and shellfish) and abundant scallop beds in shallow areas • Within the Port au Port Bay Fisheries Conservation Closed area, administered by DFO under the Fisheries Act, aimed at protecting Atlantic herring spring spawning stocks and lobster stocks
Sandy Point	• Contains the largest Spartina salt marsh and one of the largest eelgrass beds known to exist in the province • Houses uncommon plant species such as Seabeach Sedge, Saltmarsh Rush, Seaside Lavender and Saltwater Cordgrass • Within the St. George's Bay Fisheries Conservation Closed Area, administered by DFO under the *Fisheries Act*, aimed at the protection and conservation of Atlantic salmon stocks and Atlantic herring spring spawning stocks • Site is largely protected through the efforts of ENGOs such as the Nature Conservancy of Canada
St. George's Bay – Port au Port	• St. George's Bay contains many eelgrass beds and maritime New England type salt marshes that provide important habitat for birds and other animals

Area	Marine Habitat Importance / Conservation Status
	• Unique and rare species of cordgrass, amphipods and fish exist in the area • St. George's Bay contains submarine fans that have not been seen anywhere else in the region • Herring spawn in the area • St. George's Bay and Port au Port Bay have Fisheries Conservation Closed Areas (FCCA) administered by DFO under the *Fisheries Act* • St. George's Bay is a FCCA for protection and conservation of Atlantic salmon stocks and Atlantic Herring spring spawning stocks. The area within 55 m of the shore is closed to trap nets from January 1st to December 31st • Port au Port Bay is a FCCA for protecting Atlantic herring spring spawning stocks and lobster stocks through seasonal closures
West Coast of Newfoundland	• Significant for a large abundance of fish • Several groundfish and pelagic fish species rely on the area for feeding, especially in summer. Herring and halibut over-winter in the area, and cod, capelin and herring use it for spawning. Cod spawn in early spring in St. George's Bay • Priority area for conservation identified by DFO as an EBSA • Northern regions of the EBSA, close to the Strait of Belle Isle, are significant for marine mammals and the southern areas close to St. George's Bay are potentially significant feeding areas for Blue Whales and other cetaceans
Blow Me Down Provincial Park	• Eelgrass beds exist in the vicinity of Blow Me Down. Rockweed, kelp and communities representative of sandy seabeds are also present • York Harbour, Lark Harbour and the outer Bay of Islands contain productive lobster fishing areas • Blow Me Down Park protects natural heritage and provides outdoor recreation • Blow Me Down is within the Bay of Islands FCCA for Atlantic salmon conservation
Bonne Bay	• Bonne Bay and the estuary include 20 or more different productive marine habitats • Surrounded by Gros Morne National Park which partially protects marine areas
Table Point	• Contains many low plateau bogs. Irish moss grows around the coastline • Table Point Ecological Reserve, which protects well preserved fossils, ensures some on-land protection
The Hole-Point Riche	• Sudden depths in the sea floor create rich and diverse areas. The presence of sea pens is of particular note. • Halibut breed and shrimp spawn in or near The Hole • Capelin over winter in the deep water and spawn on the shoals • In most years, an area of open water near Port au Choix attracts seals
Sources: CPAWS (2009)	

Important Bird Areas

BirdLife International's Important Bird Areas (IBA) Program is a global effort to identify and protect the world's most critical bird habitats (a description of which was provided in Section 4.2.2.7). BirdLife Canada has identified 597 Canadian IBAs as having worldwide, continental or national significance. Of these, 80 are located partially or wholly in National Wildlife Areas or Migratory Bird Sanctuaries and all are included in science-based initiatives to identify, conserve and monitor a network of sites that provide essential habitat (BLI 2012).

Convention on Wetlands of International Importance

The 1998 Convention on Wetlands of International Importance (also referred to as the Ramsar Convention) established an objective of sustaining important wetland habitats. In 1981, Canada became a contracting party to the Ramsar Convention. To date, Canada has designated 37 Ramsar Sites of which 17 are also National Wildlife Areas or Migratory Bird Sanctuaries (Environment Canada 2012a). Those sites which are located in the Gulf of St. Lawrence region are presented in Table 4.88 and Figure 4.65.

Table 4.88 Ramsar Sites in the Gulf of St. Lawrence Region

Site	Description
Grand Codroy Estuary, Newfoundland	• One of the most productive of Newfoundland's few wetland estuaries • Fall staging area and food source for migrating Canada Geese • Large numbers of other water birds including ducks
Tabusintac Lagoon and River Estuary, New Brunswick	• Highly productive coastal lagoon • Second largest tern colony in New Brunswick • Major water bird concentration area for spring and fall migrations
Malpeque Bay, Prince Edward Island	• Abundant food source for large numbers of migrating water birds including up to 20,000 Canada Geese in spring and fall • Abundant fall migratory shorebirds including two species of duck • Important nesting colony for herons and bitterns
Sources: Ramsar Convention (2013)	

Western Hemisphere Shorebird Reserve Network

The Western Hemisphere Shorebird Reserve Network (WHSRN) conservation strategy was created in 1986. North and South American scientists established the network to protect key habitats to sustain healthy populations of shorebirds. Of the seven identified Canadian sites, only one (i.e. Bay of Fundy) is located in Eastern Canada (WHSRN 2009). Thus none are located in the Gulf of St. Lawrence.

4.3 Human Activities

The following sections provide an overview of the existing human environment of the SEA Update Area. This includes, initially, a high-level overview of the various regions and communities that comprise the Western Newfoundland region, as overall background and context.

This overview is followed by an updated description of those human activities that are particularly relevant to the scope of the SEA Update. This includes marine fisheries and other activities and elements that occur within or near the marine environment, and which therefore have the potential to interact with, and be affected by, future petroleum activities in the SEA Update Area.

4.3.1 Regions and Communities

Newfoundland and Labrador is the easternmost province of Canada, and consists of the Island of Newfoundland (111,390 km^2), as well as Labrador (294,330 km^2) which is located to the northwest on the Canadian mainland. The province currently has a population of 510,578 residents (Statistics Canada 2011). The Island of Newfoundland comprises less than 30 percent of the province's total land area, but is home to nearly 95 percent of its population. Residents live in approximately 250 municipalities and many unincorporated communities which range in population from fewer than five to more than 100,000 (NLDMA 2012). Communities are widely distributed along the coastline and throughout the interior of the Island.

The following sections provide general baseline information related to the western portion of the Island, specifically along the coast, with a focus on various relevant socioeconomic indicators such as population, infrastructure, economy, employment and business.

This existing human environment context is described in general for Western Newfoundland, including sub regions that are organized for various purposes such as government administration or data collection. The discussion of population is based on Local Areas (Figure 4.66), as defined by the NL Department of Finance's Community Accounts system, and which correspond with Statistics Canada's Census Subdivisions. For the discussion of economy, the focus is on the four relevant provincial Regional Economic Zones (Figure 4.67):

1) *Economic Zone 7:* Red Ochre Regional Board Inc.;
2) *Economic Zone 8:* Humber Economic Development Board Inc.;
3) *Economic Zone 9*: Long Range Regional Economic Development Board; and
4) *Economic Zone 10*: Marine and Mountain Zone Corporation

Although these and other Regional Economic Zones and their Boards were recently discontinued in Newfoundland and Labrador, much of the available socioeconomic information in the province is based on these boundaries, and so they are a useful focus for the presentation and analyses of data at the regional level for this SEA Update.

Figure 4.66 Western Newfoundland, Local Areas

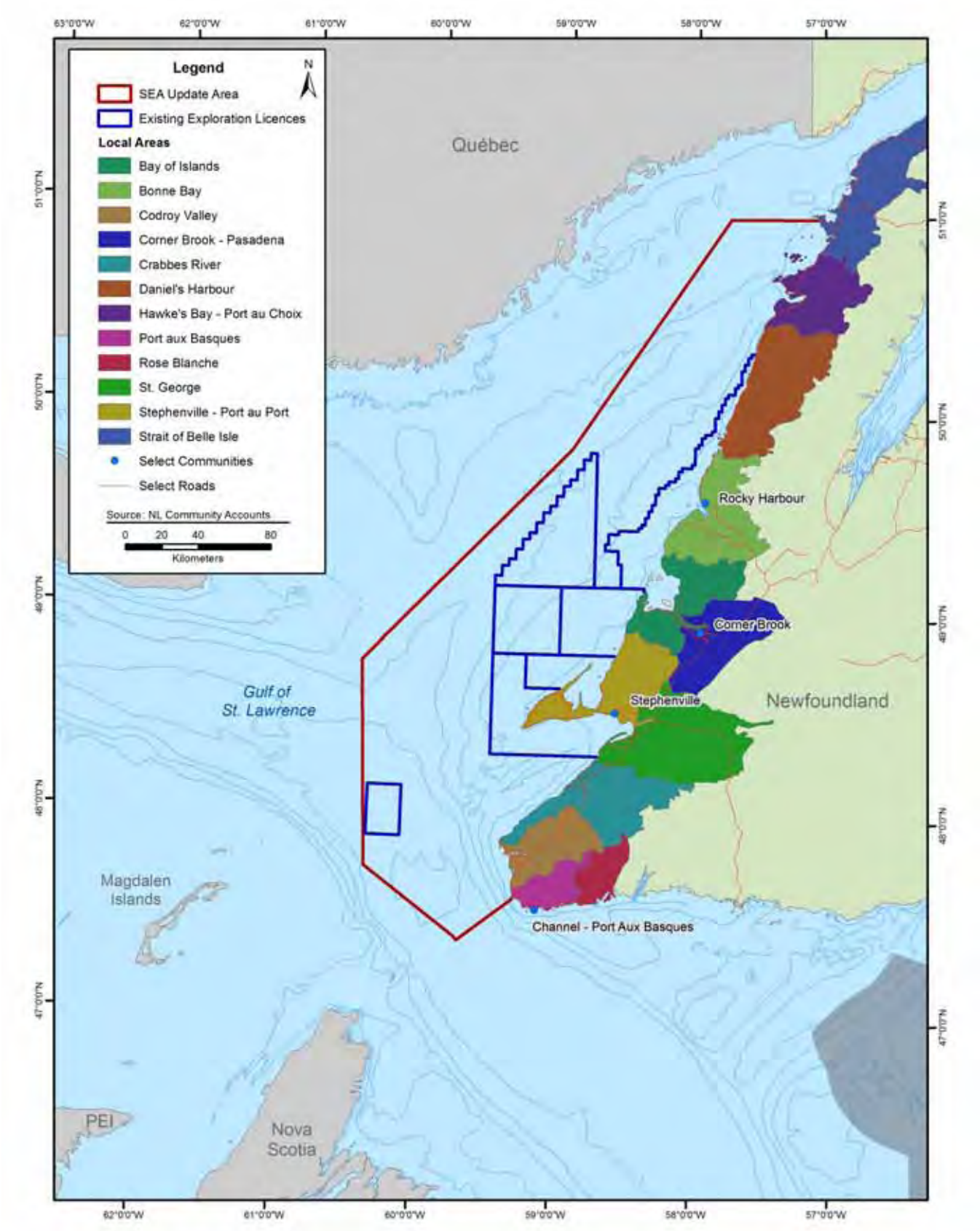
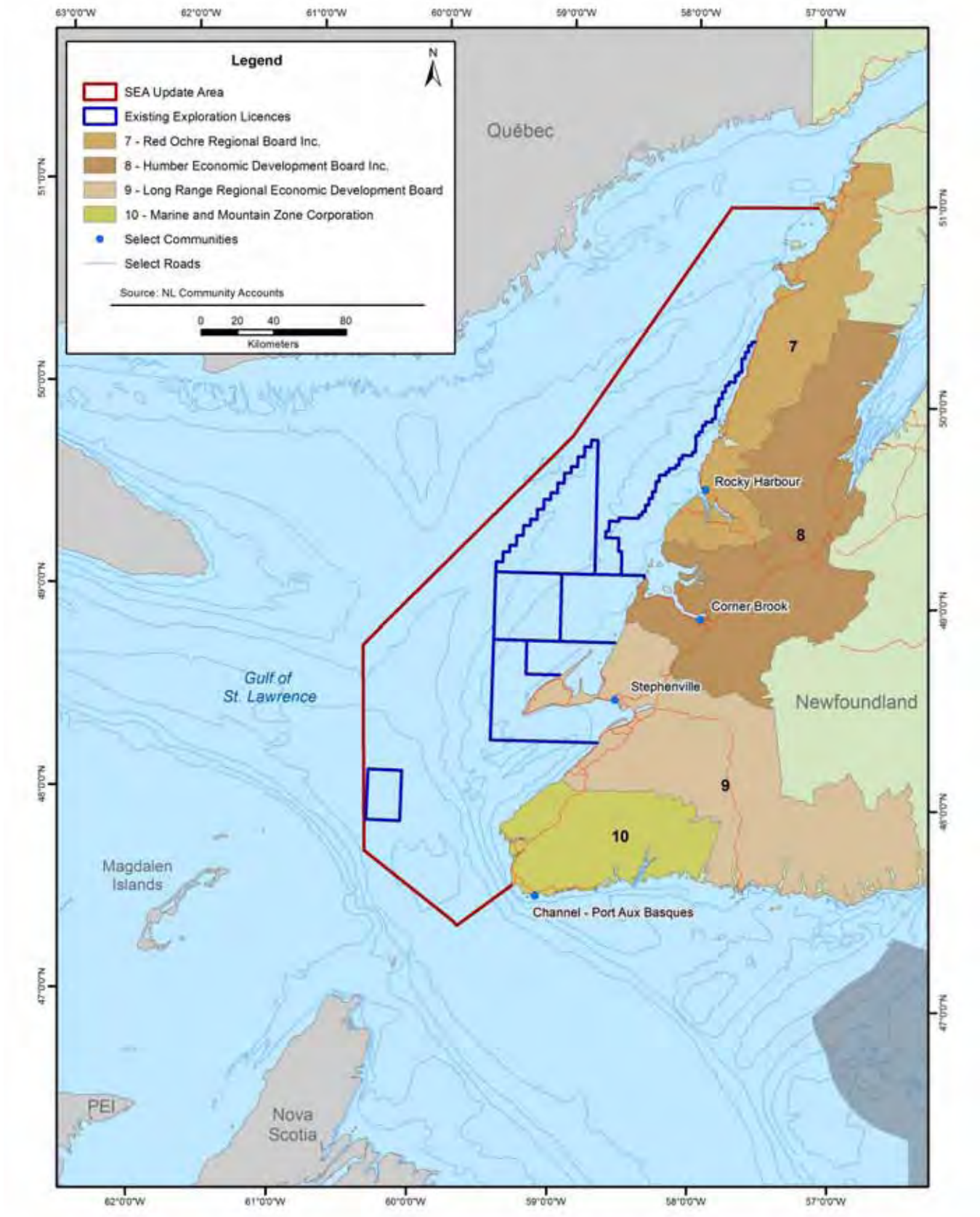


Figure 4.67 Western Newfoundland, Economic Zones



The most current and relevant available data and information are used to describe the existing human environment. Baseline data are drawn from various sources including:

- Statistics Canada;
- Newfoundland and Labrador Statistics Agency (Community Accounts NL) and other provincial Departments and Agencies;
- Regional Economic Development Boards; and
- Local and regional authorities.

Depending on the topic (e.g. population or economy), data are compiled for Local Areas, municipalities, Census Subdivisions, Economic Zones or a combination of these.

4.3.2 Population

The population of the Western Newfoundland area was approximately 66,750 persons in 2011. The majority of the communities in the region are small coastal towns, with the most densely populated areas being located around Corner Brook and Stephenville as well as a number of other smaller centres on or near the Northern Peninsula. The area's total population decreased slightly between 2001 and 2012 (Statistics Canada 2006, 2011).

The populations of most areas of Western Newfoundland are declining overall (Table 4.89). Growth has occurred in the Corner Brook-Pasadena Local Area, which is the largest regional service centre. The Codroy Valley Local Area also experienced growth in the last decade but its population is currently declining (Statistics Canada 2006; 2011).

Table 4.89 Population, Western Newfoundland Region

Local Area (Census Subdivisions and Municipalities)	2001	2006	2011	% Change (2001 to 2011)
Western Newfoundland Region (Total)	**69,106**	**67,628**	**66,743**	**-3.4**
Local Area 74: Hawke's Bay-Port au Choix Area (Division No.9 Subdivision G, Hawke's Bay, Port au Choix, Port Saunders, River of Ponds)	2,627	2,364	2,151	-18.1
Local Area 75: Daniel's Harbour Area (Division No.9 Subdivision H, Bellburns, Cow Head, Daniel's Harbour, Parson's Pond, St. Paul's)	1,899	1,749	1,622	-14.6
Local Area 70: Bonne Bay Area (Division No.9 Subdivision A, Glenburnie-Birchy Head-Shoal Brook, Norris Point, Rocky Harbour, Sally's Cove, Trout River, Woody Point)	3,148	3,189	2,923	-7.1
Local Area 40: Bay of Islands (Division No.5 Subdivision D, Cox's Cove, Humber Arm South, Lark Harbour, McIver's, York Harbour)	4,101	3,987	3,749	-8.7
Local Area 39: Corner Brook-Pasadena Area (Division No.5 Subdivision C, Division No.5 Subdivision F, Corner Brook, Massey Drive, Mount Moriah, Gillams, Hughes Brook, Irishtown-Summerside, Meadows, Pasadena, Steady Brook)	28,173	28,703	29,291	4.0
Local Area 37: Stephenville- Port au Port Peninsula (Division No.4 Subdivision E, Division No.4 Subdivision D,	16,710	15,795	15,797	-5.5

Local Area (Census Subdivisions and Municipalities)	2001	2006	2011	% Change (2001 to 2011)
Gallants, Kippens, Port au Port East, Port au Port West-Aguathuna-Felix Cove, Stephenville, Stephenville Crossing, Cape St. George, Lourdes)				
Local Area 36: St. George's Area (Division No.4 Subdivision C, St. George's)	2,272	2,091	1,935	-14.8
Local Area 35: Crabbes River (Division No.4 Subdivision B)	1,472	1,399	1,298	-11.8
Local Area 34: Codroy Valley (Division No.4 Subdivision A)	1,708	1,883	1,810	6.0
Local Area 32: Port aux Basques Area (Division No.3 Subdivision H, Burnt Islands, Channel-Port aux Basques, Isle aux Morts)	6,996	6,468	6,167	-11.8
Source: NLDOF (2012a)				

4.3.3 Municipal Administration and Infrastructure

In Newfoundland and Labrador, communities are administered in a number of ways. The method of development control is primarily related to whether or not the community is an incorporated municipality under the Newfoundland and Labrador *Municipalities Act*. Within the province, there are approximately 280 incorporated municipalities (cities and towns) and 180 Local Service Districts (LSDs) which have been organized to offer services. Additionally, a number of unorganized communities exist which have no formal local government but may provide administration and services on an informal basis.

4.3.3.1 Municipal Boundaries and Municipal Planning Areas

Municipal land use in Newfoundland and Labrador is administered by the Land Use Planning Section, Engineering and Land Use Division of the provincial Department of Municipal Affairs, which manages municipal growth and development under the provincial *Urban and Rural Planning Act*. Municipalities are required to prepare municipal plans and development regulations every ten years which are reviewed every five years. Plan amendments may be made as required. Municipal plans and development regulations are legal documents adopted, implemented and enforced by municipalities. Incorporated communities are defined by "municipal boundaries", which may be encompassed by larger "municipal planning areas" that include land outside of, but administered by, a municipality. Development permits are required within the municipal boundary or municipal planning area as defined by the municipal plan.

LSDs are not municipalities but rather comprise designated areas outside of incorporated cities and towns. LSDs are established by the Department of Municipal Affairs (under the *Municipalities Act, Local Service District Regulations*) if desirable and proven by petition of the majority of householders in a community. LSDs are given the authority to elect a committee to administer services such as water and sewer, waste management, garbage collection, street lighting, fire protection and/or animal control. LSDs do not have development control authority.

Along the coastline adjacent to the SEA Update Area, there are 28 municipal boundaries and 18 larger municipal planning areas located within 10 km of the shoreline.

4.3.3.2 Drinking Water Supplies

In Newfoundland and Labrador, drinking water supplies may be designated and protected under the authority of the provincial *Water Resources Act* with the relevant municipality applying for such designation. The majority of surface water supplies in the province have been designated as protected, and most of the population receives its drinking water from protected sources. Under the Act, water sources are designated and protected as either: "protected public water supply areas", or surface water supplies, or "protected wellheads", or ground water supplies. An area around a drinking water supply can be designated as a protected area and use of the water body and the protected land area may therefore be regulated. In designated areas, buffer zones are maintained around such drinking water supplies.

Any existing or proposed development within a protected water supply area is subject to the provincial *Policy for Land and Water Related Developments in Protected Public Water Supply Areas*. The policy identifies activities that are not permitted to occur in protected water supply areas and those that may be permitted by the Department of Environment and Conservation. Subject to government approval, certain development activities may therefore be permitted in protected water supply areas. If issued, a certificate of approval typically contains specific terms and conditions to help protect drinking water quality.

Along the coastline adjacent to the SEA Update Area, there are 79 water supply areas located within 10 km of the shoreline, 48 of which are groundwater and 31 of which are surface water supplies (Figure 4.68). These community water supply areas cover a total area of approximately 440 km^2, of which approximately 10 percent of this area is comprised of groundwater supplies and the remainder is surface water supplies.

An overview of the number of distribution of drinking water wells by community in the Western Newfoundland region is provided in Figure 4.69.

4.3.3.3 Regional Transportation Infrastructure

The Trans Canada Highway (TCH) begins at the Marine Atlantic ferry terminal in Channel-Port aux Basques and ends in St. John's. The TCH also links to the main service centres and a number of communities in Western Newfoundland. Other smaller secondary roads connect to various communities. Route 430, which begins at Deer Lake, connects the Northern Peninsula to the TCH (NLDTW 2012). The Stephenville International Airport and Deer Lake Regional Airport, which are classified as regional / local airports, serve areas of Western Newfoundland (as does the airport at St. Anthony). Landing strips are located at St. Andrews and Port aux Choix (NLDTW 2012).

Marine Atlantic operates the ferry service between Newfoundland and Nova Scotia, which travels to and from Channel-Port aux Basques (MAI 2012). The Canadian Coast Guard, oil tankers, cruise ships and shipping companies also occasionally use the port's facilities (PAB 2012). Stephenville's harbour is located approximately 50 km east of Cape St. George. The Port of Corner Brook is located in the Bay of Islands. In addition to these larger ports, various small harbours are located throughout Western Newfoundland (NLDTW 2012).

A ferry service to Southern Labrador and the Québec Lower North Shore is available between Blanc Sablon (Québec) and St. Barbe (Newfoundland) for most of the year, and between Blanc Sablon and Corner Brook when the Strait of Belle Isle is filled with sea ice.

Figure 4.68 Community Water Supplies in the Western Newfoundland Region

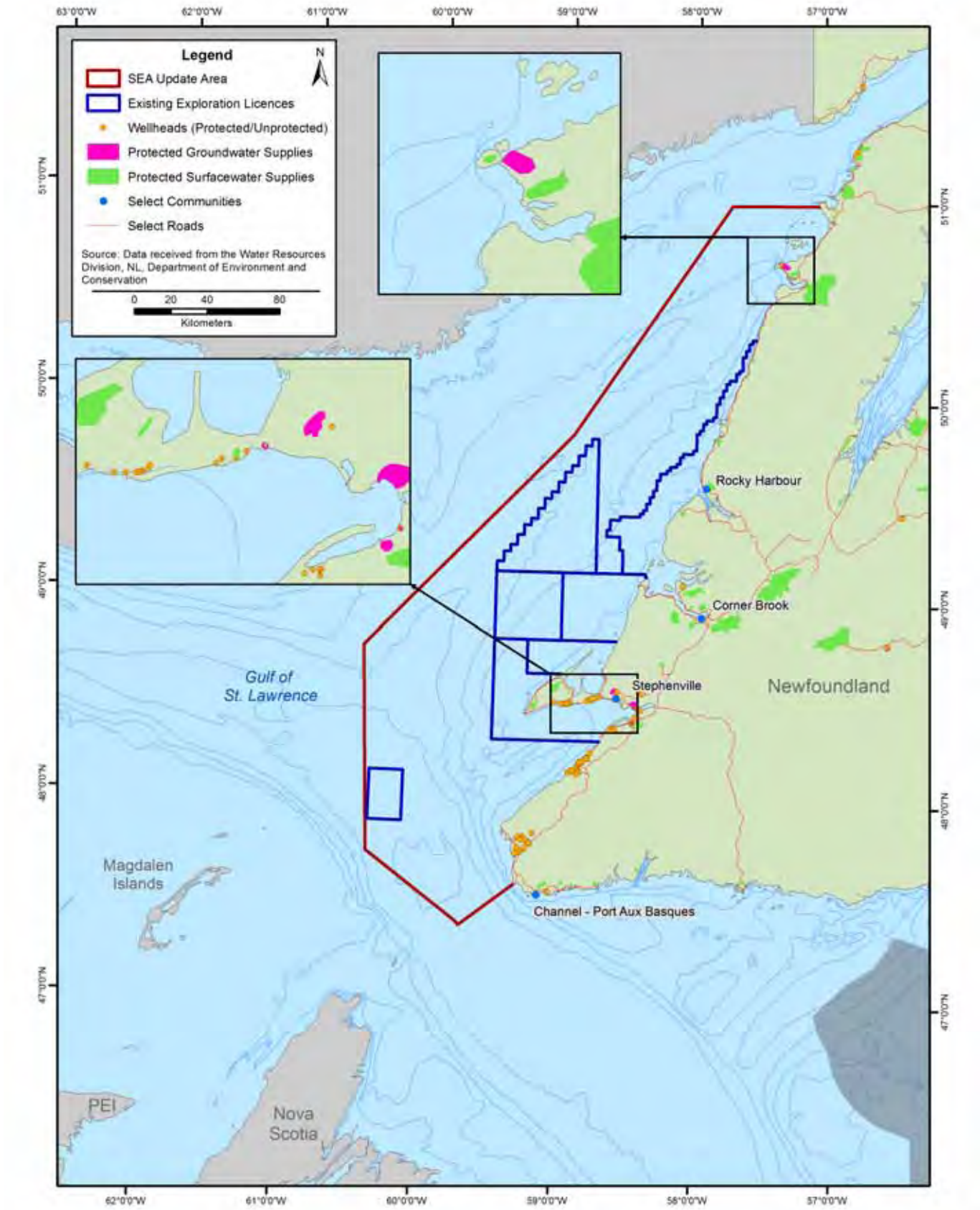
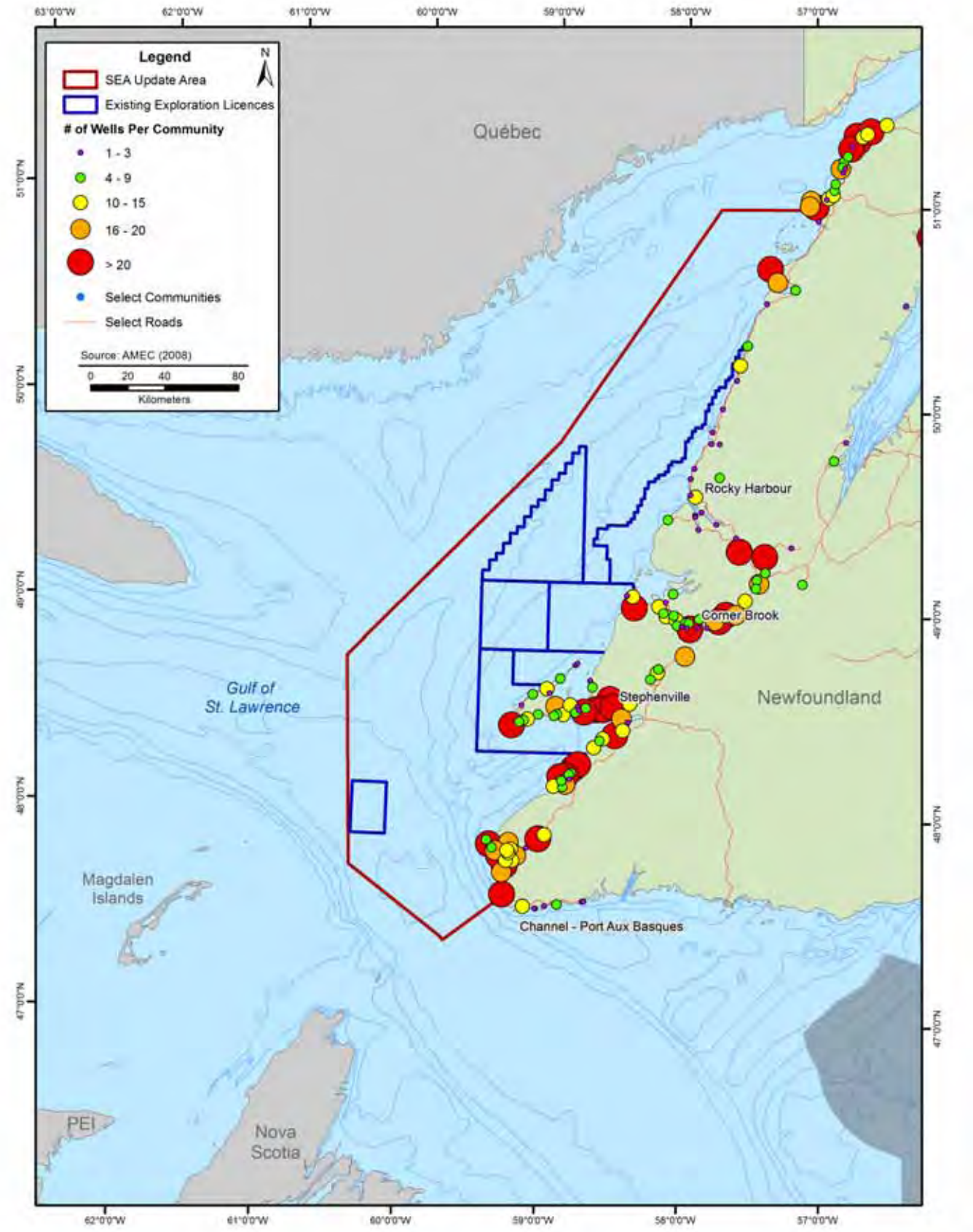


Figure 4.69 Drinking Water Wells (Numbers by Community) in the Western Newfoundland Region



4.3.4 Economy, Employment and Business

The following sections provide a general and relatively high-level description of the overall economy and associated employment and business activity in Western Newfoundland, as background and context for the SEA Update. Additional information on specific aspects of the regional economy that are especially relevant to the focus and scope of the SEA Update, such as fisheries, tourism and other commercial activities, is also provided in later sections.

4.3.4.1 Economic Overview

The economy of Western Newfoundland is predominantly natural resource-based with various small urban centres – Corner Brook, Stephenville and Channel-Port aux Basques – that provide a variety of retail, commercial and government services. The following provide brief descriptions of the four economic zones in the relevant area of Western Newfoundland (see Figure 4.67).

> *Economic Zone 7:* Red Ochre Regional Board Inc., is located on the west coast of the Northern Peninsula from St. Barbe in the north to Trout River in the south.
>
> *Economic Zone 8:* Humber Economic Development Board Inc., serves the southern part of the Northern Peninsula, on the west coast of Newfoundland, from Jackson's Arm in the north to Bay of Islands in the south.
>
> *Economic Zone 9:* Long Range Regional Economic Development Board, is located on the west coast and includes the Port au Port Peninsula. It generally extends from Gallants in the north to River Brook in the south and includes Burgeo and Francois on the south coast of Newfoundland.
>
> *Economic Zone 10:* Marine and Mountain Zone Corporation serves southwest Newfoundland and begins at Highlands to the southern tip of the west coast and includes La Poile on the south coast.

The southern portion of the SEA Update Area (Economic Zones 8, 9 and 10) includes some of the most productive and active farmland in Newfoundland. Agricultural activities include dairy farming, root vegetables and cranberry production, and some farms grow hay and silage to support their operations. Several livestock farms and one abattoir operate in the area (NLDOF 2011). A secondary processing sector is well-established with facilities for egg and dairy products (HEDB 2012). Each of the four economic zones has active commercial fisheries (see Section 4.3.5). Aquaculture is concentrated in the Bay St. George-Port au Port Peninsula area and includes blue mussels and land-based salmon smolt production. Secondary processing is conducted at several seafood plants throughout Western Newfoundland and mainly on the Northern Peninsula (NLDOF 2012b).

Mining activity in Western Newfoundland is limited to industrial minerals extraction, namely limestone, dolomite and tungsten. Two companies operate year-round and employ over 100 people at peak production. Four prospecting companies are currently exploring the feasibility of gold, salt, copper, nickel, magnetite, titanium and vanadium deposits (NLDOF 2012b). The SEA Update Area includes five Provincial Forestry Management Districts: 14, 15, 16, 17 and 18. Forestry had been a major contributor to the regional economy, but diminished global demand for forest products (i.e. newsprint and lumber) and the closure of several key facilities (at Stephenville and Grand Falls-Windsor) have affected the industry's future. Corner Brook Pulp and Paper, the only remaining

paper mill in the province, has decreased production. Economic activity related to forest extraction and forest products is limited and employment in the sector is declining (HEDB 2012).

The bulk of other business activity occurs in the centres of Stephenville, Corner Brook and Channel-Port aux Basques. These towns form the centres of Western Newfoundland's commercial, financial, retail and government services. GDP data are not available for sub-provincial areas, but some general trends are evident. As with many rural economies in Atlantic Canada, Western Newfoundland (Economic Zones 7, 8, 9 and 10) has experienced declines or minimal growth in employment in agriculture, forestry, construction and manufacturing (Statistics Canada 2006).

4.3.4.2 Employment and Business

Employment and unemployment rates in Western Newfoundland vary according to the economic base in the given area (Table 4.90). Regional service centres have stronger employment rates than rural areas due to greater employment opportunities. Economic Zone 8, which includes Corner Brook, has the highest employment rate in the SEA Update Area. With a diversified economy, this area has a variety of employment opportunities in government agencies, post-secondary educational institutions, health care facilities, tourism, agriculture, the commercial / retail sector and a regional airport. Economic Zone 7, which has the highest unemployment rate, is a rural region with a larger seasonal workforce (e.g. fishing, seafood processing, tourism) (Statistics Canada 2006).

Table 4.90 Employment Characteristics, Western Newfoundland (2006)

Jurisdiction	Labour Force	Participation Rate	Employment Rate	Unemployment Rate
Zone 7 (Red Ochre)	4,620	74.0%	47.4%	36.1%
Zone 8 (Humber)	19,845	70.5%	58.1%	17.6%
Zone 9 (Long Range)	9,010	61.4%	44.6%	27.4%
Zone 10 (Marine and Mountain)	4,320	68.8%	45.7%	33.7%
Newfoundland and Labrador	248,685	72.0%	58.7%	18.5%
Source: Community Accounts NL (2012)				

The majority of residents in the SEA Update Area are employed in occupations related to sales and services. Because of the mainly rural nature of the area, small retail stores (e.g. grocery stores, gas stations) are the main commercial businesses and a common source of employment for residents. Larger retail businesses and government services in the SEA Update Area's service centres also contribute to occupations in sales and services. Jobs associated with primary industries also account for a large share of employment throughout the SEA Update Area (Statistics Canada 2006) (Table 4.91).

Table 4.91 Labour Force by Occupation, Western Newfoundland (2005)

Occupation / Sector (Select)	Zone 7 (Red Ochre)	Zone 8 (Humber)	Zone 9 (Long Range)	Zone 10 (Marine and Mountain)	Province of Newfoundland and Labrador
Health	145	1,330	435	110	13,320
Education	235	990	565	170	12,270
Primary industries	1,195	985	1,290	470	20,415
Sales and Services	1,385	6,465	2,630	1,205	70,465
Management	320	1,565	585	245	19,740
Office related	280	2,880	1,190	365	38,485

Occupation / Sector (Select)	Zone 7 (Red Ochre)	Zone 8 (Humber)	Zone 9 (Long Range)	Zone 10 (Marine and Mountain)	Province of Newfoundland and Labrador
Construction related	830	3,630	1,700	970	44,300
Processing and Manufacturing	530	1,350	630	420	17,540
All Occupations	5,140	21,255	9,825	4,440	267,175
Source: Community Accounts NL (2012)					

Corner Brook and surrounding areas have a diversified economy that provides employment opportunities requiring higher education (e.g. post-secondary education institutions, health care). The lowest educational attainment levels are found in Zones 7 and 10 (Statistics Canada 2006). This is reflective of the fact that many people work in resource-based industries (e.g. fishing, seafood processing, farming, forestry), construction and tourism where higher education is not required. Apprenticeship and trades certification, required for occupations in construction and primary industries, is common in the SEA Update Area and frequently higher than the provincial average.

Income levels in Western Newfoundland are generally below the provincial average (Table 4.92). The highest per capita incomes are earned in Economic Zones 8 and 10, where the regional service centres of Corner Brook and Channel-Port aux Basques provide a wider variety of employment opportunities.

Table 4.92 Median Annual Per Capita Income, Western Newfoundland (2005)

Area	Median Annual Per Capita Income
Economic Zone 7	$20,200
Economic Zone 8	$23,800
Economic Zone 9	$19,700
Economic Zone 10	$21,900
Province of Newfoundland and Labrador	$24,900
Source: Community Accounts NL (2012)	

Western Newfoundland (Economic Zones 7, 8, 9 and 10) has 2,691 businesses (Table 4.93) (NLDOF 2012a). Over half of these enterprises are located in Economic Zone 8, which includes the regional service centre of Corner Brook.

Table 4.93 Number of Businesses by Economic Zone, Western Newfoundland (2011)

Economic Zone	Number of Businesses	Percentage of Total
Economic Zone 7	397	14.7%
Economic Zone 8	1,416	52.6%
Economic Zone 9	593	22.0%
Economic Zone 10	285	10.5%
Total	2,691	100.0%
Source: NLDOF (2012a)		

More than 65 percent of businesses in the Western Newfoundland region provide services (e.g. retail, health care and social, construction, accommodations and food services and other services). Although the number of firms remained fairly consistent between 2000 and 2011, this is accounted for primarily by growth in the “other services” and “real estate” categories (Table 4.94). Otherwise, the number of enterprises in all categories has

declined. Notable areas of decline are retail trade, manufacturing and agriculture and forestry, fishing and hunting (NLDOF 2011).

Table 4.94 Number of Businesses by Type, Western Newfoundland (2000 and 2011)

Industry Sector	2000	2011	+/- Change (2000 to 2011)
Mining and oil and gas extraction	x	x	x
Utilities	x	x	x
Other services (except public administration)	326	477	151
Real estate and rental leasing	88	94	6
Construction	254	257	3
Management of companies and enterprises	18	17	-1
Public administration	65	64	-1
Finance and insurance	70	63	-7
Administrative and support, waste management and remediation services	98	85	-13
Professional, scientific and technical services	116	100	-16
Information and cultural industries	23	5	-18
Educational services	38	18	-20
Arts, entertainment and recreation	84	62	-22
Wholesale trade	120	94	-26
Transportation and warehousing	178	130	-48
Health care and social assistance	363	311	-52
Accommodation and food services	297	243	-54
Agriculture, forestry, fishing and hunting	177	120	-57
Manufacturing	116	54	-62
Retail trade	540	468	-72
Total	2,990	2,691	-299

"x" indicates confidential data because there are too few firms in the category.
Source: NLDOF (2012a)

Although the number of businesses has declined (Table 4.95), the number of employees per business has increased, possibly suggesting consolidation among firms or closure of some businesses and growth of others. There are few businesses with more than 100 employees in the region.

Table 4.95 Number of Businesses by Employment, Western Newfoundland

Employment Size Range	Number of Businesses	
	2000	2011
1 to 4 employees	1,941	1,523
5 to 19 employees	802	919
20 to 99 employees	164	192
100 to 499 employees	17	x
500 + employees	4	x

"x" indicates confidential data because there are too few firms in the category.
Source: NLDOF (2012a)

4.3.5 Marine Fisheries

Marine fisheries are an integral component of the socioeconomic environment of Newfoundland and Labrador and other parts of Canada, including the various communities and regions that extend along the coastline of Western Newfoundland and which surround the Gulf of St. Lawrence. The fishery has played a key role in the region's history, and thus in shaping its people, communities and overall culture, and it continues to be an essential element of the economy and lifestyles of the people that live in these areas.

Numerous individuals and organizations depend on fish harvesting and its associated processing and spin-off industries, with many residents participating in recreational and subsistence fishing as an important aspect of their culture and overall way of life. Aboriginal people and communities throughout the Gulf of St. Lawrence also continue to undertake fishing activities for commercial and traditional purposes, and many groups have depended on the resources of the sea to sustain their people and cultures for generations.

The following sections provide an updated overview of marine fisheries and related activities within and around the SEA Update Area, including commercial fisheries, aquaculture and recreational and Aboriginal fishing activity. The primary focus is on current fishing activity within the SEA Update Area itself, as it is within this region that there would be the most potential for direct interaction between fisheries and any future offshore petroleum activities within the SEA Update Area. Marine fisheries in the larger Gulf of St. Lawrence are also generally described as additional background and context and given the possibility for these to be affected through, for example, a potential accidental event (especially, a large oil spill) or through any associated effects on fish populations that occur within or move through the area.

4.3.5.1 Data Areas and Sources

For administrative purposes, the Northwest Atlantic is divided into a series of North Atlantic Fisheries Organization (NAFO) Divisions, Subdivisions and Unit Areas. Although fish harvesting activities and fisheries management responsibilities do extend across these areas and their boundaries, they are used to regulate and describe fishing activity throughout the Gulf of St. Lawrence and elsewhere off Eastern Canada.

The SEA Update Area overlaps with a number of NAFO Divisions, Subdivisions and Unit Areas, and although it does not correspond directly with any particular such zones, various combinations of these are used in this section to describe fishing activity in and around the SEA Update Area and in the larger Gulf of St. Lawrence:

1) *Primary Fisheries Study Area:* The initial and primary focus of the marine fisheries description focuses upon those NAFO Unit Areas that encompass most of (and best correspond to) the SEA Update Area. Similar to the original (2005) SEA, these include NAFO Unit Areas 4Rb, 4Rc and 4Rd (Figure 4.70); and

2) *Regional Fisheries Study Area:* In order to include other areas within and near the SEA Update Area that fall slightly outside the above referenced NAFO Unit Areas, as well as to generally describe fishing activity in the larger Gulf of St. Lawrence, fisheries information is also provided for those NAFO Divisions and Subdivisions which encompass the SEA Update Area and adjacent areas, namely 4R, 4S, 4T, 4Vn and 3Pn (Figure 4.71).

Figure 4.70 NAFO Unit Areas Within and Immediately Adjacent to the SEA Update Area

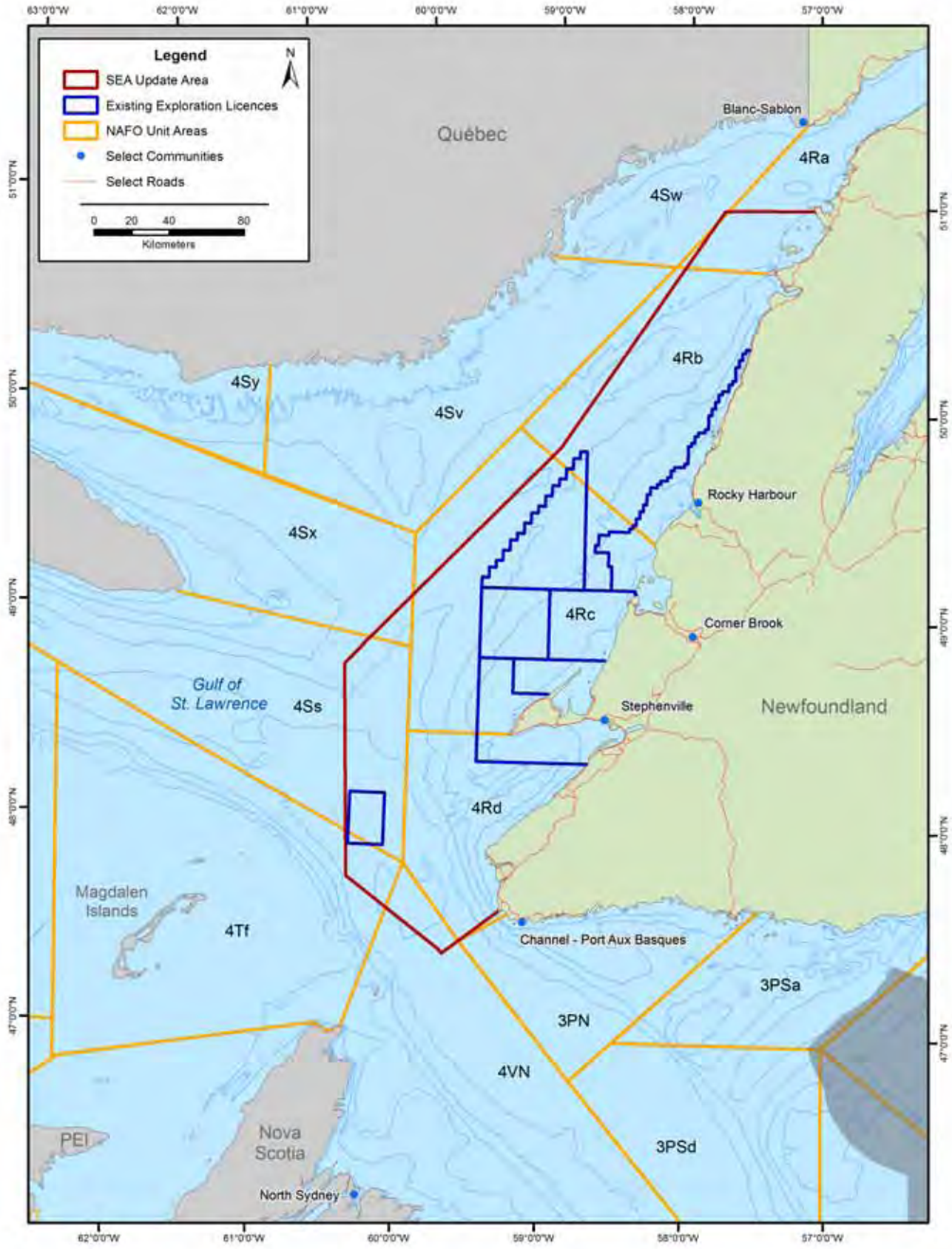
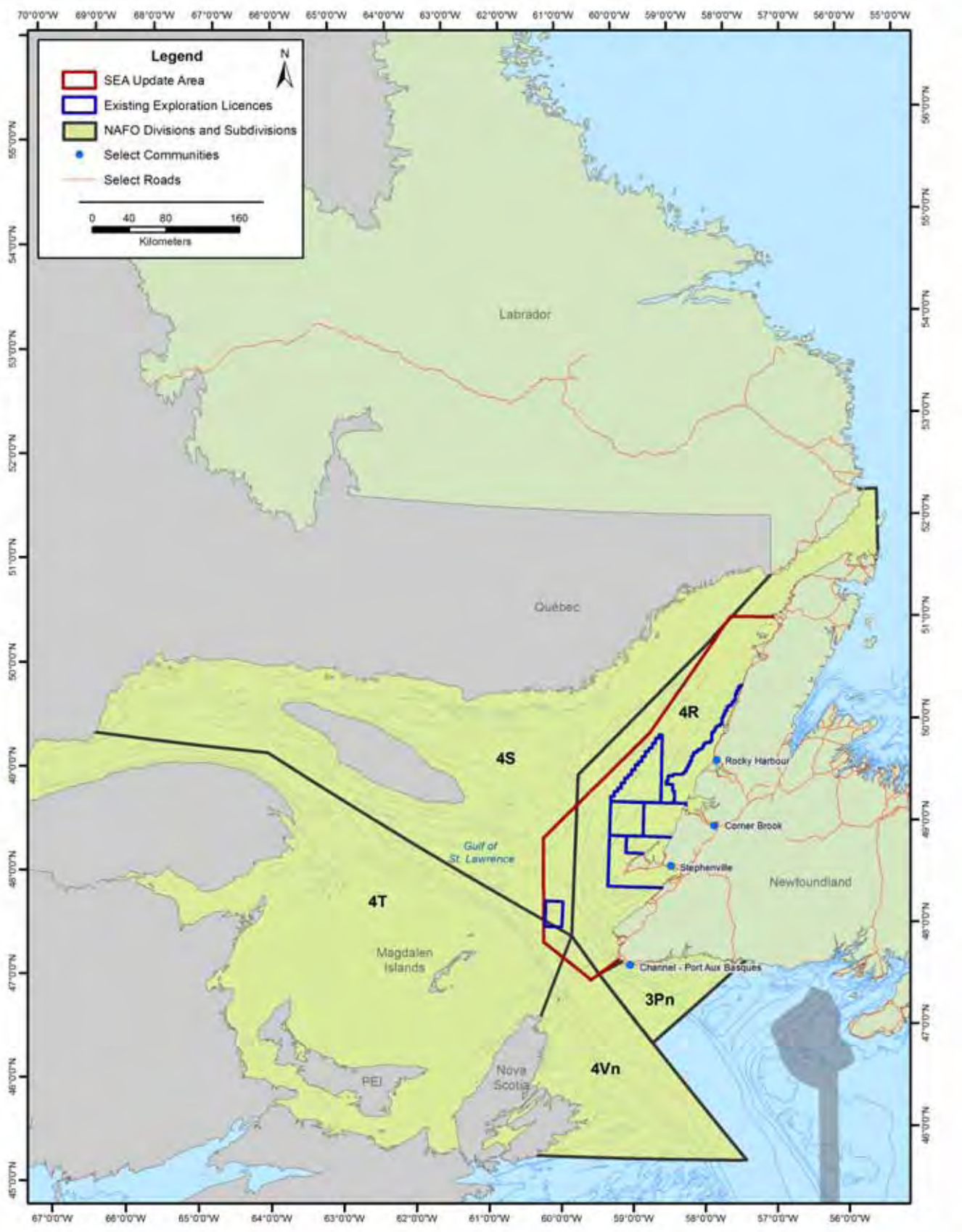


Figure 4.71 NAFO Divisions and Subdivisions Within and Surrounding the Gulf of St. Lawrence



Commercial fish landings (weight and landed value) information for each of these NAFO Unit Areas, Divisions and Subdivisions is presented in the following sections for the period 2005 – 2011, and was provided by Fisheries and Oceans Canada (DFO) Statistical Services in Ottawa, ON. The DFO datasets record domestic and foreign fish harvests landed in Canada. Fish landings by weight are reported in the Tables in their original units (kg), although for brevity the text and associated graphs describe fish quantities in tonnes. The landed value is the value of the catch "at the wharf", generally the price paid to the harvesting sector. It does not include or reflect, for instance, the "downstream" indirect or induced economic benefits of the fish harvest, during or after processing or other value-added manufacturing of fish products. Information on commercial fishing licences and enterprises in NAFO Division 4R is also presented, and was provided by the Newfoundland and Labrador Region of DFO.

Mapping (geospatial) information on the location and timing of fishing activity was also provided by DFO Statistical Services in Ottawa, ON. It should be noted that the type and level of information on fishing locations that was provided by DFO and used in this SEA Update is considerably less than that which has been available for use in previous EAs and SEAs in the NL Offshore Area, including the original (2005 and 2007) Western NL SEAs. DFO has indicated that, in the interests of protecting commercially sensitive and/or personal information on fish harvesters, it is no longer able to provide specific locations (coordinates) for commercial fishing activity. Instead, DFO provides aggregated data sets which give a general indication of fishing areas (by species, gear types, fleet and other pre-determined categories and data classes) for defined geographic areas (in this case, for a series of "cells" that are approximately 6 x 4 nautical miles in size that together comprise a map grid that covers the area of interest).

The fishing activity maps that are provided in these sections are therefore based on the type and level of data provided and the resulting analysis that was possible given the level and format of this information. The maps generally indicate where and when fishing activity was recorded (at one or more locations) within a pre-determined grid block, but do not indicate the total amount or intensity of fishing effort or the amount of fish harvested (quantity / value) from a particular location. As has traditionally been the case, the DFO mapping dataset is also not comprehensive and typically accounts for a portion of total fishing activity in a region (in terms of total weight and value), and does not include specific locational information for particular fisheries (particularly for inshore fisheries undertaken by smaller vessels, such as those for lobster, etc). Therefore, while useful as a tool to measure the overall commercial fishing activity in the Atlantic region, it is not comprehensive enough to measure all indicators associated with every type of activity for each specific fishery.

The available information and associated mapping does, however, provide a general indication and overview of the nature and spatial and temporal distribution of commercial fishing activity within the region, at a level appropriate for SEA analysis and related planning.

The various fisheries data sets referenced above were supplemented with other existing and available information related to fisheries in the area, including published and unpublished reports, information received during the SEA Update consultation process (see Chapter 2 and Appendix A) and other available information sources.

4.3.5.2 Commercial Fisheries

The fishing industry is an important and long-standing component of the Newfoundland and Labrador economy. In 2011, fish landings in the province totalled approximately 268,000 tonnes with a total landed value of nearly $570 million and a total production value of approximately $1 billion. The province's fishing industry employed

over 20,000 persons in 2011, including almost 11,000 individuals working in fish harvesting and another nearly 10,000 working in processing activities in the province's over 120 licenced fish plants (NLDFA 2013).

The following sections provide an updated overview of current commercial fishing activity in the various Fisheries Study Areas described above, focussing on the time period since the initial Western NL SEA was completed. An overview of historical fisheries in these regions is provided in the initial SEA Reports (LGL Limited 2005, 2007) and is therefore not repeated in this SEA Update.

The available fisheries data sets cover the period 2005 – 2011, for which both annual and multi-year (cumulative) information is provided in the text, tables and figures that follow. It should be noted that reporting of fishing information by NAFO Unit Areas, Divisions and Subdivisions in the DFO datasets used herein indicates the area in which fish is caught, rather than where it was landed.

Commercial Fish Harvests (Quantities and Values)

NAFO 4Rb, 4Rc and 4Rd

The 2011 commercial fish harvest within the Primary Fisheries Study Area (NAFO Unit Areas 4Rb, 4Rc and 4Rd) totalled 41,833 tonnes and had a landed value of approximately $39.3 million. Fish landings in that area from 2005 to 2011 were at their lowest quantities in 2011, peaked at 62,051 tonnes in 2009, and totalled approximately 360,480 tonnes over the entire seven year period from 2005 to 2011. The landed value of fish harvested in the region during that time period ranged from approximately $31.7 million (in 2010) to $41.5 million (in 2005) and total about $262.9 million over the 2005 – 2011 period.

Herring and mackerel together comprised approximately 64 percent of the total fish landings by weight in this region from 2005 – 2011, followed by Northern shrimp (referred to in the DFO data sets as *Pandalus borealis* shrimp) (16 percent) and capelin (10 percent), with no other species accounting for greater than 5 percent of total landings by weight. In terms of landed value, lobster and shrimp accounted for nearly half of the area's fishery from 2005 to 2011 overall, followed by mackerel (15 percent), herring (10 percent), cod and turbot (also known as Greenland flounder or halibut) (6 percent each) and others.

Figure 4.72 Fish Harvests by Year by Weight - NAFO 4Rb, 4Rc and 4Rd (2005 – 2011)

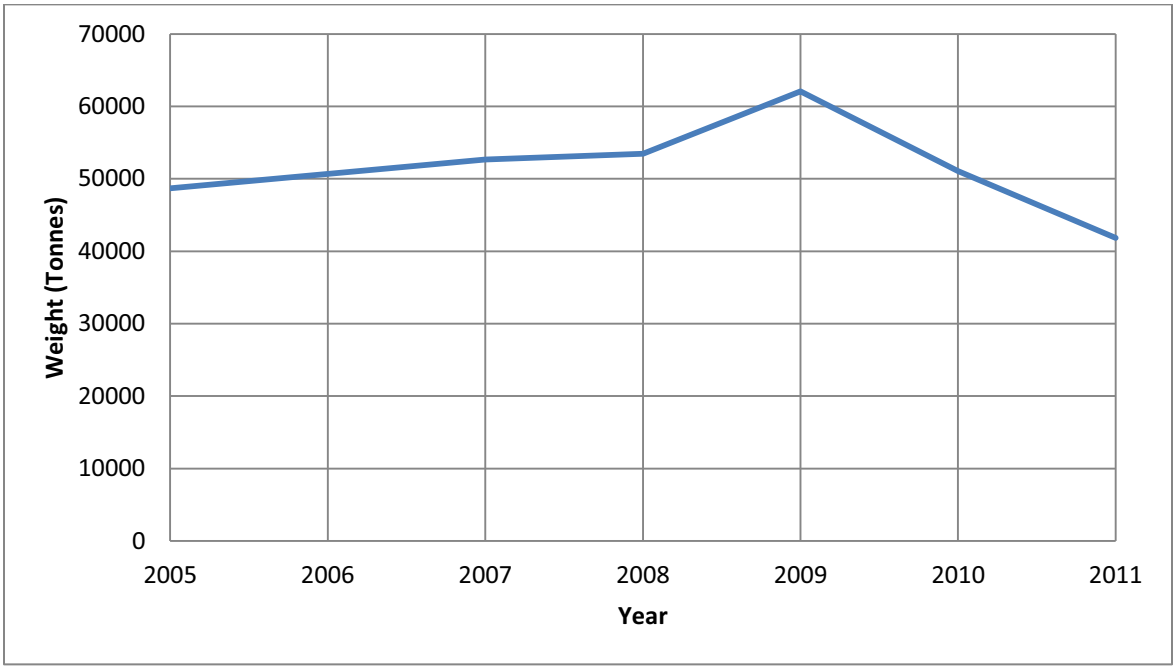


Figure 4.73 Fish Harvests by Year by Value - NAFO 4Rb, 4Rc and 4Rd (2005 – 2011)

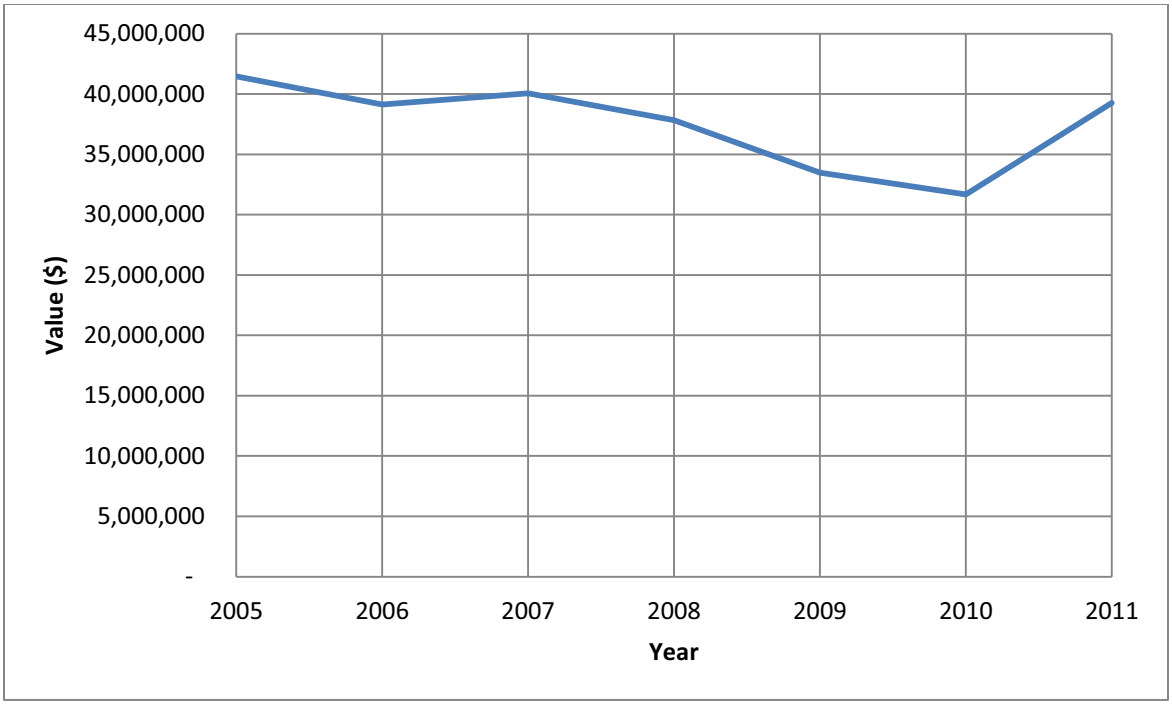


Figure 4.74 Fish Harvests by Weight by Species - NAFO 4Rb, 4Rc and 4Rd (2005 – 2011 Total)

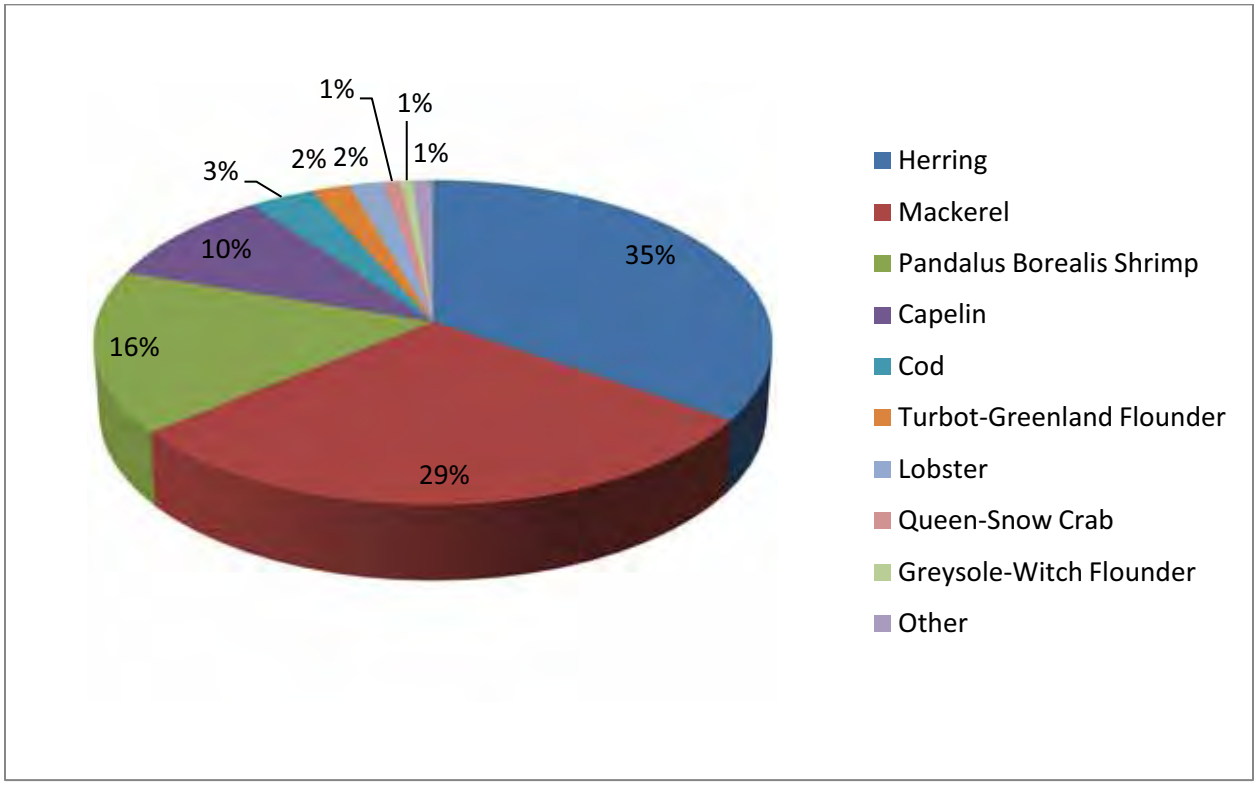


Table 4.96 Fish Harvests by Weight (kg) - NAFO 4Rb, 4Rc and 4Rd (2005 – 2011)

Species	2005	2006	2007	2008	2009	2010	2011	Total
Herring	16,759,905	17,639,875	15,120,477	20,011,249	19,414,054	18,220,763	17,776,730	124,943,053
Mackerel	13,430,693	15,826,962	23,272,969	13,103,109	21,633,575	13,455,649	5,225,766	105,948,723
Pandalus Borealis Shrimp	8,466,666	8,187,178	7,601,093	7,967,636	8,427,948	9,192,139	8,430,256	58,272,916
Capelin	3,633,919	3,295,265	770,384	6,963,039	7,576,652	6,359,759	6,512,647	35,111,665
Cod	1,907,148	2,281,897	2,600,865	2,467,145	1,815,993	1,039,382	412,550	12,524,980
Turbot-Greenland Flounder	1,053,145	912,431	874,429	706,108	1,265,695	1,148,689	1,466,561	7,427,058
Lobster	1,021,271	1,070,429	1,039,160	1,157,002	913,919	839,795	645,224	6,686,800
Queen-Snow Crab	857,161	518,490	549,537	373,392	272,683	205,309	615,202	3,391,774
Greysole-Witch Flounder	477,981	412,142	427,919	301,441	244,152	117,955	318,250	2,299,840
Redfish	561,822	125,364	5,339	62,078	94,327	162,243	110,595	1,121,768
Atlantic Halibut	144,267	131,184	113,068	179,626	197,632	157,719	144,513	1,068,009
American Plaice	123,730	66,960	101,852	77,457	118,593	85,143	80,028	653,763

Species	2005	2006	2007	2008	2009	2010	2011	Total
Seal Fat	146,178	69,177	75,175	-	3,763	-	-	294,293
Skate	13,412	26,266	31,730	24,794	9,625	9,368	7,126	122,321
Sea Scallops	-	-	2,101	23,481	14,917	27,155	47,947	115,601
Lumpfish Roe	27,357	45,694	7,877	2,925	249	1,591	295	85,988
Other Fish, Unspecified	28,995	18,047	221	11,737	-	25,912	543	85,455
Striped Catfish	7,219	7,723	11,366	17,257	16,227	18,756	6,154	84,702
Eel	-	-	23,608	-	20,297	-	15,650	59,555
White Hake	10,166	4,555	6,957	12,994	4,287	4,830	6,245	50,034
Rock Crab	-	-	34,878	-	-	-	-	34,878
Molluscs, Unspecified	14,443	11,046	-	424	-	-	-	25,913
Pollock	172	17,471	299	869	2,409	207	217	21,644
Winter Flounder	441	298	973	6,161	715	171	4,178	12,937
Groundfish, Unspecified	275	31	2,475	2,581	499	6,464	107	12,432
Unspecified Items	369	-	-	2,914	15	653	3,823	7,774
Monkfish	1,538	604	459	577	508	845	2,333	6,864
Mako Shark	2,727	1,782	555	-	653	612	-	6,329
Crustaceans, Unspecified	1,059	-	-	-	-	-	-	1,059
Shark, unspecified	320	-	-	-	572	-	-	892
Porbeagle Shark	-	-	-	-	540	-	-	540
Pelagics, Unspecified	-	-	-	501	-	-	-	501
Haddock	-	0	0	25	20	30	24	99
Cod Roe	-	-	-	-	-	-	38	38
Total	**48,692,379**	**50,670,871**	**52,675,766**	**53,476,522**	**62,050,519**	**51,081,139**	**41,833,002**	**360,480,198**

Figure 4.75 Fish Harvests by Value by Species - NAFO 4Rb, 4Rc and 4Rd (2005 – 2011 Total)

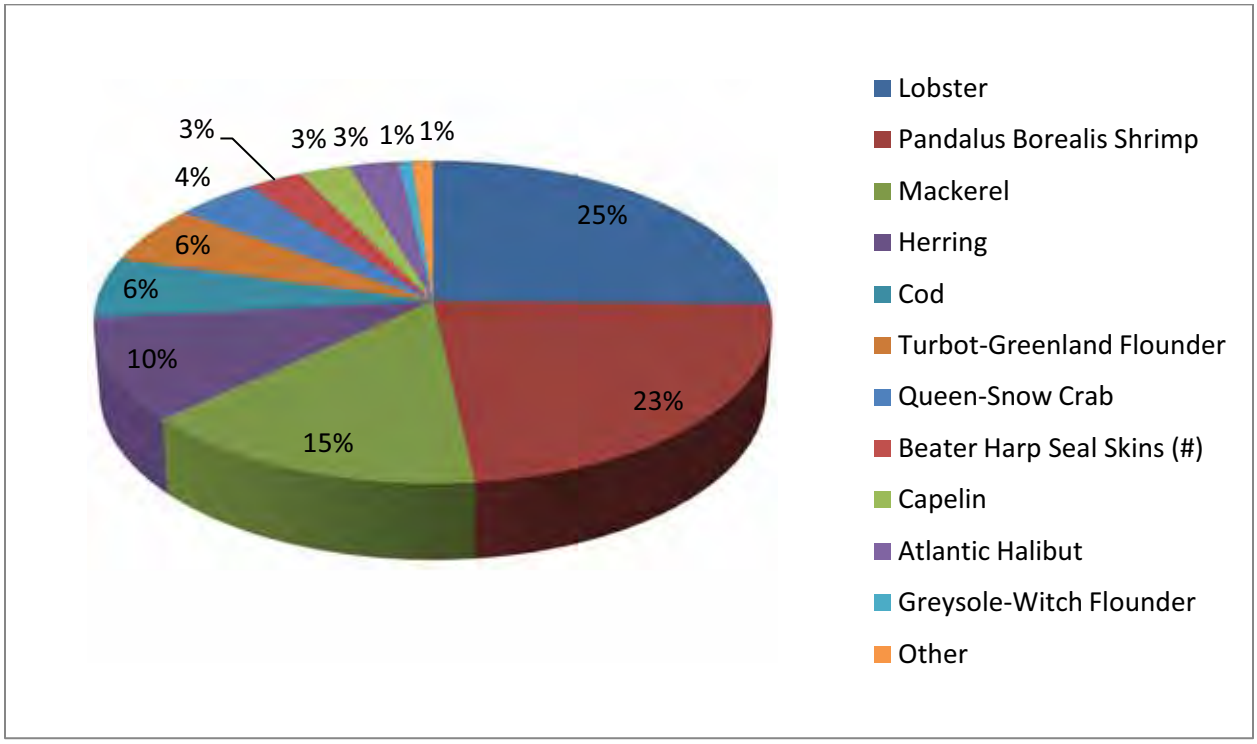


Table 4.97 Fish Harvests by Value ($) - NAFO 4Rb, 4Rc and 4Rd (2005 – 2011)

Species	2005	2006	2007	2008	2009	2010	2011	Total
Lobster	12,160,570	11,718,916	13,061,632	11,065,809	6,813,827	6,121,225	5,515,232	66,457,211
Pandalus Borealis Shrimp	8,183,960	6,483,773	6,974,699	8,626,193	7,712,018	9,559,516	12,873,105	60,413,264
Mackerel	4,833,973	5,121,303	6,810,432	4,399,255	6,673,706	5,933,689	5,156,670	38,929,028
Herring	4,087,394	3,547,446	3,016,267	3,732,271	4,280,011	3,613,392	4,663,717	26,940,498
Cod	2,002,853	2,655,309	3,851,563	3,832,569	1,987,482	1,109,159	479,127	15,918,063
Turbot-Greenland Flounder	2,134,893	1,604,186	1,431,991	1,127,731	2,169,409	2,522,852	4,495,344	15,486,406
Queen-Snow Crab	2,851,224	1,142,281	1,943,116	1,280,725	867,207	615,374	2,921,846	11,621,773
Beater Harp Seal Skins (#)	1,959,524	4,266,465	1,270,300	392,515	41,897	-	-	7,930,701
Capelin	1,041,261	949,939	206,696	1,843,221	1,169,258	771,149	1,162,994	7,144,518
Atlantic Halibut	916,223	820,554	664,248	1,084,359	1,261,810	994,621	1,352,795	7,094,609
Greysole-Witch Flounder	420,882	361,902	374,370	212,526	212,054	82,832	277,429	1,941,994
Redfish	303,722	87,347	3,165	36,642	69,084	108,813	96,526	705,300
American	86,649	46,919	76,347	51,576	96,231	69,629	55,608	482,958

Species	2005	2006	2007	2008	2009	2010	2011	Total
Plaice								
Other Fish, Unspecified	144,646	95,370	176	37,120	-	92,844	173	370,329
Eel	-	-	133,977	-	73,307	-	86,422	293,705
Ragged Jacket Harp Seal Skins (#)	123,332	36,010	98,908	-	-	-	-	258,250
Lumpfish Roe	86,089	90,660	31,398	22,531	2,209	15,932	2,439	251,257
Sea Scallops	-	-	3,143	39,203	23,168	42,412	89,145	197,072
Seal Fat	65,034	44,428	41,431	-	1,659	-	-	152,552
Molluscs, Unspecified	41,713	17,506	-	308	-	-	-	59,527
White Hake	5,754	2,926	4,743	8,223	3,139	3,860	5,211	33,856
Skate	2,872	5,450	9,556	6,216	2,574	2,049	1,851	30,568
Striped Catfish	2,701	2,757	3,388	6,123	5,530	6,226	2,696	29,421
Seal Flippers (#)	-	9,848	13,989	1,636	-	-	-	25,473
Unspecified Items	2,178	10	190	1,298	57	1,679	15,461	20,873
Rock Crab	-	-	19,808	-	-	-	-	19,808
Pollock	108	9,337	185	520	1,494	122	205	11,970
Monkfish	1,586	476	310	231	471	835	3,856	7,766
Winter Flounder	173	121	488	3,129	333	87	2,097	6,428
Groundfish, Unspecified	103	25	675	865	241	4,218	14	6,141
Bedlamer Harp Seal Skins (#)	231	732	4,433	46	-	-	-	5,442
Mako Shark	1,895	906	540	-	614	550	-	4,505
Pelagics, Unspecified	-	-	-	3,534	-	-	-	3,534
Crustaceans, Unspecified	953	-	-	-	-	-	-	953
Porbeagle Shark	-	-	-	-	767	-	-	767
Shark, unspecified	287	-	-	-	251	-	-	538
Haddock	0	0	0	28	15	28	103	174
Cod Roe	-	-	-	-	-	-	166	166
Old Harp Seal Skins (#)	-	-	27	-	-	-	-	27
Total	**41,462,781**	**39,122,901**	**40,052,190**	**37,816,402**	**33,469,825**	**31,673,093**	**39,260,232**	**262,857,424**

NAFO 4R, 4S, 4T, 4Vn and 3Pn

The commercial fish harvest within the Regional Fisheries Study Area (NAFO 4R, 4S, 4T, 4Vn and 3Pn) in 2011 totalled 196,415 tonnes and had a landed value of approximately $511.5 million.

Fish landings in that area from 2005 to 2011 were likewise at their lowest in 2011 having declined somewhat steadily over that 7 year period, and totalled approximately 1.7 million tonnes over the period from 2005 to 2011 inclusive. The landed value of fish harvested in the region during that period ranged from approximately $411.8 million (in 2010) to $612.4 million (in 2005) and totalled about $3.6 billion over the 2005 – 2011 period.

Herring comprised approximately 30 percent of the total fish landings by weight in this region from 2005 – 2011, followed by Northern shrimp (15 percent), snow crab (13 percent), lobster (11 percent) and mackerel (10 percent), with no other species accounting for 5 percent or more of total landings by weight.

In terms of landed value, lobster in itself comprised almost half (49 percent) of the overall commercial value of the area's fishery from 2005 and 2011, followed by snow crab (25 percent), Northern shrimp (8 percent), and others.

Figure 4.76 Fish Harvests by Year by Weight - NAFO 4R, 4S, 4T, 4Vn and 3Pn (2005 – 2011)

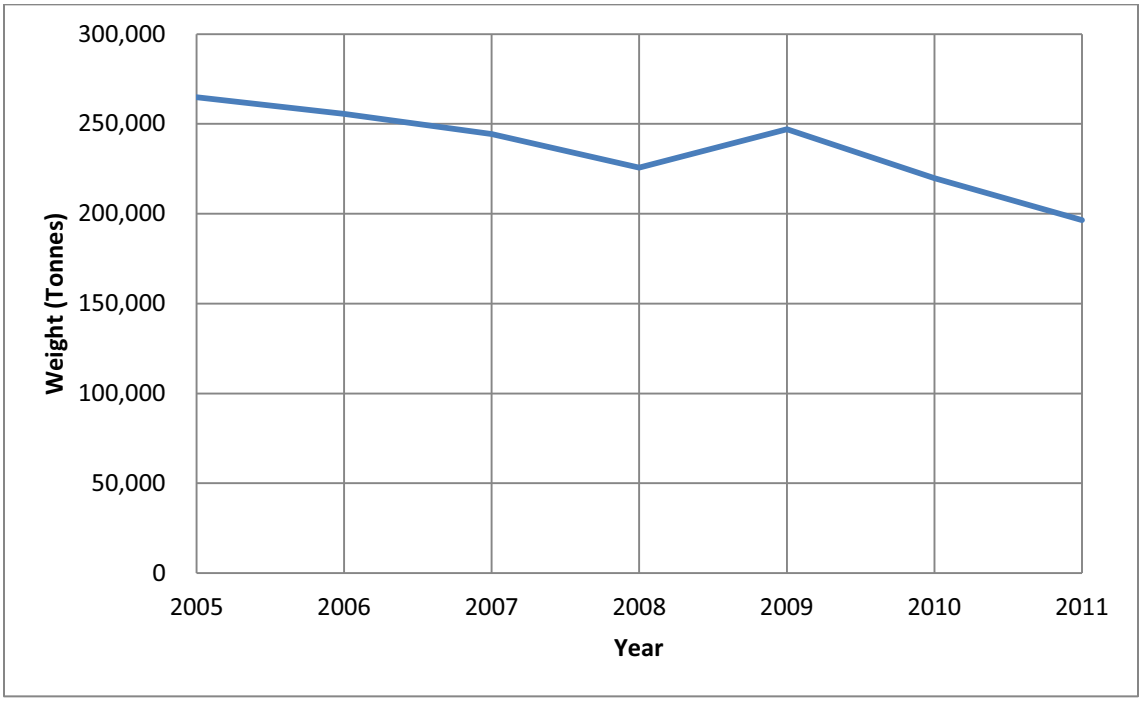


Figure 4.77 Fish Harvests by Year by Value - NAFO 4R, 4S, 4T, 4Vn and 3Pn (2005 – 2011)

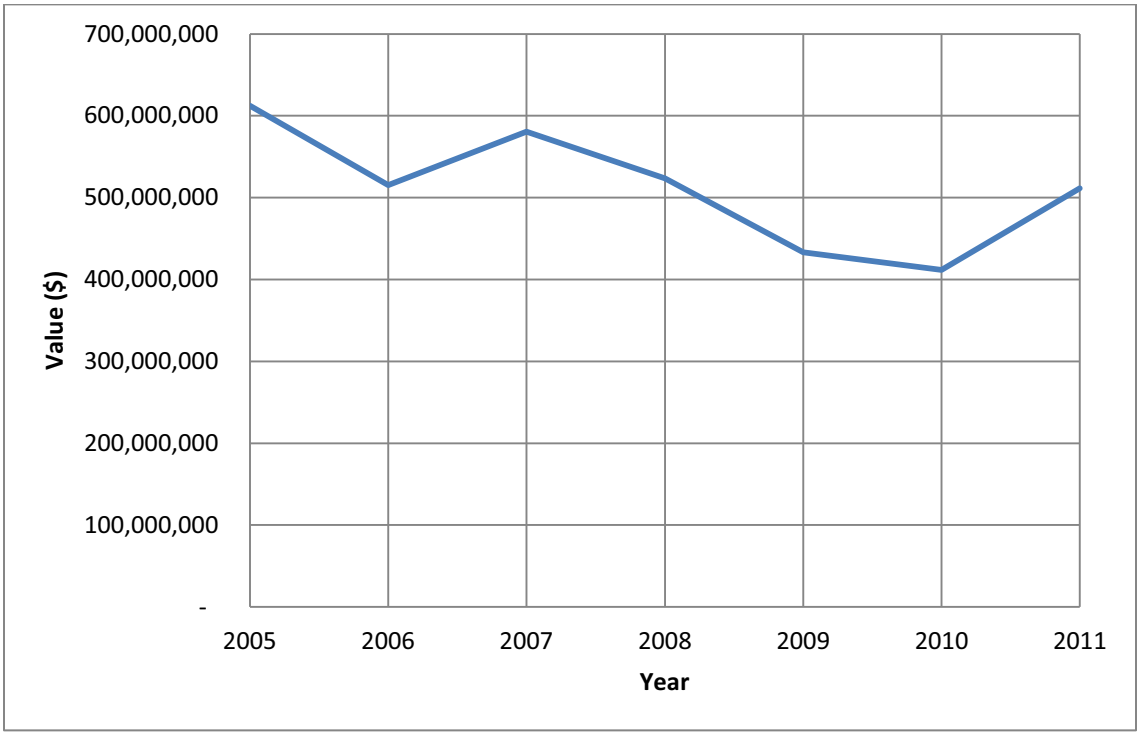


Figure 4.78 Fish Harvests by Weight by Species - NAFO 4R, 4S, 4T, 4Vn and 3Pn (2005 – 2011 Total)

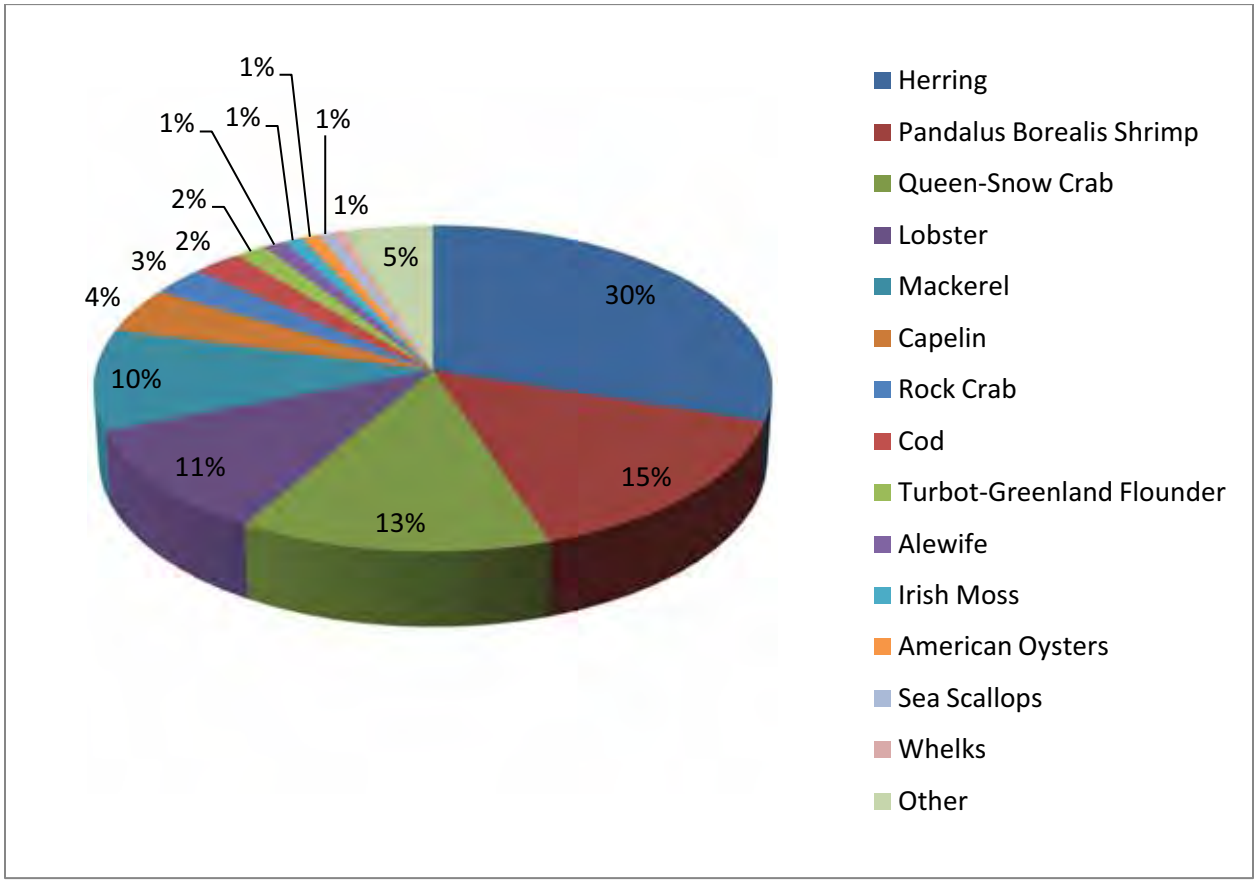


Table 4.98 Fish Harvests by Weight (kg) - NAFO 4R, 4S, 4T, 4Vn and 3Pn (2005 – 2011)

Species	2005	2006	2007	2008	2009	2010	2011	Total
Herring	84,633,115	74,760,768	68,507,107	66,086,582	70,589,818	68,391,180	63,284,326	496,252,896
Pandalus Borealis Shrimp	31,944,241	35,154,688	36,405,245	35,809,906	36,256,975	36,568,589	34,857,651	246,997,295
Queen-Snow Crab	44,761,786	37,980,329	35,566,348	32,789,530	32,989,157	18,795,691	19,991,219	222,874,060
Lobster	22,005,878	23,723,959	23,396,885	25,872,050	26,629,695	28,708,618	26,287,495	176,624,580
Mackerel	24,741,861	25,033,340	30,981,890	18,769,980	33,710,308	23,051,390	9,569,770	165,858,539
Capelin	8,997,710	11,878,994	7,911,422	10,071,327	12,080,000	10,822,483	12,314,743	74,076,679
Rock Crab	7,623,899	6,966,553	7,324,385	6,870,883	6,747,466	6,466,628	6,294,676	48,294,490
Cod	7,534,042	8,890,301	7,995,368	7,838,866	4,883,307	3,679,724	1,912,129	42,733,737
Turbot-Greenland Flounder	4,130,295	3,764,271	3,970,501	3,694,791	4,369,441	4,029,324	3,739,078	27,697,701
Alewife	3,039,327	3,611,631	2,755,655	3,116,239	2,759,030	2,125,649	1,525,647	18,933,178
Irish Moss	5,043,189	5,100,666	2,733,761	770,918	-	1,346,923	1,321,262	16,316,719
American Oysters	3,275,672	2,405,143	2,354,872	1,684,292	2,167,965	1,934,340	1,877,377	15,699,661
Sea Scallops	2,071,803	1,924,114	1,908,158	1,807,249	1,796,532	1,340,393	1,659,537	12,507,786
Whelks	1,726,459	1,619,689	1,277,576	1,159,313	1,284,342	1,494,689	1,438,901	10,000,969
Redfish	1,677,393	1,405,495	649,195	1,079,065	1,524,619	1,280,717	1,146,133	8,762,617
Soft shell Clams	1,563,195	1,179,272	939,458	675,164	1,385,295	366,147	268,138	6,376,669
Greysole-Witch Flounder	1,248,224	1,206,573	1,197,987	925,636	543,214	335,753	575,189	6,032,576
Bar Clams	806,105	762,658	829,001	659,747	920,952	928,619	840,670	5,747,752
Stimpsons Surf Clams	882,355	914,435	624,681	651,725	893,689	910,967	843,782	5,721,634
Smelts	956,303	876,481	788,125	635,691	707,183	617,152	389,024	4,969,959
Atlantic Halibut	479,098	448,808	499,261	658,760	786,195	744,635	866,255	4,483,012
Sea Urchins	243,789	746,708	820,839	503,891	423,505	695,222	764,510	4,198,464
Spider-Toad Crab	963,172	830,885	831,778	211,264	166,982	207,554	258,611	3,470,246
Quahaugs, Clams	914,302	433,651	381,496	451,020	420,700	457,079	338,436	3,396,684
Silversides	272,873	551,473	494,537	444,268	488,346	688,875	325,221	3,265,593
Molluscs, Unspecified	270,844	196,335	338,059	385,871	657,667	71,342	1,130,784	3,050,902
Icelandic Scallops	459,544	667,831	282,364	110,295	401,337	492,052	523,684	2,937,107
American Plaice	503,823	587,122	518,909	285,851	278,532	259,525	205,911	2,639,673
Wireweed-Horsetail	-	143,106	748,374	373,222	-	945,493	386,396	2,596,591

Species	2005	2006	2007	2008	2009	2010	2011	Total
Winter Flounder	410,358	247,212	194,754	204,659	219,540	324,003	350,397	1,950,923
Bluefin Tuna	250,703	315,906	214,515	265,884	268,287	209,311	201,486	1,726,092
Eel	209,494	242,723	265,350	180,826	202,663	222,295	247,597	1,570,948
Yellowtail Flounder	175,518	182,242	141,940	91,596	104,326	185,977	180,767	1,062,366
White Hake	157,046	123,208	104,822	119,763	92,626	67,079	108,480	773,024
Lumpfish Roe	266,393	201,196	70,606	109,424	11,289	48,470	33,356	740,734
Sea Cucumber	-	-	-	-	-	696,821	-	696,821
Windowpane Flounder	51,576	22,161	104,501	67,057	84,362	134,451	171,721	635,829
Seal Fat	220,875	177,202	122,527	9,065	19,370	-	21,880	570,919
Unspecified Items	132,780	7,562	1,485	19	7,774	6,476	75,182	231,278
Skate	44,512	39,564	49,036	39,054	25,233	21,336	12,123	230,858
Tomcod	12,160	70,315	8,007	20,806	17,405	13,647	-	142,340
Striped Catfish	17,258	12,444	16,682	26,650	30,066	23,487	8,315	134,902
Groundfish, Unspecified	9,331	8,985	23,015	6,811	683	5,506	31,654	85,985
Monkfish	14,953	9,154	7,969	11,614	14,768	11,661	12,288	82,407
Pollock	7,090	30,401	7,678	4,429	10,595	3,386	1,645	65,224
Sculpin	2,036	1,822	2,281	4,251	3,998	2,845	8,722	25,955
Seal Meat	-	-	-	-	-	22,825	-	22,825
Mako Shark	4,883	2,952	2,675	1,741	2,839	2,026	602	17,718
Other Fish, Unspecified	1,633	2,779	6,609	399	302	266	5,416	17,404
Haddock	3,330	6,027	2,162	2,460	1,082	541	696	16,298
Rock Cod	15,185	0	0	0	0	0	60	15,245
Catfish	899	389	396	3,659	402	7,596	-	13,341
Dogfish	9,863	1,039	360	209	57	-	-	11,528
Porbeagle Shark	773	1,580	2,983	938	2,379	1,141	730	10,524
Shark, unspecified	2,416	2,452	845	661	1,284	848	1,073	9,579
Clams, unspecified	-	6,678	-	-	-	-	-	6,678
Jonah Crab	-	-	-	375	269	634	2,629	3,907
Illex Squid	-	1,801	-	-	-	-	-	1,801
Cusk	140	207	98	314	161	605	223	1,748
Lumpfish	-	-	-	-	-	-	1,555	1,555
Crustaceans, Unspecified	-	1,247	182	-	24	-	-	1,453
Flounders, Unspecified	-	889	-	-	-	-	-	889
Blue Shark	-	362	-	-	-	237	-	599

Species	2005	2006	2007	2008	2009	2010	2011	Total
Pelagics, Unspecified	-	-	-	-	-	147	269	416
Swordfish	-	-	-	100	-	-	-	100
Cod Roe	-	-	-	-	-	-	38	38
Albacore Tuna	-	-	-	5	-	-	-	5
Total	**264,791,502**	**255,485,778**	**244,384,715**	**225,566,165**	**246,984,036**	**219,770,370**	**196,415,459**	**1,653,398,025**

Figure 4.79 Fish Harvests by Value by Species - NAFO 4R, 4S, 4T, 4Vn and 3Pn (2005 – 2011 Total)

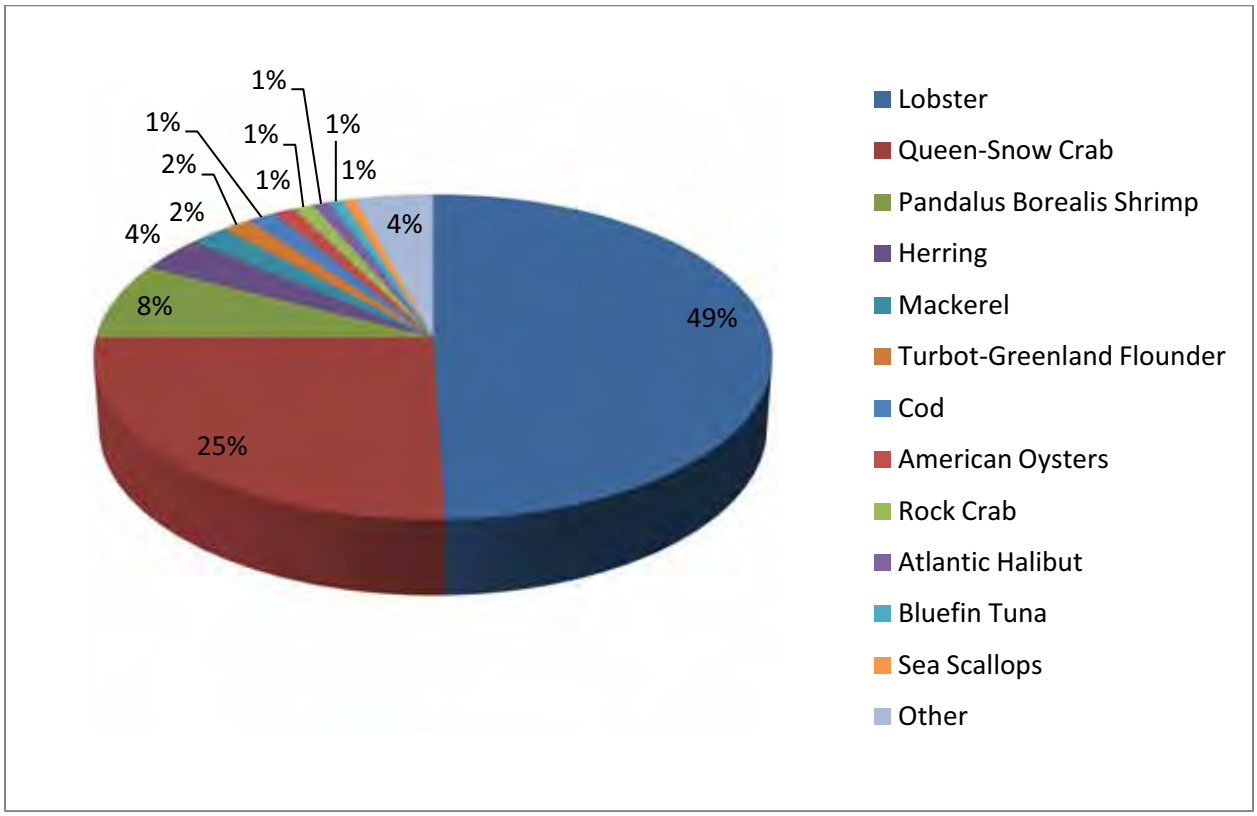


Table 4.99 Fish Harvests by Value ($) - NAFO 4R, 4S, 4T, 4Vn and 3Pn (2005 – 2011)

Species	2005	2006	2007	2008	2009	2010	2011	Total
Lobster	281,540,551	280,482,528	289,726,133	262,676,697	197,901,298	221,347,317	242,303,877	1,775,978,400
Queen-Snow Crab	189,492,816	101,844,610	167,413,796	139,219,578	114,149,527	71,893,010	130,461,751	914,475,088
Pandalus Borealis Shrimp	38,950,766	32,076,299	35,302,115	40,206,930	36,228,663	39,551,541	51,436,993	273,753,307
Herring	23,231,527	15,183,544	15,321,821	15,543,482	17,785,339	19,120,491	20,744,445	126,930,648
Mackerel	12,033,054	10,190,013	11,186,866	7,812,965	12,588,989	11,285,093	8,922,777	74,019,757
Turbot-Greenland Flounder	8,631,946	6,517,939	7,201,244	6,975,301	8,434,150	8,637,530	10,044,829	56,442,939

Species	2005	2006	2007	2008	2009	2010	2011	Total
Cod	8,446,660	10,778,027	11,723,329	11,778,480	5,248,441	3,800,351	2,275,355	54,050,643
American Oysters	7,688,790	7,162,999	6,791,387	4,160,608	5,436,339	4,867,446	4,943,289	41,050,858
Rock Crab	5,322,079	5,430,661	5,612,214	5,731,879	5,854,356	5,548,627	5,584,196	39,084,012
Atlantic Halibut	3,123,566	3,050,573	3,397,260	4,337,884	5,351,853	5,352,489	7,952,306	32,565,930
Bluefin Tuna	3,639,735	4,696,558	2,784,653	5,294,293	3,540,864	2,579,531	3,740,141	26,275,774
Sea Scallops	3,698,665	3,478,314	3,915,121	3,415,611	3,357,133	2,623,703	3,767,676	24,256,223
Beater Harp Seal Skins (#)	3,814,156	11,580,375	2,163,951	993,057	160,223	121,566	72,387	18,905,715
Capelin	2,590,124	3,141,596	2,098,856	2,510,447	1,794,748	1,290,410	2,107,701	15,533,882
Soft shell Clams	3,897,340	2,482,952	1,988,411	1,285,281	3,083,017	669,494	592,056	13,998,550
Whelks	1,755,107	1,611,853	1,313,340	1,225,062	1,373,569	1,649,476	1,636,838	10,565,246
Alewife	1,108,425	1,841,581	1,280,497	1,547,023	1,806,693	901,723	937,967	9,423,908
Eel	1,096,589	1,358,033	1,564,680	850,153	765,325	935,833	1,525,806	8,096,420
Sea Urchins	364,740	898,304	1,099,361	891,718	796,428	1,272,231	1,556,620	6,879,403
Quahaugs, Clams	1,714,482	999,874	778,592	698,759	849,144	971,240	730,506	6,742,596
Bar Clams	951,268	869,206	944,129	754,708	1,071,064	957,296	906,582	6,454,252
Redfish	1,080,513	968,912	472,122	794,673	1,004,957	884,112	978,271	6,183,560
Greysole-Witch Flounder	1,341,207	1,168,170	1,198,687	844,973	540,058	266,323	512,992	5,872,410
Stimpsons Surf Clams	643,341	682,009	455,492	526,494	786,264	800,818	735,084	4,629,502
Irish Moss	1,168,595	1,493,256	634,670	181,964	-	321,380	307,193	4,107,058
Icelandic Scallops	683,717	903,290	388,022	148,519	563,270	564,023	852,228	4,103,069
Smelts	815,242	706,798	639,447	445,331	580,608	463,313	434,752	4,085,490
Silversides	291,213	615,301	427,283	407,369	478,987	805,010	312,117	3,337,281
Lumpfish Roe	848,134	399,133	294,195	870,447	98,202	457,362	275,740	3,243,213
American Plaice	396,492	733,658	449,598	239,970	277,478	254,422	227,219	2,578,838
Winter Flounder	393,878	254,861	235,408	293,633	289,854	431,739	586,830	2,486,203
Other Fish, Unspecified	12,469	12,767	20,110	1,055	37,097	1,444	2,358,390	2,443,333
Spider-Toad Crab	642,929	643,781	502,358	167,804	130,939	138,791	195,006	2,421,608
Molluscs, Unspecified	304,769	187,352	443,975	235,750	279,213	93,821	592,465	2,137,346
Yellowtail Flounder	135,237	192,632	165,354	118,898	146,556	276,564	331,042	1,366,283
Windowpane Flounder	42,109	23,951	124,499	87,172	124,211	201,123	320,477	923,542
White Hake	110,467	100,737	86,079	97,554	77,020	59,678	101,748	633,284
Ragged Jacket Harp Seal	209,687	97,940	164,420	-	-	-	2,085	474,132

Species	2005	2006	2007	2008	2009	2010	2011	Total
Skins (#)								
Wireweed-Horsetail	-	20,060	112,567	80,450	-	121,386	55,559	390,022
Seal Fat	97,970	115,589	67,530	3,997	8,540	-	12,059	305,685
Sea Cucumber	-	-	-	-	-	286,886	-	286,886
Tomcod	6,999	36,916	7,946	11,022	10,312	9,232	-	82,427
Groundfish, Unspecified	9,660	8,609	22,762	6,108	432	3,214	18,936	69,722
Monkfish	12,063	6,390	6,180	7,782	8,966	8,525	11,475	61,381
Unspecified Items	20,792	5,231	1,422	136	1,943	2,222	28,980	60,727
Skate	8,594	8,954	14,942	10,307	6,710	6,490	3,561	59,559
Seal Flippers (#)	-	25,330	18,187	4,212	-	-	1,805	49,534
Striped Catfish	6,355	4,400	5,056	9,477	10,342	7,737	3,496	46,863
Pollock	4,075	21,142	4,829	2,668	6,633	2,075	1,367	42,790
Haddock	5,042	9,503	2,941	3,352	1,679	699	1,085	24,302
Seal Meat	-	-	-	-	-	19,354	-	19,354
Mako Shark	4,007	2,044	2,615	1,720	3,009	2,349	783	16,526
Porbeagle Shark	1,003	2,150	2,970	1,337	3,265	1,705	1,156	13,585
Bedlamer Harp Seal Skins (#)	1,762	1,886	9,708	46	-	-	-	13,402
Catfish	406	289	243	3,470	179	5,054	-	9,640
Shark, unspecified	2,548	2,914	890	459	584	602	833	8,829
Rock Cod	7,123	-	-	-	-	-	42	7,165
Sculpin	560	611	957	1,836	946	318	1,315	6,542
Dogfish	4,339	317	120	55	19	-	-	4,850
Jonah Crab	-	-	-	185	58	13	2,999	3,255
Clams, unspecified	-	3,210	-	-	-	-	-	3,210
Pelagics, Unspecified	-	-	-	-	-	1,171	1,883	3,054
Flounders, Unspecified	-	1,424	-	-	-	-	-	1,424
Cusk	88	166	40	85	56	473	140	1,048
Blue Shark	-	371	-	-	-	371	-	742
Swordfish	-	-	-	637	-	-	-	637
Illex Squid	-	523	-	-	-	-	-	523
Lumpfish	-	-	-	-	-	-	434	434
Cod Roe	-	-	-	-	-	-	166	166
Crustaceans, Unspecified	-	26	4	-	106	-	-	135

Species	2005	2006	2007	2008	2009	2010	2011	Total
Old Harp Seal Skins (#)	-	-	27	-	-	-	-	27
Albacore Tuna	-	-	-	2	-	-	-	2
Total	**612,405,770**	**515,138,441**	**580,591,411**	**523,520,864**	**433,055,656**	**411,876,194**	**511,515,810**	**3,588,104,147**

Commercial Fish Harvests (Overall Geographic Distribution: 2005-2011)

The following Figures provide a general indication of the overall geographic distribution of commercial fishing activity within and adjacent to the SEA Update Area, for the year 2011 and then from 2005 to 2011 overall , for all species, gear types, fleets, etc. As indicated previously, the information provided in these maps is based on the geospatial data received from DFO, and shows the general presence of recorded fishing activity for a series of 6 x 4 nautical mile "cells" that together comprise a map grid that covers the region. For the multi-year fishing maps, where fishing activity occurred within a single cell in two or more years, the Figure indicates only the most recent year in which fishing activity occurred within that cell. Individual maps showing overall fishing activity for each year from 2005 – 2010 are provided in Appendix C.

Further information on commercial fishing activity by month / season, gear type, fleet, species and other parameters is also provided in later sections.

Figure 4.80 Commercial Fishing Locations: 2011

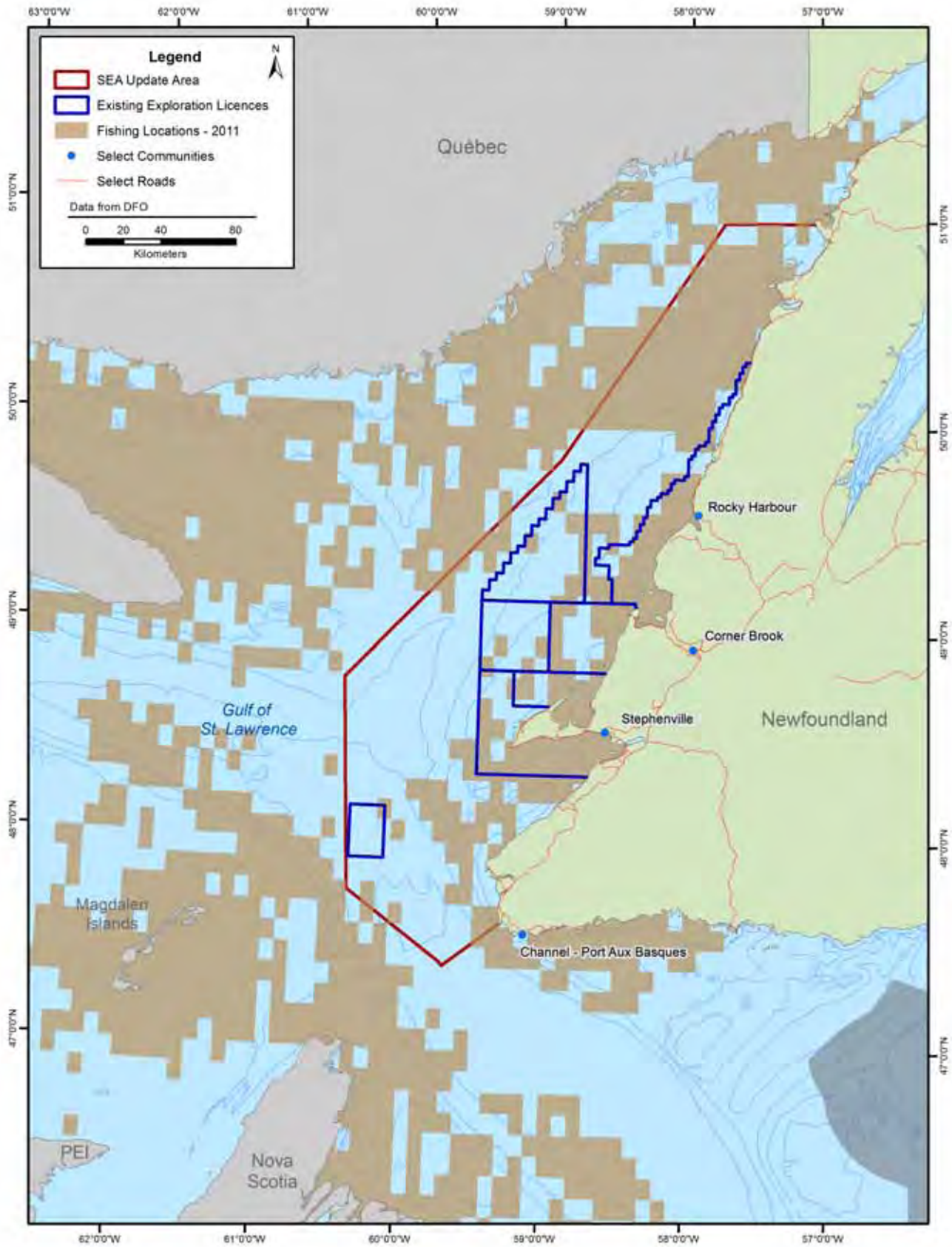
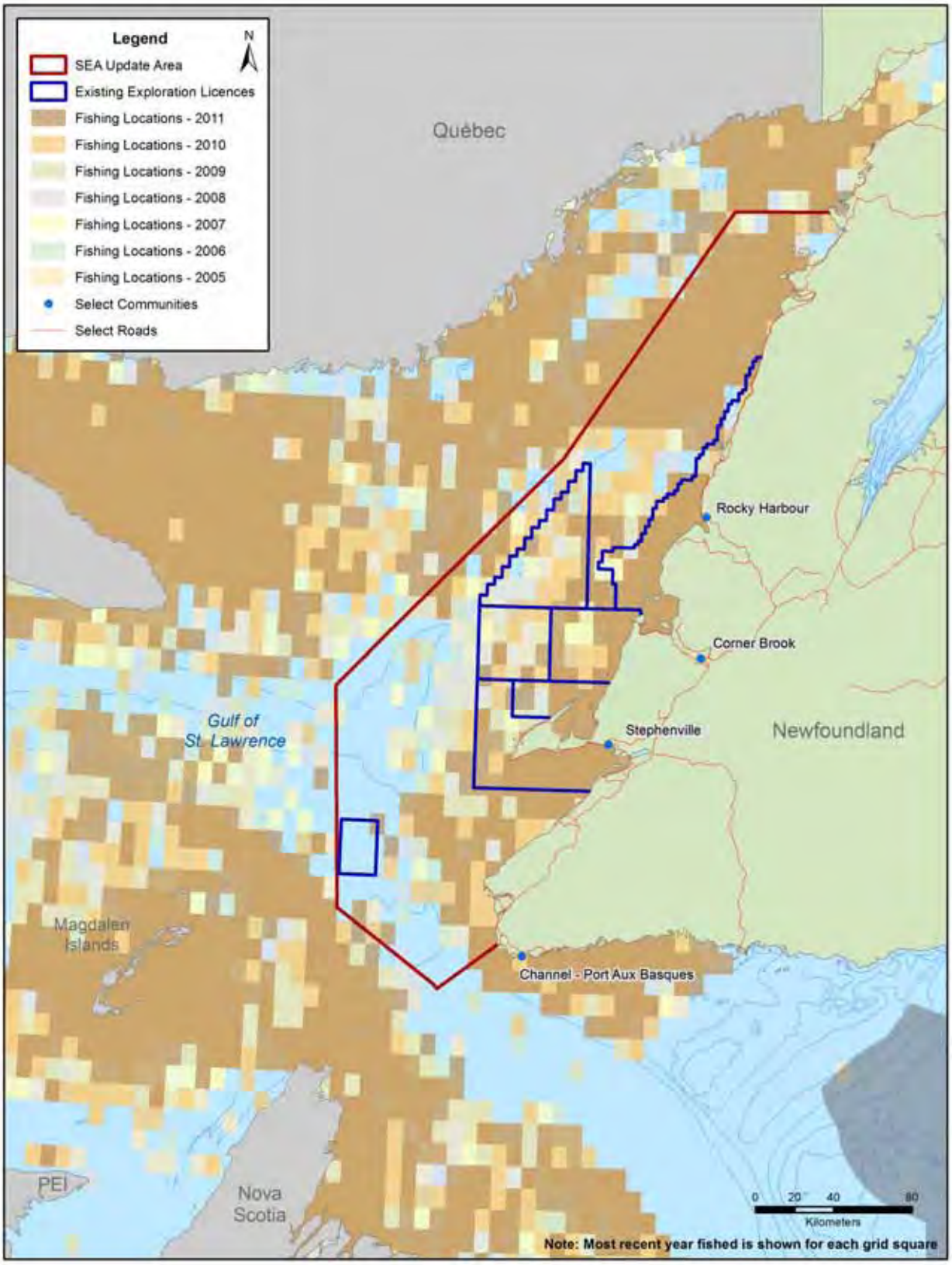


Figure 4.81 Commercial Fishing Locations: 2005-2011



Commercial Fishing - Seasonality

The timing of fishing activity varies by location and species, and is often dictated by such factors as weather and ice conditions, the availability of a resource in an area at a particular time, fisheries licencing and other regulatory and management considerations, as well as individual fishers' harvesting plans and preferences.

NAFO 4Rb, 4Rc and 4Rd

Fishing activity in the Primary Fisheries Study Area (NAFO Unit Areas 4Rb, 4Rc and 4Rd) during the 2005 to 2011 period generally extended from March to December, with the highest landings by weight occurring in the Fall (October – November) period, but with approximately half of the total fish value being harvested in the Spring and early Summer (May – June) season.

Table 4.100 Monthly Fish Harvests by Weight and Value - NAFO 4Rb, 4Rc and 4Rd (2005 – 2011)

Month	Weight (kg)	Value ($)
	(2005 – 2011 Inclusive)	
January	0	0
February	0	0
March	20,084	285,563
April	3,974,555	25,216,894
May	37,240,224	73,264,494
June	67,135,602	58,115,998
July	18,854,898	22,755,556
August	14,433,393	10,215,277
September	41,141,552	17,627,381
October	96,424,344	35,352,289
November	68,484,382	17,308,749
December	12,771,164	2,715,223
Total (All Months)	**360,480,198**	**262,857,424**

Figure 4.82 Monthly Fish Harvests by Weight - NAFO 4Rb, 4Rc and 4Rd (2005 – 2011)

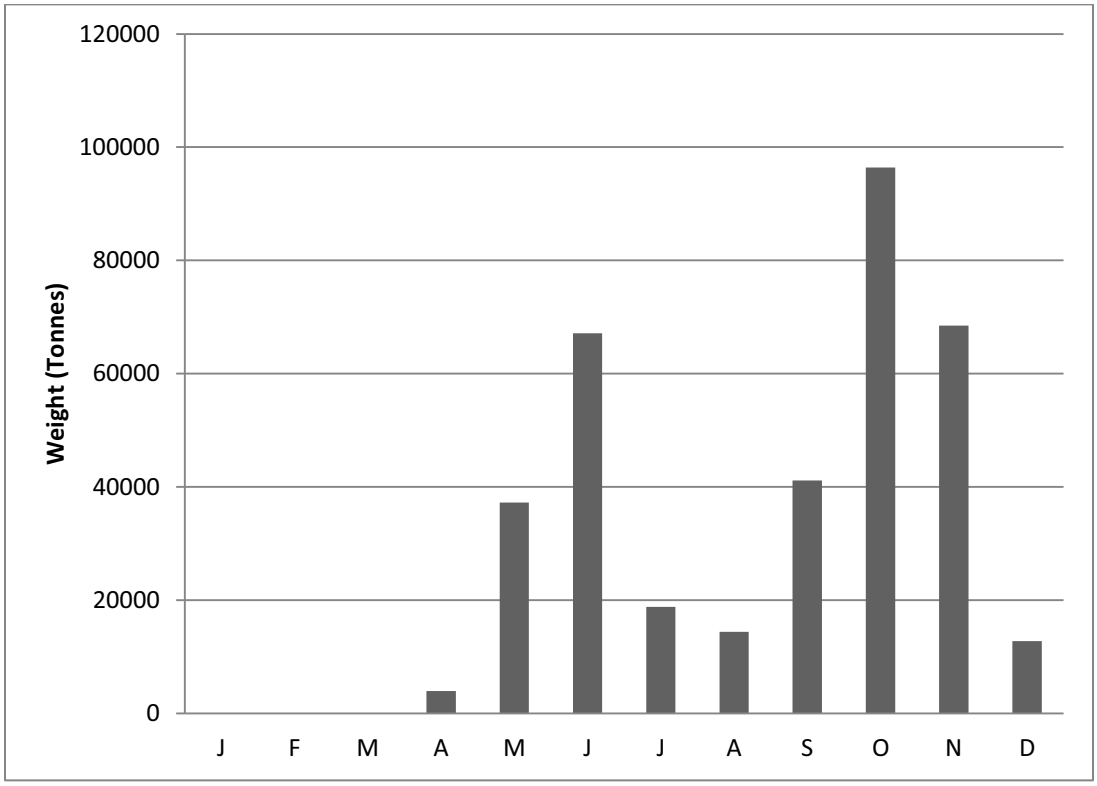
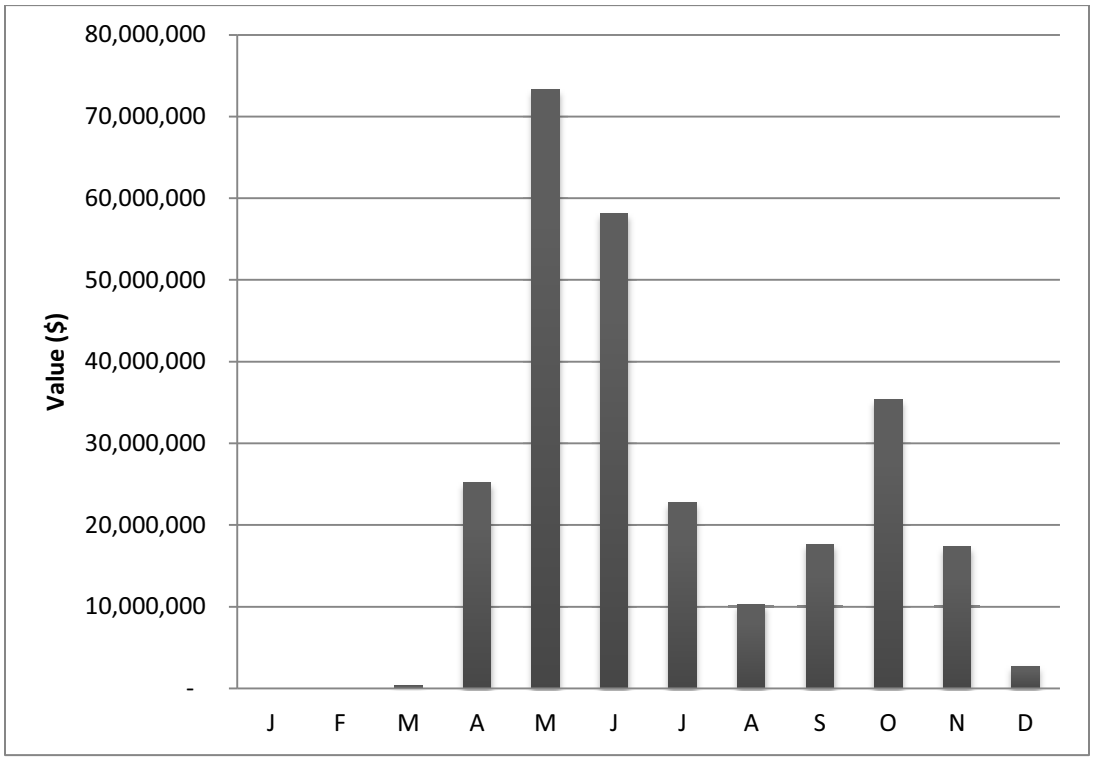


Figure 4.83 Monthly Fish Harvests by Value - NAFO 4Rb, 4Rc and 4Rd (2005 – 2011)



NAFO 4R, 4S, 4T, 4Vn and 3Pn

Commercial fishing in the larger Regional Fisheries Study Area (NAFO 4R, 4S, 4T, 4Vn and 3Pn) generally occurred on a year round basis from 2005 to 2011, with the highest landings by weight occurring in the Spring and early Summer (May - June) period, followed by the late Summer and early Fall period. Nearly 70 percent of the total fish value occurred in the May – June period, with lower but significant catch values also occurring throughout the rest of the Summer and early Fall timeframes.

Table 4.101 Monthly Fish Harvests by Weight and Value - NAFO 4R, 4S, 4T, 4Vn and 3Pn (2005 – 2011)

Month	Weight (kg)	Value ($)
	(2005 – 2011 Inclusive)	
January	1,740,175	1,997,791
February	2,063,050	1,802,264
March	1,869,962	3,738,910
April	79,388,160	227,072,257
May	305,759,545	1,470,262,642
June	296,350,333	958,050,436
July	154,249,790	278,985,462
August	236,629,946	269,145,785
September	297,301,595	221,050,985
October	157,362,114	107,644,913
November	100,046,165	40,800,558
December	20,637,190	7,552,145
Total (All Months)	**1,653,398,025**	**3,588,104,148**

Figure 4.84 Monthly Fish Harvests by Weight - NAFO 4R, 4S, 4T, 4Vn and 3Pn (2005 – 2011)

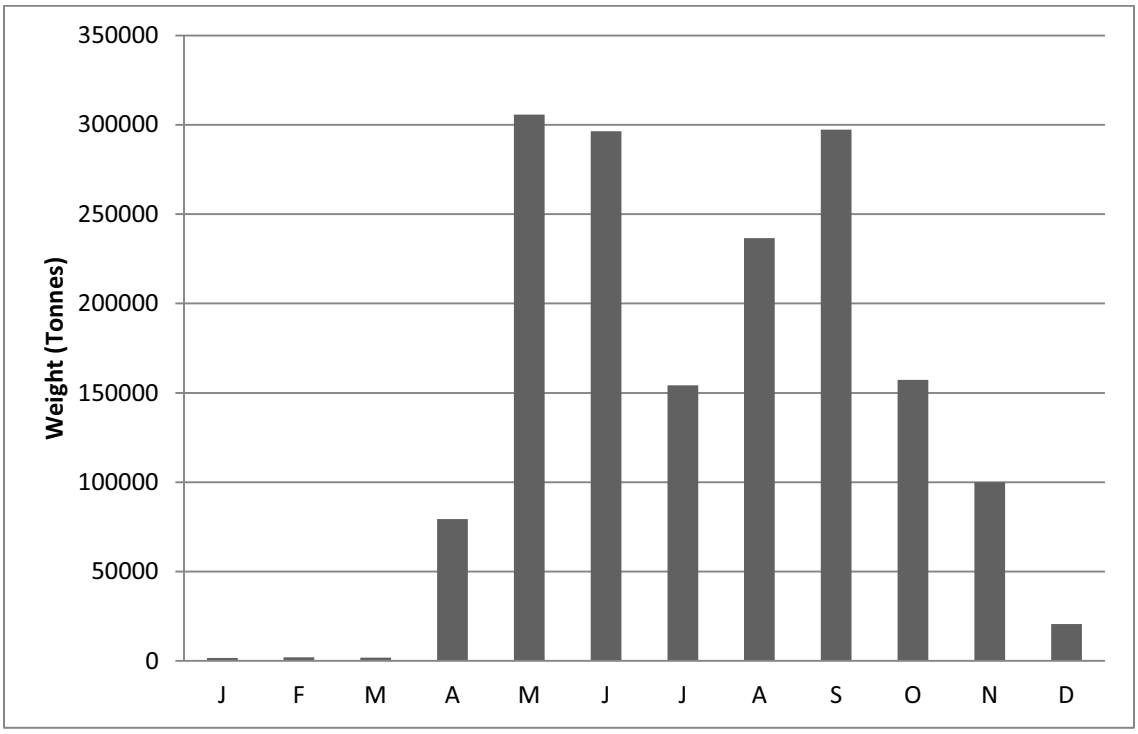
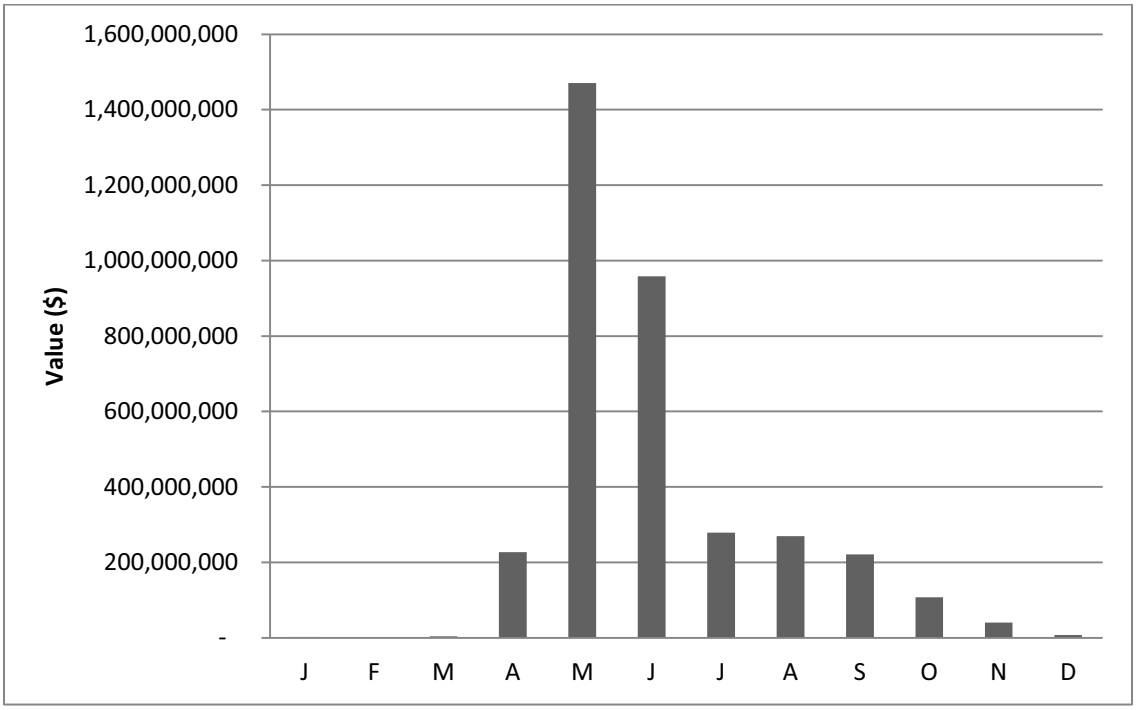


Figure 4.85 Monthly Fish Harvests by Value - NAFO 4R, 4S, 4T, 4Vn and 3Pn (2005 – 2011)



The following Figures show the seasonal distribution (by quarter) of recorded fishing activity for 2011 and the period 2005 – 2011 overall. Monthly maps (for 2011 and the 2005-2011 period) are included in Appendix D.

Figure 4.86 Commercial Fishing Locations: January – March 2011

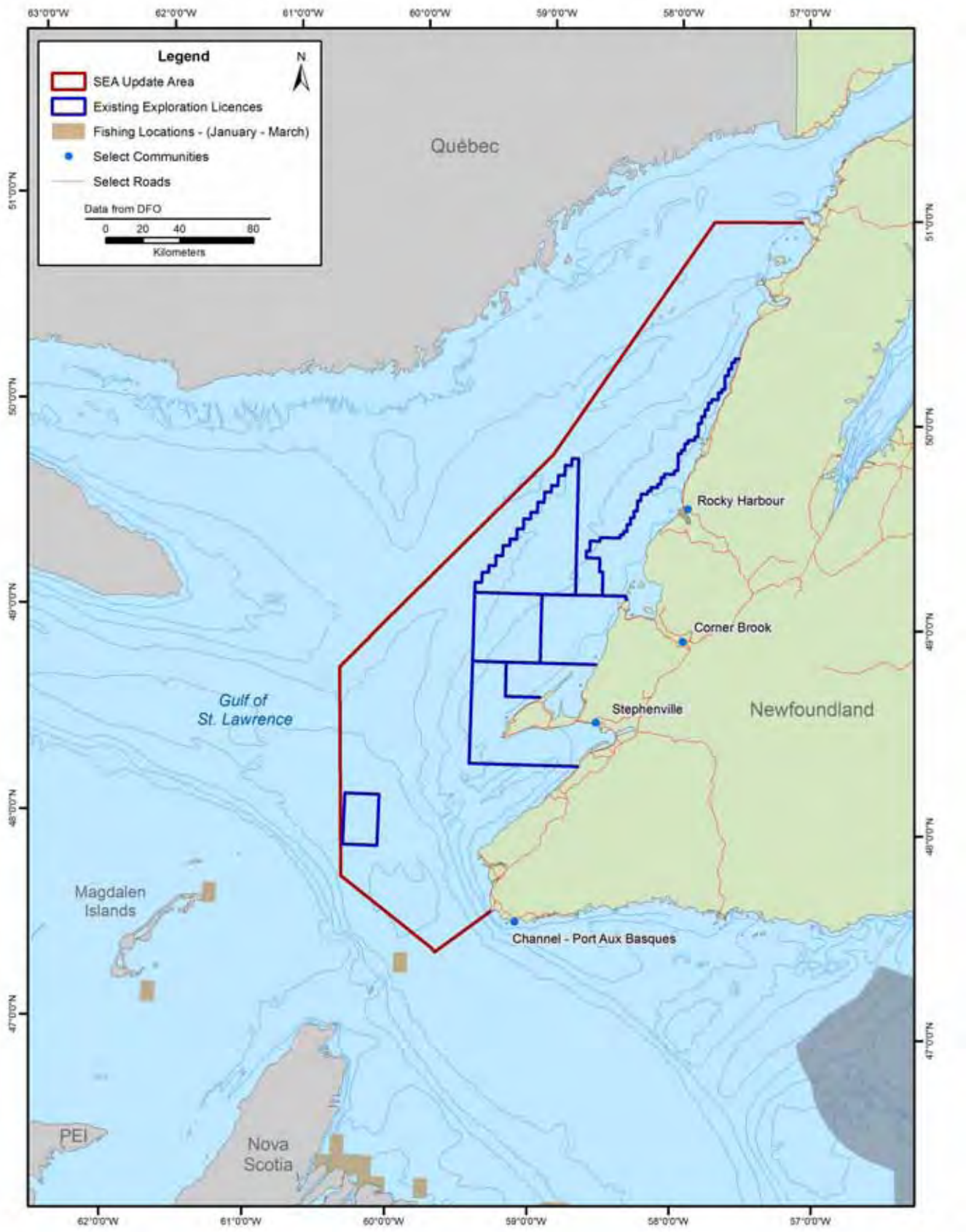


Figure 4.87 Commercial Fishing Locations: April - June 2011

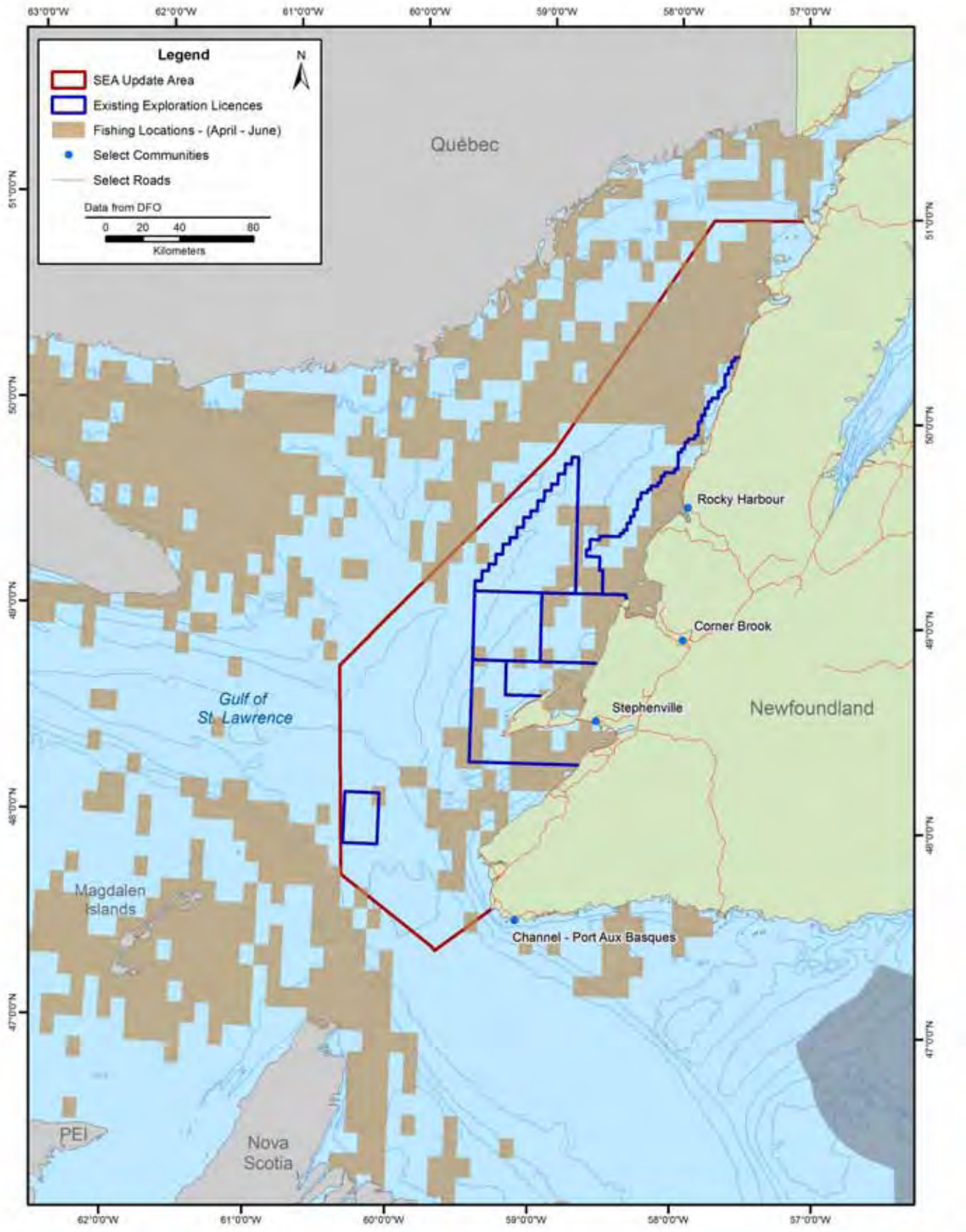


Figure 4.88 Commercial Fishing Locations: July - September 2011

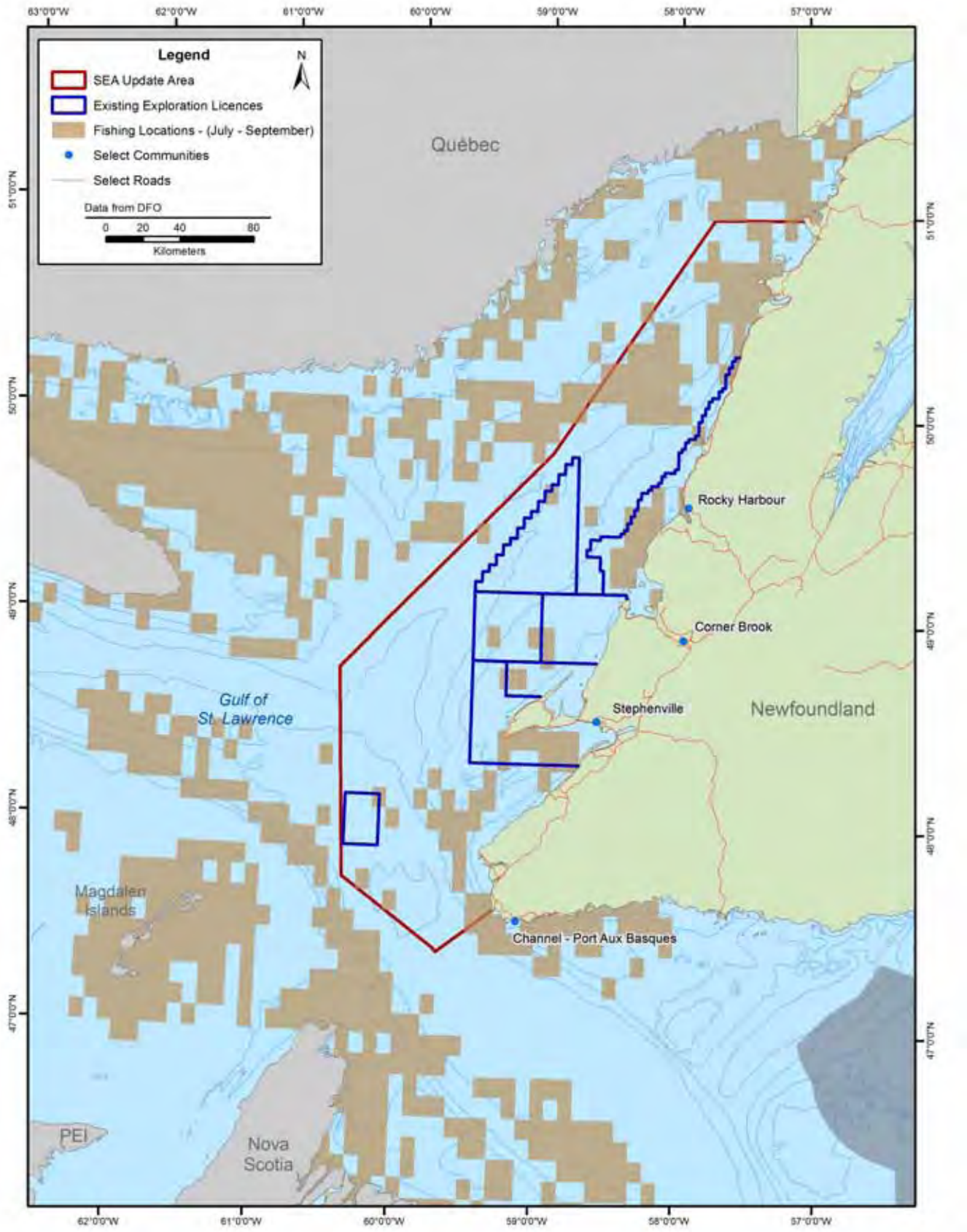


Figure 4.89 Commercial Fishing Locations: October – December 2011

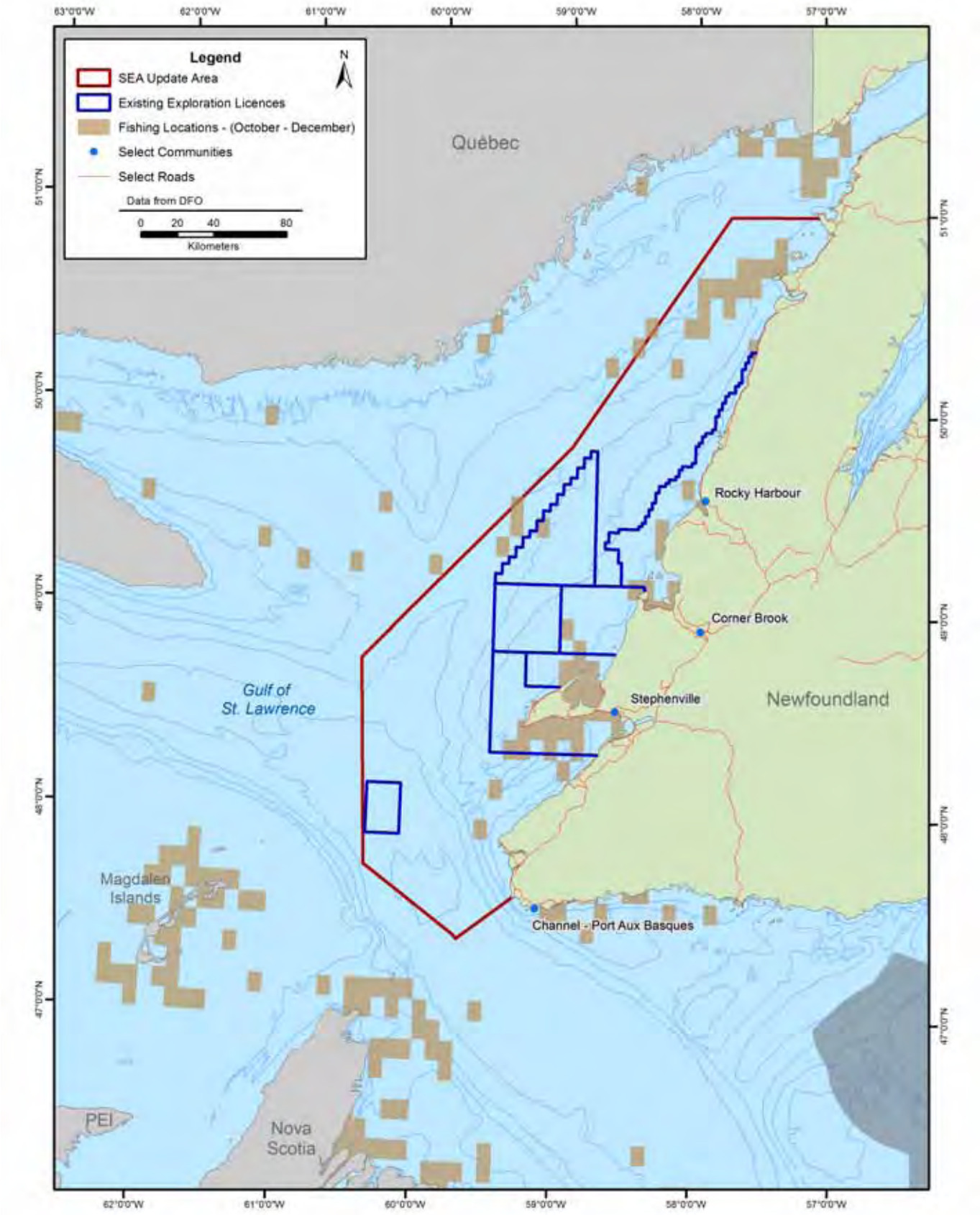


Figure 4.90 Commercial Fishing Locations: January – March 2005-2011

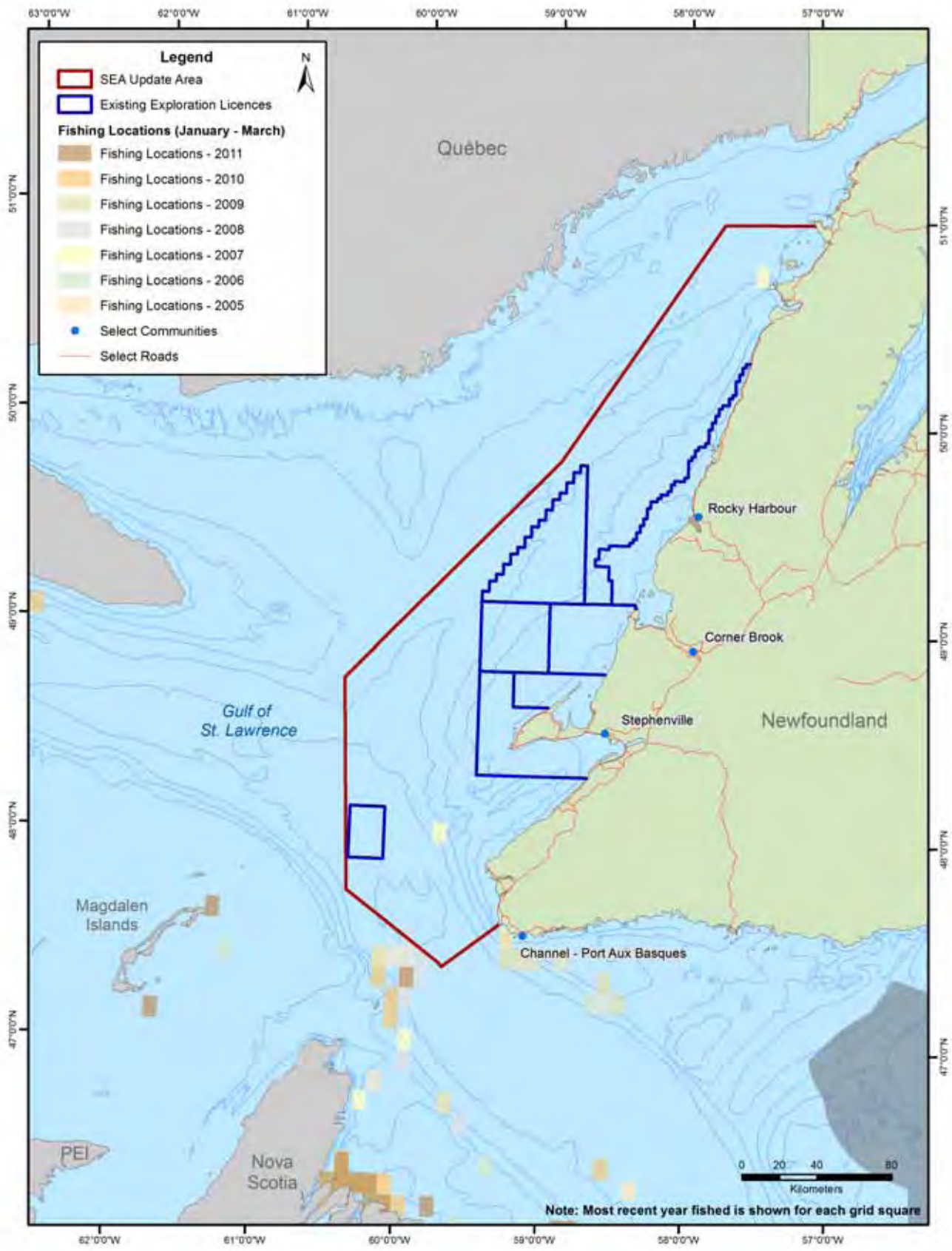


Figure 4.91 Commercial Fishing Locations: April - June 2005-2011

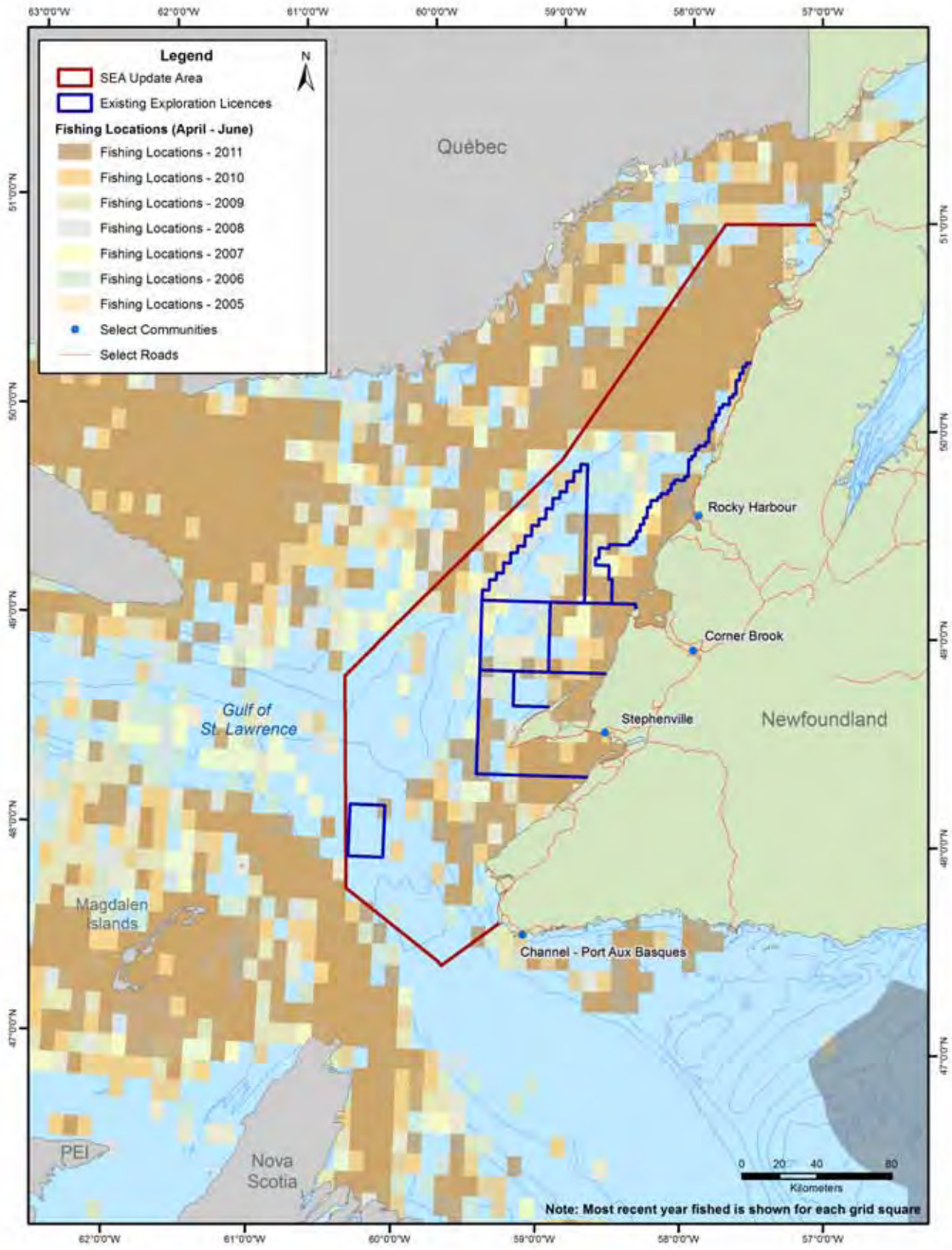


Figure 4.92 Commercial Fishing Locations: July - September 2005-2011

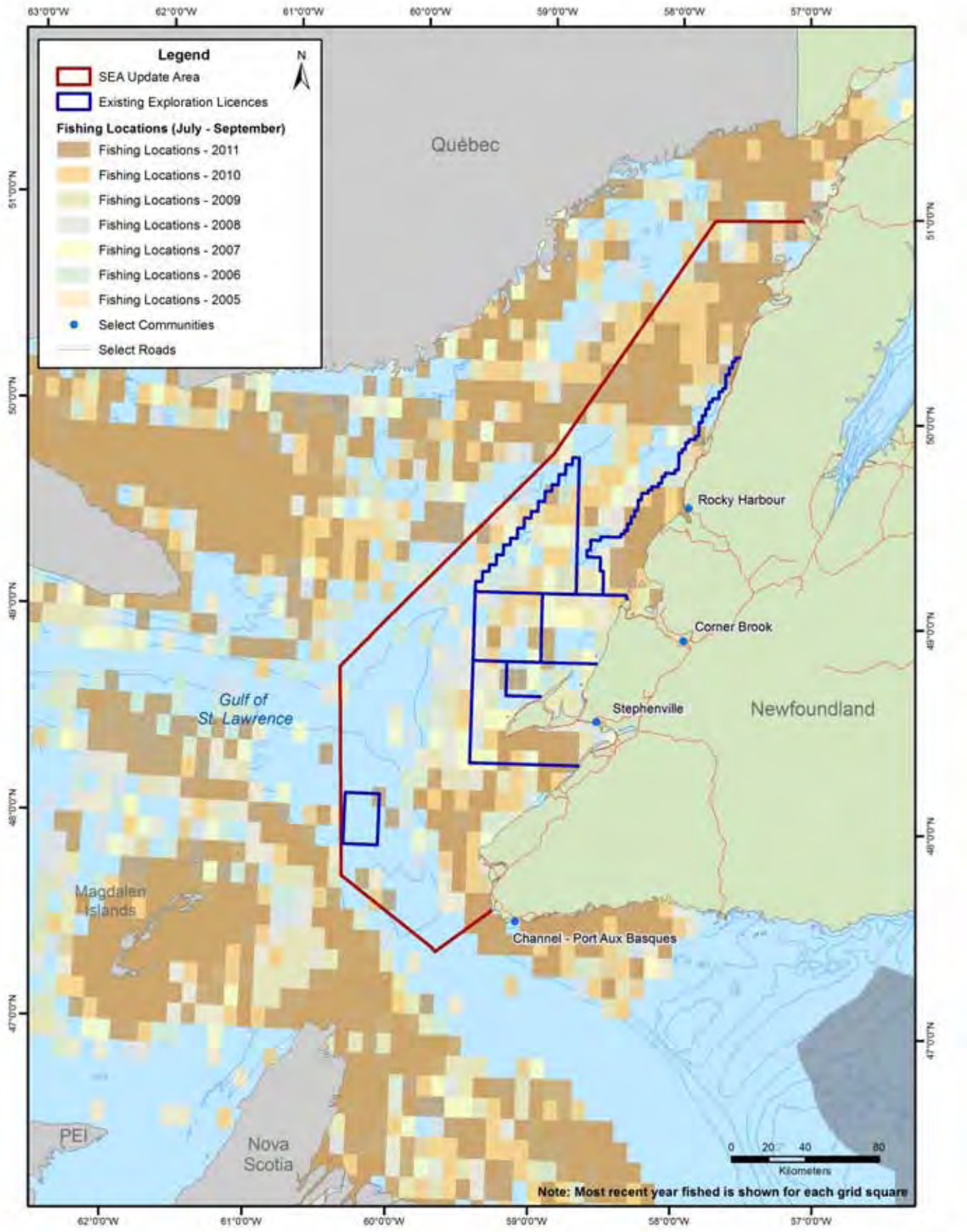
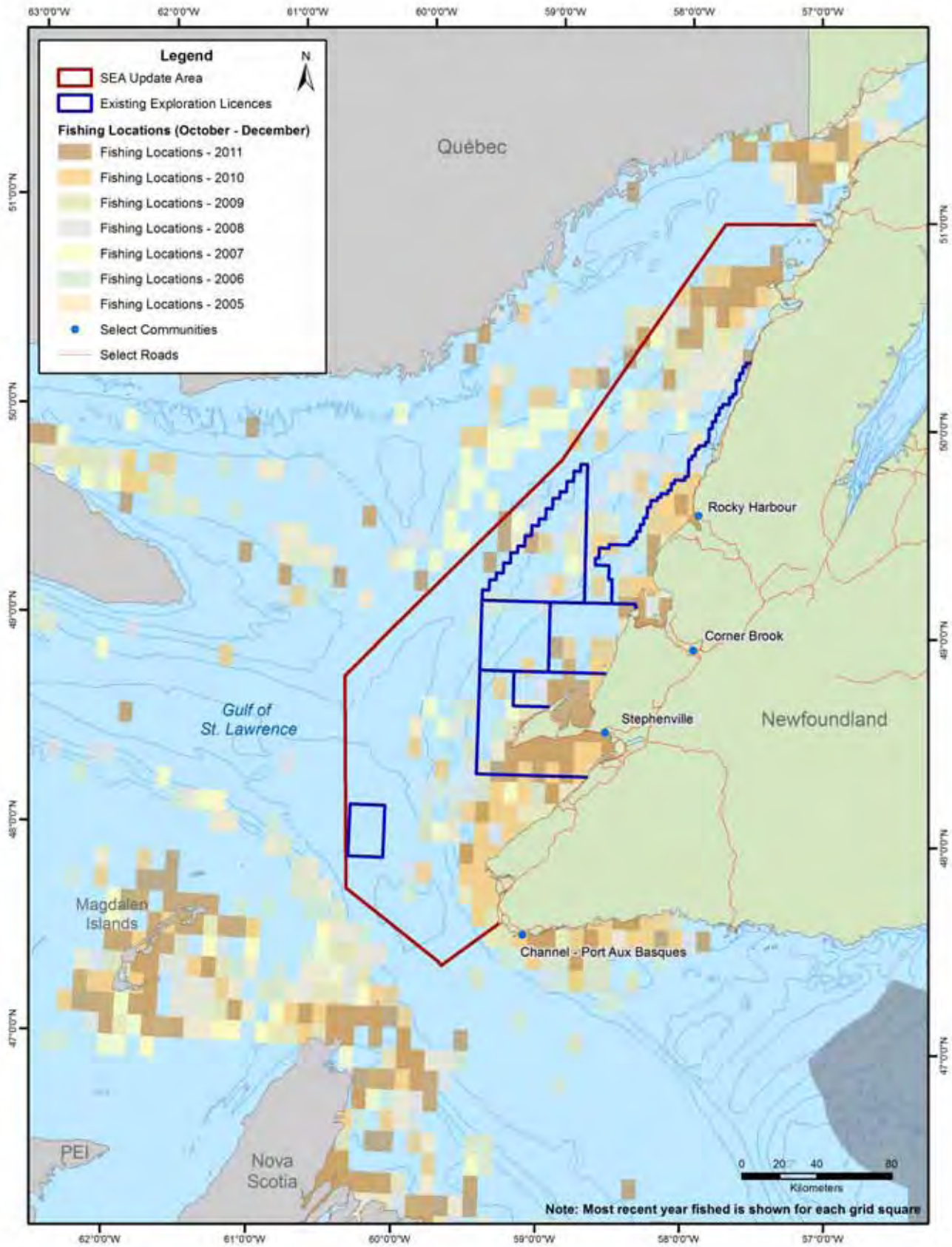


Figure 4.93 Commercial Fishing Locations: October – December 2005-2011



Commercial Fishing – Gear Types (NAFO 4Rb, 4Rc and 4Rd)

Various types of fishing gear are used to harvest fish and shellfish off Newfoundland and Labrador and elsewhere in Eastern Canada. Cod, for example, are typically fished using fixed gear, such as handlines, longlines and gillnets (CSAS 2012a). The main fishing gear used to capture herring is mobile purse seines, with tuck seines (modified bar seines), gillnets and traps also used (CSAS 2012b). Mackerel are mainly fished inshore using gillnets, jiggers, handlines, seines (both purse and tuck) and traps, although the type of gear varies by region and time of year (CSAS 2012c). Most capelin are caught using purse seines (CSAS 2011). Lobsters are caught live in baited wooden-frame or plastic-coated steel-mesh traps (or pots) (CSAS 2009), and shrimp are trawled (DFO 2012d). Crab are harvested in baited conical traps made of steel rims with knitted nylon mesh (CSAS 2012d).

A wide range of fishing gear types were used as part of the commercial fishery within the Primary Fisheries Study Area (NAFO Unit Areas 4Rb, 4Rc and 4Rd) from 2005 to 2011. Of these, purse seines accounted for approximately 64 percent of the total fish landings over that period by weight, followed by shrimp trawls (16 percent), tuck seines (9 percent) and others.

In terms of fishing gear types by landed value, pots used in the shellfish (lobster and crab) fisheries accounted for approximately 30 percent of the total value of the fishery in that area over that time period, followed by purse seines (24 percent), shrimp trawls (23 percent), gillnets (9 percent) and others.

Figure 4.94 Fish Harvests (Weight) by Gear Type - NAFO 4Rb, 4Rc and 4Rd (2005 – 2011 Total)

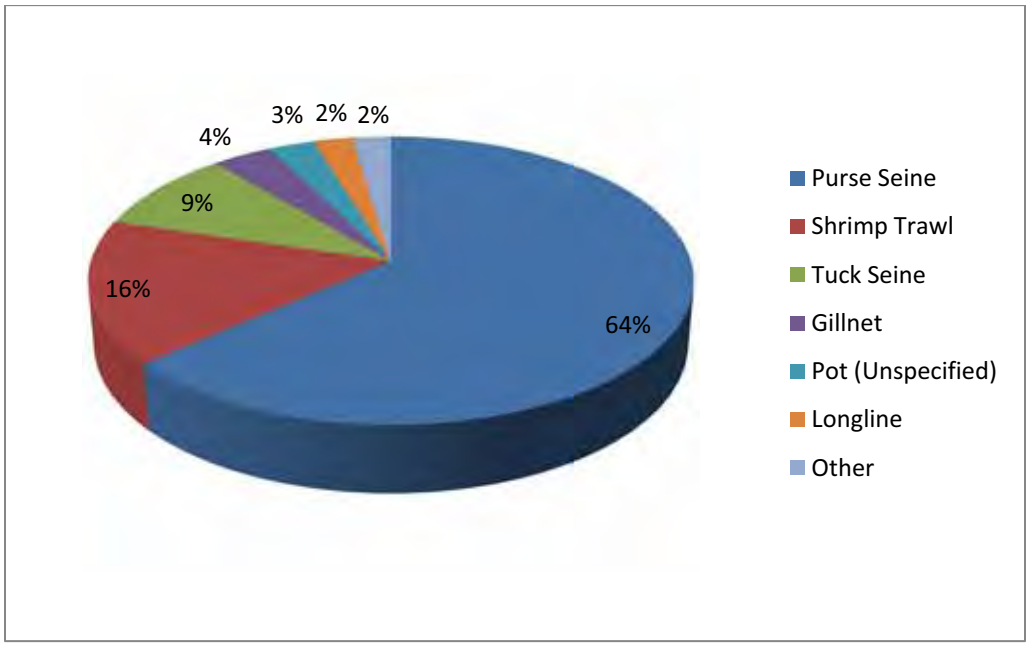


Table 4.102 Fish Harvests by Gear Type by Weight (kg) - NAFO 4Rb, 4Rc and 4Rd (2005 – 2011)

Gear Type	2005	2006	2007	2008	2009	2010	2011	Total
Purse Seine	31,198,510	31,784,497	34,107,325	33,351,096	40,743,062	32,239,035	25,349,390	28,772,915
Shrimp Trawl	8,466,720	8,187,355	7,601,216	7,967,896	8,428,082	9,192,357	8,430,601	58,274,227
Tuck Seine	1,183,521	4,254,104	4,644,856	6,656,258	7,305,381	5,498,564	3,519,744	33,062,428
Gillnet (set of fixed)	2,321,084	1,916,448	1,910,628	1,531,610	1,971,948	1,676,850	1,859,543	13,188,111
Pot (Unspecified)	1,879,716	1,588,919	1,623,582	1,520,098	1,182,536	1,031,504	1,249,969	10,076,324
Longline	1,175,061	1,537,646	1,795,323	1,795,062	1,308,166	760,647	271,427	8,643,332
Miscellaneous Gear	28,995	562,531	10,036	63,799	240,592	203,582	864,051	1,973,586
Danish Seine	581,915	-	498,154	366,982	298,432	-	-	1,745,483
Trap Net	315,979	243,645	192,286	39,625	397,115	216,453	129,825	1,534,928
Hand Line (Baited)	211,005	305,177	193,005	147,318	138,346	84,969	110,505	1,190,325
Bottom Otter Trawl (Stern)	599,103	221,372	-	-	-	138,587	-	59,062
Beach and Bar Seine	569,970	-	-	-	-	-	-	569,970
Hunting	146,547	69,177	75,175	2,914	3,763	-	-	297,576
Dredge (Boat)	14,253	-	2,101	23,481	14,917	27,155	47,947	129,854
Fyke Net	-	-	22,079	-	14,113	-	-	36,192
Japanese Trap	-	-	-	10,383	4,066	11,436	-	25,885
Total	**48,692,379**	**50,670,871**	**52,675,766**	**53,476,522**	**62,050,519**	**51,081,139**	**41,833,002**	**360,480,198**

Figure 4.95 Fish Harvests (Value) by Gear Type - NAFO 4Rb, 4Rc and 4Rd (2005 – 2011 Total)

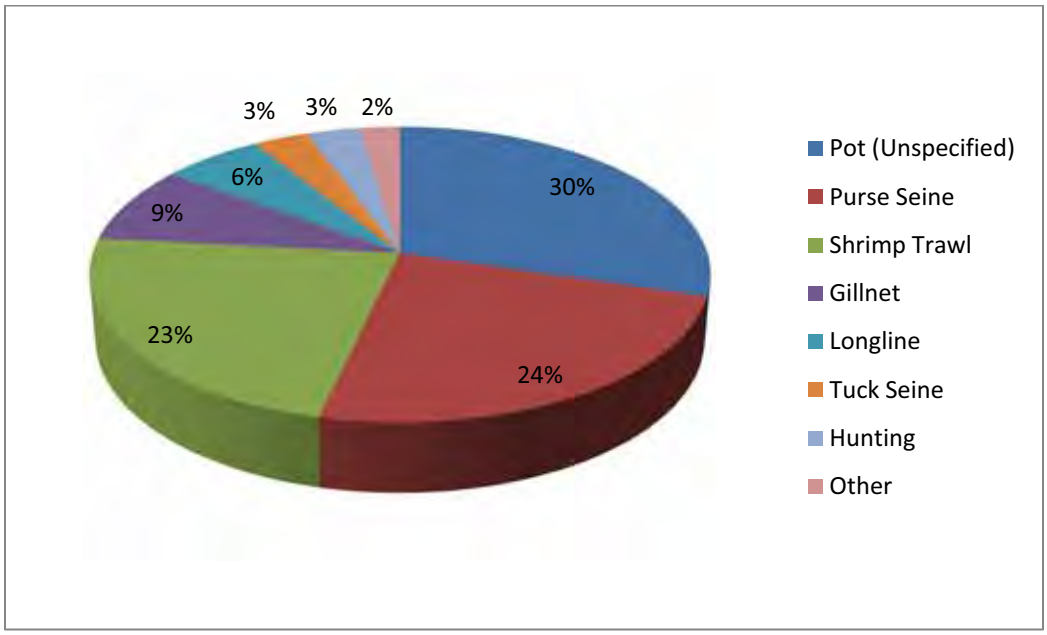


Table 4.103 Fish Harvests by Gear Type by Value ($) - NAFO 4Rb, 4Rc and 4Rd (2005 – 2011)

Gear Type	2005	2006	2007	2008	2009	2010	2011	Total
Pot (Unspecified)	15,013,010	12,861,197	15,024,600	12,311,799	7,669,381	6,691,798	8,379,652	77,951,437
Purse Seine	9,234,126	8,420,872	8,770,109	8,460,428	10,271,375	8,813,205	9,097,423	63,067,538
Shrimp Trawl	8,184,306	6,484,767	6,975,406	8,627,696	7,712,799	9,561,109	12,875,511	60,421,595
Gillnet (set of fixed)	3,097,101	2,544,880	2,883,413	2,614,824	2,996,132	3,086,381	4,972,689	22,195,419
Longline	1,933,310	2,400,612	2,997,961	3,264,028	2,376,320	1,543,913	1,343,499	15,859,644
Tuck Seine	326,680	1,002,630	1,155,014	1,492,264	1,712,028	1,402,476	1,536,025	8,627,115
Hunting	2,150,299	4,357,493	1,429,278	395,494	43,576	-	-	8,376,140
Miscellaneous Gear	144,646	548,383	10,375	67,946	112,192	234,624	744,106	1,862,272
Danish Seine	514,392	-	449,994	283,356	264,252	-	-	1,511,993
Hand Line (Baited)	209,854	231,257	175,738	210,787	117,420	78,382	97,398	1,120,836
Bottom Otter Trawl (Stern)	352,985	202,336	-	-	-	93,542	-	648,863
Trap Net	105,124	68,475	51,530	14,241	106,950	87,612	124,785	558,716
Dredge (Boat)	41,519	-	3,143	39,203	23,168	42,412	89,145	238,591
Fyke Net	-	-	125,629	-	52,580	-	-	178,208
Beach and Bar Seine	155,430	-	-	-	-	-	-	155,430
Japanese Trap	-	-	-	34,334	11,652	37,640	-	83,626
Total	**41,462,781**	**39,122,901**	**40,052,190**	**37,816,402**	**33,469,825**	**31,673,093**	**39,260,232**	**262,857,424**

The following Figures provide an overview of the distribution of 2011 commercial fishing activity within and adjacent to the SEA Update Area by gear type.

Figure 4.96 Commercial Fishing Locations by Gear Type (2011)

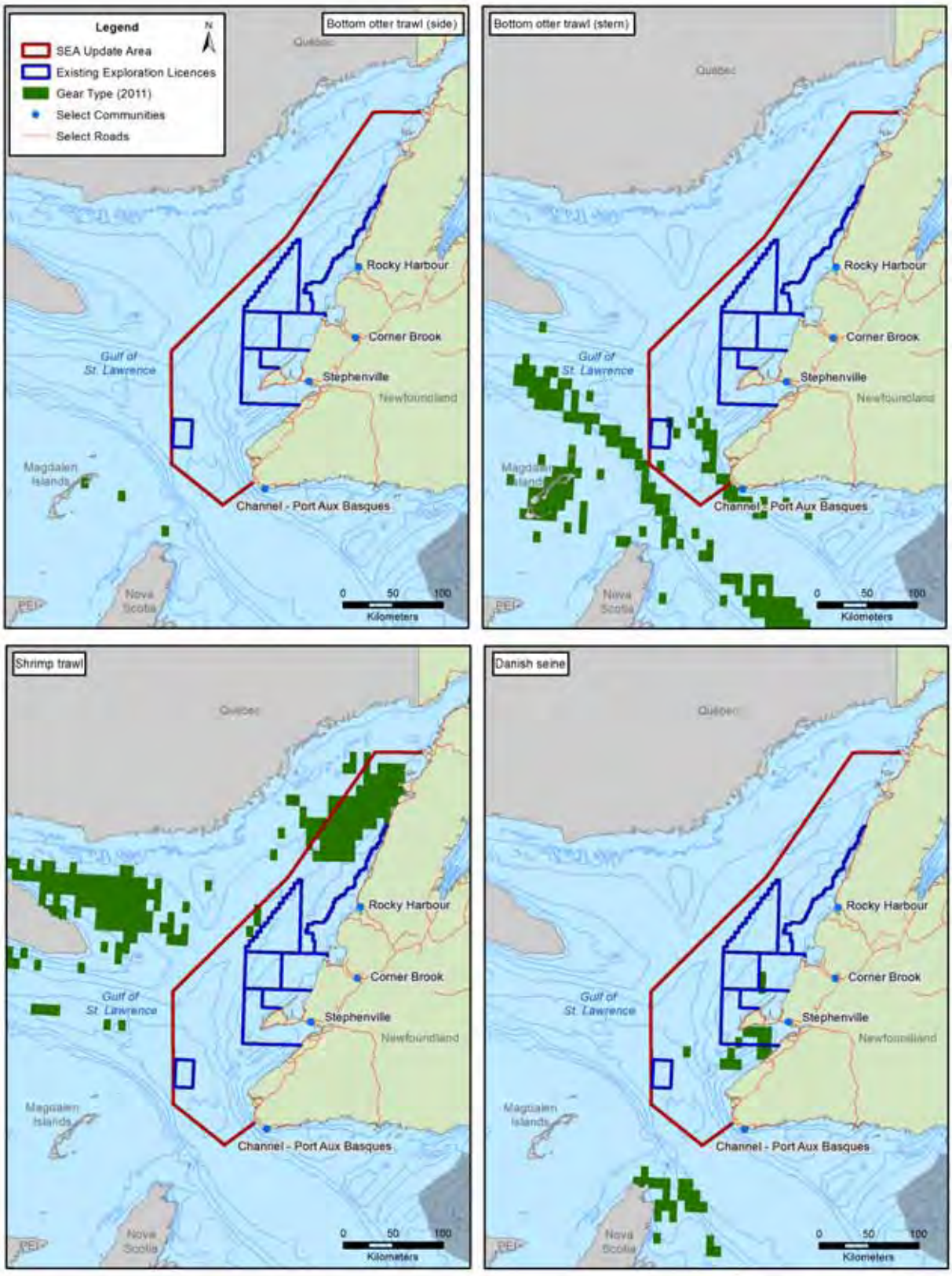


Figure 4.96 Commercial Fishing Locations by Gear Type (2011) - Continued

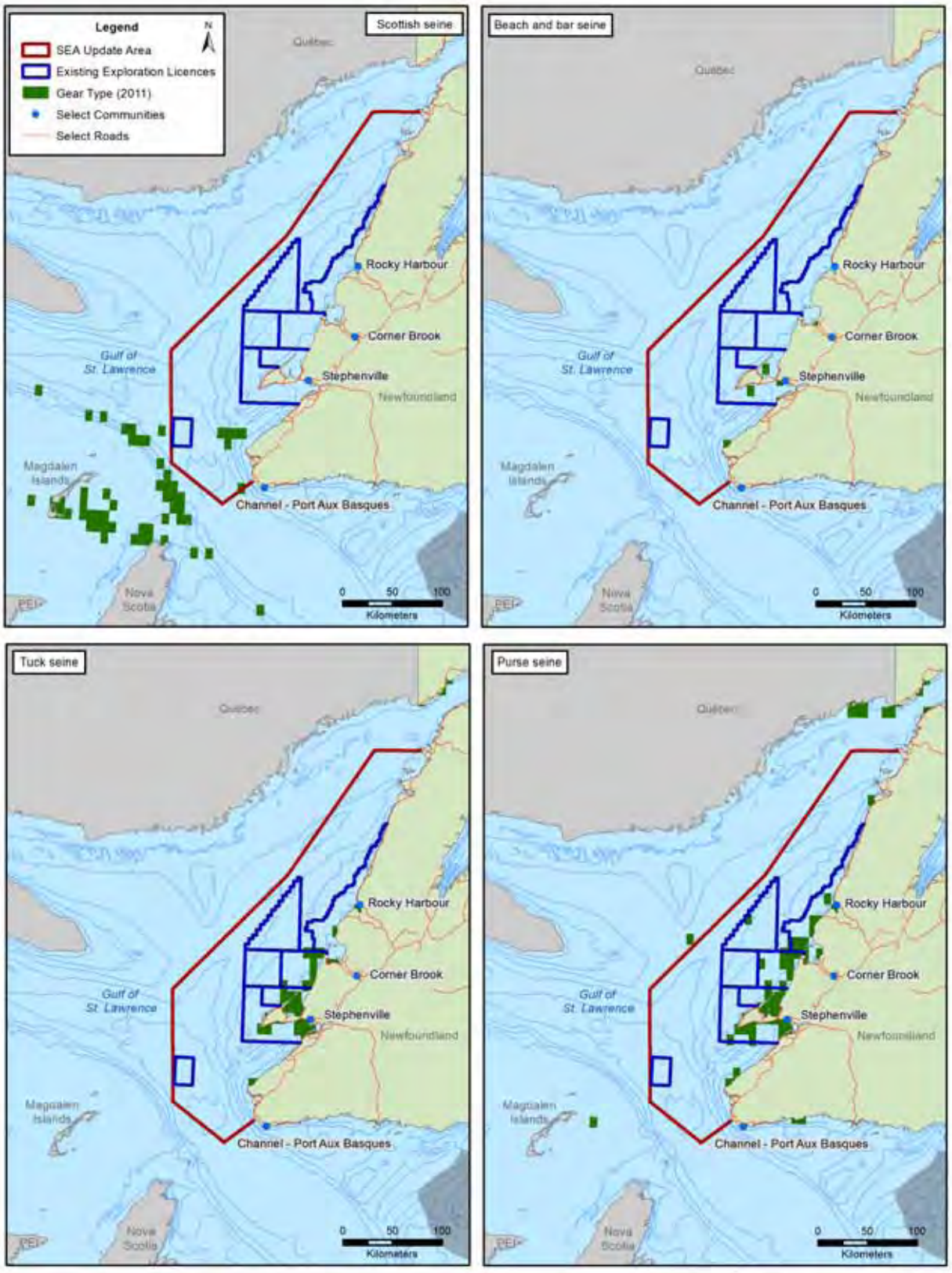


Figure 4.96 Commercial Fishing Locations by Gear Type (2011) - Continued

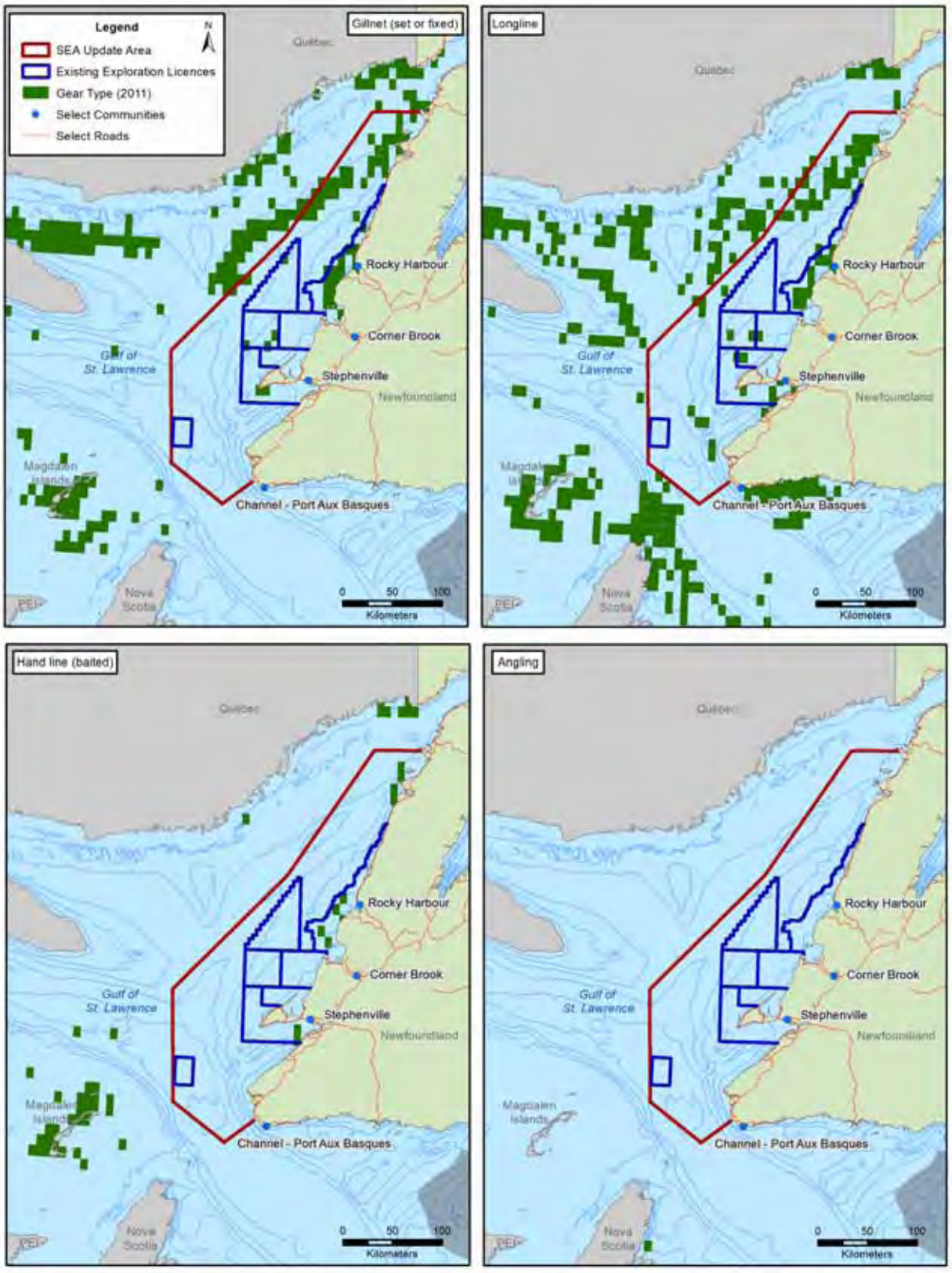


Figure 4.96 Commercial Fishing Locations by Gear Type (2011) - Continued

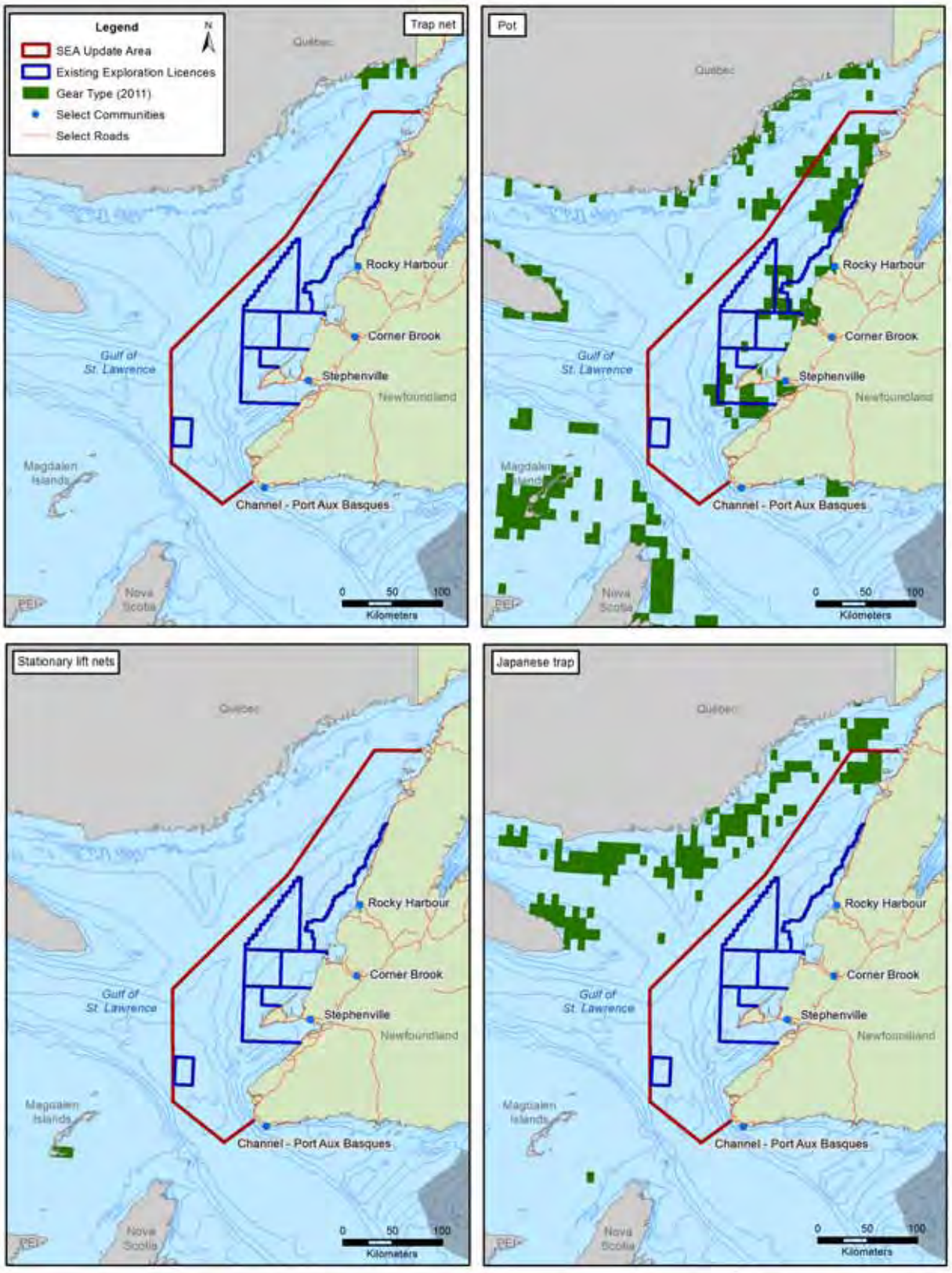


Figure 4.96 Commercial Fishing Locations by Gear Type (2011) - Continued

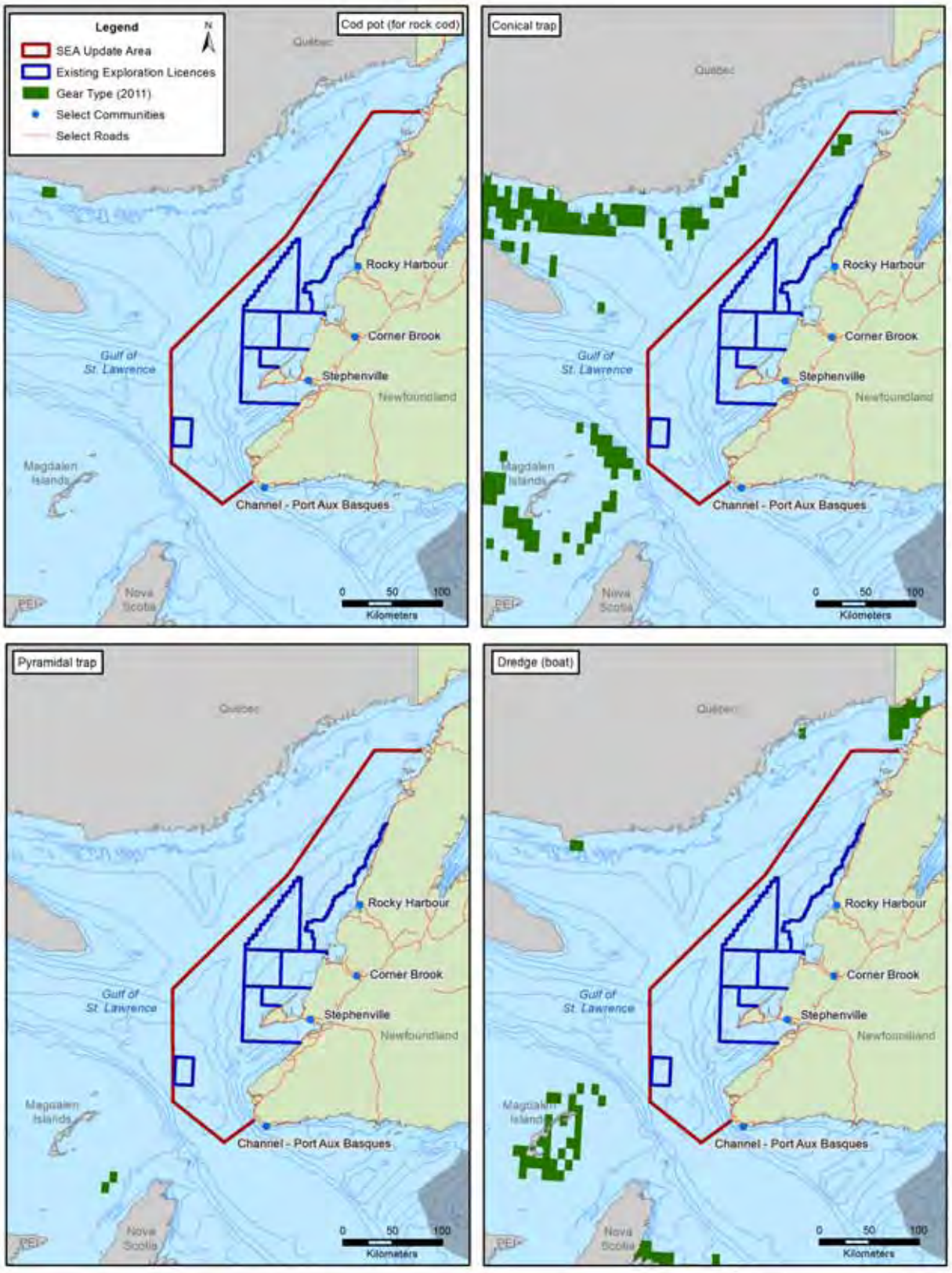
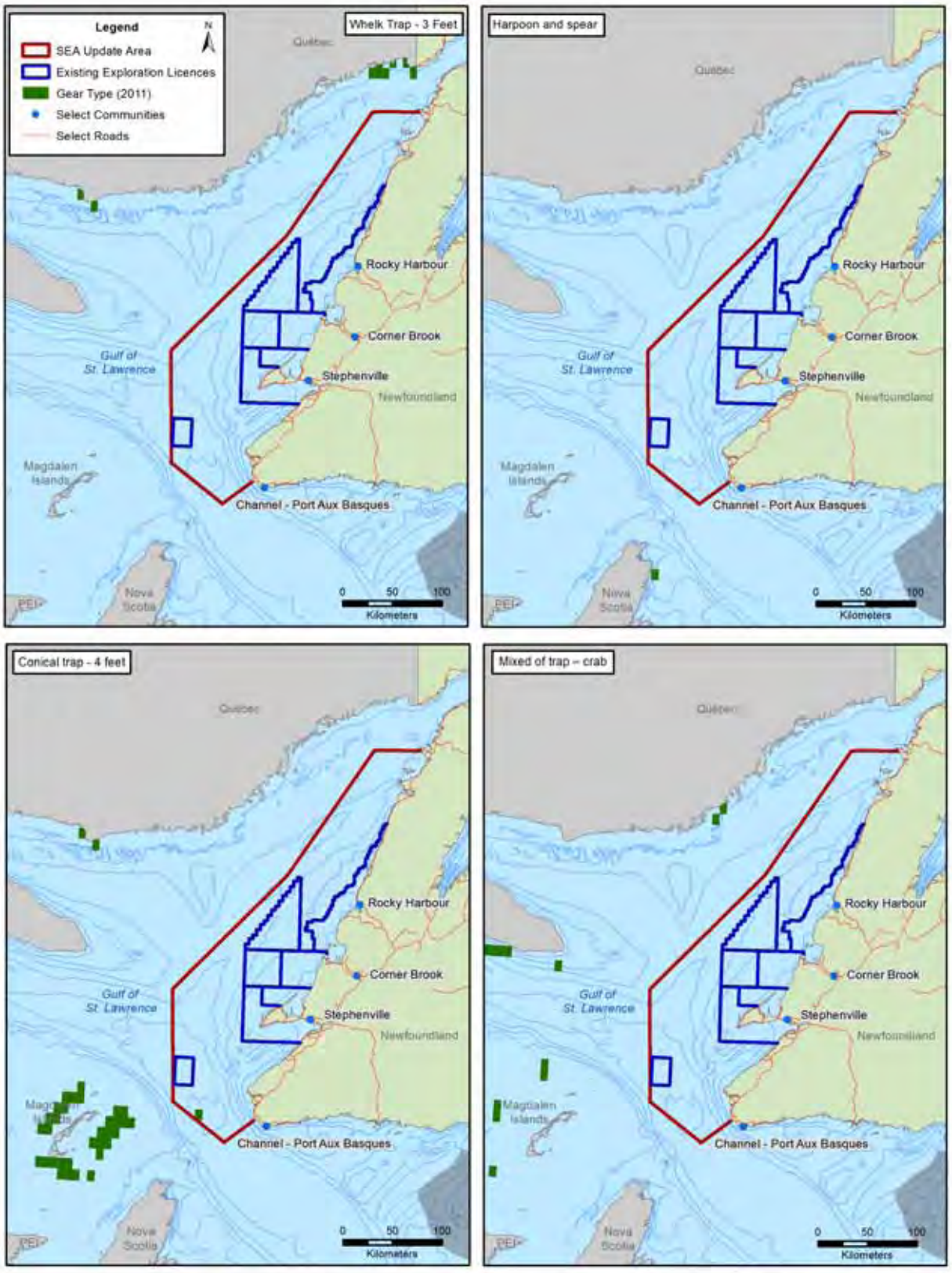


Figure 4.96 Commercial Fishing Locations by Gear Type (2011) – Continued



Commercial Fishing – 2012 Licences and Enterprises (NAFO 4R)

The following Tables provide information related to the number of fishing enterprises and licences within NAFO Division 4R as a whole (See Figures 4.70 and 4.71).

In 2012 there were 869 fishing enterprises involved in the commercial fishery in NAFO Division 4R, of which approximately 85 percent were comprised of vessels less than 40 feet in length and the remaining 15 percent were greater than or equal to 40 feet (Table 4.104).

Of the 869 fishing enterprises in the region in 2012, approximately 82 percent were "*core*" enterprises, which are defined by DFO as those which are headed by a core fisher, who must be the head of an enterprise, hold key species licences (i.e., for Newfoundland and Labrador, groundfish, capelin, lobster, snow crab, scallop, shrimp, and all species caught using purse seine), have a demonstrated attachment to the fishery, and be dependent on the fishery.

An overview of the total number of fishing licences in NAFO Division 4R in 2012 is also provided in Table 4.105, including the number of licences by species (and gear type where applicable).

Table 4.104 Number of Fishing Enterprises for NAFO Division 4R by Fleet (2012)

Enterprise Type	# of Enterprises by Vessel Eligibility		
	<40 feet	>=40 feet	Total
Independent Core and Core	584	125	709
Non-Core	158	2	160
Total	**742**	**127**	**869**
Note: Data include Key Licence Holders only			

Table 4.105 Fishing Licences for NAFO Division 4R by Species (2012)

Species	Licence Count
Bait - Commercial	654
Capelin FG - Commercial	233
Capelin MG - Commercial	20
Cod Handline - Commercial	-
Eels - Commercial	41
Groundfish Danish Seine - FG - Commercial	1
Groundfish FG - Commercial	727
Groundfish MG - Commercial	50
Hagfish - Emerging	-
Herring FG - Commercial	605
Herring MG - Commercial	19
Herring MG - Experimental	-
Lobster - Commercial	653
Mackerel FG - Commercial	520
Mackerel MG - Commercial	25
Rock Crabs - Commercial	10

Species	Licence Count
Salmon (Atlantic) - Commercial	2
Salmon/Char - Commercial	-
Scallop - Commercial	121
Scallop - Recreational	187
Sea Cucumber - Emerging	2
Sea Urchins - Commercial	-
Seal - Assistant - Commercial	644
Seal - Experimental	-
Seal - Personal Use	160
Seal - Professional - Commercial	1509
Seal - Temporary Assistant - Temporary	32
Shark - Recreational	9
Shrimp - Beam Trawl - Commercial	-
Shrimp - Beam Trawl - Temporary	-
Shrimp Cartwright Allocation - Temporary	-
Shrimp Gulf - Commercial	37
Shrimp SFA 04 Northern - Commercial	-
Shrimp SFA 06 Northern - Commercial	50
Shrimp SFA 08/Gulf - Commercial	8
Smelts - Commercial	6
Snow Crab - Commercial	58
Snow Crab - Fulltime - Commercial	-
Snow Crab - Inshore - Commercial	287
Snow Crab - Large Supplementary - Commercial	-
Snow Crab - Small Supplementary - Commercial	-
Snow Crab - Supplementary - Commercial	-
Squid - Commercial	108
Swordfish - Commercial	-
Toad Crab - Commercial	36
Trout - Commercial	-
Tuna, Bluefin - Commercial	-
Tuna, Bluefin - Recreational	-
Tuna, Other - Commercial	-
Whelk - Commercial	204
Total	**7,018**

The following Figures provide an overview of the distribution of 2011 commercial fishing activity within and adjacent to the SEA Update Area by vessel province of origin.

Maps illustrating commercial fishing activity by vessel size (length class) are provided in Appendix E.

Figure 4.97 Commercial Fishing Locations – Newfoundland and Labrador Vessels (2011)

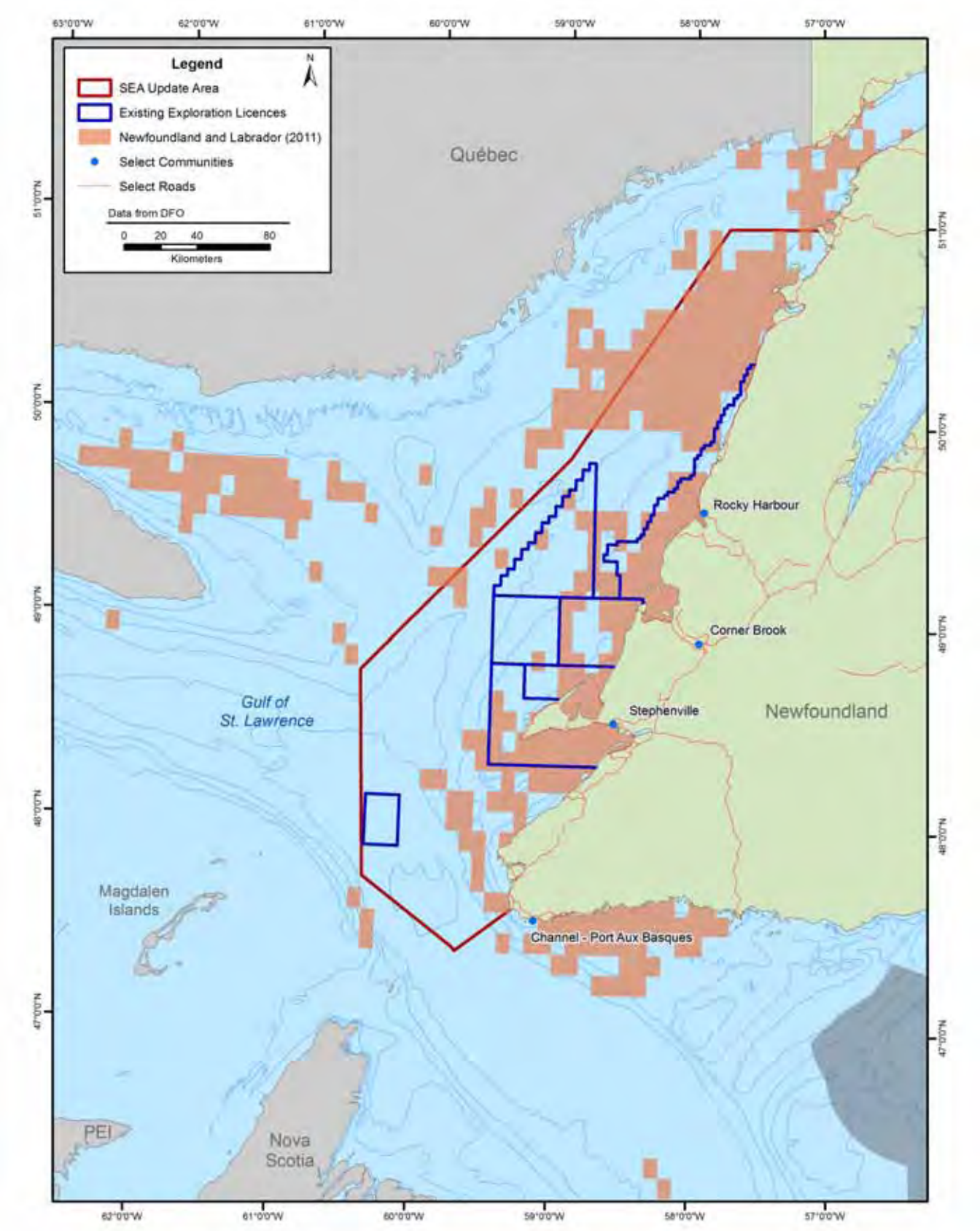
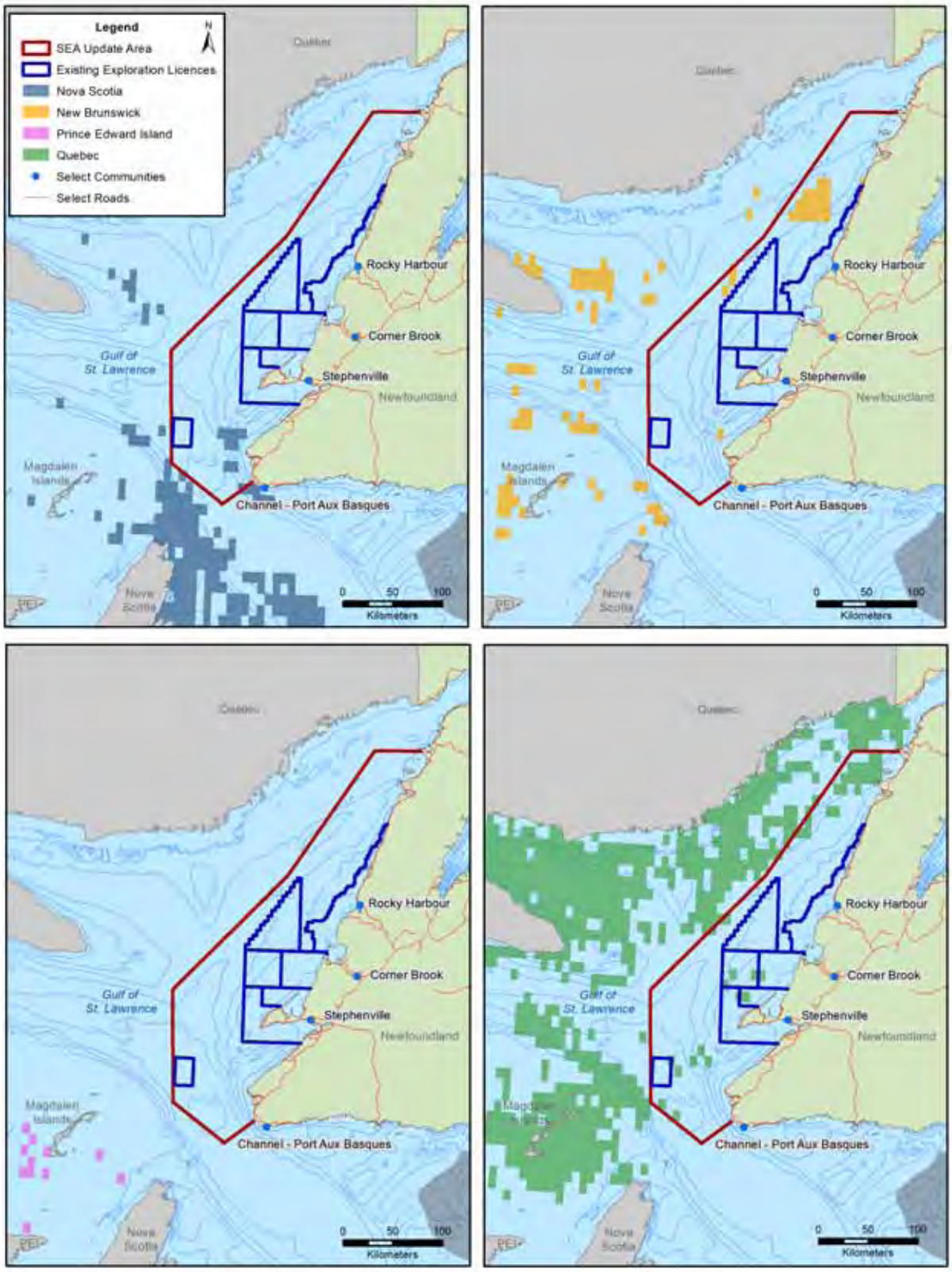


Figure 4.98 Commercial Fishing Locations – Maritime Provinces and Québec Vessels (2011)



Principal Species Fisheries

The following sections provide an overview of several of the key fisheries in the region, focussing upon those species which comprise a significant proportion of the current fishing activity in the region (in terms of landed weight and/or value).

Groundfish

The groundfish harvest has declined significantly in the region over the past few decades, primarily as a result of changes in the cod fishery (see LGL Limited 2005 for an historical overview). At present, the groundfish harvest is comprised primarily of the following species:

- Atlantic Cod
- Turbot (Greenland Flounder / Halibut)
- Greysole – Witch Flounder
- Redfish, and
- Atlantic Halibut

Table 4.106 Overview of Key Fisheries - Groundfish

Atlantic Cod	
2011 Harvest (NAFO 4Rb, 4Rc, 4Rd):	413 tonnes, $479,000
2005-2011 Total Harvest (NAFO 4Rb, 4Rc, 4Rd):	12,524 tonnes, $15.9 million
2011 Harvest (NAFO 4R, 4S, 4T, 4Vn, 3Pn):	1,912 tonnes, $2.3 million
2005-2011 Total Harvest (NAFO 4R, 4S, 4T, 4Vn, 3Pn):	42,733 tonnes, $54.0 million
Key Fishing Months / Season:	April - October
Gear Type(s):	Gillnets, longlines, handlines, seines
Turbot (Greenland Flounder / Halibut)	
2011 Harvest (NAFO 4Rb, 4Rc, 4Rd):	1,467 tonnes, $4.5 million
2005-2011 Total Harvest (NAFO 4Rb, 4Rc, 4Rd):	7,427 tonnes, $15.5 million
2011 Harvest (NAFO 4R, 4S, 4T, 4Vn, 3Pn):	3,739 tonnes, $10.0 million
2005-2011 Total Harvest (NAFO 4R, 4S, 4T, 4Vn, 3Pn):	27,698 tonnes, $56.4 million
Key Fishing Months / Season:	May-September
Gear Type(s):	Gillnets, longlines, otter trawls, seines
Greysole – Witch Flounder	
2011 Harvest (NAFO 4Rb, 4Rc, 4Rd):	318 tonnes, $277,500

2005-2011 Total Harvest (NAFO 4Rb, 4Rc, 4Rd):	2,299 tonnes, $1.9 million
2011 Harvest (NAFO 4R, 4S, 4T, 4Vn, 3Pn):	575 tonnes, $513,000
2005-2011 Total Harvest (NAFO 4R, 4S, 4T, 4Vn, 3Pn):	6,032 tonnes, $5.9 million
Key Fishing Months / Season:	May-November
Gear Type(s):	Seines, otter trawls
Redfish	
2011 Harvest (NAFO 4Rb, 4Rc, 4Rd):	111 tonnes, $97,000
2005-2011 Total Harvest (NAFO 4Rb, 4Rc, 4Rd):	1,121 tonnes, $705,000
2011 Harvest (NAFO 4R, 4S, 4T, 4Vn, 3Pn):	1,146 tonnes, $978,000
2005-2011 Total Harvest (NAFO 4R, 4S, 4T, 4Vn, 3Pn):	8,763 tonnes, $6.2 million
Key Fishing Months / Season:	May - September
Gear Type(s):	Otter trawls, gillnets, longlines, seines
Atlantic Halibut	
2011 Harvest (NAFO 4Rb, 4Rc, 4Rd):	145 tonnes, $1.3 million
2005-2011 Total Harvest (NAFO 4Rb, 4Rc, 4Rd):	1,068 tonnes, $7.0 million
2011 Harvest (NAFO 4R, 4S, 4T, 4Vn, 3Pn):	866 tonnes, $8.0 million
2005-2011 Total Harvest (NAFO 4R, 4S, 4T, 4Vn, 3Pn):	4,483 tonnes, $32.6 million
Key Fishing Months / Season:	April-September
Gear Type(s):	Longlines, gillnets, otter trawls

The following Figures illustrate the distribution of recorded commercial fishing activity for each of the above species within and adjacent to the SEA Update Area by season for 2011. Similar information for all of the years from 2005 - 2011 combined is provided in the maps included as Appendix F.

Figure 4.99 Fishing Locations by Season – Cod (2011)

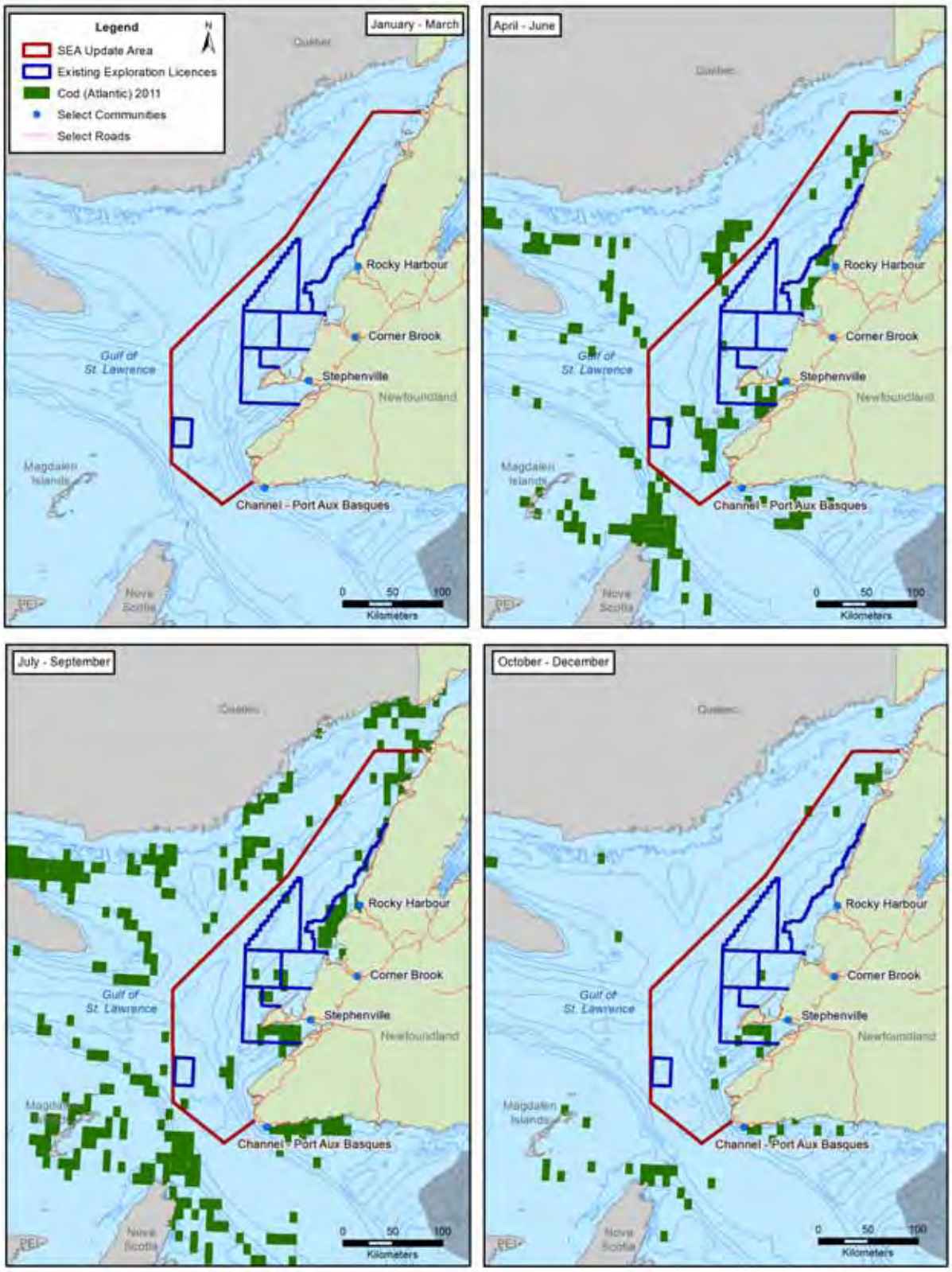


Figure 4.100 Fishing Locations by Season – Turbot / Greenland Halibut (2011)

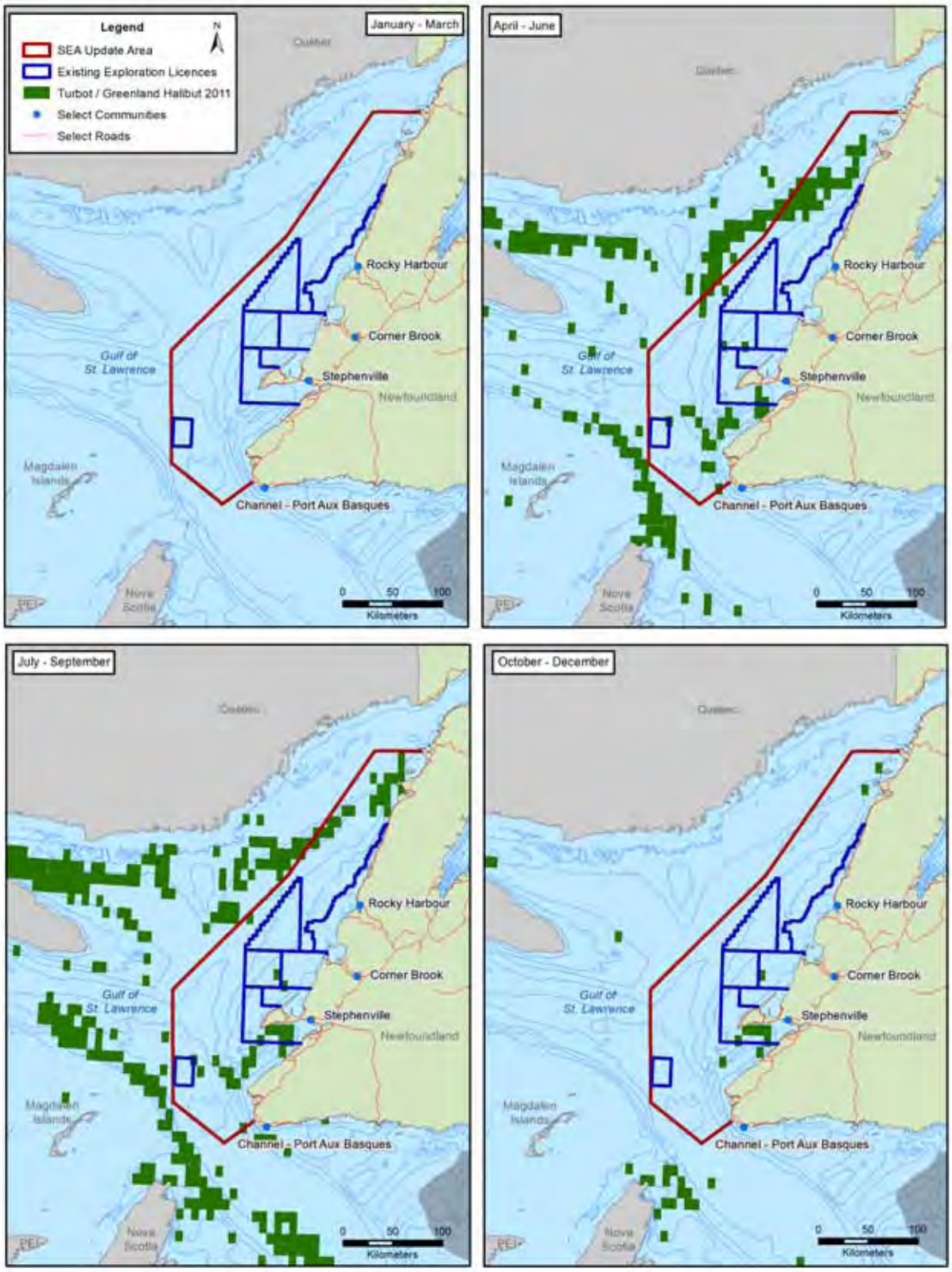


Figure 4.101 Fishing Locations by Season – Greysole / Witch Flounder (2011)

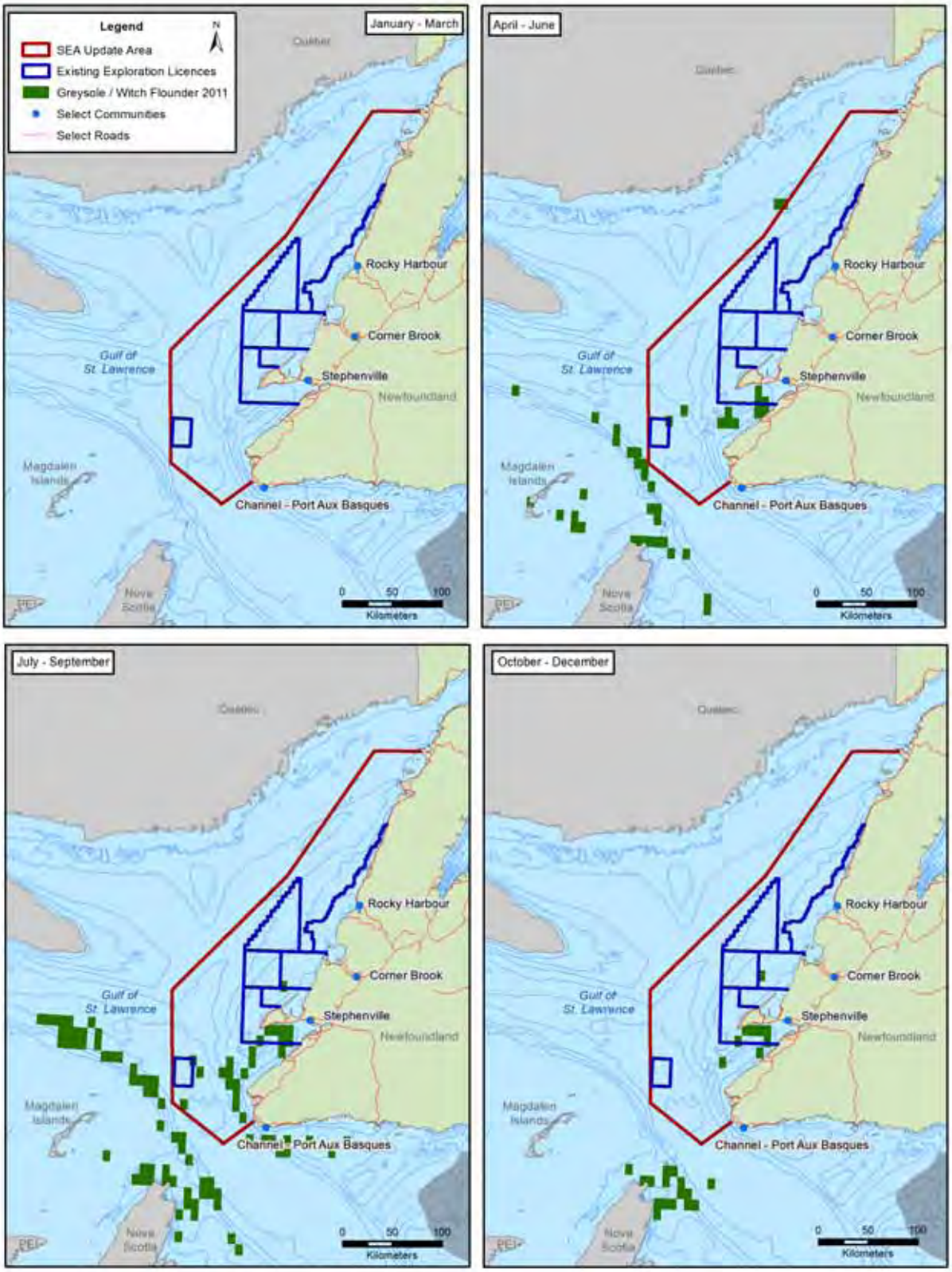


Figure 4.102 Fishing Locations by Season – Redfish (2011)

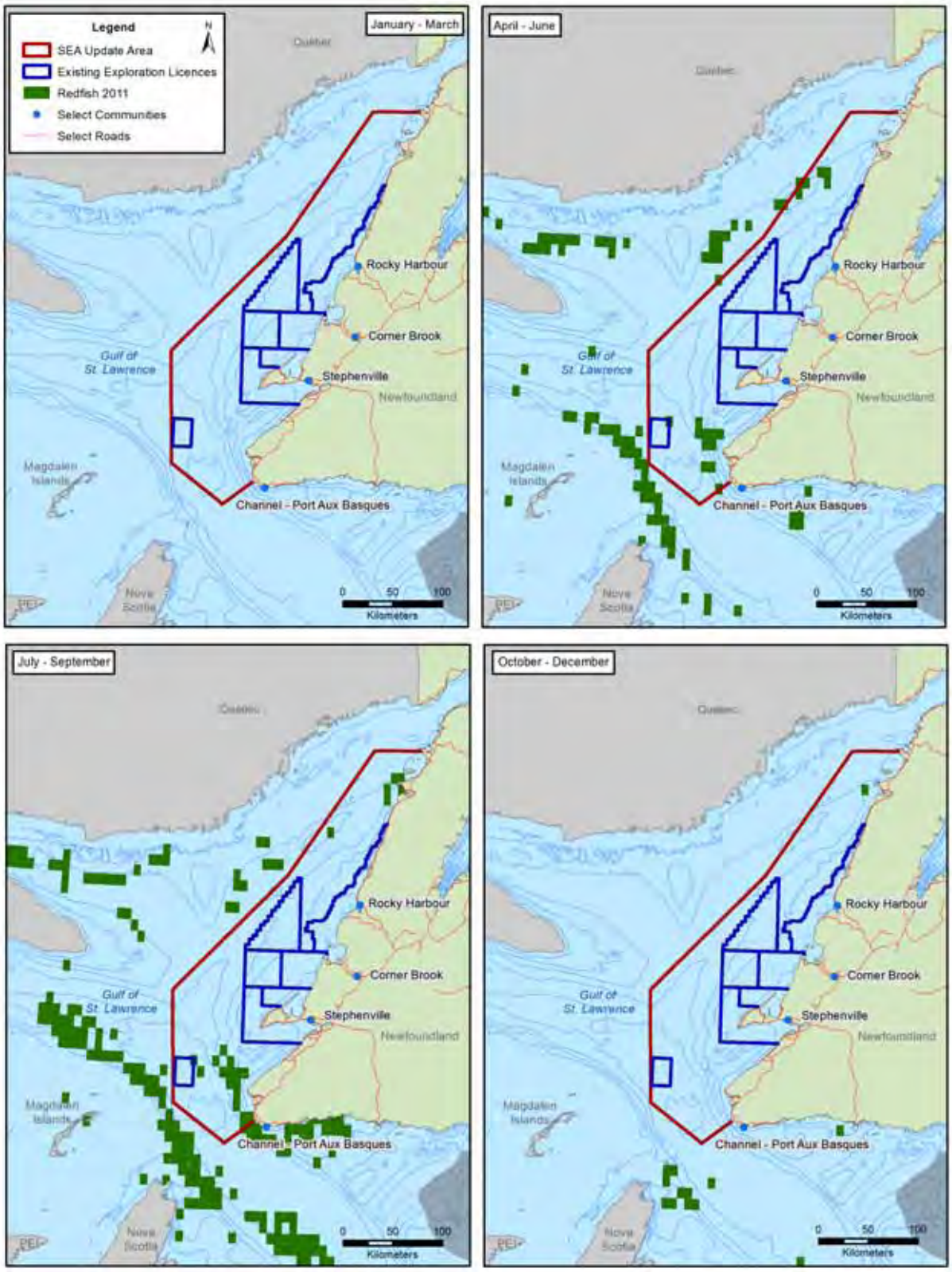
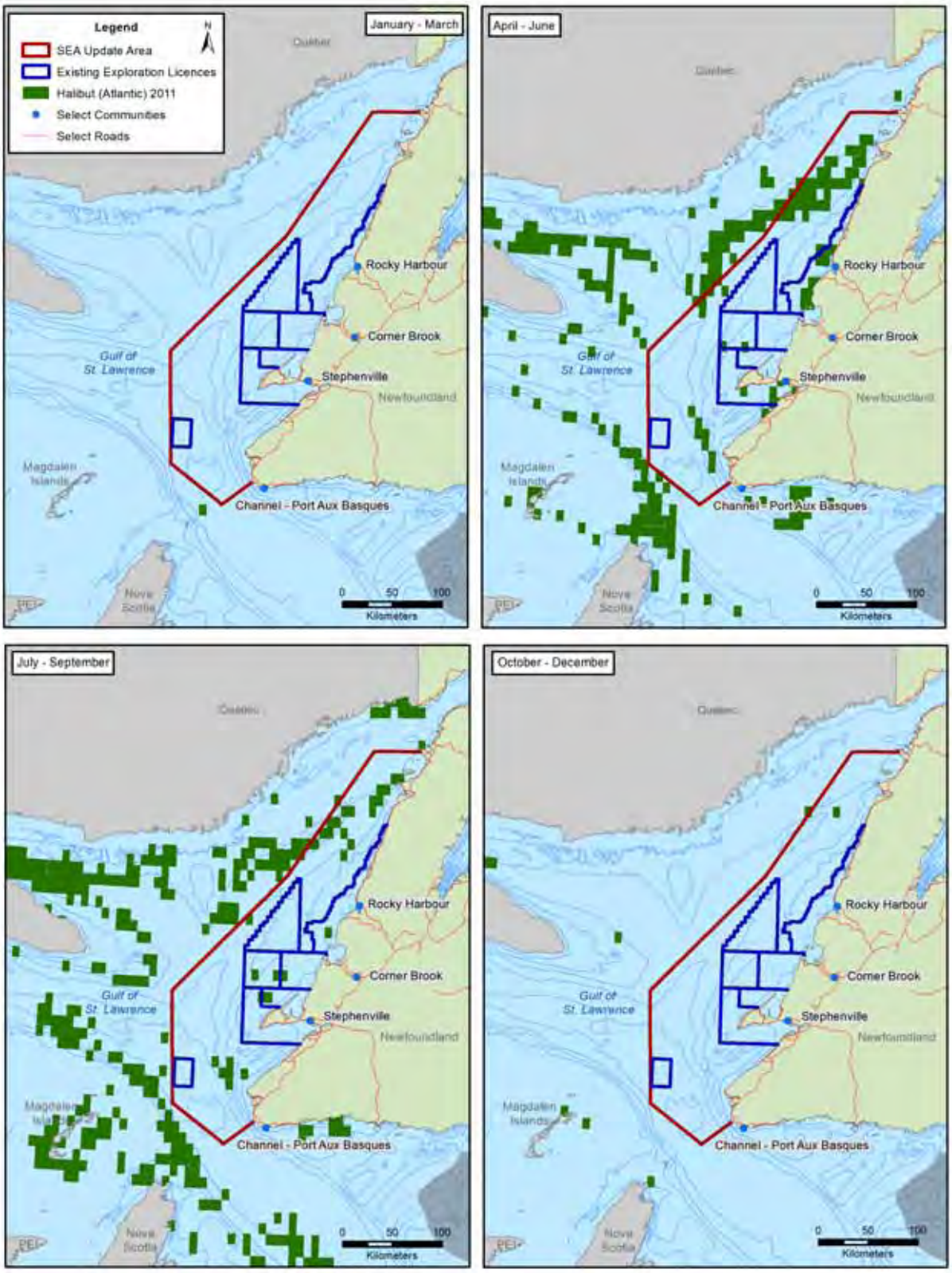


Figure 4.103 Fishing Locations by Season – Atlantic Halibut (2011)



Pelagics

The commercial fisheries for pelagic species currently accounts for a significant proportion of fishing activity in this region in terms of both landed weight and value, particularly the following species:

- Herring,
- Mackerel, and
- Capelin

Table 4.107 Overview of Key Fisheries – Pelagics

Herring	
2011 Harvest (NAFO 4Rb, 4Rc, 4Rd):	17,777 tonnes, $4.6 million
2005-2011 Total Harvest (NAFO 4Rb, 4Rc, 4Rd):	124,943 tonnes, $26.9 million
2011 Harvest (NAFO 4R, 4S, 4T, 4Vn, 3Pn):	63,284 tonnes, $20.8 million
2005-2011 Total Harvest (NAFO 4R, 4S, 4T, 4Vn, 3Pn):	496,253 tonnes, $126.9 million
Key Fishing Months / Season:	April-November
Gear Type(s):	Purse seines, tuck seines, gillnets
Mackerel	
2011 Harvest (NAFO 4Rb, 4Rc, 4Rd):	5,225 tonnes, $5.2 million
2005-2011 Total Harvest (NAFO 4Rb, 4Rc, 4Rd):	105,949 tonnes, $38.9 million
2011 Harvest (NAFO 4R, 4S, 4T, 4Vn, 3Pn):	9,570 tonnes, $8.9 million
2005-2011 Total Harvest (NAFO 4R, 4S, 4T, 4Vn, 3Pn):	165,859 tonnes, $74.0 million
Key Fishing Months / Season:	June-October
Gear Type(s):	Handlines, purse seines, gillnets
Capelin	
2011 Harvest (NAFO 4Rb, 4Rc, 4Rd):	6,513 tonnes, $1.2 million
2005-2011 Total Harvest (NAFO 4Rb, 4Rc, 4Rd):	35,112 tonnes, $7.1 million
2011 Harvest (NAFO 4R, 4S, 4T, 4Vn, 3Pn):	12,315 tonnes, $2.1 million
2005-2011 Total Harvest (NAFO 4R, 4S, 4T, 4Vn, 3Pn):	74,077 tonnes, $15.5 million
Key Fishing Months / Season:	June-July
Gear Type(s):	Purse seines

The following Figures illustrate the distribution of recorded commercial fishing activity for each of the above species within and adjacent to the SEA Update Area by season for 2011. Similar information for all of the years from 2005 - 2011 combined is provided in the maps included as Appendix F.

Figure 4.104 Fishing Locations by Season – Herring (2011)

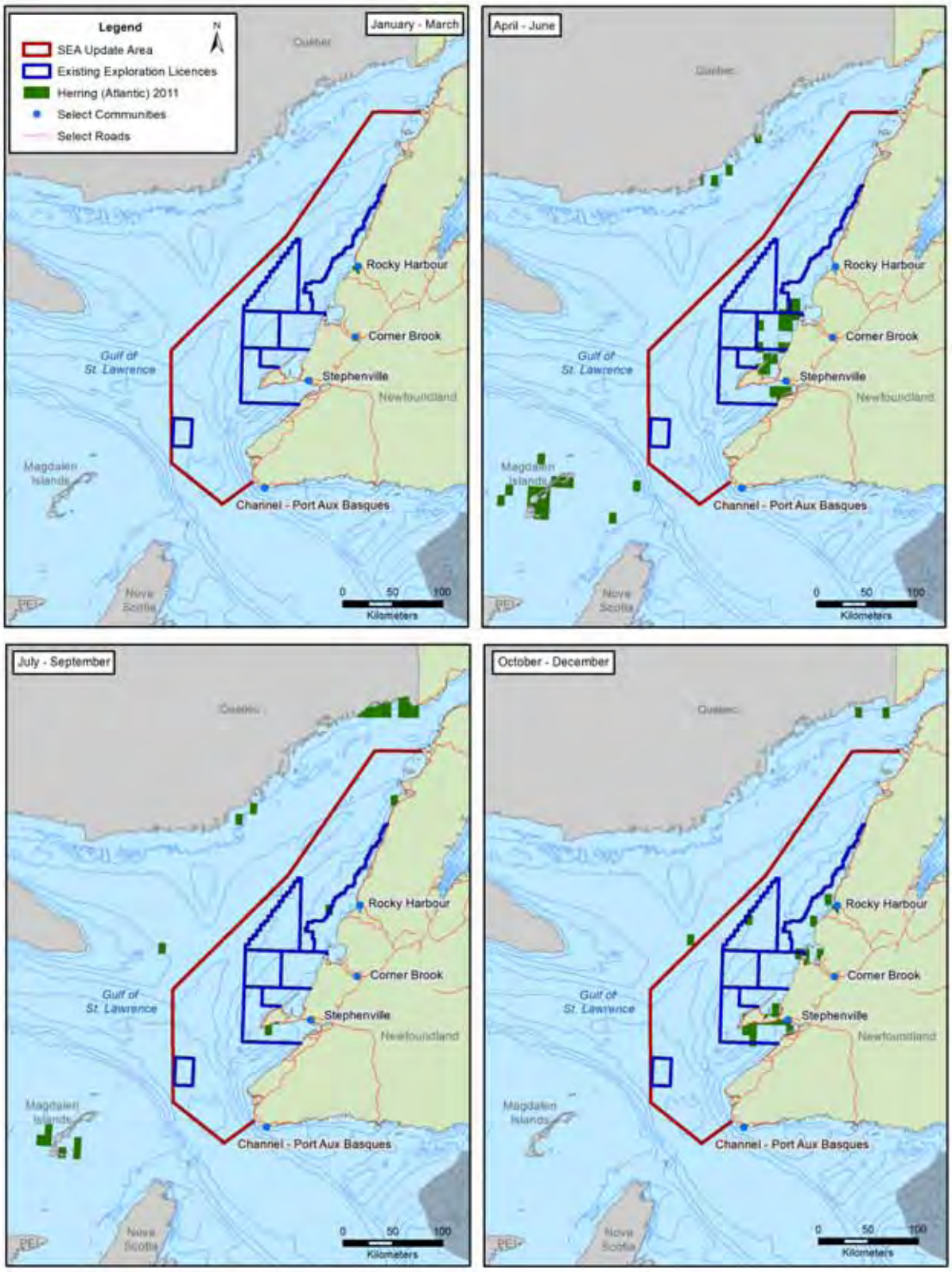


Figure 4.105 Fishing Locations by Season – Mackerel (2011)

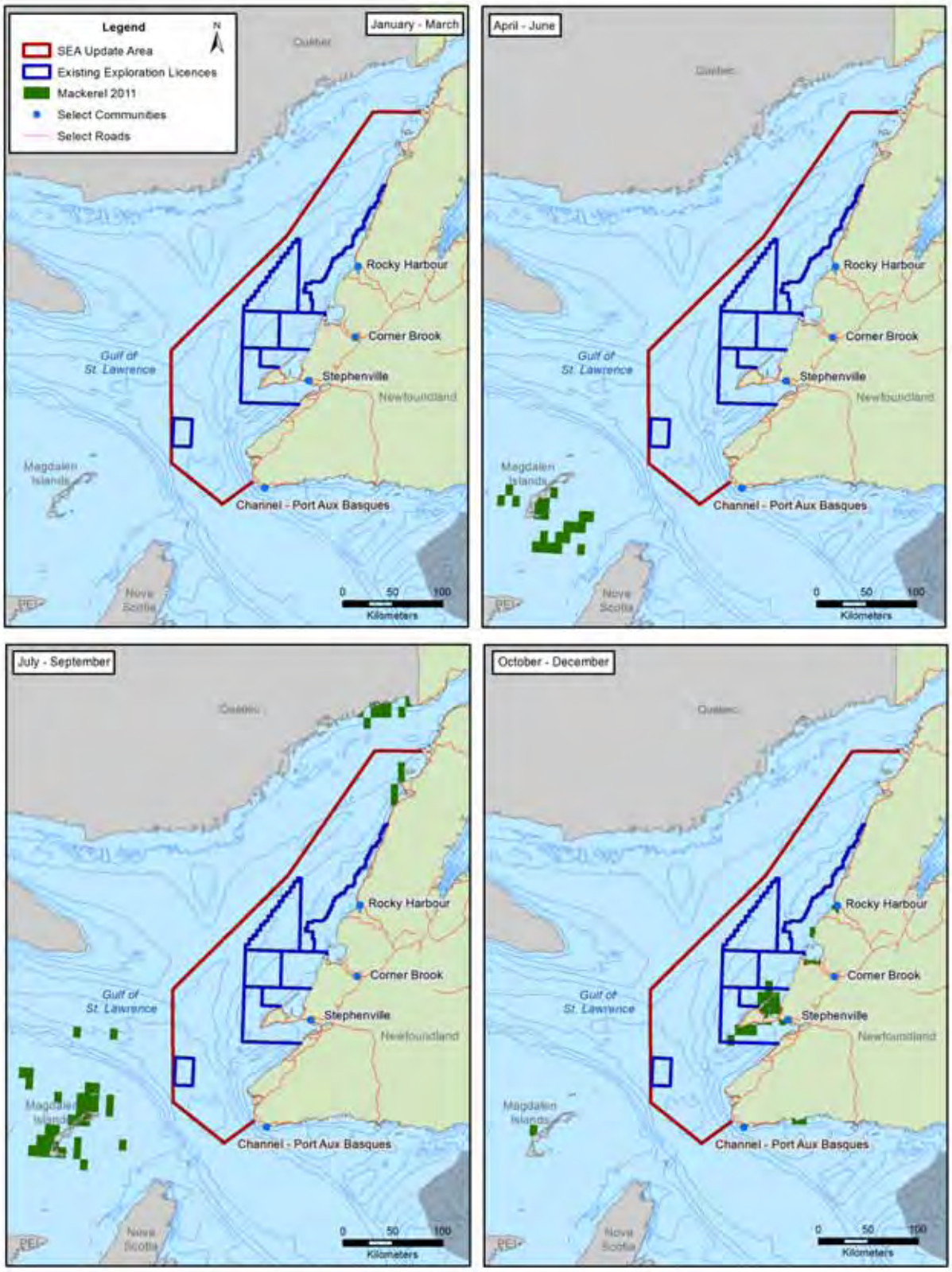
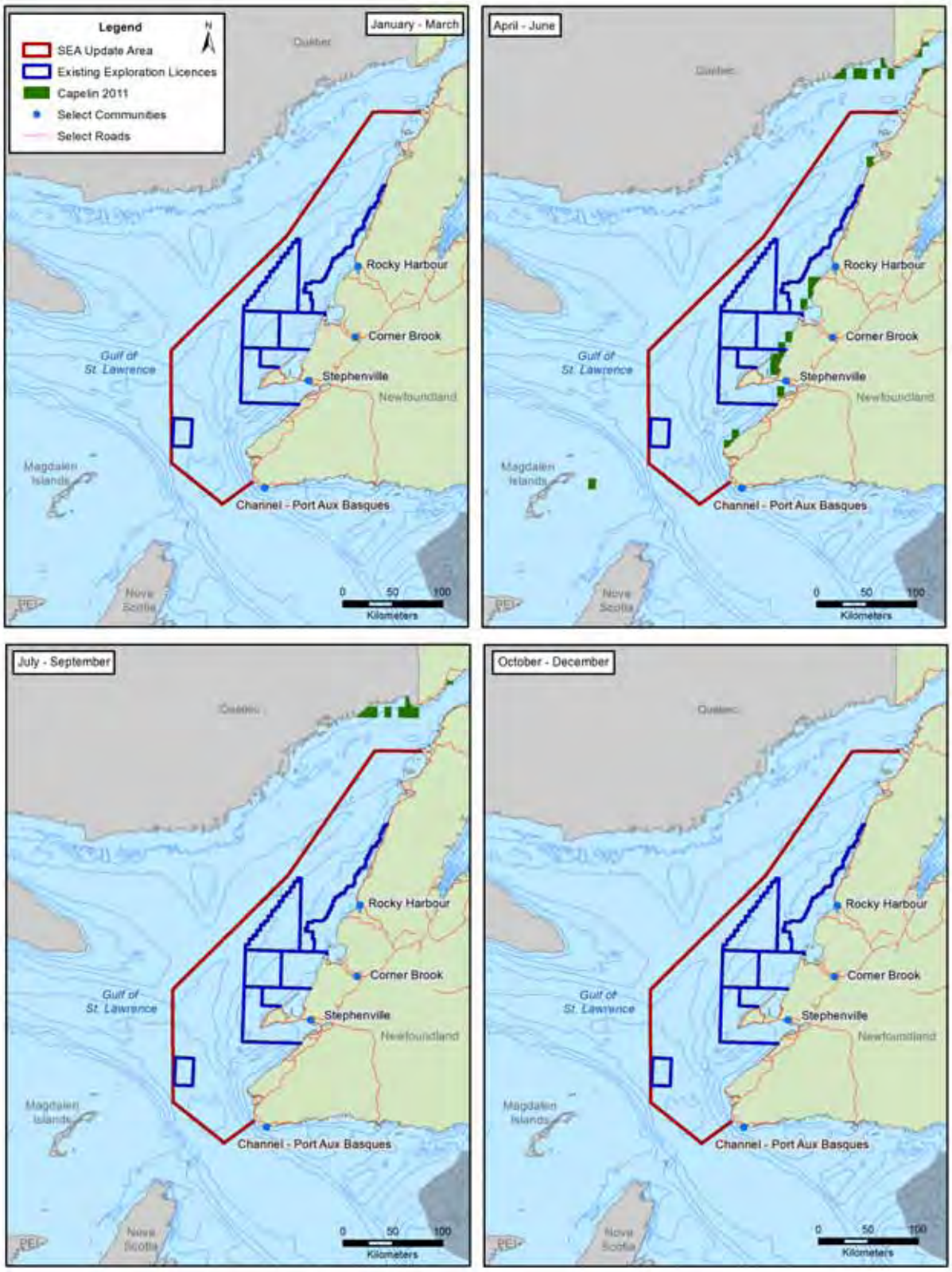


Figure 4.106 Fishing Locations by Season – Capelin (2011)



Shellfish

Shellfish currently dominate the region's commercial fishery, particularly the following species:

- Northern Shrimp;
- Lobster, and
- Snow / Queen Crab

Over the period 2005 – 2011 these three species collectively accounted for over half of the landed value of the commercial fishery in the Primary Fisheries Study Area (NAFO Unit Areas 4Rb, 4Rc, 4Rd) and approximately 82 percent of the landed value of the fishery in the larger Regional Fisheries Study Area (NAFO 4R, 4S, 4T, 4Vn, 3Pn).

Table 4.108 Overview of Key Fisheries - Shellfish

Northern Shrimp	
2011 Harvest (NAFO 4Rb, 4Rc, 4Rd):	8,430 tonnes, $12.9 million
2005-2011 Total Harvest (NAFO 4Rb, 4Rc, 4Rd):	58,272 tonnes, $60.4 million
2011 Harvest (NAFO 4R, 4S, 4T, 4Vn, 3Pn):	34,858 tonnes, $51.4 million
2005-2011 Total Harvest (NAFO 4R, 4S, 4T, 4Vn, 3Pn):	246,997 tonnes, $273.8 million
Key Fishing Months / Season:	April-September
Gear Type(s):	Shrimp trawls
Lobster	
2011 Harvest (NAFO 4Rb, 4Rc, 4Rd):	645 tonnes, $5.5 million
2005-2011 Total Harvest (NAFO 4Rb, 4Rc, 4Rd):	6,686 tonnes, $66.5 million
2011 Harvest (NAFO 4R, 4S, 4T, 4Vn, 3Pn):	26,287 tonnes, $242.3 million
2005-2011 Total Harvest (NAFO 4R, 4S, 4T, 4Vn, 3Pn):	176,625 tonnes, $1.8 billion
Key Fishing Months / Season:	May-August
Gear Type(s):	Pots
Snow / Queen Crab	
2011 Harvest (NAFO 4Rb, 4Rc, 4Rd):	615 tonnes, $2.9 million
2005-2011 Total Harvest (NAFO 4Rb, 4Rc, 4Rd):	3,392 tonnes, $11.6 million
2011 Harvest (NAFO 4R, 4S, 4T, 4Vn, 3Pn):	19,991 tonnes, $130.5 million

2005-2011 Total Harvest (NAFO 4R, 4S, 4T, 4Vn, 3Pn):	222,874 tonnes, $914.5 million
Key Fishing Months / Season:	April-July
Gear Type(s):	Conical traps, pots, other traps

The following Figures illustrate the distribution of recorded commercial fishing activity for each of the above species within and adjacent to the SEA Update Area by season for 2011. Similar information for all of the years from 2005 - 2011 combined is provided in the maps included as Appendix F.

Figure 4.107 Fishing Locations by Season – Northern Shrimp (2011)

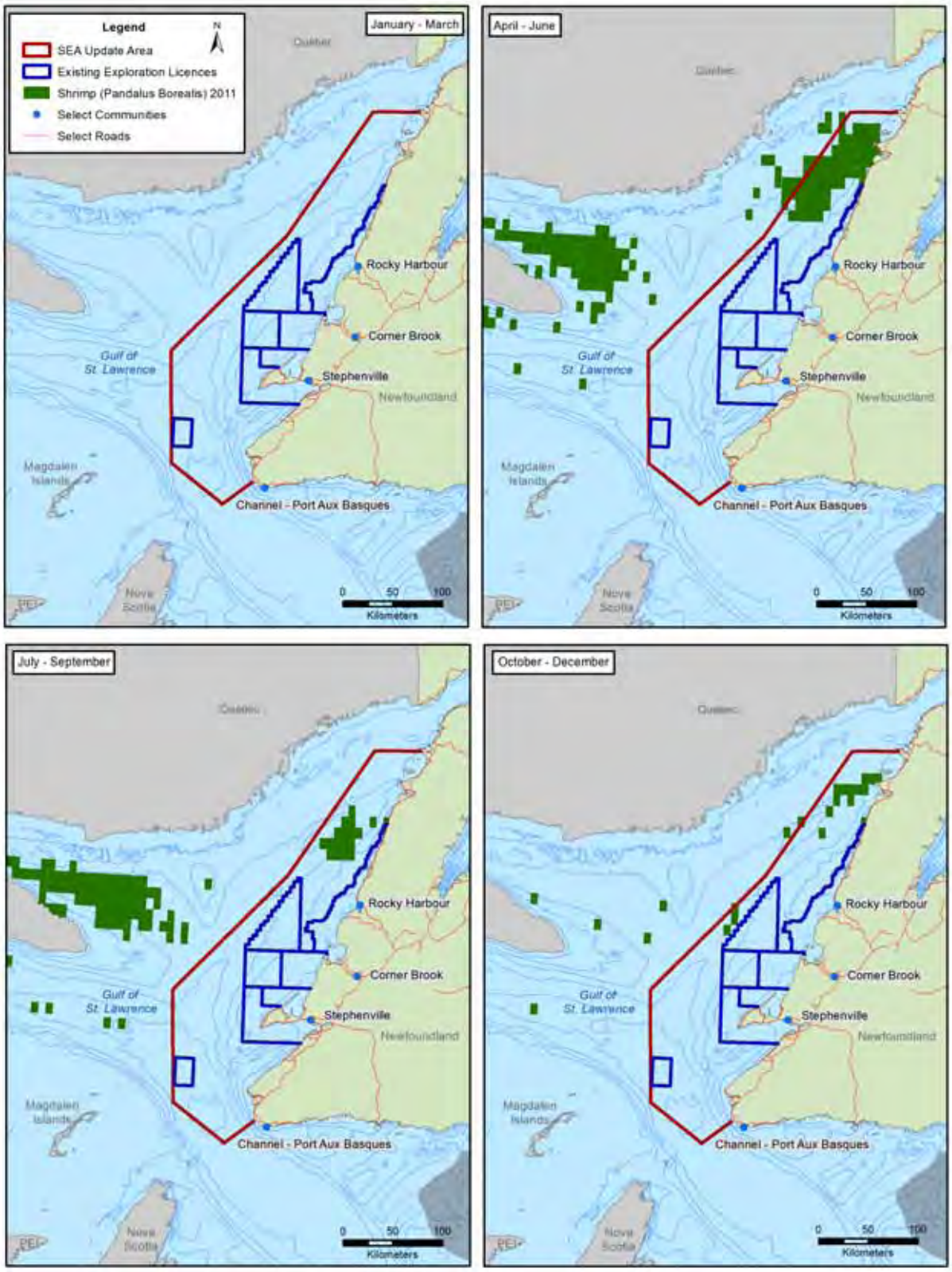


Figure 4.108 Fishing Locations by Season – Lobster (2011)

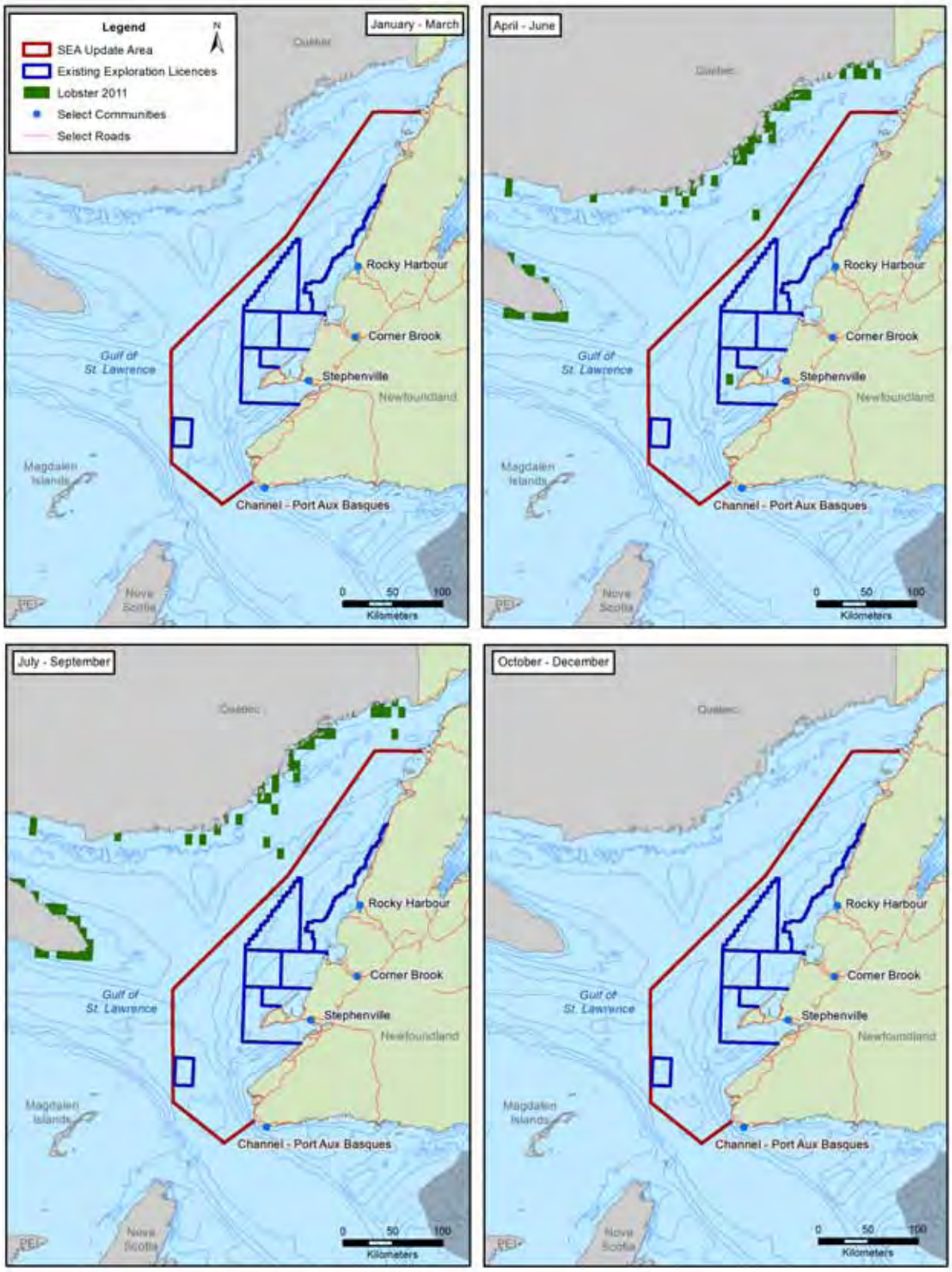
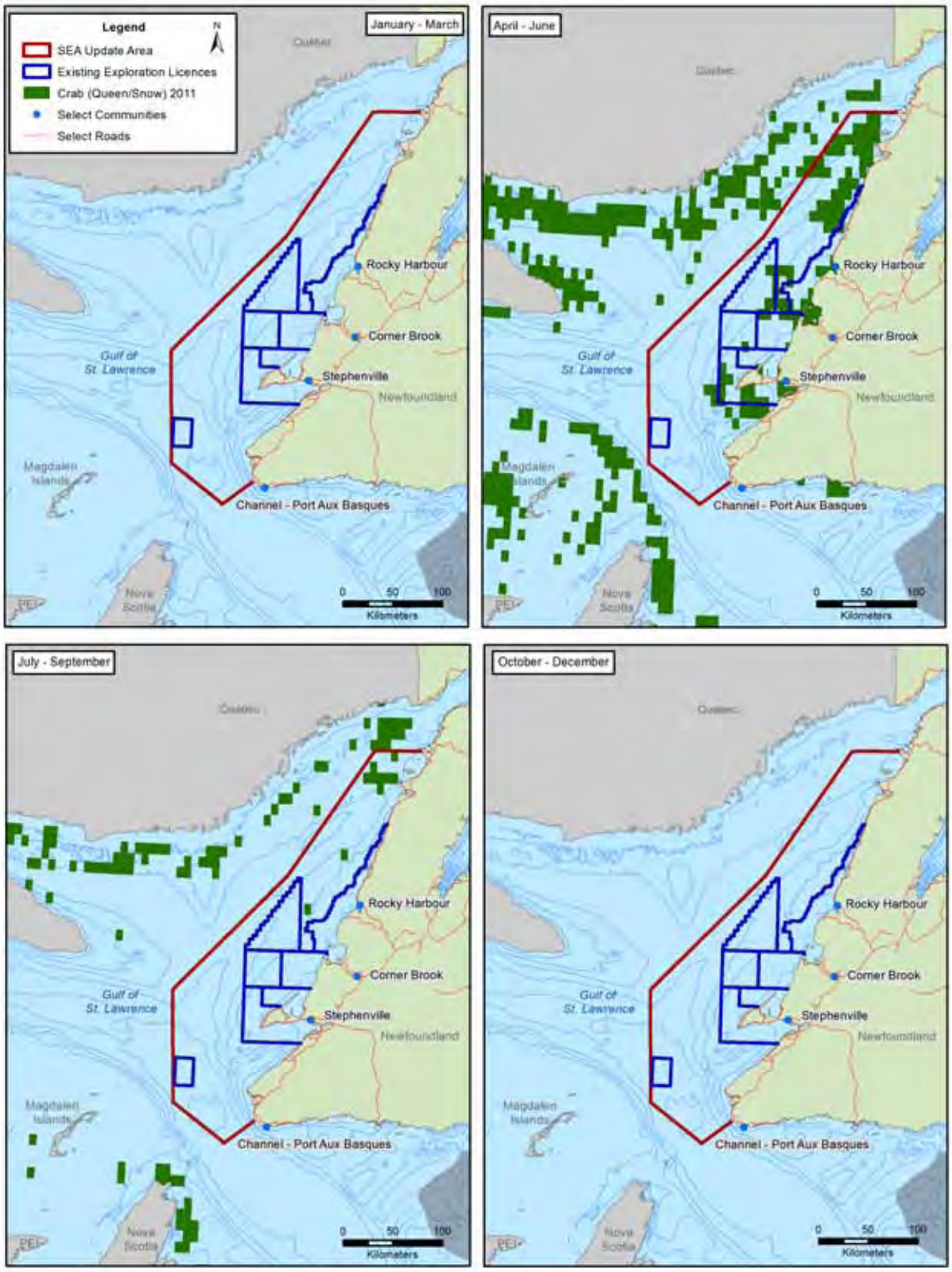


Figure 4.109 Fishing Locations by Season – Snow / Queen Crab (2011)



Sealing

The seal harvest has been and remains an important source of income for commercial fishers and has contributed as much as 25 percent of fishers' annual incomes in many communities (DFO 2010d). Since its inception in the early 1800s as source of oil, the hunt subsequently evolved into a diverse product industry. There are six species of seals commonly found along the coast of Atlantic Canada (harp, hooded, grey, ringed, bearded and harbour), of which only a few are harvested in the coastal waters of Newfoundland and Labrador and elsewhere in the Gulf to produce leather, handicrafts, oil and meat for human and animal consumption.

The seal harvest is managed by DFO, and an Integrated Management Plan is updated annually with input from DFO's Science Branch, provincial Fisheries Departments and seal harvesters' organizations. The Gulf of St. Lawrence seal quota is allocated to provincially-based fleets in accordance with historical landings. Based on this strategy, 70 percent of the Gulf seal quota has been allocated to Western Newfoundland harvesters. While a number of seal species may be found along the coast of Western Newfoundland, the harp seal has been the principle focus for the commercial harvest given its relative abundance. The Gulf quota includes access to seals in six Sealing Zones (9, 10, 11, 13, 14 and 15) which are located in or near the SEA Update Area. The open season in these areas is typically between November 15 and May 15 (DFO 2011c). DFO and the Newfoundland and Labrador Department of Fisheries and Aquaculture do not collect site or area specific information on harvest levels (M. Warren, pers comm 2012, J. Kean, pers comm 2012).

There has been significant growth in overall seal populations in the Gulf Region since 2005 (NLDFA 2012a), although the provincial seal harvest (landings) has declined by over 40 percent due to animal rights controversies and international pressure resulting in poor market conditions (NLDFA 2012b). The harp seal population has nearly tripled in size – from less than two million animals in the 1970s to more than seven million today. DFO currently issues an average of 16,000 seal harvester licenses in Atlantic Canada, but it is estimated that only 390 hunters participated in 2010, primarily due to the weak markets for seal products and poor ice conditions (DFO 2012d). Many harvesters continue to renew their licenses in anticipation of improved markets and their desire to remain active in the seal hunt.

The total value of seal landings has been decreasing since 2006, when it was valued at over $34 million and sealers received over $100 per pelt. Significant drops in both the quantity of and prices for harvested pelts, the latter being driven by large fluctuations as a result of changing global demand for seal products, accounted for this trend. The value of the harvest remained considerably low in 2010 ($1.3 million) and pelt prices were approximately $20 per pelt. There has since been a modest increase in pelt prices ($32.50/pelt in 2013) due to concerted marketing efforts and new market development (D. Dankins, pers comm. 2013).

On the Island of Newfoundland, the Rocky Harbour and Port aux Basques areas have historically been important seal landing ports in the Western Newfoundland region, although there has been relatively little activity in recent years for the reasons outlined above and due to poor ice conditions.

4.3.5.3 Aquaculture

Aquaculture has become an increasingly important component of Newfoundland and Labrador's fishing industry and overall economy. Fish production from this sector has increased steadily in recent years, from fewer than 1,000 tonnes and less than $8 million in value in 1995 to more than 17,000 tonnes and a value of more than $120 million in 2011. The primary fish species farmed in Newfoundland and Labrador are blue mussels, Atlantic salmon and steelhead trout (NLDFA 2012a). At present, aquaculture sites in the province are located primarily around Bay D'Espoir, the Connaigre Peninsula and Notre Dame Bay, with a smaller number of sites located near St. Anthony and in Placentia Bay, Trinity Bay and Bonavista Bay (NLSA 2010).

The Western Newfoundland area accounts for a relatively small portion of the number of aquaculture sites and overall production and value in the province as a whole. Less than one percent of the province's aquaculture production (in terms of both quantity and value) occurs from facilities located in the Gulf of St. Lawrence, and the number and type of aquaculture sites has decreased in recent years.

Five aquaculture sites are currently located in the Western Newfoundland area (Table 4.109, Figure 4.110), including two blue mussel farms located in Piccadilly Bay, salmon hatcheries at Stephenville and Daniel's Harbour, and a licenced cod grow-out site located near Keppel Island at the mouth of Port Saunders Harbour which has not been active for over 10 years (L. House, pers comm 2012).

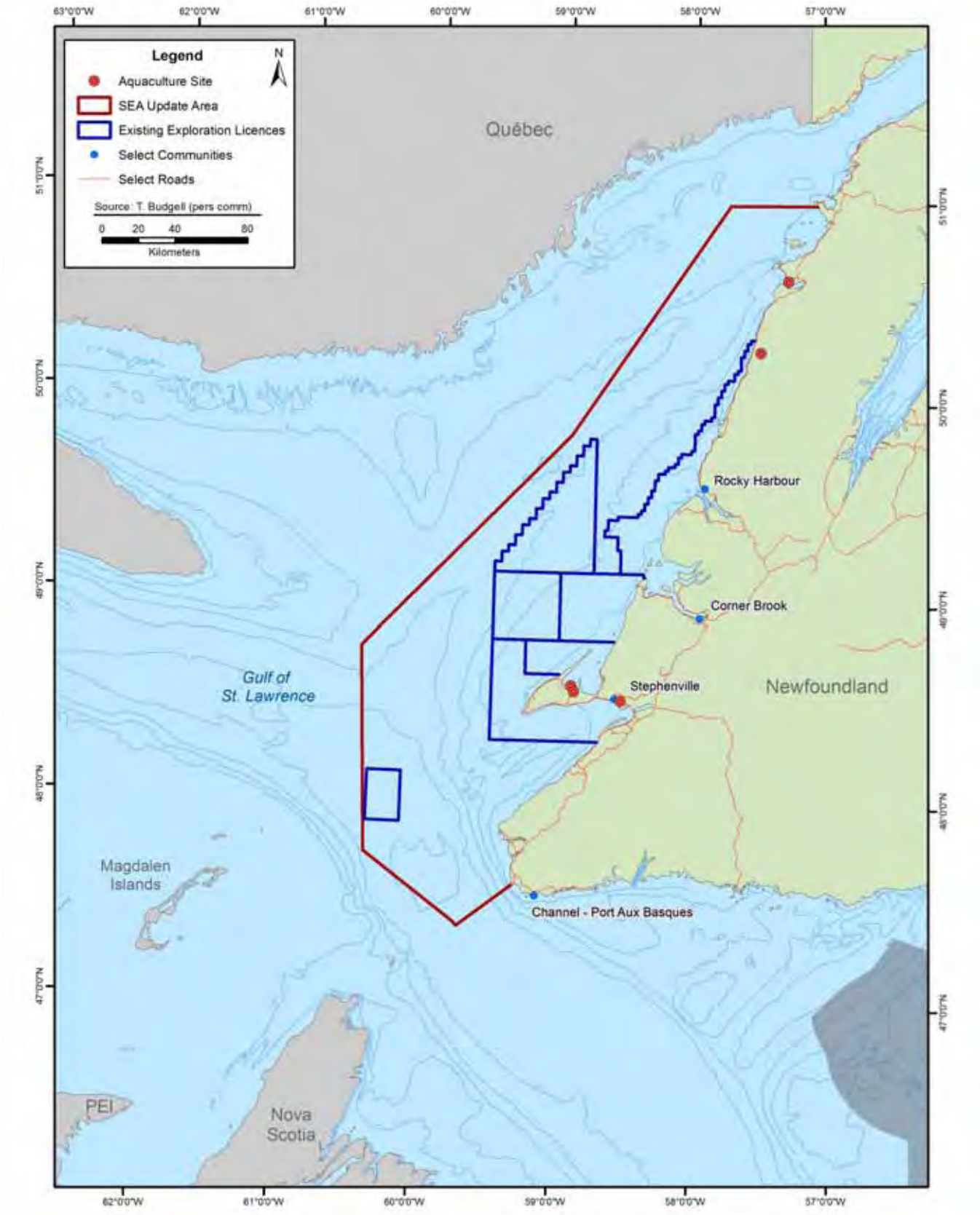
Table 4.109 Western Newfoundland Aquaculture Sites

Operator	Location	Description
Eugene Caines	Keppel Harbour	Cod grow-out facility
Cold Ocean Salmon Inc.	Daniels Harbour	Land-based salmon hatchery
Plastik Industries of Canada Ltd.	Piccadilly Bay	Blue mussel production
Plastik Industries of Canada Ltd.	Piccadilly Bay	Blue mussel production
Northern Harvest Smolt Ltd.	Stephenville	Land-based salmon hatchery
Source: T. Budgell, pers comm. 2012; L. House, pers comm 2012		

Elsewhere in the Gulf of St. Lawrence, marine aquaculture continues to emerge as an important economic generator. There are currently approximately 1,800 aquaculture sites distributed throughout the Gulf of St. Lawrence, with about 96 percent of these concentrated along the coasts of Prince Edward Island, New Brunswick and Nova Scotia (Alexander et al 2010). In Québec, aquaculture activity occurs along the Gaspé Peninsula, the Québec North Shore and the Îles-de-la-Madeleine. Shellfish operations account for approximately 99 percent of aquaculture sites throughout the Gulf of St. Lawrence (84 percent of which are oysters and blue mussels). Finfish (especially Atlantic salmon and rainbow trout) operations account for only one percent of the current aquaculture sites in the Gulf, the majority of which are land-based (hatcheries / fish-out ponds) and concentrated along the north shore of Nova Scotia, with a few seasonal marine grow-out sites distributed along Western Newfoundland (Atlantic cod) and near Baie des Sept Îles (flounder and herring) on the Québec North Shore (Alexander et al 2010).

The aquaculture industry is also continuously exploring the potential to establish operations for other shellfish species which occur naturally throughout the Gulf of St. Lawrence. Recent experimental operations in the Gulf region have involved testing for shellfish species such as sea urchin (such as in Rimouski and Blanc Sablon, Québec), lobster, snow crab, and rock crab (Baie des Sept Îles), soft-shelled clam, bar clam and quahaug (various locations in New Brunswick, Nova Scotia, Prince Edward Island and Îles-de-la-Madeleine) (Alexander et al 2010).

Figure 4.110 Western Newfoundland Aquaculture Sites



4.3.5.4 Recreational Marine Fisheries

In Newfoundland and Labrador, recreational fishing may take place in coastal and inland waters. For specified periods during the summer and fall, residents and non-residents of Newfoundland and Labrador are permitted to participate (with licences or tags not being required) in a recreational / food fishery for groundfish. The sale of catch from the recreational fishery is not permitted and commercial fishing vessels are unable to participate (DFO 2013a).

Table 4.110 Western Newfoundland Recreational Groundfish Fishery (2012)

Species	Season(s)	Individual Retention Limit	Boat Retention Limit
Groundfish (with some fish prohibited)	• July 21-August 12 • September 22-30	5 groundfish (including cod) per fisher per day	15 groundfish when 3 or more are fishing in one boat (including tour boats)
Source: DFO (2013a)			

Smelt angling in coastal waters is permitted throughout the year, and there is no bag limit or possession limit for this species. Angling in coastal waters for salmon and trout also take place according to applicable regulations and guidelines.

There are 186 scheduled salmon rivers in Newfoundland and Labrador, 43 of which occur in the Western Newfoundland and Southern Labrador region (Zones 14B, 14A, and 13). These rivers are subject to specific angling (fly fishing) regulations and requirements, which vary depending on the river, with special management measures may be applied to some rivers or sections of rivers. The angling season for scheduled salmon rivers along Western Newfoundland is from June 1 – September 7 (Zones 13 and 14A) and from June 15 – September 15 in Southern Labrador (Zone 14B). Fall angling occurs on the Humber River from September 8 – October 7 (DFO 2013b).

Recreational fishing is a common and valued activity throughout the Gulf of St. Lawrence. As with Newfoundland and Labrador, there are specific federal and provincial regulations governing recreational fishing including licensing, catch limits, gear restrictions, size limits, fishing season and area closures. The Miramichi River in New Brunswick and the Grand Cascapedia in Québec, for example, are known for being some of the most important Atlantic salmon rivers in the world (Gardner Pinfold 2011), and these and other rivers throughout Eastern Canada support a thriving angling industry. The Miramichi River alone has $20 million in annual spending, generating $16 million in GDP, about 637 full-time equivalent jobs, and $19.1 million worth of income. Annual spending for the Grand Cascapedia in Québec is about $6.2 million, which generates $7.2 million in GDP, 172 full-time equivalent jobs, and $5.2 million worth of income. In 2010, total salmon-related spending in New Brunswick was $43.9 million and $26.7 million in Québec (Gardner Pinfold 2011).

Deep sea fishing is also a popular form of marine-based tourism in PEI and elsewhere, with charter operations catching species such as mackerel, bluefin tuna or shark. During the public consultation process it was stated that the recreational tuna catch and release fishery is reportedly growing in the Sydney, Nova Scotia area, with associated direct economic and spin off benefits. Throughout the Gulf of St. Lawrence there are also recreational shellfish fisheries for species such as scallops, mussels, soft-shell clams and others.

4.3.5.5 Aboriginal Marine Fisheries

A number of Aboriginal communities and organizations occur throughout the Gulf of St. Lawrence region, many of which are involved in marine fishing activity in the SEA Update Area and/or elsewhere in the Gulf, including for traditional and commercial purposes.

Aboriginal traditional uses are often considered to refer to the practices, traditions and customs that distinguish the distinctive culture of an Aboriginal group and which were practiced prior to European contact and control, and can include, for example, fishing for food and ceremonial purposes. Section 35 of the Canadian *Constitution Act* (1982) recognizes and affirms the existing Aboriginal and treaty rights of the Indian, Inuit, and Métis peoples of Canada, the nature, scope and existence of which have been further defined through various legal decisions as well as through Land Claims and other agreements (treaties) between governments and particular Aboriginal groups in specific areas. A number of Aboriginal communities and organizations in Newfoundland and Labrador, Nova Scotia, New Brunswick, PEI and Québec claim and assert Aboriginal rights and/or title to areas of Eastern Canada, including, in some cases, to marine and coastal areas along and within the Gulf of St. Lawrence. These claims are at varying stages of recognition, negotiation, and settlement.

The Mi'kmaq, Innu and other Aboriginal groups have, for example, asserted Aboriginal or treaty rights to the fish resources in the Gulf of St. Lawrence and elsewhere for food, social and ceremonial purposes and/or as commercial activities pursuant to recent court decisions. This section provides a very general overview of known Aboriginal fishing activity in or near the SEA Update Area, as input to the SEA analysis and future planning and decision-making by the C-NLOPB. It is not the purpose or intent of this section to determine or comment on the overall question of whether or not Aboriginal groups possess Aboriginal rights or title in or near the area and/or the nature or degree of any such rights, or indeed, whether any such fishing activities are being undertaken as the assertion of an Aboriginal right.

The Mi'kmaq are a First Nations people which are indigenous to Canada's Maritime Provinces and the Gaspé Peninsula of Québec. On September 26, 2011, the creation of the Qalipu Mi'kmaq First Nation Band was announced, through which this group of Newfoundland Mi'kmaq became recognized as Status Indians under the federal *Indian Act*. The Qalipu Mi'kmaq First Nation is governed by a Band Council comprised of a Chief, two Regional Vice-Chiefs and nine Electoral Ward Councillors, and its membership resides in communities throughout Western Newfoundland and elsewhere. Newfoundland Mi'kmaq who are members of the Qalipu Mi'Kmaq First Nation Band now have access to many federal programs and services that are dedicated to Status Indians and others, and the creation of this Band does not deal with (provide or remove) Aboriginal rights or title issues involving its members.

Individuals who are (or will be) members of the Qalipu Mi'kmaq First Nation Band are currently involved in commercial and recreational fisheries in the SEA Update Area, as described above, and it is anticipated that Band members will be increasing involved in the fishery in the future (Western Star 2012). The Qalipu Band itself has obtained several groundfish, snow crab and lobster licenses in NAFO Division 4R, and the organization is actively working these licenses at present (A. Oxford, pers comm. 2012).

Other Aboriginal groups in the Maritime Provinces and Québec are also known to undertake fishing activity within or near the SEA Update Area or elsewhere in the larger Gulf of St. Lawrence. A number of Québec Innu communities, for example, formed the Agency Mamu Innu Kaikusseth (AMIK) in 2006 to coordinate and advance their commercial fishery operations. Today, fishery operations under AMIK employ over 120 fishers and fishery

workers on vessels owned and operated by AMIK or the seven associated Band Councils. The activities of the Innu of Québec in the SEA Update Area include fishing commercially for turbot and shrimp (K. Wilkins, pers comm. 2012).

As described in Chapter 2 of this Report, as part of its consultation processes for the SEA Update the C-NLOPB wrote to various Aboriginal communities and organizations in Newfoundland and Labrador, Québec and each of the Maritime Provinces to provide information on the SEA Update and to extend an invitation for them to contact the C-NLOPB if the group had interests related to the SEA Update. In several cases, this led to further correspondence and meetings with several groups. Through further correspondence from, and an October 2012 meeting with, the Innu Council of Ekuanitshit (Mingan, Québec), for example, the Innu reiterated the importance of commercial fisheries to their community and its residents, including key snow crab and scallop fisheries in the Gulf and the importance of the salmon resource for commercial and traditional (subsistence and ceremonial) purposes. Similarly, in a subsequent meeting with the Mi'gmawei Mawiomi Secretariat in Gesgapegiag, Québec, the Mi'gmag stressed the economic and spiritual importance of Atlantic salmon to their communities and to the contemporary and traditional ways of life of their people.

4.3.6 Other Human Activities

The following sections describe a number of other activities and elements that occur within or near the marine environment, and which therefore have the potential to interact with, and be affected by, future offshore petroleum activities in the SEA Update Area.

The overview focuses primarily upon the section of the Newfoundland coastline that extends across the SEA Update Area, which includes many of the major ports, marine transportation routes, sensitive and protected coastal areas and important tourism destinations of Western Newfoundland.

Data and information were obtained from Canadian government agencies such as Statistics Canada, Transport Canada, DFO, the Department of National Defence (DND) and Canadian Forces as well as Parks Canada. Provincial government sources include Department of Transportation and Works, Department of Environment and Conservation (Parks and Wildlife Divisions), Department of Tourism, Culture and Recreation (tourism information) and the Newfoundland and Labrador Statistics Agency. In addition, information was found on websites of various types of agencies including port corporations, municipalities, tourism promotion organizations, conservation groups and others.

4.3.6.1 Marine Shipping and Transportation

Marine shipping and transportation have played an important role in the location and sustainability of coastal communities throughout Western Newfoundland and throughout the Gulf of St. Lawrence. Traditionally, small to medium sized vessels transported goods and people to and from coastal communities. Currently, the road system is the primary mode of transportation and marine shipping is limited mainly to sea ports with the required infrastructure and services for large vessels. Freight services are handled primarily by private companies such as Oceanex, which operates cargo vessels from larger centres such as Montreal and Halifax to Corner Brook and St. John's (TC 2012). Ferries move people and goods between provinces and to islands and other communities that are either not connected, or difficult to access, by road. Smaller harbours are maintained for fishing and recreational activities.

Harbours are regulated under federal jurisdiction of Canada's *Navigable Waters Protection Act* and *Fishing and Recreational Harbours Act.* DFO, through Canadian Coast Guard (CCG) Marine Communications and Traffic Services (MCTS) provides communications and traffic management services in certain Canadian ports. A number of Western Newfoundland ports and harbours locations are shown in Figure 4.111.

The west coast of Newfoundland and the Strait of Belle Isle are adjacent to shipping routes of the Gulf of St. Lawrence and the St. Lawrence Seaway (Figure 4.112). The Gulf of St. Lawrence accommodates approximately 6,400 commercial vessel transits annually through the Cabot Strait, with the Strait of Belle Isle providing an alternate route during ice-free seasons. The Strait of Belle Isle is on the most direct route between the Great Lakes and European ports but relatively little international marine shipping moves through the Strait. This may be because the Strait of Belle Isle is generally ice-filled from January to March. Ships also traverse the coastal areas of Western Newfoundland en-route to ports in Labrador and Nunavut, on a seasonal basis.

Figure 4.111 Western Newfoundland Ports, Harbours and Ferries

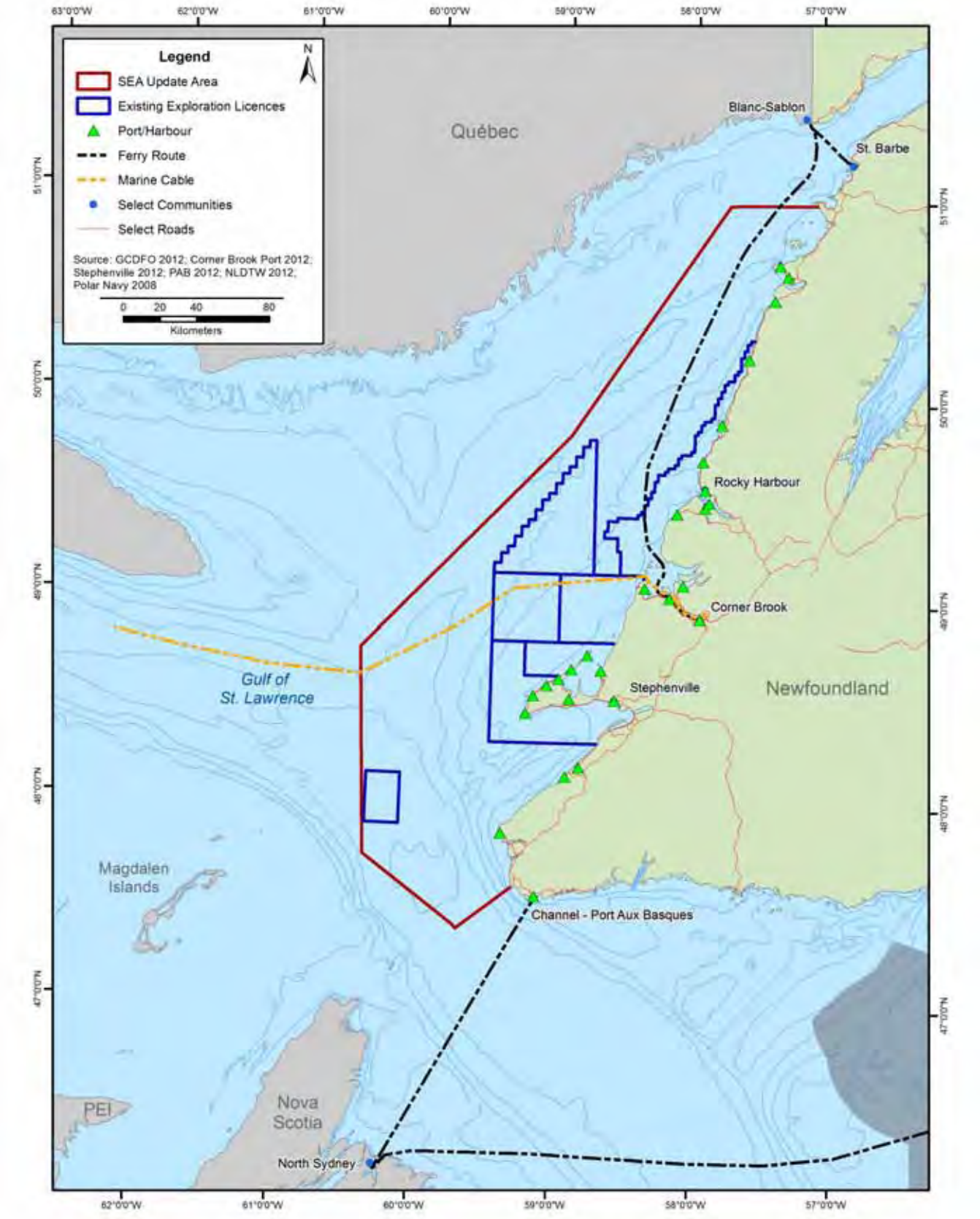
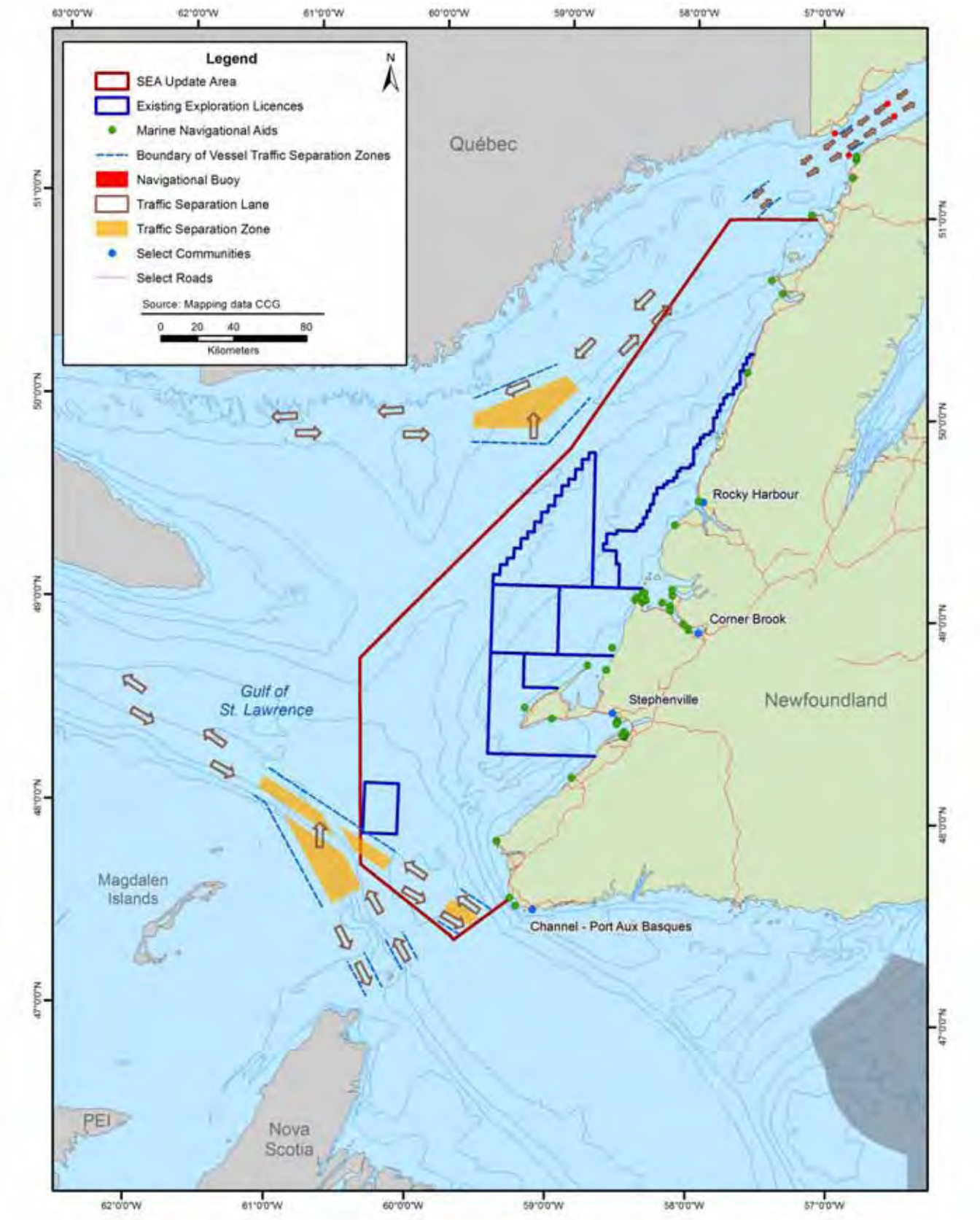


Figure 4.112 Shipping in and Near the SEA Update Area



Marine transportation continues to play an important role in the economy by moving goods in and out of Western Newfoundland though the larger ports of Corner Brook, Stephenville and at times Port aux Basques. Table 4.111 displays international cargo shipping to and from Western Newfoundland ports. International shipping in the SEA Update Area is 12 percent of total marine shipping conducted to and from provincial ports (Statistics Canada 2012).

Table 4.111 International Shipping in Western Newfoundland (2010)

Selected Ports	Ballast			Cargo			Total Tonnage Handled ('000 t)
	Number of Movements	Gross Tonnage ('000 t)	Net Tonnage ('000 t)	Number of Movements	Gross Tonnage ('000 t)	Net Tonnage ('000 t)	
Corner Brook	72	1,929.5	943.7	58	1,227.2	537.7	1,092.7
Stephenville	11	116.4	57.2	9	84.7	41.1	94
Port aux Basques	2	11.3	5.6	0	0	0	0
Total	85	2,057.2	1,006.5	67	1,311.9	578.8	1,186.7
Source: Statistics Canada (2012)							

Domestic shipping is more active than international shipping from Western Newfoundland ports (Table 4.112). Corner Brook is the busiest of the three ports for both international and domestic shipping.

Table 4.112 Domestic Shipping in Western Newfoundland (2010)

Selected Ports	Ballast			Cargo			Total Tonnage Handled
	Number of Movements	Gross Tonnage ('000 t)	Net Tonnage ('000 t)	Number of Movements	Gross Tonnage ('000 t)	Net Tonnage ('000 t)	
Corner Brook	95	1,397	586.3	170	3,010.2	1,076.0	1,450.3
Stephenville	8	99.8	48.4	9	135.7	67.1	105.4
Port aux Basques	9	95.1	40.7	9	95.1	40.7	54.4
Total	112	1,591.9	675.4	188	3,241	1,183.8	1,610.1
Source: Statistics Canada (2012)							

Corner Brook

The Port of Corner Brook, which is operated by the Corner Brook Port Corporation, is the largest in the SEA Update Area, the key elements and capacity of which is summarized in Table 4.113. Vessels of all sizes from fishing boats to cruise ships navigate the port year round. Oceanex provides weekly year-round container service from Corner Brook to St. John's and Halifax as well as a seasonal service to Montreal (Corner Brook Port 2012). Newsprint from Corner Brook Pulp and Paper is shipped to international markets. The southern Labrador ferry sails from Corner Brook in the winter months when the Strait of Belle Isle is ice-filled (i.e. January to March / April).

Table 4.113 Corner Brook Port Capacity

Parameter	Details
Berthage	362 m
Deck Elevation	4.1 m
Minimum Dockside Depth	10.1 m
Channel Width	1.6 km

Parameter	Details
Channel Depth	46 m
Turning Basin Diameter	1,530 m
Tidal Range	2 m
Source: Corner Brook Port (2012)	

Stephenville

Stephenville Harbour (Port Harmon) is operated by the Little Port Harmon Harbour Authority, and was an important shipping port for paper products until Abitibi-Consolidated closed the Stephenville paper mill in 2005. The Port, which was dredged in 2005-2006 to improve capacity for vessels, can be navigable year-round with some icebreaking (Town of Stephenville 2012). The key characteristics and capacity of this port are summarized in Table 4.114.

Table 4.114 Stephenville Port Capacity

Parameter	Details
Berthage	293 m
Deck Elevation	3.6 m
Minimum Dockside Depth	10.1 m
Channel Depth	9.1 m
Tidal Range	1.7 m
Source: NOIA (2012)	

Port aux Basques

The harbour at Port aux Basques is used primarily for large ferry ships that carry passengers and freight to and from Nova Scotia. Marine Atlantic moves approximately 400,000 passengers, 130,000 passenger vehicles and 88,000 commercial vehicles annually (MAI 2012). The majority of Marine Atlantic's customers use Port aux Basques' because the Argentia ferry service is seasonal. The Canadian Coast Guard, oil tankers, cruise ships and other shipping companies occasionally use the port facilities (PAB 2012). The characteristics and capacity of this port are summarized in Table 4.115.

Table 4.115 Port aux Basques Port Capacity

Parameter	Details
Berthage	386 m
Deck Elevation	3.6 m
Minimum Dockside Depth	10 m
Channel Width	55 m
Depth at Docks	7-7.5 m
Source: PAB (2012)	

Ferries

In Eastern Canada, marine ferries deliver people and goods between provinces and to coastal communities and some of these routes operate in the Gulf of St. Lawrence. In Newfoundland and Labrador, the Department of Transportation and Works operates and/or administers the provincial ferry system. This service delivers passengers and freight to remote south coast communities, several island communities that are not connected

by road and to coastal Labrador communities. The Southern Labrador ferry (Table 4.116) operates from St. Barbe on the Northern Peninsula to Blanc Sablon, Québec for most of the year and offers two ferry crossings daily with additional crossings added during peak periods (NLDTW 2012). For the past three winters, the Southern Labrador Ferry operated from Corner Brook to Blanc Sablon generally from January to April when the Strait of Belle was ice-filled. In each of the three seasons that the ferry has operated between Corner Brook and Blanc Sablon, the 12-hour voyage was available twice per week in each direction (D. Cooper, pers. comm).

Table 4.116 Southern Labrador Ferry

Season	Passengers	Passenger Vehicles	Commercial Vehicles
2010 (February 3 - April 7)	2,484	981	257
2011 (January 26 - March 16)	1,858	749	279
2012 (January 18 - March 14)	1,908	778	326
Source: D. Cooper, pers. comm. October 2012			

The interprovincial ferry service provides access to North Sydney, Nova Scotia through Port aux Basques year-round and to Argentia from mid-June to late September. The Port aux Basques to North Sydney service operates twice daily and the Argentia ferry, two to three times per week (MAI 2012). Commercial vehicles represent 70 percent of the total traffic. Marine Atlantic transports approximately 50 percent of goods and 90 percent of perishable goods entering the province of Newfoundland and Labrador (City of Corner Brook 2012).

Small Craft Harbours

As many coastal communities in Western Newfoundland and elsewhere in Eastern Canada have traditional fishing economies, a large number of small harbours exist throughout the region. In Newfoundland and Labrador, a total of 264 harbours are operated by 214 harbour authorities (DFO 2012e). These small fishing harbours, located along the coast, are used for transhipment of fish and seafood products as well as recreational boating and other marine tourism activities. DFO Small Craft Harbours oversees management of these ports, which are operated by local harbour authorities (Table 4.117).

Table 4.117 Western Newfoundland Harbour Authorities and Harbours

Harbour Authorities	Managed Harbours
Bay St. George South	Brown's Cove (Heatherton), Fischells, Heatherton, Highlands (Eel Hole), Seal Cove (Heatherton), St. David's (Crabbe's River)
Black Duck Brook	Black Duck Brook
Blue Beach	Blue Beach
Cape St. George	Cape St. George (Rouzes Brook)
Codroy	Codroy
Cow Head	Cow Head
Cox's Cove	Cox's Cove
Daniel's Harbour	Daniel's Harbour
Fox Island River	Fox Island River
Frenchman's Cove (Bay of Islands)	Frenchman's Cove (Bay of Islands)
Lark Harbour-York Harbour-Little Port	Lark Harbour Little Port
Little Port Harmon	Port Harmon
Lourdes	Lourdes

Harbour Authorities	Managed Harbours
Mainland-Three Rock Cove	Mainland Three Rock Cove
Norris Point	Norris Point
Piccadilly	Abrahams Cove Piccadilly Ship Cove (St. George's Bay)
Port au Choix	Port au Choix
Port aux Basques	Channel (Port aux Basques)
Port Saunders	Port Saunders
River of Ponds	River of Ponds
Rocky Harbour	Rocky Harbour
Sally's Cove	Sally's Cove
Trout River	Trout River
Woody Point	Woody Point
Source: DFO (2012e)	

4.3.6.2 Marine Cables

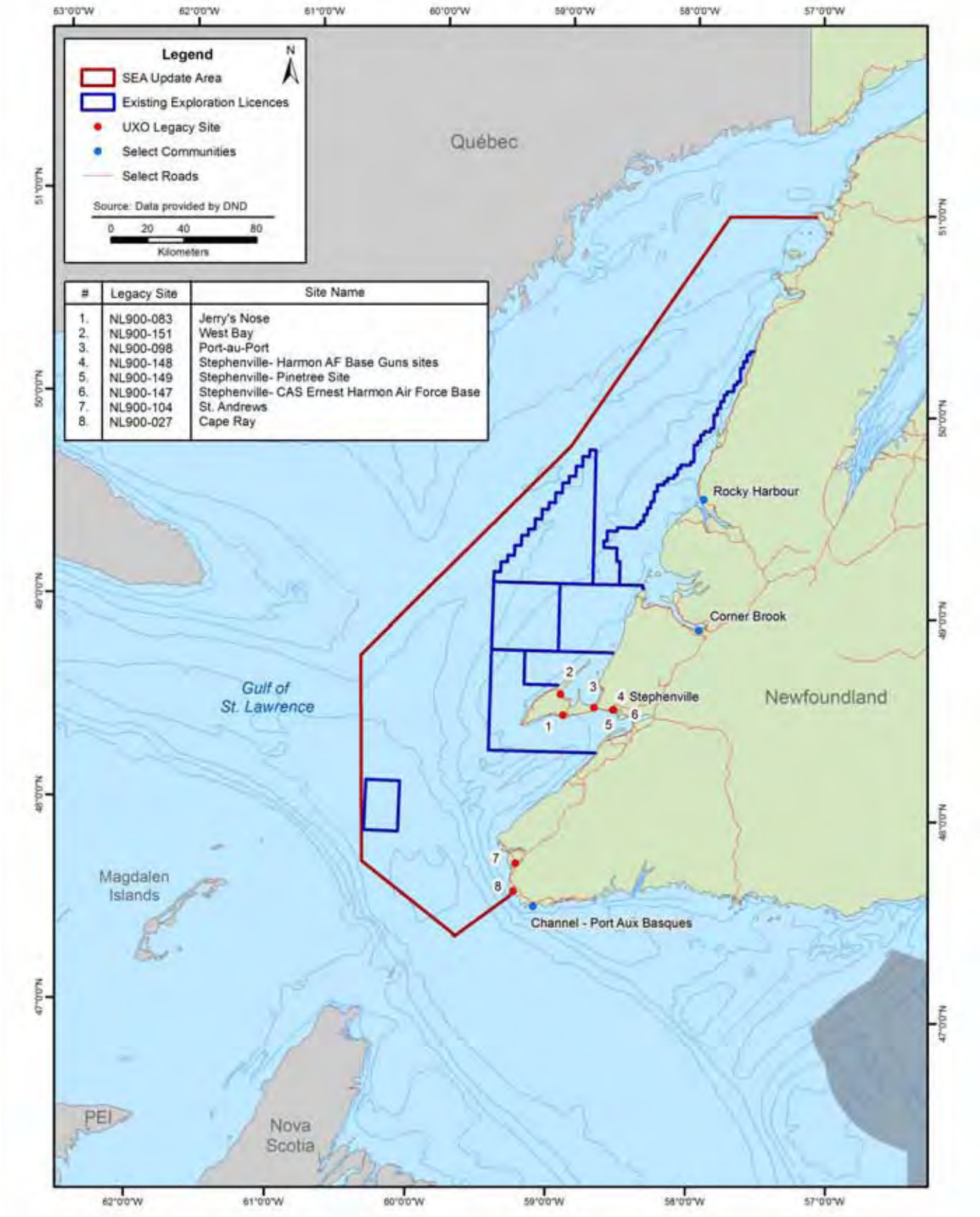
An existing submarine cable transects the SEA Update Area from the Bay of Islands in Western Newfoundland to the Gaspé region of Québec (see Figure 4.111) (Polar Navy 2008). This is a portion of the TransAtlantic Telephone Cable (CANTAT) and was laid in 1961 between Corner Brook, Newfoundland and Grosses Roches, Québec (Atlantic Cable 2013). Emera Newfoundland & Labrador is also proposing to construct and operate the Maritime Link to connect the electrical transmission systems of Nova Scotia and Newfoundland and Labrador through a subsea cable across the Cabot Strait. Two subsea cables spanning approximately 180 km from Point Aconi, Nova Scotia to Cape Ray, Newfoundland (exact location to be determined) are currently being proposed.

4.3.6.3 Unexploded Ordinances

Many locations across Canada have been used for military operations, training and weapons testing in the past. Wartime action along Canada's coasts and incidents involving ships, planes or vehicles carrying ammunition and explosives have also created legacy sites at which unexploded ordnance (UXO) may still remain today. A UXO legacy site is any property that was owned, leased or used by DND but no longer resides within DND's inventory and for which there exists a UXO risk associated with past Departmental activities. Several hundred UXO legacy sites are known to exist at locations spread across Canada's land mass. In addition, 1,100 sites are known to exist off Canada's east coast, with 26 more on the Pacific coast (DND 2010).

DND's UXO and Legacy Sites Program was established in 2005, with the objective of reducing safety risks posed by UXO at all "legacy sites" across Canada. The program identifies and catalogues such sites, assesses risks, and works to reduce UXO risk through property controls, assessment surveys, UXO clearance operations, and public education. At some sites where the potential risk is great, public safety must be ensured by restricting access to the sites. In other locations where the risk is minimal, signage and information campaigns to alert the public to potential hazards may be the preferred action (DND 2010). There are various known UXO sites within the NL Offshore Area. Those known sites that are located in the Western Newfoundland Offshore Area are illustrated in Figure 4.113.

Figure 4.113 UXO and Legacy Sites in the SEA Update Area



4.3.6.4 Military Activities

Canada is a maritime country with a wide range of interests in three oceans, and the sea has been a vital component in the development of its economy. Canada's maritime interests in the Gulf of St. Lawrence include:

- Marine transportation and trade: Shipping, shipbuilding and repair, ports, harbours and waterways, icebreaking, aids to navigation, search and rescue and response to marine emergencies;
- The ocean environment: Habitat protection, species conservation, environmental forecasting and pollution prevention and control;
- Resource development: Fisheries, aquaculture, offshore petroleum, minerals and energy;
- Marine science and technology: Which enhance national capabilities in oceans sectors; and
- Maritime security and sovereignty: Covering functions such as defence, sovereignty, law enforcement and international stability.

Canadian policy for the protection of its maritime interests has been implemented through a blend of law, force and diplomacy, implemented through a strategy of surveillance, monitoring and enforcement, or in military terms, naval presence and sea control (Crickard 1995).

Under the authority established in the *National Defence Act*, DND is responsible for several military and civilian organizations and agencies (DND 2012). DND oversees matters of national security, including the defence and protection of Canada's marine jurisdiction. To meet national security obligations, Canada's Royal Navy and Air Force operate routine surveillance and monitoring operations throughout Atlantic Canadian waters, often with associated training operations. As a result, DND may operate aircraft or marine patrols in the region. In some instances naval frigates (Halifax Class) or coastal patrol vessels (Kingston Class) may operate training or other naval operations in the SEA Update Area, or traverse the region en route to and from patrols in Canada's northern territorial waters. Navy vessels also sometimes provide support to DFO in conducting fishery patrols in Atlantic Canada, including the coastal waters of Newfoundland. Civilian security operations are conducted by the Canadian Coast Guard.

The Royal Canadian Navy has operated sovereignty patrols in the SEA Update Area, but no recent operations have been conducted and there are reportedly no immediate plans to conduct military exercises in, or near, the region in the near future.

4.3.6.5 Tourism

The tourism industry is a key component of the Newfoundland and Labrador economy, and is one which has seen significant expansion and evolution in recent years. The tourism sector in the province includes both residents who travel within the province and non-residents who visit the province, which together resulted in an estimated $1 billion in spending in 2011. The resident market continues to be a very substantial contributor to the province's tourism sector, representing nearly 60 percent of total tourism spending in 2011. The number of non-resident visitors in 2012 was approximately 504,400 persons, an increase of nearly 10 percent from the previous year (Government of Newfoundland and Labrador 2013).

Western Newfoundland is perhaps best known to tourists as the location of Gros Morne National Park, a UNESCO World Heritage Site. Gros Morne is renowned for its fascinating geological history, scenic beauty, wildlife viewing opportunities and recreational activities. The National Park is one of the most important tourism destinations in Newfoundland and Labrador, attracting upwards of 180,000 visitors each year and accounting for in excess of $37 million in economic benefits (Government of Newfoundland and Labrador 2012; Department of Tourism, Culture and Recreation 2011; Parks Canada 2012d).

In addition to Gros Morne, Western Newfoundland has a number of other key tourism attractions including provincial and national sites that protect and exhibit key areas of ecological, natural heritage, cultural and/or recreational importance. Protected Areas are described in Section 4.2.4. From Port au Choix to Cape Ray, the area has more than 30 RV parks and campgrounds, five of which are in Gros Morne National Park with four located in provincial parks. The region has nearly 90 natural and adventure attractions which include hiking and walking trails, nature parks and beaches. Winter activities include alpine and nordic skiing, snowshoeing and snowmobiling. Nearly 35 walking and hiking trails are also found in the area, including various segments of the International Appalachian Trail, the T'Railway Provincial Park and trails in Gros Morne National Park and elsewhere. Approximately 15 tour operators provide boating, sea kayaking, walking, hiking, bicycling, rock climbing, snowshoeing and snowmobiling tours (NLT 2012).

This region also has almost 50 cultural and heritage attractions that commemorate important people, places and events. These are mainly museums and interpretation centres with various themes (e.g. the railway, fishing, lighthouses, churches, ethnic cultures). At least 30 annual festivals celebrate seasonal activities (e.g. winter activities or summer / fall harvests), provide cultural enrichment (e.g. music, theatre, writers festival), celebrate seasonal foods (e.g. strawberries, lobster, crab), or provide community events such as come home years (NLT 2012). Seven golf courses are located in the Western Newfoundland region including facilities at the Humber Valley Resort. The Marble Mountain ski area and a zip lining facility are located at Steady Brook (NLT 2012).

In Western Newfoundland, tourism generally occurs within a four month period (June to September) with the peak months being July and August. The exceptions are business and convention travel in the Corner Brook area and winter activities such as those undertaken at the Marble Mountain Ski Resort. Related infrastructure and facilities are also well developed in the region.

Marine and Coastal Tourism and Recreation

The following sections further describe select marine-based tourism areas and activities along Newfoundland's west coast. Similar marine-based tourism and recreation activities may be found in all of the provinces that border the Gulf of St. Lawrence. In each area, the tourism industry relies, at least in part, on the existence and nature of coastal communities, the availability of fresh seafood and opportunities to view wildlife and participate in marine-based activities such as boat tours and sea kayaking.

Western Newfoundland's tourist attractions include national and provincial coastal parks (Section 4.2.4) and marine-based activities (as well as inland areas and land-based ones). Provincial and national parks provide recreational opportunities, as do other beaches and coastal areas. These include: Bottle Cove Beach at Lark Harbour in the Bay of Islands, Grand Codroy Beach / Searston Beach at the mouth of the Grand Codroy River and Grand Bay West Beach near Port aux Basques (NLT 2012; Go Western 2012). Western Newfoundland has several noteworthy areas, including coastal bird watching sites. In summer and fall, various ports are visited by large cruise ships on trans-Atlantic tours or small cruise ships that visit coastal Newfoundland and Labrador.

Marine Tours and Attractions

Western Newfoundland has many kilometres of coastline and marine-based recreational activities occur on the open ocean and in sheltered bays. For many tourists, taking a boat tour and viewing marine life are essential parts of any trip to Newfoundland. Businesses offer ocean adventures and marine related activities such as salmon angling for residents and tourists. Western Newfoundland has a variety of marine-based tourism activities (Figure 4.114). These are clustered in two main areas: Bonne Bay and the Bay of Islands, both of which are relatively sheltered from the ocean. Boat tours and sea kayaking are offered in Norris Point. Similar activities are available in the Humber Arm-Bay of Islands area (Table 4.118).

Table 4.118 Marine-Based Tours and Activities (Select and Illustrative Examples)

Operator	Location	Activities
Long Range Adventures	Sally's Cove	Sea kayaking
Bonne Bay Marine Station	Norris Point, Bonne Bay	Boat tours, touch tank
Bon Tours	Norris Point, Bonne Bay	Boat tours
Gros Morne Adventures	Norris Point, Bonne Bay	Sea kayaking
Explore Newfoundland Adventures	Bay of Islands	Sea kayaking
Crystal Waters Boat Charters and Tours	Curling, Humber Arm	Boat tours, whale and bird watching
True North Charters and Tours	Cox's Cove, Bay of Islands	Boat tours, whale and bird watching, ocean fishing
Four Seasons Tours	Cox's Cove, Bay of Islands	Dory tours, whale and bird watching, ocean fishing
Sources: NLT (2012); Go Western (2012)		

Bonne Bay Marine Station is a Memorial University marine biology research and teaching facility located at Norris Point. The station, which also provides public education programs, maintains live specimens in aquaria and a popular touch tank which are all supplied by circulating seawater (BBMS 2012).

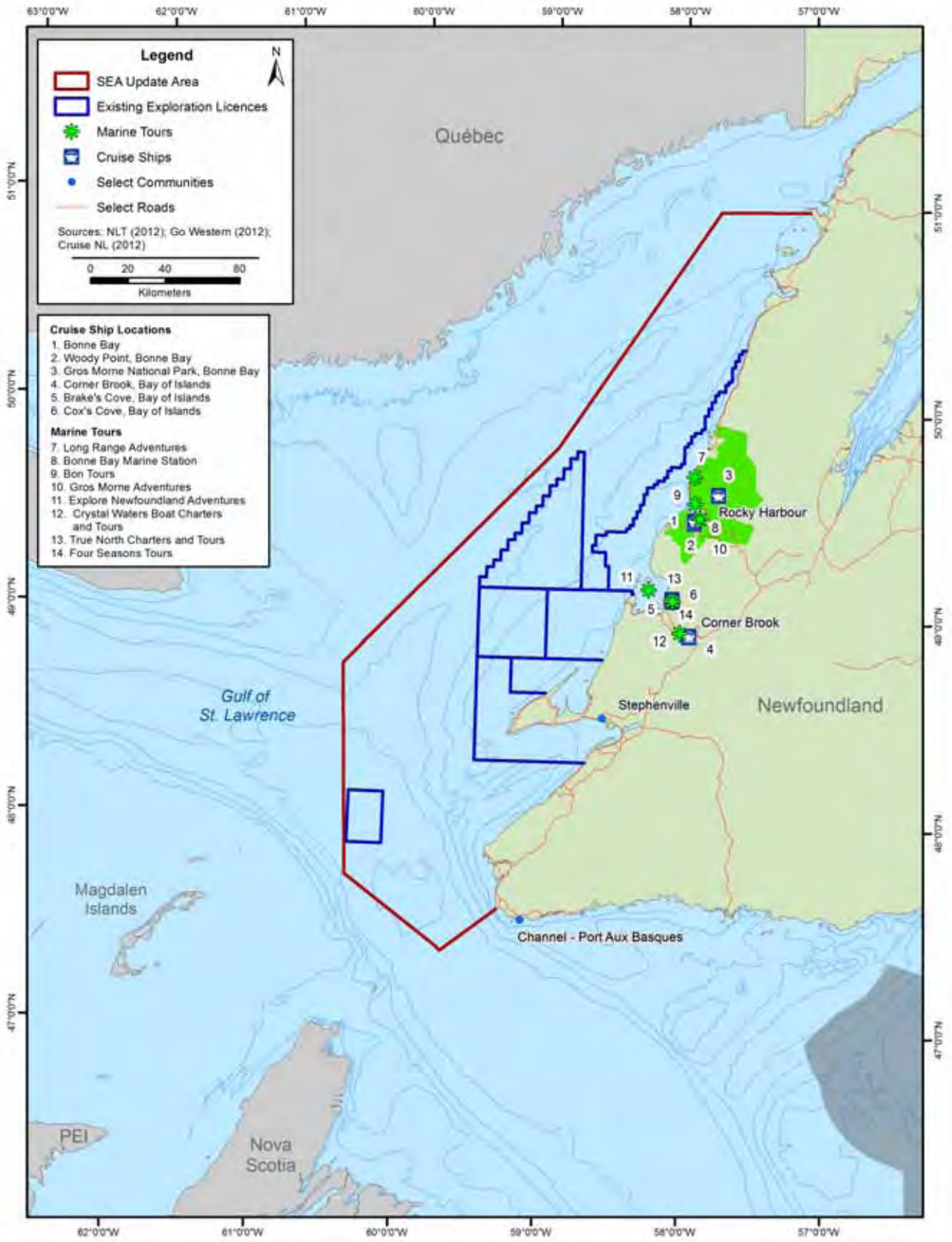
Cruise Ships

In Western Newfoundland, Cruise NL identifies Port au Choix, Norris Point, Woody Point, Lark Harbour, Stephenville, Codroy Valley and Port aux Basques as ports-of-call. The main cruise ship destinations in 2012 were Bonne Bay and the Bay of Islands, which had cruise ship visits scheduled in July, September and October (Cruise NL 2012). Corner Brook receives the majority of cruise ship visits. September and October are the busiest months for cruise ships in Western Newfoundland (Table 4.119).

Table 4.119 Western Newfoundland Cruise Ship Activity (2012)

Destination*	Ship Visits**	Schedule
Bonne Bay	1	September
Woody Point, Bonne Bay	1	September
Gros Morne National Park, Bonne Bay	3	July (1), September (1), October (1)
Corner Brook, Bay of Islands	15	July (1), September (5), October (9)
Brake's Cove, Bay of Islands	1	October
Cox's Cove, Bay of Islands	1	October
*A specific port may not have been identified as of August 23 2012 **May include repeat or return visits by the same ship on the same cruise Source: Cruise NL (2012)		

Figure 4.114 Marine-Based Tourism Activities in the SEA Update Area



Coastal Birdwatching

As described previously, several Important Bird Areas (IBAs) are located along the coast of Western Newfoundland (Section 4.2.2.7), including Codroy Valley, Codroy Valley Estuary, Grand Bay West to Cheeseman Provincial Park and Gros Morne National Park (IBA 2012). These areas may also be completely or partially protected by the federal and provincial government parks systems and this is addressed in an earlier Section. Important Bird Areas are described here in relation to human interest in bird watching (Table 4.120).

Table 4.120 Western Newfoundland Important Bird Areas

Name	Description	Birds
Gros Morne National Park	Coastal environments include sandy beaches with dune grass, coastal cliffs and cobble beaches.	Two hundred and seven (207) bird species have been recorded.
Codroy Valley Estuary	The Codroy River broadens into an estuary up to 3 kilometres wide and 12 kilometres long where the Grand Codroy River flows in the Atlantic Ocean. The IBA site is limited to the open waters of the estuary up to the high tide marks on the shoreline.	Important breeding and staging site for numerous waterfowl species including significant numbers of north Atlantic Canada goose. A pair of piping plovers, which inhabited the beach at the mouth of the estuary from 1992 to 1998, successfully fledged young.
Codroy Valley	The Codroy Valley IBA, on the southwestern tip of Newfoundland, encompasses a large triangular parcel of land between the Little Codroy River and the Grand Codroy River.	This IBA is home to a number of forest bird species, including two species of restricted range, the Ovenbird and the Red Crossbill. The IBA is rich in woodland warbler species, and several species that are uncommon or absent elsewhere in Newfoundland are found here, including Ruby-throated Hummingbird, Gray Catbird, Red-eyed Vireo and Rose-breasted Grosbeak. Bobolink also breed in this IBA.
Grand Bay West to Cheeseman Provincial Park	Cheeseman Park is located at the western edge of the site and Grand Bay West beaches cover the central and eastern sections of a beach system of approximately 8 km of coastline, with a few small rocky sections and a low rocky peninsula located near the eastern end. Beach is mostly between 50 and 100 m wide with some small sand dunes.	Nesting habitat for the globally vulnerable and nationally endangered piping plover. In 1996, 18 piping plovers were recorded at this site, representing 4.2 percent of the estimated Atlantic Canada population. Between 1995 and 1998, an average of 17 adult piping plovers was observed annually.
Source: IBA (2012)		

4.3.6.6 Other Current or Traditional Uses of the Marine and Coastal Environments

In Canada, bird hunting is permitted under the *Migratory Birds Hunting Regulations*. Environment Canada provides annual hunting regulations, including season dates and bag limits, for each province and territory. The variety of species hunted in marine and inland areas differ by province, region and habitat type. Residents of Newfoundland and Labrador hunt various migratory bird species in marine and inland areas (NLDEC 2012b).

These birds (various species of waterfowl and murres) have long been an important source of food in traditional diets.

The SEA Update Area is bounded by the Western Coastal Migratory Game Bird Hunting Zone and Murre Hunting Zones 2 and 3 (Figure 4.115). Table 4.121 presents bag and possession limits for coastal areas in Western Newfoundland. There is no spring / summer bird hunting season. Birds are hunted in fall and winter: from September to March (NLDEC 2012b).

Approximately 20 percent of the appropriately 16,000 Migratory Game Bird Hunting Permits sold annually in Newfoundland and Labrador in recent years has been to residents of the Western Newfoundland region (CWS, unpublished information).

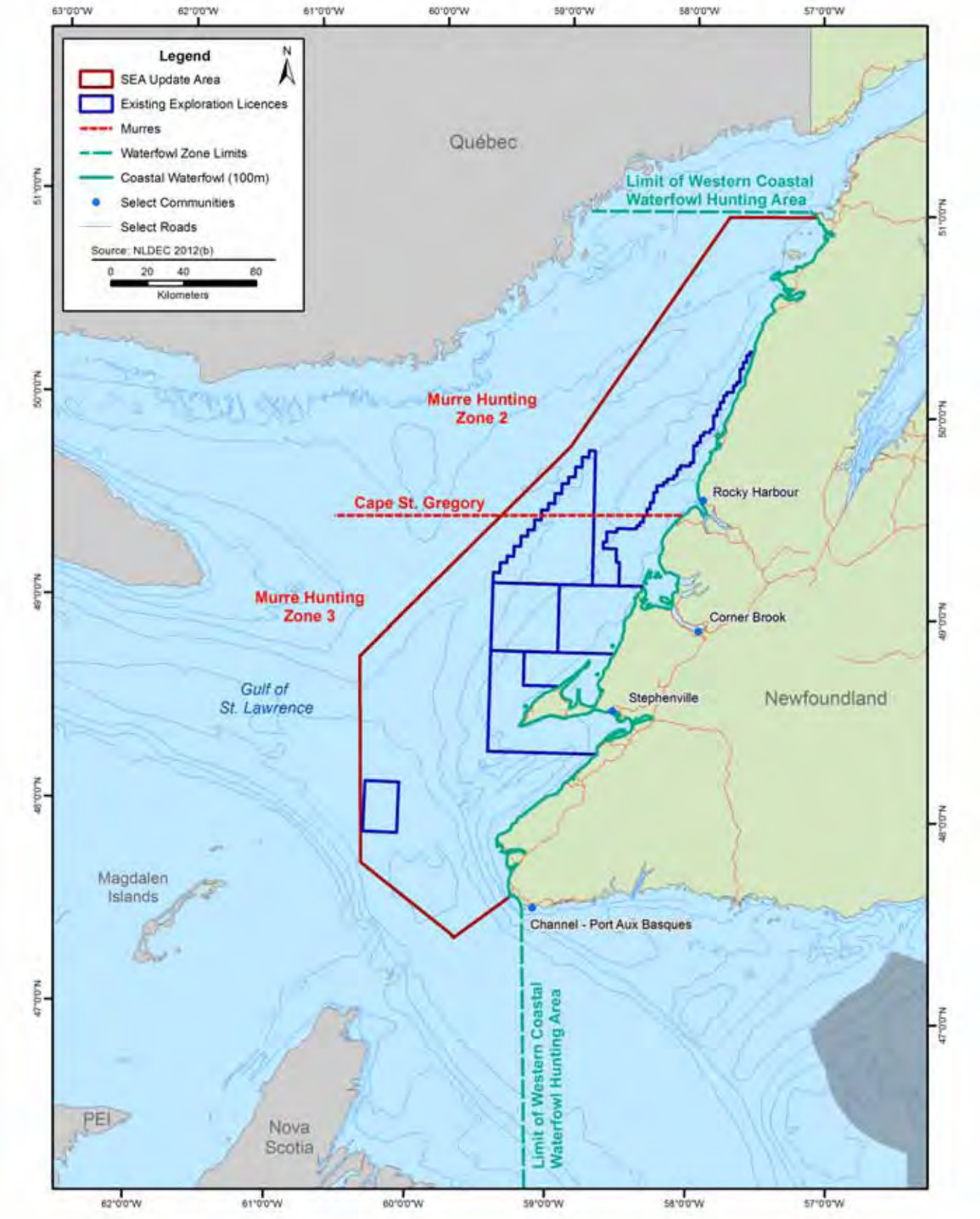
Table 4.121 Waterfowl and Murre Hunting (2012-2013)

Species	Management Areas	Spring / Summer Seasons	Fall / Winter Seasons	Bag and Possession Limits
Waterfowl* Ducks including Mergansers, Geese and Snipe	Western Coastal	No season	3rd Saturday in September to last Saturday in December	Ducks (6 daily, 12 possession with other limitations) Mergansers (6 daily, 12 possession) Geese (5 daily, 10 possession) Snipe (10 daily 20 possession)
Waterfowl Long-tailed Ducks, Eiders and Scoters			4th Saturday in November to last day of February	6 daily, 12 possession
Murre (Turr)	Hunting Zone 2		October 6 to January 20	20 per hunter per day / 40 per hunter at any one time
	Hunting Zone 3		November 25 to March 10	

* No open season for Harlequin Ducks
Source: NLDEC (2012b)

Newfoundland residents and visitors also gather shellfish such as mussels and clams in coastal areas, but specific and detailed information is not available on where, when and how much is harvested.

Figure 4.115 Waterfowl and Murre Hunting Areas



5 ENVIRONMENTAL INTERACTIONS, MITIGATION AND KEY PLANNING CONSIDERATIONS

This Chapter provides an identification and analysis of potential environmental issues and effects, mitigation measures and planning considerations related to possible future offshore petroleum activities in the SEA Update Area. Each VEC is addressed in a separate section, which includes a discussion of:

- Potential environmental interactions and standard mitigation measures which may be applied to oil and gas activities to avoid or reduce adverse environmental effects;

- Key environmental planning and management considerations, as well as a discussion of any additional activity, site or time-specific mitigation measures which may be required or appropriate;

- Potential cumulative environmental effects which may result from future offshore petroleum activities in combination with each other and with other projects and activities in the region, as well as associated planning considerations to help avoid or reduce such effects; and

- An evaluation of the availability and adequacy of existing information and any relevant data gaps and requirements.

5.1 Fish and Fish Habitat (including Species at Risk)

Fish and their habitats are important considerations in the EA of proposed or potential activities that may occur within, and affect, the aquatic environment. A range of fish species are known or likely to occur within the SEA Update Area, with different species and species groups occupying different habitats, at different times, for the purposes of carrying out various aspects of their life histories in this region. As noted previously, this rather broad VEC includes relevant fish species, as well as plankton, algae, benthos and other relevant aspects of fish habitats, given the clear interrelationships between these ecological components. Where relevant, differences between these components and their potential interactions with offshore oil and gas activities are also highlighted.

An updated overview of marine fish species in the region was provided in Section 4.2.1. This included information on their life histories, habitat preferences and reproduction patterns and practices, as well as known fish presence and abundance, spatial and temporal distribution and movements within the SEA Update Area. This information has been used to assess and evaluate the key potential interactions of this VEC with potential offshore petroleum activities in the area.

5.1.1 Potential Environmental Interactions and Effects

The potential environmental interactions between offshore petroleum activities and marine fish and their habitats may be both direct and indirect in nature, and include the following:

- Possible injury or mortality due to exposure to underwater sounds such as seismic signals, explosions or others at very close range (particularly immobile species);

- Fish displacement through the avoidance of certain areas that would otherwise be used (such as insonified areas during seismic surveys, drilling activity, inshore or offshore vessel traffic), with these behavioural effects altering the presence and abundance of marine fish, as well as potentially disturbing their movements / migration (to and through the area), feeding and other important activities;

- Interference with (and the masking of) sounds within the marine environment that originate from and/or are used by marine fish, such as in communication, the identification and detection of prey and other activities and requirements;

- The potential contamination of fish and their habitats due to environmental discharges during planned and routine petroleum exploration or production activities (e.g., hydrocarbons or other deleterious substances in deck drainage, wastewater, produced water, or run-off from onshore drill pads);

- Possible destruction or other alteration of fish habitats due to the discharge and deposition of drill cuttings (smothering), placement of other project infrastructure or activities, or possibly the introduction and spread of aquatic invasive species;

- The attraction of individuals to project installations and vessels (lights, etc.), resulting in increased potential for injury, contamination or other interactions;

- Possible changes in the availability, distribution or quality of feed sources and/or habitats for fish as a result of planned petroleum activities and their environmental emissions; and

- Changes in the presence, abundance, distribution and/or health of fish as a result accidental spills from offshore exploration or production installations or vessels (through physical exposure, ingestion, effects on prey and habitats, etc).

Table 5.1 provides a summary overview of the key potential environmental interactions between fish and fish habitat and various types of offshore petroleum exploration and production activities, including the main elements and activities that are typically associated with them. It also highlights some of the standard mitigation measures that are often required or otherwise implemented to avoid or reduce such effects.

The Table also summarizes some examples of existing information and knowledge that is provided through the literature and other relevant sources regarding these potential issues and effects. The intent is to generally and briefly reference and highlight some of this available information and its main findings (particularly any that has become available since the original SEA, and any areas of on-going uncertainty), in order to generally inform the analyses. A more detailed review and discussion of this literature and other relevant information is provided in the initial SEA Report (LGL Limited 2005) and has been reported extensively in other sources.

Table 5.1 Fish and Fish Habitat (Including Species at Risk): Summary of Potential Environmental Interactions and Effects

Components / Activities	Potential Environmental Interactions	Summary of Some Known and Potential Environmental Effects Based on Available Information Sources	Some Standard Mitigation Measures (See Section 5.1.2)
SEISMIC SURVEYS			
Air Gun Operations	Possible injury or mortality Avoidance of areas during and/or following seismic surveys	• A considerable amount of research has been conducted on the effects of offshore seismic surveys (of various types and intensities) on marine fish. This has included scientific research, monitoring studies and anecdotal reports of observed reactions (see, for example, DFO 2004 for a review). • The possible effects on this VEC resulting from sound in the marine environment due to offshore seismic surveys may be behavioural (avoidance, other changes in distribution or activities) or involve injury to or mortality of individual fish. • Immediate behavioural reactions to exposure to seismic sound have been widely documented in marine organisms (DFO 2004). • The available literature indicates that when exposed to an operating air-gun, mobile marine fish may exhibit a range of responses, including: no change in behaviour (Pickett et al 1994; Wardle et al 2001), temporary avoidance of the area for a period (McCauley et al 2000a, 2000b), and other behaviours such as swimming to deeper depths, milling in compact schools or becoming more active (Slotte et al 2004). • Most of the sound energy produced by an airgun array is in the range of 10-300 hertz (Hz), with highest levels at frequencies of less than 100 Hz (see Chapter 3). • Airgun emission frequencies fall within the hearing band of most fish species, and could therefore be audible, and affect fish behaviour, at distances where levels are sufficiently high. Although effect threshold levels (ETLs) have not been definitively defined for all fish species and circumstances, a review by Turnpenny and Nedwell (1994), for example, indicated that studies have shown ETLs for fish	• Avoidance of sensitive areas and times • Minimization of airgun source level and use of "ramp up" procedures • Adherence to the C-NLOPB's *Geophysical, Geological, Environmental and Geotechnical Program Guidelines*, which include various requirements and other measures related to environmental planning, mitigation, monitoring and reporting • Adherence to the associated *Statement of Canadian Practice with respect to the Mitigation of Seismic Sound in the Marine Environment (*such as in the planning of seismic surveys; establishment and monitoring of a safety zone; prescribed start-up and shut-down procedures, see below)

Components / Activities	Potential Environmental Interactions	Summary of Some Known and Potential Environmental Effects Based on Available Information Sources	Some Standard Mitigation Measures (See Section 5.1.2)
		behavioural reactions to airgun noise ranging from 160 – 188 dB re 1 µPa. Depending on airgun source levels and for spreading, these levels could occur from less than 1 km to dozens of km from the survey location. • A number of studies cite seismic activity as the cause of decreased fish abundance and catches (e.g Skalski et al 1992; Engås et al 1996)., with such effects at times being evident within several kilometres of the sound source and continuing for a day or more after the cessation of seismic activity (Lokkeborg 1991). • Other studies have also shown that catches for some species / gear types (such as gillnet catches of orange rockfish and halibut) have increased during seismic activity whereas others (such as longline catches of haddock) have been observed to decrease (Lokkeborg 2012). • Others studies have suggested, however, that seismic airguns have had little or no such behavioural effects on fish (e.g Andriguetto-Filho et al 2005). • Studies have also investigated potential fish injury, such as damage to hearing structures (e.g. Popper et al 2005) and/or mortality of fish, fish eggs or larvae (e.g. Parry and Gason 2006). • While it is evident that fish often respond to sounds emitted from air guns, little direct physical damage to fish occurs at distances greater than several meters from the source has been documented. Due to the avoidance behaviour of free-swimming fish, they typically do not suffer physical damage from seismic surveys (Gausland 1993). • Indeed, there are no documented cases of fish mortality under exposure to seismic sound under field operating conditions (DFO 2004; Payne 2004) and overall, exposure to seismic sound is considered unlikely to result in direct fish mortality (DFO 2004). • Most such studies have found that stationary fish affected by seismic surveys were located within a few	

Components / Activities	Potential Environmental Interactions	Summary of Some Known and Potential Environmental Effects Based on Available Information Sources	Some Standard Mitigation Measures (See Section 5.1.2)
		metres of airguns, or caged close to the source (see McCauley et al 2003 and Turnpenny and Nedwell 1994 for a review). • The effects of seismic surveys on marine phytoplankton, zooplankton and the planktonic life stages of various marine fish species have also been investigated (see Dalen et al 2007 for a review). Several studies have shown mortality of fish eggs and larvae within several meters of airguns (e.g., Kosheleva 1992, Booman et al 1996), whereas others have investigated or estimated the effect of seismic airguns on plankton (e.g., Davis et al 1998; Gausland 1993). • The timing and location of seismic activity is a key factor in the likelihood and potential degree of effect, as airguns operating in areas and times of strong seasonal stratifications or upwelling may affect more planktonic material because of its higher densities (Boudreau et al 2001). • Other potential implications of seismic activity on fish include chronic effects (e.g., elevation of neurohormones such as adrenaline and cortisol, which often occur in fish under stressful conditions) as well as the potential risk of effects on reproduction (Payne et. al 2008).	
Vessel Traffic	Disturbances, possible avoidance or attraction by marine fish Contamination of fish and/or alteration of their habitats Reduced fish mortality due to presence of safety zone	• Noise generated by vessel traffic can be transmitted through water, causing avoidance by some species. • Physiological and reproductive effects have been reported when fish are continually exposed to noise (Clark et al 1996). • Given the opportunity, fish will generally avoid areas where noise levels exceed their threshold of hearing by 30 dB or more (ICES 1995). • Another possible issue associated with vessel traffic is the potential introduction and spread of aquatic invasive species and resulting habitat degradation (Morris et al 2011).	• Avoidance of sensitive areas and times • Minimize discharges • Compliance with the *Canada Shipping Act* and other relevant regulations

Components / Activities	Potential Environmental Interactions	Summary of Some Known and Potential Environmental Effects Based on Available Information Sources	Some Standard Mitigation Measures (See Section 5.1.2)
EXPLORATION DRILLING AND/OR PRODUCTION (Offshore or Onshore)			
Planned Activities			
Vessel Traffic	Disturbances, possible avoidance or attraction by marine fish Discharges causing contamination of fish and/or their habitats	• See above	• Minimization of vessel traffic volume • Use of existing and common travel routes where possible • Minimize discharges • Compliance with the *Canada Shipping Act* and other relevant regulations • Avoid low-level operations • Minimization of activity
Aircraft Traffic	Disturbances (low flying aircraft)		
Vehicular Traffic	Noise, dust, discharges causing contamination of fish and/or their habitats		
Presence of Structures, Drilling, Lights, Noise, Other Activities and Disturbances (offshore and/or Inshore)	Disturbances, possible avoidance or attraction by fish Discharges causing contamination of fish and/or their habitats Site preparation activities (on-land clearing) causing sedimentation, loss of riparian habitats, etc Increased access to remote areas and associated environmental issues due to human presence Reduced fish mortality due to presence of safety zone	• The presence of a petroleum installation in marine waters will often attract some fish and invertebrate species, which is often referred to as a "reef effect" (Picken and McIntyre 1989; LGL Limited *et al* 2000). Lights from drill units and seismic and support vessels may also attract some species. • Less of a reef effect typically occurs around exploratory drilling units than production rigs, as the amount of subsurface structure is less and the duration of the interaction is much shorter (LGL Limited *et al* 2000). • Noise from marine structures or activities may cause avoidance by some species, with short term and low frequency noises appearing to elicit temporary avoidance due to startling effects with longer-term avoidance of the noise is higher frequency or continuous (Missund et al 1996; Wilson and Dill 2002).	• Avoidance of sensitive areas and times • Use of existing sites and access roads, or minimization of project footprint • Sediment control measures • Site / access rehabilitation following project completion

Components / Activities	Potential Environmental Interactions	Summary of Some Known and Potential Environmental Effects Based on Available Information Sources	Some Standard Mitigation Measures (See Section 5.1.2)
Routine Discharges (sewage, deck drainage, bilge / cooling water, wash fluids, produced water, other waste)	Discharges causing contamination of fish and/or their habitats (water and sediment quality)	• Reviews indicate that the response of the benthic community to drill cuttings discharges can be dependent on the types of drilling fluid used (Netto et al 2008). • The accumulation of drill cuttings can cause reduced abundances and differences in community composition (Schaanning et al 2008; Neff et al 2000). • Water-based muds can affect macrofauna due to, for example associated oxygen enrichment that can initiate a eutrophication response (e.g. Trannum et al 2010). • Biological effects are not normally found beyond about 250-500-m from a drilling platform (Hurley and Ellis 2004; Jorissena et al 2009; Santosa et al 2009), and actual environmental monitoring data from offshore oil developments in the NL Offshore Area have indicated that the actual area of effect has been much smaller than predicted (reviewed in LGL Limited 2005). • A general recovery in terms of abundance, species richness and diversity has been observed for the benthic communities one year after drilling (Husky Energy 2000; Netto et al 2008; Manoukian et al 2010). The rate of recovery will, however, depend on site-specific environmental characteristics and processes, and the associated rate of recruitment and recolonization by the benthic fauna characteristic of the area (Neff et al 2000). • Offshore oil and gas activities may affect deep sea corals through physical damage of the coral or dislodgement of organisms from anchoring and/or mooring of floating vessels, increased turbidity, smothering from drill cuttings, and the release of hydrocarbons into the marine environment (Campbell and Simms 2009)	• Minimization of environmental discharges and emissions and compliance with relevant regulations and standards • Compliance with the *OWTG* • Chemical screening and selection • Use of an oily water separator to process contained deck drainage; collected oil stored and disposed of properly • Appropriate handling, storage, transportation and on-shore disposal of solid and hazardous wastes
Drill Muds and Cuttings Other Seabed and Coastal / On-land Disturbances (excavations, equipment installation)	Contamination, taint, bioaccumulation Decreased water quality Habitat loss / alteration Smothering of benthic communities		• Use of WBMs where possible and technically feasible • Use of non-toxic drilling fluids • Treatment of SBM-associated drill cuttings to compliance with the *OWTG* prior to discharge • Chemical screening and selection • Sediment control measures
Atmospheric Emissions (exhaust, gas venting, flaring)	Particulate deposition on water, associated water quality effects		• Atomize any produced water with hydrocarbons in flare (using high efficiency burners) and/or appropriate treatment and disposal
Well Abandonment	Blasting (noise) effects (if required)	• Should explosives be used during well abandonment, shock waves produced by high explosives may be damaging to fish (Davis et al 1998).	• Use of mechanical separation where possible, including design of well and casings to facilitate this

Components / Activities	Potential Environmental Interactions	Summary of Some Known and Potential Environmental Effects Based on Available Information Sources	Some Standard Mitigation Measures (See Section 5.1.2)
		• The detonation of explosives in or adjacent to fish habitat can cause disturbance, injury and/or death to fish, and/or the alteration, disruption or destruction of their habitats, sometimes at a considerable distance from the point of detonation (Wright and Hopky 1998).	• If blasting is required, appropriate scheduling, setting charges below the sediment surface, minimize amount of explosives used, use of high velocity explosives, minimize number of consecutive blasts per group of detonations, staggering of individual blasts
Unplanned Events			
Accidental Spills of Oil or other Substances - Offshore (surface and subsurface - Onshore (within / near waterbodies)	Contamination, taint, toxicity, bioaccumulation Decreased water quality Habitat alteration	• A great deal of research has been completed regarding the effects of exposure of oil on marine fish and habitat. • These effects depend on a variety of factors, including: the amount and type of oil, environmental conditions, species and life stage, lifestyle, fish condition, degree of confinement of experimental subjects and others (LGL Limited 2005). • Finfish may be affected through direct physical effects (e.g., coating of gills and suffocation) or more subtle physiological effects (e.g., abnormal gill function, decreased growth, or organ damage) (for a review, see LGL Limited 2005). • Recent studies have shown that exposure to oil can affect fish embryo development (Murakamia et al 2008), lower the density of invertebrate populations (Andersen et al 2008), and can cause a notable change in the composition and abundance of the benthic fauna (Pérez del Olmo et al 2007). • Possible behavioural effects on fish include avoidance of the contaminated area or altered natural behaviours related to predator avoidance or feeding (LGL Limited). • Juvenile and adult fish have been known to leave an area after a spill (Roth and Baltz 2009). However, fish may not show avoidance behaviour, depending on such factors as migration impulse or concentrations of toxic components (Rice 1985, cited in LGL Limited et al 2000).	• Spill prevention and design considerations • Preparedness and response procedures • Spill containment around on-shore drill sites

Components / Activities	Potential Environmental Interactions	Summary of Some Known and Potential Environmental Effects Based on Available Information Sources	Some Standard Mitigation Measures (See Section 5.1.2)
		• With regard to the recent Gulf of Mexico spill, complex oceanographic processes have made it difficult to determine the current and future distribution of spilled and dispersant materials from the surface to the sea floor and the duration of their persistence in the marine environment. There is therefore no clear picture yet concerning short- and long-term effects on habitats and marine organisms (McCrea-Strub et al 2011; Liu et al 2011).	

5.1.2 Environmental Mitigation Measures

The following provides an overview of some of the typical mitigation measures that are often required and/or otherwise implemented during offshore petroleum activities to help avoid or reduce adverse environmental effects on fish and fish habitat.

The C-NLOPB's *Geophysical, Geological, Environmental and Geotechnical Program Guidelines* (C-NLOPB 2012) include various requirements and other measures related to environmental planning, mitigation, monitoring and reporting which are intended to help avoid or reduce the potential effects of seismic noise in the marine environment, as well as interactions with other ocean users and other issues. The Guidelines include the *Statement of Canadian Practice with Respect to the Mitigation of Seismic Sound in the Marine Environment* (DFO 2007), which set out a series of mitigation requirements related to these activities, including measures related to the:

- Planning of seismic surveys;
- Establishment and monitoring of a safety zone;
- Prescribed marine mammal observation and detection measures;
- Prescribed start-up procedures; and
- Prescribed shut-down requirements.

Other applicable environmental guidelines and measures for oil and gas activities in the NL Offshore Area, including those related to offshore waste treatment (NEB et al 2010), chemical selection (NEB et al 2009) and others are referenced in Section 3.2.2.3 and are available at C-NLOPB (2013).

These and other standard mitigation measures which are often applied to offshore petroleum activities in the NL Offshore Area are listed below:

- Avoidance of known species at risk and/or sensitive areas and/or times in the planning and conduct of offshore, near-shore or on-land oil and gas activities;

- Reduction of airgun source levels in the design and implementation of offshore seismic programs to the minimum level practical for the survey, including the amount and frequency of energy used and its likely horizontal propagation;

- Establishment of a safety zone around the seismic air source array (with a radius of at least 500 m), which is monitored by a qualified Marine Mammal Observer (or through Passive Acoustic Monitoring in low visibility conditions), with specific protocols regarding observation requirements and times and shut-down as required;

- The use of a gradual "ramp-up" procedure over a minimum 20 minute period to allow mobile marine animals to move away from the area if they are disturbed by the underwater sound levels associated with a seismic survey;

- Shut-down of the seismic sound source(s) during line changes and maintenance activities with associated monitoring and ramp-up provisions;

- Minimizing the amount of associated vessel and aircraft traffic, and the use of existing and common travel routes where possible and the avoidance of low-level aircraft operations;

- Minimizing environmental discharges and emissions from planned operations and activities, including compliance with relevant regulations and standards;

- The installation and use of oil water separators to treat contained deck drainage, with collected oil stored and disposed of properly;

- Selection of non-toxic drilling fluids, including the use of WBMs wherever possible and technically feasible;

- Treatment of operational discharges (such as sewage, deck drainage, bilge / cooling water, wash fluids, produced water, other waste) prior to release in compliance with the *Offshore Waste Treatment Guidelines* and other applicable regulations and standards;

- Appropriate handling, storage, transportation and on-shore disposal of solid and hazardous wastes;

- Water contaminated with hydrocarbons generated during flow testing (within certain tolerances), can be atomized in the flare (using high efficiency burners) or shipped on-shore for disposal;

- Selection and screening of chemicals used in offshore petroleum activities under the *Offshore Chemical Screening Guidelines*;

- Establishment of a berm around on-land drill sites and associated equipment and facilities and other measures to prevent or contain any spilled materials;

- Use of sediment control measures during on-shore, near-shore or on-land construction and operational activities;

- The use of mechanical separation during well completion and abandonment activities where possible, including the proactive design of well structures to facilitate this; and

- Should blasting be required (such as in well abandonment), appropriate scheduling of these activities to avoid sensitive times, as well as setting of charges below the sediment surface, minimizing the amount of explosives utilized the use of high velocity explosives and staggering of individual blasts.

The above list provides some examples of typical environmental protection measures which may be implemented to avoid or reduce adverse effects on fish and fish habitat, as well as referencing a number of relevant compliance standards which may apply to such activities. It should also be noted that the above list is not intended to be necessarily comprehensive or prescriptive, but rather provides a general summary of typical mitigation at a level of detail appropriate for an SEA Update.

Additional and/or refined measures may therefore also be appropriate and required for particular projects, depending on their specific characteristics, location, timing, environmental settings, and possible effects.

Required mitigation measures are therefore determined on a project-specific basis, through the individual regulatory reviews of proposed seismic surveys or exploration drilling programs or production projects in the NL Offshore Area. Indeed, as a result of the rather "project-specific" nature of individual offshore programs and their environmental emissions and effects, the regulatory reviews of proposed drilling programs for example typically include an analysis of possible spill types and probabilities, as well as detailed modelling of drill cutting deposition on the seafloor and the likely fate and behaviour of hypothetical oil spills based on project and site specific factors such as hydrocarbon types and properties, water depths and characteristics, currents and other oceanographic conditions.

Environmental compliance monitoring (including reporting on waste discharges, emissions, and treatment systems) is also required to verify adherence to applicable legislation and any conditions of regulatory approval.

An accidental event or malfunction is an unlikely, although unfortunately possible, occurrence during an offshore petroleum exploration or production project. Environmental incidents which may be associated with offshore drilling programs include potential blowouts (subsea and surface), as well as other possible spills of hydrocarbons or other substances from the drill rig and/or associated vessel activities, which may vary considerably in terms of their nature, scale, duration and potential environmental outcomes.

As indicated previously, the potential for, and possible adverse environmental outcomes of, an accidental oil spill resulting from future petroleum activities in the Western NL Offshore Area was a key concern raised during the consultations undertaken for the SEA Update (Chapter 2 and Appendix A). This included the need to prevent such an incident from occurring in the Gulf of St. Lawrence, as well as ensuring that appropriate procedures and measures are in place to effectively respond to any such accidental event or malfunction should one occur, including the required equipment, expertise and compensation for affected parties. Given the semi-enclosed nature of the Gulf of St. Lawrence and its oceanographic (currents, waves and winds) conditions and processes, there was concern raised that any large spill could reach the coastlines of one or more provinces, with associated adverse environmental and socioeconomic outcomes. There were also questions raised regarding the potential for an effective oil spill response during the winter months when there is ice in the Gulf of St. Lawrence, as well as the likely oil spill response times (and therefore, response effectiveness) given the current lack of regional (Tier 2) spill response equipment and capacity in the Western Newfoundland area at present.

An overview of the current regulatory processes and other requirements that apply to offshore oil and gas activities in the NL Offshore Area was provided in Chapter 3, with associated oil spill prevention and response measures described in Section 3.2.6.3. As noted, the C-NLOPB is also currently completing an overall review of the spill response capability of operators working in areas under its jurisdiction, including the SEA Update Area (C-NLOPB 2013). In the event of increased offshore petroleum activity in the SEA Update Area, other considerations at a regional and strategic level could include, for example: potential pre-deployment of response equipment and materials in Western Newfoundland and/or around the Gulf of St. Lawrence; development of inter-jurisdictional protocols to respond to a major environmental emergency (including response management); inter-jurisdictional waste management coordination; and inter-jurisdictional response exercising.

5.1.3 Environmental Planning Considerations

Marine fish are present in the SEA Update Area throughout the year, with many species moving in and out of the area at different times according to their life histories, habitat preferences and seasonal activities. Available

information on species presence and the overall geographic and seasonal occurrence of marine fish in and near the region is presented in Section 4.2.1.

5.1.3.1 Fish Species at Risk

A number of fish species that are designated as being at risk (and which are formally protected) under the Canadian *Species at Risk Act* (*SARA*) and/or the Newfoundland and Labrador *Endangered Species Act* (*NL ESA*) are known or likely to occur in the SEA Update Area, including several species of wolffish as well as the white shark.

The Northern wolffish has been designated as threatened, given that the number of this large, slow-growing, long-lived, solitary, nest-building fish have declined over 95 percent in recent years, and the number of areas where the fish is found has likewise decreased. Spotted wolffish were also designated for similar reasons, as its populations have declined over 90 percent in three generations, and the number of locations where this species is found has also decreased. Another species, the Atlantic wolffish, was assessed by COSEWIC as being of "special concern", suggesting that it is particularly sensitive to human activities or natural events, but it is not formally designated as protected at this time. Specific threats to these species of wolffish identified by COSEWIC include by-catch mortality in commercial fisheries and habitat alteration by trawling gear. All three wolffish species were reassessed by COSEWIC in 2012 and their recommended statuses have not changed. There is, however, a recovery and management strategy outlined in Kulka et al (2007) to help increase the population levels and distributions of these wolffish species.

Section 4.2.1.5 presents the results of recent DFO surveys that overlap with the SEA Update Area, and which found two wolffish species (Atlantic and Spotted) in the region. Spotted wolffish had relatively high densities throughout much of the SEA Update Area, with the highest distributions from St. George's Bay to north of Rocky Harbour and another area of relatively high density offshore from Port au Choix. The Atlantic wolffish had an even wider range of high density areas covering much of the SEA Update Area, with the only low density areas being at the northern tip and southwestern edge. Although Northern wolffish are rarely seen in the Gulf, it is noteworthy that most of their known occurrences in the region have occurred within the SEA Update Area (Dutil et al 2011).

Although the range of the white shark extends to the Canadian waters of the North Atlantic, it is considered to be quite rare (only 32 records over 132 years for Atlantic Canada; COSEWIC 2006b). Its numbers have been estimated to have declined by about 80 percent over 14 years (less than one generation) in areas of the northwest Atlantic Ocean outside of Canadian waters. This species was assessed in 2006 as being endangered under Schedule 1 of *SARA*, with no update since that time.

Several other species in the SEA Update Area have also been evaluated and designated by COSEWIC, but are not currently protected under *SARA*. In many cases, these species occur in expected habitat zones during some seasons and/or have somewhat predictable migrations. For example, aggregations of a given Atlantic salmon population can occur near natal estuaries when smolt leave rivers for marine migrations (spring) and as adults return for spawning migrations (summer). Other species, such as the American eel, will migrate through the Gulf as larval eels (leptohilia) or glass eels (quite likely by the millions) in the spring and adults will migrate through the area in the fall. Various other COSEWIC-listed species aggregate for migration and spawning (e.g. Atlantic cod) or are restricted to limited areas (e.g. the Bonne Bay population of Acadian redfish).

5.1.3.2 Important Areas and Times for Fish and Fish Habitat

Plankton comprise the largest group of organisms in the ocean, both in terms of diversity and biomass. They play an important role in the marine environment in that they serve as the base layers of most food webs (primary and secondary production). The following events and areas are of particular importance and relevance in the SEA Update Area:

- The spring phytoplankton bloom occurs in the North East Gulf in April-May (Bui et al 2010), and plays a critical role in secondary (zooplankton) and in turn tertiary (fish) production (the lower St. Lawrence Estuary has a spring bloom in June-July, but this is not within close proximity to the SEA Update Area);

- Areas with high meroplankton that are critical to recruitment of key species along the west coast of Newfoundland (EBSA #10), including, for example:

    - An area off of St. George's Bay which has an abundance of cod eggs in the spring (April / June);

    - A coastal area north of the Port au Port Peninsula, which has a large abundance of herring and capelin larvae (May / June); and

    - The central Laurentian region is the main redfish larval zone (Savenkoff et al 2007b) with larval extrusion occurring from April to July.

Benthic organisms are plants and animals that live on or in the seafloor, and comprise the greatest marine species diversity in the Gulf of St. Lawrence (with greater than 1,500 species present) (Dufour and Ouellet 2007). This includes several important commercial fish species such as American lobster, snow crab, Atlantic scallop, blue mussel and northern shrimp. As many benthic invertebrates are relatively immobile, they are at greater risk of being affected by offshore petroleum exploration and production activities, including their direct "footprints" on the ocean floor as well as their various emissions and discharges (planned and accidental).

Deep sea corals are relatively slow growing, long-lived and particularly sensitive to disturbance, through direct disturbance of the seafloor as well as associated increased turbidity or the release of other substances into the water column. As described and illustrated in Section 4.2.1, there are known locations of deep sea corals throughout the SEA Update Area, including aggregations of sea pens off of the southwest corner and just outside the boundaries of the SEA Update Area which are considered important (DFO 2010a).

A wide range of marine finfish species also occur within the SEA Update Area, occupying different habitats at different times throughout the year. A number of areas and times are of particular importance and relevance in the area, including:

- Generally, the shallower regions of the Gulf are more important as habitat during the warm water season. Deep channels and slopes serve as habitat for species year-round but are particularly important in cold water seasons when many finfish species move to these areas for refuge and/or spawning;

- Estuaries are often extremely productive and serve as important feeding, staging and nursery habitat for a variety of vertebrate and invertebrate species. This is especially true of eelgrass beds (*Zostera marina*) which has been designated as an ecologically significant species in Eastern Canada (DFO 2009);

- There are areas in and along the slopes of the Laurentian and Esquiman Channels that are important in the life cycle components of many demersal and pelagic fish in terms of migration, refuge, and feeding (DFO 2007); and

- The particular timing and locations of spawning and sensitive periods for key species (as outlined previously in Chapter 4).

A number of other important locations within the SEA Update Area were identified through the available information (including the 2005 and 2007 SEA Reports) and/or the SEA Update information review and consultation process, including (see text and Figures in Section 4.2.1 for an overview):

- A steep slope area at the northern end of the Esquiman Channel, known locally as the "Hole";

- A slope area close to shore between Bellburns and River of Ponds;

- The area around Ramea - Port aux Basques and east, north to St. George's Bay was identified as an important lobster area;

- Green Point Banks, an inshore area between Trout River and Sally's Cove that is an important area for fish species such as mackerel, lobster, and herring (spawning); and

- Bonne Bay is also a particularly important area from an ecological, scientific and socioeconomic perspective. The bay has an incredible diversity of seaweeds, invertebrates, fish, and other marine life. The Bonne Bay Biological Field Station has also contributed extensively to our knowledge of the Gulf and the North Atlantic in general.

Areas and times that are known to be of particular importance for fish spawning and other aspects of reproduction within the SEA Update Area (based on ecological relevance and as identified through available information sources and/or stakeholder input) include:

- The Cape St. George area has spawning of cod (April through June) and spring spawning herring (May and June);

- The coastal area north of the Port au Port Peninsula has a large abundance of herring and capelin larvae (May and June);

- There are several capelin spawning beaches along the west coast including: Trout River, Beach south of Baker's Brook, Sandy Cove Bay, Port au Choix, Port Saunders, River of Ponds, Bellburns, Meadows, John's Beach, Ship Cove (June / July);

- There are several herring spawning grounds along the west coast including spring spawning locations in the May-June period (e.g St. George's Bay, Green Point, Bay of Islands, Port au Port Bay, Sally's Cove) and fall locations in July-September (e.g St. John Bay, Ingornachoix Bay);

- The Laurentian Channel sees Greenland halibut spawning in the January through March period;

- The slope regions of the Laurentian Channel and the Esquiman Channel are thought to see wolffish spawning from approximately October through December; and

- Important lobster areas in the region include areas off Ramea, Port aux Basques and east, north to St. George's Bay, and identified lobster spawning areas from Outer Port au Port to Shag Bay, as well as near Shoal Point, Outer Bay of Islands (just above North Head) and Trout River Bay (May through July).

There are also various other important areas used in the life cycles of pelagic and demersal fish within the SEA Update Area. In general, many species use the entire Esquiman Channel (including the Cabot Strait Escarpment) as their principal migration corridor (cod, redfish) and refuge area (capelin, herring) in the Gulf (DFO 2007). Specific areas of importance regarding migration routes and critical life stages of fish that are within or near the SEA Update Area include:

- Atlantic cod populations that overlap the area are found in shallow waters in summer (0 – 50 m) and move to deeper waters in winter, going through the Cabot Strait and off of Newfoundland's south coast. They return to shallower waters again in June;

- Atlantic salmon that move through the both the Strait of Belle Isle and Cabot Strait in early summer into the Gulf and return in summer to spawn in freshwater;

- Atlantic mackerel migrate into the Gulf through the Cabot Strait in late spring / summer, particularly towards the Magdalen Shallows, and migrate out of the Gulf in the fall; and

- There are summer feeding grounds for pelagic species (herring, capelin, barracudina, spiny dogfish, silver hake, and pollock) at the head of the Esquiman Channel in the vicinity of the Port au Port Peninsula.

The ecosystem in the Gulf of St. Lawrence is dynamic. Although there is still some disagreement to the extent that fishing activity (Frank 2005; Frank et al 2006) or changes in water temperatures (Sainte-Marie et al 1996, Mowbray 2002, Chabot et al 2008, McQuinn 2009, Benoit et al 2012) have caused these changes, it is generally agreed that there has been a trophic shift over the last 30 years that may not yet be stabilized, and consequently, the ecosystem may have somewhat less of a buffering capacity to potential stressors (Dufour and Ouellet 2007, Benoit et al 2012). Climate change has a compounding effect on the marine fish community with climate driven shifts in the presence, abundance and distribution of marine fish species throughout the region (Benoit and Swain 2008, Benoit et al 2012). Aquatic invasive species are also an area of general concern for the region, with coastal areas being particularly vulnerable to the introduction (and effects) of such species.

5.1.4 Cumulative Environmental Effects

Fish and fish habitat in the SEA Update Area and in the larger Gulf of St. Lawrence have been and may also be affected by a wide variety of other natural and anthropogenic factors and processes, including past and future fishing activity, general vessel traffic and other human activities, as well as effects of climate change and other processes. The widespread and migratory nature of many species also increases the potential for fish populations to be affected by multiple (unrelated) perturbations, and therefore, for cumulative environmental effects to occur.

Offshore oil and gas activities may affect fish and fish habitat through direct and indirect influences. This includes possible injury, mortality or behavioural effects due to noise or other disturbances in the marine environment, possible contamination resulting from routine activities (discharges) or unplanned and accidental events (oil spills), and through the alteration of marine habitats.

Information on the specific nature and spatial and temporal distribution of potential offshore exploration (seismic and drilling) activities and possible production projects in the SEA Update Area and their environmental effects is not currently available. As indicated earlier, it is assumed that there could be a certain number of wells drilled in the region during the period of any future licences as well as several seismic surveys conducted annually over the next few years in the region. This anticipated level of exploration in the area and the relatively short-term nature of these individual actions will likely mean that seismic surveys and drilling programs (and possibly, any development projects) will likely be separated enough in space and time that cumulative effects between them are unlikely to occur. This will, of course, depend on the eventual intensity and spatial and temporal distribution of these activities and their respective environmental effects and their zones of influence. Although seismic activities would likely be conducted sequentially rather than concurrently, the often spatially extensive nature of these surveys (especially in the case of 2D), increases the potential for interactions between the effects of individual programs and/or with other disturbances in the marine environment. In addition, good sound propagation may occur in portions of the SEA Update Area (especially the deeper channel areas). The environmental emissions and discharges associated with drilling programs are typically restricted to a fairly focussed zone of influence around the rig itself, and these are therefore unlikely to overlap in space or time.

The nature, magnitude and spatial and temporal distribution of any environmental effects from planned seismic and drilling projects would have to be assessed and evaluated through project-specific modelling and analyses as part of individual EA reviews. Avoiding or reducing such overlap between offshore petroleum projects and/or with other unrelated activities in the Gulf (and therefore, any resulting cumulative effects) can therefore be considered in planning and reviewing any individual projects and activities as they are defined and proposed.

5.1.5 Information Availability and Requirements

The marine ecosystem of the SEA Update Area and the larger Gulf of St. Lawrence is dynamic and complex, with environmental conditions occurring and changing in particular areas and over time, through various natural and/or anthropogenic processes and influences. The marine biota within these systems are linked to one another and their habitats, resulting in a somewhat complex system of inter-relationships and evolving characteristics. Further influenced by human activities such as fishing and a changing climate, the marine biota have been subject to considerable, ecosystem-wide changes (trophic cascades) in recent years (Savenkoff et al 2007a).

Although the Gulf of St. Lawrence is a relatively well studied marine area, and at a regional scale some of its ecosystem components are reasonably well understood, the work to date has focussed primarily on marine species of social and/or commercial interest. There are several areas within the Gulf in which there is limited information on critical elements of the food chain such as zooplankton (Locke 2002; DFO 2007). There is also a lack of research on the bacterioplankton community, despite the fact that in some areas the heterotrophic food web is largely based on bacterial production (Dufour and Ouellet 2007). Other important marine taxa, such as deep sea corals and Atlantic salmon, have unique life histories and occupy habitats that often make their study somewhat challenging, leading to relatively less available information and understanding. Also, the life history and spawning times of the three wolffish species in the Gulf remain somewhat unclear, and there is limited information on the distribution of some important fish and invertebrate eggs and larvae. At the ecosystem level, scientists are beginning to understand and identify the changes and interactions in the Gulf food web (i.e. trophic shift away from large groundfish). The overall stability of the new regime is not entirely known, however, especially as environmental conditions (especially climate change) continue to act on this ecosystem (Benoit and Swain 2008). Existing and available information, knowledge and understanding regarding fish and their habitats in the SEA Update Area and adjacent environments is therefore both impressive and, inevitably, incomplete.

A lack of specific information and knowledge regarding the distribution and behaviours of some species (in the Gulf of St. Lawrence and in general) has been identified as a challenge. This, along with an incomplete understanding of the specific effects of certain activities and disturbances (such as seismic energy) on marine animals was identified as a data gap in the original SEA for the Western NL Offshore Area (LGL Limited 2005), and as indicated in Table 5.1, there remain various areas of on-going uncertainty around some issues and therefore, a need for further research and evaluation.

Although the application of many of the mitigation measures outlined earlier has become standard practice in the conduct of oil and gas exploration and/or development projects in the NL Offshore Area in recent years (either voluntarily or as conditions of associated regulatory approvals), the overall effectiveness of certain measures for particular effects and/or circumstances is not always clear, and this subject has not been the subject of a great deal of follow-up study. While, for example, the use of ramp-up procedures and other measures are routinely implemented and/or required (and indeed, have been formalized by regulatory agencies through codes of practice or other directives), there are questions around the effectiveness, or required nature, of such procedures, and it has been noted that this has yet to be confirmed empirically (Compton et al 2008; DFO 2004, 2010). As a result, it has been stated that “the effectiveness of all potential mitigation measures needs to be explored and documented more fully” (DFO 2004: 14).

As indicated above, some key environmental characteristics and trends for the SEA Update Area have been identified and highlighted, which are appropriate for an SEA level of analysis. This information would also be relevant to the planning and review of any future petroleum exploration activities in the region, which may also require additional and location-specific environmental information and analyses.

5.2 Water Birds (including Species at Risk)

A number of bird species occur in the SEA Update Area and adjacent marine and coastal environments, including seabirds, waterfowl, shorebirds, and other bird species that inhabit the region at specific or extended periods for nesting, breeding, feeding, migration and other activities (Section 4.2.2). Several important areas and habitats have also been identified at locations along the coastline of Western Newfoundland and elsewhere in the Gulf of St. Lawrence.

5.2.1 Potential Environmental Interactions and Effects

The key potential environmental interactions between offshore petroleum activities and Water Birds include the following:

- The attraction of night-flying birds to oil and gas exploration or production installations and vessels (offshore or on-shore), including their lights, flares or other emissions, resulting in possible injury or mortality (strikes, incineration, disorientation, energy expenditure);

- Bird attraction or disturbance resulting from other activities and equipment associated with offshore or on-land oil and gas activities (such as drill rigs, containment structures, etc) and possible injury or mortality;

- Disturbance to birds and their activities as a result of vessel, aircraft and/or vehicular movements, as well as through the presence of offshore and/or on-shore structures and activities and their associated disturbances (lights, noise, land clearing, etc);

- Possible injury of birds as a result of exposure to noise within the water column during seismic exploration activities (particularly diving birds) or other resulting disruptions to and changes in their feeding and other behaviours;

- Changes in the availability, distribution and/or quality of feed sources or habitats (water surface, coastal areas) for Water Birds as a result of petroleum activities and their environmental effects; and

- Changes in the presence, abundance, distribution and/or health of Water Birds (individuals and populations) as a result of exposure to accidental oil spills from installations or vessels, which may affect individuals (physical exposure, ingestion) and important habitats (including offshore, coastal and on-land areas).

Table 5.2 provides a summary overview of the key potential environmental interactions between Water Birds and various types of petroleum activities, as well as some examples of existing information and knowledge from the literature and other sources on each of these potential effects. Again, a more detailed review and discussion of such information is provided in the initial SEA Report (LGL Limited 2005), and has been reported in other sources.

Table 5.2 Water Birds (Including Species at Risk): Summary of Potential Environmental Interactions and Effects

Components / Activities	Potential Environmental Interactions	Summary of Some Known and Potential Environmental Effects Based on Available Information Sources	Some Standard Mitigation Measures (See Section 5.2.2)
SEISMIC SURVEYS			
Air Gun Operations	Possible effects to some diving bird species (injury, other disturbance)	• There is relatively little research that has investigated the effects of seismic activity on water birds. • A number of past studies found no evidence of negative effects on various bird species resulting from seismic sound sources (Turnpenny and Nedwell 1994; Lacroix et al 2003). • Previous research has also indicated no evidence that seabirds were attracted to or repelled by seismic activity (Evans et al 1993).	• Avoidance of known and observed bird colonies and significant aggregations of avifauna • Adherence to the C-NLOPB's *Geophysical, Geological, Environmental and Geotechnical Program Guidelines*, which include various requirements and other measures related to environmental planning, mitigation, monitoring and reporting
Vessel Traffic	Attraction and disturbance	• The possible effects of marine vessel traffic on water birds include: behavioural changes that may have energetic consequences (Schummer and Eddleman 2003), and a loss of suitable habitat as vessel traffic can reduce bird use of vessel disturbed areas (Bramford et al 1990).	• Avoidance of known and observed bird colonies and significant aggregations of avifauna • Minimizing the amount and adjusting the duration and frequency of lighting used • Protocols for the collection and release of birds that become stranded • Minimize discharges, and compliance with the *Canada Shipping Act* and other relevant regulations
EXPLORATION DRILLING AND/OR PRODUCTION (Offshore or Onshore)			
Planned Activities			
Vessel Traffic	Attraction and disturbance	• See above	• Avoidance of known and observed bird colonies and significant aggregations of avifauna • Minimizing the amount and adjusting the duration and frequency of lighting used • Protocols for the collection and release

Components / Activities	Potential Environmental Interactions	Summary of Some Known and Potential Environmental Effects Based on Available Information Sources	Some Standard Mitigation Measures (See Section 5.2.2)
			of birds that become stranded • Minimization of vessel traffic volume • Use of existing and common travel routes where possible • Minimize discharges, and compliance with the *Canada Shipping Act* and other relevant regulations
Aircraft Traffic	Disturbance	• Possible disturbance effects of aircraft overflights on birds include: temporary loss of useable habitat, increased energy expenditure of birds due to escape reactions, lower food intake due to interruptions and other interactions (Ellis et al 1991; Komenda-Zehnder et al 2003).	• Minimization of activity • Avoid low-level operations • Avoidance of sensitive areas and times
Vehicular Traffic	Mortality, noise, dust, discharges causing contamination,		
Presence of Structures, Drilling, Lights, Noise, Other Activities and Disturbances (offshore, inshore, on-shore)	Attraction and disturbance / disorientation, potential injury or mortality (marine, coastal and terrestrial avifauna) Site preparation activities (on-land clearing) causing loss of habitats Increased access to remote areas and associated environmental issues due to human presence	• Birds that are attracted to oil and gas installations may experience mortality due to direct collisions with equipment and infrastructure or by coming into contact with flares or other components. • Although there is a known association of birds with oil platforms (Baird 1990; Wiesse and Montevecchi 2000), the nature, degree, timing and extent of any associated mortality is generally unknown (Montevecchi et al 1999). • Other health effects may also occur due to altered behaviours (disorientation), which can lead to energy consumption, delayed foraging or migration, increased susceptibility to predation, and others (Wiesse et al 2001; Jones and Francis 2003).	• Minimizing the amount and adjusting the duration and frequency of lighting used • Protocols for the collection and release of birds that become stranded • Use of existing sites and access roads, or minimization of project footprint • Site / access rehabilitation following project completion
Routine Discharges (sewage, deck drainage, bilge / cooling water,	Bird health / mortality issues Effects on prey species	• Operational discharges such as sheens of crude oil and other substances may alter the feather weight and microstructure of pelagic seabirds (O'Hara and Morandin 2010).	• Minimization of environmental discharges and emissions and compliance with relevant regulations and standards

Components / Activities	Potential Environmental Interactions	Summary of Some Known and Potential Environmental Effects Based on Available Information Sources	Some Standard Mitigation Measures (See Section 5.2.2)
wash fluids, produced water, other waste)	Habitat loss or alteration	• As underwater discharges, such as drill cuttings, typically do not form sheens on the water surface, they often do not interact directly with water birds. • Any effects to the fish species upon which these avifauna depend may also indirectly affect birds (see Table 5.1).	• Compliance with the *OWTG* • Chemical screening and selection • Use of an oily water separator to process contained deck drainage; collected oil stored and disposed of properly • Appropriate handling, storage, transportation and on-shore disposal of solid and hazardous wastes
Drill Muds and Cuttings Other Seabed and Coastal / On-land Disturbances (excavations, equipment installation)			• Use of WBMs where possible and technically feasible • Use of non-toxic drilling fluids • Treatment of SBM-associated drill cuttings to compliance with the OWTG prior to discharge • Sediment control measures
Atmospheric Emissions (exhaust, gas venting, flaring)			• Chemical screening and selection • Avoid or minimize flaring, use of high efficiency burners and/or treatment and on-shore disposal
Well Abandonment	Effects of blasting (if required) Possible effects on prey species		• Use of mechanical separation where possible, including design of well and casings to facilitate this • If required, appropriate scheduling of blasting, setting charges below the sediment, minimize amount of explosives used, use of high velocity explosives, minimize number of consecutive blasts per group of detonations, staggering of individual blasts

Components / Activities	Potential Environmental Interactions	Summary of Some Known and Potential Environmental Effects Based on Available Information Sources	Some Standard Mitigation Measures (See Section 5.2.2)
Unplanned Events			
Accidental Spills of Oil or other Substances - Offshore (surface and subsurface - Onshore (within / near waterbodies or other habitats)	Bird mortality and health effects Habitat quality and availability Possible effects on prey species	• Water birds are amongst the most at risk from oil spills and blowouts, as they spend much of their time upon the surface of the ocean (LGL Limited 2005). In the event of a spill coastal birds may also be at risk on beaches and in intertidal zones. • An accidental release of hydrocarbons can result in the direct physical exposure of birds to oil within the affected area. • The possible physical effects oil exposure on birds include changes in thermoregulatory capability (hypothermia) and buoyancy (drowning) due to feather matting (Clark 1984; Hartung 1995; Montevecchi et al 1999), as well as oil ingestion from excessive preening (Hartung 1995). • Ingested oil can cause lethal and sublethal effects (McEwan and Whitehead 1980); including damage to the liver (Khan and Ryan 1991), pneumonia (Hartung and Hunt 1966), brain damage (Lawler et al 1978), and starvation due to increased energy needs to compensate for heat loss resulting from oiling and loss of insulation (Peakall et al 1980; 1982; MMS 2001). • The likely effects of oil exposure on birds varies between species, as well as with different types of oil (Gorsline et al 1981), weather conditions, times of year, migratory patterns and other activities (Wiese et al 2001; Montevecchi et al 2012). • There is apparently no direct relationship between the volume of oil spilled and bird mortality, but rather it is primarily the timing and location of a spill that influences mortality rates (Weisse et al 2001). • Nesting seabirds that survive oil exposure often exhibit decreased reproductive success (LGL 2005), although oiled birds treated quickly have reduced risk (Barham et al 2007).	• Spill prevention and design considerations • Preparedness and response procedures • Spill containment around on-shore drill sites

Components / Activities	Potential Environmental Interactions	Summary of Some Known and Potential Environmental Effects Based on Available Information Sources	Some Standard Mitigation Measures (See Section 5.2.2)
		• Cleaned birds have also been shown to survive at almost the same rate as unoiled birds (Altwegg et al 2008), although cleaning oil birds is not considered to be a preferred overall mitigation given that many or most oiled birds are never captured or cleaned. • The available literature states that direct, long-term sublethal toxic effects on birds are unlikely (Hartung 1995), and even spills of high magnitude may not always have material long-term effects on seabird populations (Clark 1984; Wiens 1995).	

5.2.2 Environmental Mitigation Measures

Some of the standard mitigation measures that are often implemented in relation to offshore petroleum activities to help avoid or reduce potential environmental effects to birds include:

- The avoidance of known and observed bird colonies and significant aggregations of avifauna in the planning and conduct of oil and gas activities, as well as identified critical habitats and protected or sensitive areas and times;

- Minimizing the amount and adjusting the duration and frequency of lighting used, particularly when migratory birds are especially vulnerable to disturbance and associated effects (e.g., during spring and fall migration, inclement weather);

- Programs and protocols for the collection and release of Water Birds that become stranded on offshore installations (including associated regulatory guidance and permit requirements);

- Avoiding or minimizing flaring, and the use of high efficiency burners;

- Minimizing the amount of associated vessel and aircraft traffic, and the use of existing and common travel routes where possible;

- Avoidance of low-level aircraft operations wherever possible and feasible;

- Minimizing environmental discharges and emissions from planned operations and activities, including compliance with relevant regulations and standards;

- The installation and use of oil water separators to treat contained deck drainage, with collected oil stored and disposed of properly;

- Treatment of operational discharges prior to release in compliance with the *Offshore Waste Treatment Guidelines* and other applicable regulations and standards;

- Selection and screening of chemicals used in offshore petroleum activities under the *Offshore Chemical Screening Guidelines;*

- Use of sediment control measures during on-shore, near-shore or on-land construction and operational activities;

- Establishment of a berm around on-shore drill sites and equipment and other measures to prevent or contain any spilled materials; and

- Oil spill prevention plans and procedures, with associated and effective spill preparedness and response plans in place.

Additional environmental protection measures may also be required for particular projects, depending on their specific characteristics, location, timing and possible environmental effects. Mitigation measures are therefore determined on a project-specific basis, through the individual regulatory reviews of proposed seismic surveys or drilling programs in the NL Offshore Area. The regulatory review of proposed drilling programs also typically include an analysis of possible oil spill types and probabilities, as well as detailed modelling of the likely fate and behaviour of hypothetical oil spills based on project and site specific factors such as hydrocarbon types and properties, water depths and characteristics, currents and other oceanographic conditions. Environmental compliance monitoring (including reporting on waste discharges, emissions, and treatment systems) is also required to verify adherence to applicable legislation and any conditions of regulatory approval. In the unlikely event of a spill or blowout, an operational oil spill contingency plan would be activated. A post-spill environmental effects monitoring (EEM) program may be a specific component of any such response plan.

5.2.3 Environmental Planning Considerations

Water Birds are present in the SEA Update Area throughout the year, with many species moving in and out of the area at different times according to their particular characteristics, habitat preferences and seasonal activities. Existing and available information on the presence and geographic and seasonal occurrence of birds in and near the region is presented in Section 4.2.2

5.2.3.1 Water Bird Species at Risk

Several bird species that are currently or soon likely to be designated as being at risk (and which are therefore protected) under the Canadian *Species at Risk Act* (SARA) and/or the Newfoundland and Labrador *Endangered Species Act* (NL ESA) are known or likely to occur in the SEA Update Area. These include the: 1) Piping Plover; 2) Harlequin Duck; 3) Barrow's Goldeneye; 4) Ivory Gull; 5) Red Knot (rufa subspecies); 6) Buff-breasted Sandpiper; 7) Peregrine Falcon; 8) Short-eared Owl; and 9) Bank Swallow. Four of these avifauna species (the Piping Plover, Harlequin Duck, Short-eared Owl and Bank Swallow), are known to breed in coastal habitats in Western Newfoundland. Available information on the likely presence and known spatial and temporal distribution of these species was provided earlier and is again summarized below:

- *Piping Plover*: Designated as endangered under *SARA* and the *NL ESA*, the Recovery Plan for this species identifies a number of critical habitat beaches, including sites in the southern and southwestern part of the SEA Update Area, notably the Grand Bay West to Cheeseman Provincial Park IBA and Shallow Bay and Western Brook Beach in the Gros Morne IBA (Parks Canada 2012d; Environment Canada 2012b). The Piping Plover is present in the breeding grounds from April to September. As well, the Piping Plover nests on the Îles-de-la-Madeleine, where approximately 40 pairs are present each year. Québec provincial authorities have identified critical habitats for this species which will be legally protected under the provincial Co*nservation et mise en valeur de la faune* act in the near future.

- *Harlequin Duck*: The Eastern Population of this species is designated as being of special concern under *SARA*, and is considered vulnerable under the *NL ESA*. The Harlequin Duck breeds in fast-flowing streams, including several watercourses in Gros Morne National Park (Stassinu Stantec 2010), and occurs in coastal waters during both spring and fall staging at the mouths of nesting streams in the SEA Update Area. In late summer to fall, a moulting concentration of approximately 30 individuals congregates at Stearin Island, the largest of only three such sites in Newfoundland (Parks Canada

2012d). In the winter, they are found along rocky coastline, subtidal ledges, and exposed headlands (NLDEC 2012a).

- *Barrow's Goldeneye*: Designated as being of special concern and vulnerable under the *SARA* and *NL ESA*, respectively, the species moults and winters in small numbers (often in groups with the Common Goldeneye), off the coast of Eastern Canada. It has been reported in Western Newfoundland at Stephenville Crossing and at the mouth of the Humber River (Schmelzer 2006), regularly winters in Rocky Harbour, and has also been observed in small numbers at Portland Creek, Shallow Bay / Cow Head, St. Paul's Bay, Western Brook Beach, Norris Point and Corner Brook (Parks Canada 2012d). These birds are known to congregate in relatively small geographic areas in key shipping corridors, and therefore the population is considered to be particularly vulnerable to oil spills and the bioacculmulation of other environmental contaminants (NLDEC 2012a).

- *Ivory Gull*: This species is currently designated as endangered under both the federal and provincial legislation. It winters offshore, occurring in small numbers in the Strait of Belle Isle and northern Gulf of St. Lawrence. They are found most often amongst pack ice, and are more rarely seen on the coast of the Northern Peninsula and ashore (Stenhouse 2004; NLDEC 2012a).

- *Red Knot (rufa subspecies):* This species has been sighted in various coastal Newfoundland locations. On the west coast of the Island, the majority of sightings have been at Stephenville Crossing, Shallow Bay (Belldowns Point), Sandy Point and St. Paul's Inlet (Garland and Thomas 2009; Parks Canada 2012d), although they have also been observed in small numbers at Western Brook Beach and in Rocky Harbour (Parks Canada 2012d). During fall migration, from mid-August through late September, they frequent open sandy inlets, coastal mudflats, sand flats, salt marshes, sandy estuaries and areas with rotting kelp deposits (Garland and Thomas 2009; NLDEC 2012a). Newfoundland is not considered to be a major stopover location, and so the species is not likely to be significantly affected by activities in the area (Garland and Thomas 2009).

- *Buff-breasted Sandpiper*: This species was recently designated as a species of special concern by COSEWIC (2012), and is not yet listed on Schedule 1. During fall migration surveys, small numbers of this species were observed by Parks Canada personnel in salt marshes at Tickle Point in St. Paul's Bay in 1994, 2010 and 2012 (Parks Canada 2012d).

- *Peregrine Falcon*: Designated as a species of Special Concern under *SARA* (both anatum and tundrius subspecies) and vulnerable under *NL ESA*, this species migrates along the west coast of Newfoundland during the fall and preys on concentrations of migrating shorebirds, including in the Gros Morne area at St. Paul's Bay and Western Brook Beach (Parks Canada 2012d).

- *Short-eared Owl*: This species, designated as being of special concern under *SARA* and vulnerable under *NL ESA*, occurs in low numbers on the west coast of Newfoundland where it typically nests in coastal barrens and grasslands, including in the Gros Morne area at Cow Head. Short-eared Owls have been observed hunting in dunegrass at Shallow Bay, Tickle Point (St. Paul's Bay) and Western Brook Beach (Parks Canada 2012d).

- *Bank Swallow*: This species, currently under assessment by COSEWIC (report expected in April 2013), nests on the west coast of Newfoundland in burrows constructed in steep banks. Colonies are found near Tickle Point and Parson's Pond (Parks Canada 2012d).

The Bald Eagle, designated in Québec as vulnerable, is also somewhat common along coastal Newfoundland. They feed primarily on large fish taken from the near water surface with their strong talons.

Two additional marine avifauna species at risk in Eastern Canada, the Roseate Tern and the Eskimo Curlew, are not considered likely to occur in the SEA Update Area. Within North America, the Roseate Tern breeds in southern Nova Scotia and northeastern United States, and winters further south (Gochfeld et al 1998). The Eskimo Curlew once bred in large numbers in the Arctic and passed through Newfoundland and Labrador on its migration to its South American wintering grounds in the fall. Its numbers have declined sharply, however, and there have been no confirmed sightings of the species since 1963, leading some to suspect that the species is possibly extinct (COSEWIC 2009).

In terms of other regionally rare species, the Black-headed Gull, previously a strictly European species, has very recently started to expand its breeding range into North America. Small breeding colonies at Flat Bay Island / Sandy Point and at Stephenville Crossing are, therefore, important to the North American population of the species. Black-legged Kittiwakes, while abundant in eastern and northeastern Newfoundland, are restricted to just five colonies in western Newfoundland, all in the Port-au-Port area. The enriched coastal marshes of Flat Bay Island / Sandy Point and Stephenville Crossing areas also provide the only known nesting areas in Newfoundland for Willet, Sora and Great Blue Heron. Caspian Terns are also believed to nest at Stephenville Crossing and in Gros Morne National Park (IBA 2012; Parks Canada 2012d).

5.2.3.2 Important Areas and Times for Water Birds

Areas that are considered to be of particular importance to one or more bird species may be identified as IBAs, of which there are four located in the SEA Update Area (IBA 2012):

1) Codroy Valley (NF040);

2) Codroy Valley Estuary (NF041);

3) Grand Bay West to Cheeseman Provincial Park (NF038); and

4) Gros Morne National Park (NF045).

Breeding sites for colonial species and species at risk also constitute important habitats. Section 4.2.2.7 also identified and illustrates the locations of known seabird colonies in and adjacent to the SEA Update Area.

Critical habitat for breeding Piping Plovers in Newfoundland has also been identified, and recommendations for conservation and management of this habitat have been made to the federal Piping Plover Recovery Team as well as to the provincial government. Amirault (2005) identified various sites in or near the SEA Update Area that meet the criteria for critical Piping Plover habitat, including Stephenville Crossing, Sandy Point / Flat Bay Island, Flat Bay Peninsula, Searston, Codroy, East of Windsor Point, J.T. Cheeseman Provincial Park, Jerret Point-Windsor Point, Big Barachois, Bottle's Barachois and Rocky Barachois Bight. The federal recovery strategy for the

Piping Plover (Environment Canada 2012b) identifies several critical habitat beaches in Western Newfoundland and elsewhere in the Gulf.

Gros Morne National Park is of particular importance to birds. Off Shallow Bay / Cow Head, for example, a large number of seabird species nest on Stearin Island and Belldowns Island including Common, Arctic and Caspian Terns, Common Eider, Black-legged Kittiwake, large gulls and cormorants (Parks Canada 2012d; Lock et al 1994). Harlequin Ducks breed in rivers in the Park, and Stearin Island is an important moulting area for the species. Relatively large aggregations of shorebirds and waterfowl occur during migration in St. Paul's Inlet and at Shallow Bay, and shorebird aggregations also occur at Shallow Bay and Western Brook Beach during the fall migration. Piping Plovers were reported breeding in the Park, for the first time in over 30 years, in 2009 (NLDEC 2012a). There is currently one designated Piping Plover critical habitat beach in the park (Shallow Bay), and a second (Western Brook Beach) will soon be designated. In the winter, the waters off Gros Morne National Park are important to winter waterfowl, particularly the Common Goldeneye and American Black Duck.

The Sandy Point / Flat Bay Islands areas have been considered for special protection for their importance to birds, particularly for providing habitat for several breeding pairs of Piping Plovers comprising approximately a third of the Newfoundland population. A notable abundance and diversity of shorebirds has been recorded in this area. Indeed, in 2005 four hectares on Sandy Point were acquired by the Nature Conservancy of Canada. The area is an important migration stopover for a number of waterfowl species, including American Wigeon, American Black Duck, Green-winged Teal, Red-breasted Merganser, Northern Pintail, Greater Scaup, White-winged Scoter and Common Goldeneye. Sandy Point is one of only two known colonies of breeding Willets in Newfoundland.

The Stephenville Crossing area is home to breeding Piping Plovers, Willets and Black-headed Gulls, and it is believed that small numbers of Caspian Terns also nest there. Other species nesting in this area that are not known to nest elsewhere in Newfoundland include Sora and Great Blue Heron. Rare birds are at times reported at Stephenville Crossing, including a much publicized 2005 sighting of a Western Reef Heron, native to West Africa. Stephenville Crossing supports a relatively rich series of intertidal flats and marshes that are considered unique within insular Newfoundland, and the area supports some of the largest concentrations of migrating shorebirds in the province.

Overall, the greatest concentration of pelagic seabirds in the SEA Update Area occurs in the winter months and through the breeding season. During winter, Arctic-nesting species including Northern Fulmar, Glaucous Gull, Black-legged Kittiwake, Thick-billed Murre and Dovekie move southward into Newfoundland waters, while many summer residents move offshore but stay relatively close to their breeding grounds. During the summer breeding season, the greatest abundance of seabirds is concentrated around nesting colonies (Lock et al 1994).

Seabirds are relatively long-lived, and many species do not breed until four or five years of age. Large groups of non-breeding immature birds tend to congregate in waters close to the breeding grounds and offshore. Large aggregations of alcids may include individuals from both Québec North Shore and Newfoundland colonies. In addition to resident breeders, Southern Hemisphere seabirds such as Greater Shearwater, Sooty Shearwater, and Wilson's Storm-Petrel spend their winter in waters of the Northern Hemisphere, although only a small portion of these populations occur in the SEA Update Area.

Waterfowl breeding periods in coastal and estuarine environments, particularly for the colonial Common Eider, occur and are vulnerable times during the summer months. In the fall staging period and in the winter, species

such as eiders, scoters and mergansers can be found in relatively large numbers in coastal waters. The endangered Harlequin Duck and small numbers of Barrow's Goldeneye may be found in coastal waters outside of the breeding season. Nationally important concentrations of Canada Goose utilize parts of the Codroy Valley Estuary for staging grounds. Upwards of 500 Canada Geese are also present in St. Paul's Bay in Gros Morne National Park during staging each fall; although not nationally significant by CWS standards (i.e. > 1% of the population) this is nevertheless one of the most important staging sites in Newfoundland (Parks Canada 2012d).

Many species of shorebirds, including the endangered Red Knot, utilize a variety of coastal habitats including sandy mudflats, saltmarshes and river outlets in Western Newfoundland during their southward migration, along with various high tide roost sites; peak abundance occurs in July to October. In the breeding season, a small number of shorebird species, including the endangered Piping Plover, nest on sandy beaches and estuaries in the SEA Update Area. During the winter months, Purple Sandpipers feed on rocky shorelines and offshore ledges and islands; a flock of 200 individuals was recently observed in Gros Morne National Park.

In summary, the overall presence and abundance of Water Birds in the offshore environment is relatively low in the SEA Update Area as compared to other marine areas off Newfoundland and Labrador and elsewhere. As indicated, there are, however, a number of species at risk that are known to occur in the region, as well as various key areas and times for marine avifauna, and the area is of particular importance to migratory shorebirds, which are more abundant along the west coast of Newfoundland than elsewhere in the province.

Of particular concern in relation to planned and routine oil and gas activities, bright exterior lights and/or substation lights can attract night-migrating birds and night-flying seabirds (e.g. storm-petrels) and possibly result in injuries or death to migratory birds. Particularly sensitive times for potential effects on migratory birds include the spring (April 1st to June 1st) and fall (July 15th to October 30th) migration periods, as well as during specific meteorological conditions such as fog or inclement weather.

The main possible effects of offshore petroleum activities on Water Birds are associated with potential accidental oil spills, with the actual effects of any such oil spill being dependent on factors such as the time of year, sea conditions, the volume and type of material spilled, and type of spill (i.e., surface or sub-surface). Direct effects would occur if birds are in the immediate area and come into contact with the spill and its zone of influence. As described previously, the particular species present in the region varies considerably according to season. The effects of an accidental oil spill on pelagic birds could be considerable within the zone of influence of a spill, however, and these species are likely most vulnerable to oil spills as they spend considerable time on the surface of the water. These species occur in the area primarily in the winter period, when low temperatures may also slow down degradation or weathering of spilled oil and/or when oil spill response procedures would likely be most challenging. Appropriate and adequate oil spill prevention, preparedness and response plans by individual operators are therefore required, to help ensure that the likelihood, and likely effects, of any such accidental events are minimized.

Potential environmental effects may therefore be addressed through project-specific planning and associated regulatory processes, to seek to avoid sensitive areas and times and through the identification and implementation of project and activity-specific environmental protection (mitigation) and emergency response measures.

5.2.4 Cumulative Environmental Effects

Potential effects to Water Birds as a result of planned and routine offshore exploration and production activities relate primarily to disturbances from the lights and noise associated with the presence of offshore drilling and production platforms and associated vessel and aircraft traffic. The anticipated level of possible (and predictable) future petroleum activity in the SEA Update Area and the relatively short-term nature of any individual exploration projects will likely mean that seismic surveys and drilling programs (and possibly, any development projects) will likely be separated enough in space and time that cumulative effects between them are unlikely to occur. This will, of course, depend on the eventual intensity and spatial and temporal distribution of these activities, however, and avoiding or reducing such overlap and resulting cumulative effects can be considered in planning and reviewing individual projects and activities as they are defined and proposed.

The distribution, abundance and health of Water Birds and their populations may be influenced by both natural phenomena such as weather, food availability and oceanographic variation, as well as anthropogenic activities and their associated disturbances such as hunting, fishing activity, vessel traffic, offshore structures and pollution. Vessel movements associated with fishing activity and general marine traffic throughout the region, as well as previous offshore exploration, may have, to varying degrees, affected bird populations in the SEA Update Area. Hunting activity, both legal and illegal, also puts pressure on some bird populations. In addition to these local disturbances, migratory bird species may also be affected by a range of activities and associated effects within their often very extensive ranges, including hunting, pesticides and other pollution. The widespread and migratory nature of many bird species also therefore increases the potential for avifauna populations to be affected by multiple perturbations, and therefore, for cumulative environmental effects to occur.

5.2.5 Information Availability and Requirements

Although detailed information on the occurrence, abundance and distribution of Water Birds and particular species is not available for all locations and times throughout the SEA Update Area, some overall environmental characteristics and trends can be identified and highlighted which are appropriate for an SEA level of analysis and which would be relevant to the planning and conduct of any future petroleum activities in the region.

Overall, however, there continues to be a relatively limited amount of specific and up to date information available on the number and spatial and temporal distribution of avifauna offshore Newfoundland and Labrador and elsewhere in Eastern Canada. This is particularly the case for Western Newfoundland, where much of the available data were obtained through ship-based surveys conducted over 25 years ago (Brown et al 1975; Brown 1986), and may therefore not always represent the current conditions of species distribution, abundance and seasonality (Lock et al 1994).

As noted previously, the CWS has recently reinvigorated efforts to monitor eastern seabird species at sea, including in the Gulf of St. Lawrence. The ECSAS monitoring program is ongoing, and the Working Group is in the process of developing a publically available interactive online Atlas of seabird density and distribution that will provide more up-to-date information on the status of Water Birds in the region.
Operators may also develop and implement operational monitoring programs during offshore programs, which have included bird monitoring during exploration activities off Newfoundland and Labrador. CWS has developed a pelagic seabird monitoring protocol (Gjerdrum et al 2012) that is recommended for use by trained and experienced observers on all offshore projects. A guide to the pelagic seabirds of Atlantic Canada is also

available for assistance in identifying these avifauna. A report on any such seabird monitoring program and its results is submitted to the C-NLOPB within one year after its completion.

Any and all information gathered through such observations would, over time, also contribute to an expanded information and knowledge base regarding the presence, abundance and spatial and temporal distribution of Water Birds in the SEA Update Area.

5.3 Marine Mammals and Sea Turtles (including Species at Risk)

A number of marine mammal species are known or likely to occur within the SEA Update Area and in adjacent marine and coastal regions. These include various mysticetes (baleen whales), odontocetes (toothed whales and porpoises) and pinnipeds (seals) as well as several sea turtles. These species vary considerably in their likelihood of presence and occurrence (from common, to very rare, to possible but unlikely), as well as the particular areas and habitat types that they utilize and the times at which they occur in or pass through the region.

Given the relatively rarity of many of these species, and because several are protected under species at risk legislation in Canada and elsewhere, the presence and distribution of marine mammals and sea turtles in and near the area is also an important consideration in future planning and decision-making regarding potential future offshore petroleum activities in the region.

5.3.1 Potential Environmental Interactions and Effects

The main potential environmental interactions between offshore petroleum activities and marine mammals and sea turtles relate primarily to the underwater noises that are associated with seismic surveys, exploration drilling and production activities, and include the following:

- The avoidance of certain areas that would otherwise be used by the individuals affected, with these behavioural changes altering the presence, abundance and overall distribution of marine mammal and sea turtles and their movements, feeding and other activity. (This is of particular concern if any areas that are avoided are particularly important or rare, and/or are disturbed repeatedly);

- The possible attraction of individuals to offshore installations and vessels (seismic and supply), resulting in increased potential for injury or mortality through collisions, contamination or other interactions;

- Interference with (and the masking of) sounds within the marine environment that originate from and/or are used by marine mammals, such as in communication between individuals, the identification and detection of prey, reproduction, echolocation and other activities and requirements;

- Temporary hearing impairment or permanent injury or mortality from extremely loud and instantaneous sounds, such as those that may be experienced in close proximity to a seismic airgun or at the site of an underwater explosion;

- Potential changes in the availability, distribution or quality of feed sources and/or habitats for marine mammals and sea turtles as a result of petroleum activities and their planned and routine environmental emissions (including seismic, drilling or other activities); and

- Changes in the presence, abundance, distribution and/or health (injury or mortality) of marine mammals and sea turtles as a result of accidental oil spills from oil and gas installations or vessels (through physical exposure, ingestion, effects on prey and habitats, etc).

Table 5.3 provides a summary overview of some of the key potential environmental interactions between marine mammals and sea turtles and various types of offshore petroleum activities and components, as well as referencing some examples of existing information and knowledge that is provided through the literature. Again, a more detailed review of such information is provided in the initial SEA Report (LGL Limited 2005) and in other sources.

Table 5.3 Marine Mammals and Sea Turtles (Including Species at Risk): Summary of Potential Environmental Interactions and Effects

Components / Activities	Potential Environmental Interactions	Summary of Some Known and Potential Environmental Effects Based on Available Information Sources	Some Standard Mitigation Measures (See Section 5.3.2)
SEISMIC SURVEYS			
Air Gun Operations	Injury or mortality Behavioural effects, including possible avoidance or attraction Interference with vocal communication and other underwater sounds and their uses	• Of the various activities that may be associated with oil and gas exploration and development, seismic surveys are often considered to have the highest potential for effects on marine mammals and sea turtles. • The possible effects on this VEC resulting from sound in the marine environment due to offshore seismic surveys may be physical (injury or mortality) or behavioural (avoidance, other changes in distribution or activities) in nature. • Temporary threshold shift (TTS) is hearing deterioration due to prolonged or repeated exposure to high levels of noise and can last from minutes or hours to days, depending upon such factors as the receptor involved and the level and duration of noise exposure (Richardson et al 1995; Davis et al 1998). Permanent hearing impairment may also occur in some instances. • Although a relatively limited number of studies have investigated this issue (e.g., Finneran et al 2000, 2002, 2010; Southall et al 2007; Lucke et al 2009; Gedamke et al 2011), specific TSS thresholds for marine mammals and sea turtles are not currently known, including both the sound levels required to cause such injury as well as the distances at which these may be produced for particular air gun noise levels and oceanographic conditions. • Studies of the potential distances within which TSS in marine mammals may occur during seismic surveys have cited distances from less than 100 m from the sound source (Ridgway et al 1997), to several hundred meters (as described in LGL Limited 2005) to 1 km or more (Gedamke	• Avoidance of sensitive areas and times, including known and observed marine mammal concentrations • Minimization of airgun source level and use of “ramp up” procedures • On-board monitoring for marine mammals and sea turtles, with established protocols for avoiding or reducing interactions if animals are observed • Adherence to the C-NLOPB’s *Geophysical, Geological, Environmental and Geotechnical Program Guidelines*, which include various requirements and other measures related to environmental planning, mitigation, monitoring and reporting. • Adherence to the associated *Statement of Canadian Practice with respect to the Mitigation of Seismic Sound in the Marine Environment (*such as in the planning of seismic surveys; establishment and monitoring of a safety zone; prescribed start-up and shut-down procedures, see below)

Components / Activities	Potential Environmental Interactions	Summary of Some Known and Potential Environmental Effects Based on Available Information Sources	Some Standard Mitigation Measures (See Section 5.3.2)
		et al 2011). • Potential non-injury related effects from seismic activity are behavioural in nature, and would occur when animals are disturbed or confused by seismic noise, or where the sounds which animals used are interfered with (communications, prey, etc). Indirect effects could also arise from the displacement of prey. • The observed behavioural effects of anthropogenic noise sources on marine mammals include: changes in vocalizations (Parks et al 2007; Holt et al 2009; Miller et al 2000, 2009; Di Iorio and Clark 2010); and respiration, swim speed, diving, and foraging behaviour (Stone and Tasker 2006); displacement and avoidance (Castellote et al 2012, Weir 2008); shifts in migration paths, stress and immune depression (Romano et al 2004; Rao et al 2012) and strandings (Gentry 2000; Malakoff 2002; Weilgart 2007). • Responses to seismic activity are known to be highly variable between species, age classes, behavioural states and environmental conditions (Weilgart 2007; Miller et al 2009), and generalizations about marine mammal behavioural reactions are difficult to make as they can vary greatly depending on various factors (Wood et al 2012). • Whales have often been shown to avoid operating airguns but avoidance radii are quite variable (as reviewed by LGL Limited 2005). Some recent studies have, however, shown avoidance or other disturbances (e.g., decreased vocalizations) occurring in relation to lower noise levels, and/or at greater distances and times that those previously reported, in some cases up to several hundred kilometres and well after the	

Components / Activities	Potential Environmental Interactions	Summary of Some Known and Potential Environmental Effects Based on Available Information Sources	Some Standard Mitigation Measures (See Section 5.3.2)
		survey was completed (Nieukirk et al 2004; Nieukirk et al 2012; Risch et al 2012; Castellote et al 2012). Wood et al (2012) for example, describe relatively high levels of behavioural reactions to seismic noise at relatively low intensity (e.g., 120−140 dB re: 1 µPa rms). • The overall reduction and degradation of marine acoustic habitat as a result of anthropogenic noise in the marine environment has also been raise as a concern, particularly for low-frequency specialists such as baleen whales (Clark et al 2009). • Of particular concern is the potential for marine mammals disturbance associated with seismic surveys to interfere with species at risk and other rare species and small populations, particularly any associated disruption of animal movements, communication or other activities during key periods such as reproduction which may affect population recovery (Croll et al 2002; Beauchamp et al 2009). • Pinnipeds (seals) have been observed to exhibit reactions to seismic surveys and other anthropogenic noise, although any such disturbance is typically localized and short-term if it occurs at all (Richardson et al 1995). • Studies have also shown that sea turtles may show a strong initial avoidance response to air-gun operations (O'Hara and Wilcox 1990; McCauley et al 2000a) and temporary hearing loss has also been reported in some instances (Moein et al 1994).	
Vessel Traffic	Injury or mortality (collision) Behavioural effects, including possible	• Shipping is likely the main source of anthropogenic noise in the marine environment (Wright et al 2007) and masking has been identified as the primary auditory effect of vessel noise on marine animals (Southall 2005).	• Minimization of vessel traffic volume • Use of existing and common travel routes where possible

Components / Activities	Potential Environmental Interactions	Summary of Some Known and Potential Environmental Effects Based on Available Information Sources	Some Standard Mitigation Measures (See Section 5.3.2)
	avoidance or attraction Interference with vocal communication and other underwater sounds and their uses	• The reactions of cetaceans to ships may be avoidance, approach, or indifference (Richardson et al 1995), as well as other behavioural effects such as changes in vocalizations (Clark et al 2009). • Although cetacean species are susceptible to mortality or injury from vessel collisions (Williams and O'Hara 2010), they can often habituate to ships following a consistent course or which are frequently present in the area (Richardson et al 1995). • Vessel traffic and associated low frequency noise can be a source of chronic stress for marine mammal populations (Rolland et al 2012; Rao et al 2012).	• Avoidance of sensitive areas and times • Minimize discharges • Compliance with the *Canada Shipping Act* and other relevant regulations
EXPLORATION DRILLING AND/OR PRODUCTION (Offshore or Onshore)			
Planned Activities			
Vessel Traffic	Injury or mortality (collision) Behavioural effects, including possible avoidance or attraction	• See above for vessel traffic • Marine mammal reactions to aircraft are variable due to differences in aircraft type, altitude, and flight pattern (e.g., straight-line overflight, circling, or hovering). • Possible responses include: diving immediately, changing movement patterns, leaving the area or no change at all (Richardson et al 1995).	• See above
Aircraft Traffic	Possible avoidance or attraction (behavioural effects)		• Minimization of activity • Avoid low-level operations
Vehicular Traffic	Noise, dust, discharges causing contamination		
Presence of Structures, Drilling, Lights, Noise, Other Activities and Disturbances (offshore and/or Inshore)	Possible avoidance or attraction (behavioural effects) Interference with vocal communication and other underwater sounds and their uses	• Marine mammals have been observed to both move away from and toward offshore drill rigs, and this has been found to vary between different species and types of drilling installations (Richardson et al 1995; LGL Limited et al 2000). • These changes may range from tens of meters to	• Avoidance of sensitive areas and times, including known and observed marine mammal concentrations

Components / Activities	Potential Environmental Interactions	Summary of Some Known and Potential Environmental Effects Based on Available Information Sources	Some Standard Mitigation Measures (See Section 5.3.2)
Routine Discharges (sewage, deck drainage, bilge / cooling water, wash fluids, produced water, other waste)	Possible effects on marine mammal and sea turtle health (contamination of individuals, habitats) Effects on food sources	several kilometres, but is considered highly reversible with animals expected to return to an area once the noise source is removed (Davis et al 1998).	• Minimization of environmental discharges and emissions and compliance with relevant regulations and standards • Compliance with the OWTG • Chemical screening and selection • Use of an oily water separator to process contained deck drainage; collected oil stored and disposed of properly • Appropriate handling, storage, transportation and on-shore disposal of solid and hazardous wastes
Drill Muds and Cuttings Other Seabed and Coastal / On-land Disturbances (excavations, equipment installation)	Possible effects on marine mammal and sea turtle health (contamination of individuals, habitats) Effects on habitats and food sources		• Use of WBMs where possible and technically feasible • Use of non-toxic drilling fluids • Treatment of SBM-associated drill cuttings to compliance with the *OWTG* prior to discharge • Sediment control measures
Atmospheric Emissions (exhaust, gas venting, flaring)	Possible effects on marine mammal and sea turtle health (contamination of individuals, habitats) Effects on food sources		• Atomize any produced water with hydrocarbons in flare (using high efficiency burners) and/or appropriate treatment and disposal
Well Abandonment	Possible avoidance or attraction Injury or mortality	• The detonation of explosives may be lethal to marine mammals, may cause auditory damage under certain conditions, and has also been demonstrated to induce changes in behaviour (Ketten 1995; Wright and Hopky 1998; Morton and Symonds 2002).	• Use of mechanical separation where possible, including design of well and casings to facilitate this • If blasting is required, appropriate scheduling, setting charges below the

Components / Activities	Potential Environmental Interactions	Summary of Some Known and Potential Environmental Effects Based on Available Information Sources	Some Standard Mitigation Measures (See Section 5.3.2)
			sediment surface, minimize amount of explosives used, use of high velocity explosives, minimize number of consecutive blasts per group of detonations, staggering of individual blasts
Unplanned Events			
Accidental Spills of Oil or other Substances - Offshore (surface and subsurface)	Possible effects on marine mammal and sea turtle health (contamination of individuals, habitats) Effects on food sources	• Oil spills may affect marine mammals and sea turtles through direct exposure and associated health effects, as well as by changing the availability and quality of their food sources and habitats. • Marine mammals and sea turtles will likely avoid or move out of areas affect by oil spills, and have been observed to detect and thus avoid spills (Matkin et al 1994; Smultea and Würsig 1995). • When marine mammals have come into contact with oil, effects on their skin appear to be minor and of little relevance to the animal's overall health (Geraci 1990). Additionally, ingestion and inhalation of oil have been found to involve only trace amounts (Bence and Burns 1995). • Exposure to oil through ingestion or dermal contact is considered to be harmful and possibly fatal to sea turtles (Howard 2012). • Although some studies indicate that no clear evidence exists to link oil spills with mortality of cetaceans (Geraci 1990, Dahlheim and Matkin 1994), others report that the long-term effects of oil exposure include an inability for marine mammals to rebound to pre-spill numbers (Matkin et al 2008; Monson et al 2011). • It has been estimated, for example, that more than 5,000 individuals died as a result of the *Deepwater Horizon* incident in the Gulf of Mexico (Gero et al 2011).	• Preparedness and response procedures • Spill prevention and design considerations • Spill containment around on-shore drill sites

5.3.2 Environmental Mitigation Measures

The following section provides an overview of some of the typical mitigation measures that are often required and/or otherwise implemented during offshore petroleum activities to help avoid or reduce adverse environmental effects on marine mammals and sea turtles.

As described in Section 5.1, the C-NLOPB's *Geophysical, Geological, Environmental and Geotechnical Program Guidelines* (C-NLOPB 2012) include various requirements and other measures related to environmental planning, mitigation, monitoring and reporting which are intended to help avoid or reduce the potential effects of seismic noise in the marine environment, as well as interactions with other ocean users and marine mammal and bird monitoring and reporting. These Guidelines include the *Statement of Canadian Practice with Respect to the Mitigation of Seismic Sound in the Marine Environment* (DFO 2007), which set out a series of mitigation requirements related to these activities, including measures related to the: planning of seismic surveys; establishment and monitoring of a safety zone; prescribed marine mammal observation and detection measures; prescribed start-up procedures; and prescribed shut-down requirements.

These and other standard mitigation measures which are often applied to offshore petroleum activities in the NL Offshore Area to help avoid or reduce effects on marine mammals and sea turtles include:

- Avoidance of known and observed marine mammal concentrations in the planning and conduct of offshore petroleum activities;

- Reduction of airgun source levels in the design and implementation of offshore seismic programs to the minimum level practical for the survey, including the amount and frequency of energy used and its likely horizontal propagation;

- Establishment of a safety zone around the seismic air source array (with a radius of at least 500 m), which is monitored by a qualified Marine Mammal Observer (or through Passive Acoustic Monitoring in low visibility conditions) and specific protocols regarding observation requirements and times and shut-down as required;

- The use of a gradual "ramp-up" procedure over a minimum 20 minute period to allow mobile marine animals to move away from the area if they are disturbed by the underwater sound levels associated with a seismic survey;

- Shut-down of the seismic sound source(s) during line changes and maintenance activities with associated monitoring and ramp up provisions;

- Minimizing the amount of associated vessel and aircraft traffic and the use of existing and common travel routes where possible;

- Avoidance of low-level aircraft operations wherever possible and feasible;

- Minimizing environmental discharges and emissions from planned operations and activities, including compliance with relevant regulations and standards;

- The installation and use of oil water separators to treat contained deck drainage, with collected oil stored and disposed of properly;

- Selection of non-toxic drilling fluids, including the use of water-based muds wherever possible and technically feasible;

- Treatment of operational discharges prior to release in compliance with the *Offshore Waste Treatment Guidelines* and other applicable regulations and standards;

- Appropriate handling, storage, transportation and on-shore disposal of solid and hazardous wastes;

- Water contaminated with hydrocarbons generated during flow testing (within certain tolerances), can be atomization in the flare (using high efficiency burners) or shipped on-shore for disposal;

- Selection and screening of chemicals used in offshore petroleum activities under the *Offshore Chemical Screening Guidelines*;

- Establishment of a berm around on-shore drill sites and other facilities and other measures to prevent or contain any spilled materials;

- The use of mechanical separation during well completion and abandonment activities where possible, including the design of well and casings to facilitate this;

- Should blasting be required (such as in well abandonment), appropriate scheduling these activities, as well as marine mammal surveillance and the delay of detonation until observed marine mammals are away from the area. Setting of charges below the sediment surface, minimizing amount of explosives used , the use of high velocity explosives, and staggering of individual blasts; and

- Oil spill prevention plans and procedures, with associated and effective spill preparedness and response plans in place.

The above list provides some examples of typical environmental protection measures which may be implemented to avoid or reduce adverse effects on this VEC, as well as referencing a number of relevant compliance standards which may apply to such activities. Required environmental protection measures are determined on a project-specific basis, through the individual regulatory reviews of proposed seismic surveys or exploration drilling programs or production projects in the NL Offshore Area. These regulatory reviews often include a requirement for project-specific analysis of possible spill types and probabilities and detailed modelling of the likely fate and behaviour of hypothetical oil spills based on project and site specific factors. Environmental compliance monitoring (including reporting on waste discharges, emissions, and treatment systems) is also required to verify adherence to applicable legislation and any conditions of regulatory approval. In the unlikely event of a spill or blowout, an operational oil spill contingency plan would be activated. A post-spill EEM program may be a specific aspect of any such response plan.

5.3.3 Environmental Planning Considerations

Marine mammals and sea turtles are present in the SEA Update Area throughout the year, with many species utilizing and moving into and out of the area for various activities at different periods. Available information on the known geographic and seasonal occurrence of these species in and near the region is presented in Section 4.2.3.

5.3.3.1 Marine Mammal and Sea Turtle Species at Risk

A total of six federally listed marine mammal species at risk (Blue Whale - Atlantic Population; North Atlantic Right Whale; Northern Bottlenose Whale - Scotian Shelf Population; Beluga Whale - St. Lawrence Estuary Population; Fin Whale - Atlantic Population; and Harbour Porpoise - Northwest Atlantic Population) and one listed sea turtle (Leatherback - Atlantic Population) are known to occur in the SEA Update Area.

Two additional species that may occur in the SEA Update Area, the Killer Whale (Northwest Atlantic and Eastern Arctic populations) and Loggerhead Sea Turtle (Atlantic Ocean Population), are listed by COSEWIC.

5.3.3.2 Important Areas and Times for Marine Mammals and Sea Turtles

The Gulf of St. Lawrence has long been recognized as an area of particular significance to marine mammals (Lesage et al 2007). In 2006, efforts were made by DFO to identify and designate selected areas within the Gulf that are of ecological and biological significance to marine life (DFO 2007). As part of this effort, areas of ecological importance to marine mammals within the Gulf were identified by Lesage et al (2007). These were described in greater detail in Section 4.2.3.

One such identified area is the Western Shelf of Newfoundland (Lesage et al 2007), which extends from the Cabot Strait in the south to the Esquiman Channel in the north and covers mostly coastal waters. Water temperatures in this area are typically slightly above freezing, and the ice cover period for the area is therefore minimal. The area is significant for marine mammals, with areas of high uniqueness, concentration and adaptive values. The most important sections of the area are located in the northern margin (near the Strait of Belle Isle), and the south of the area at St. Georges Bay. The latter provides a potentially significant feeding area for many species, including the Blue Whale, divers and krill eating species, which utilize the ice-free water over much of the year (DFO 2007; Lesage et al 2007).

In the northern part of the SEA Update Area, the Strait of Belle Isle is also considered to be particularly important for marine mammals, with the associated uniqueness, concentration and adaptive value for marine mammals considered to be at their maximum in this region (Lesage et al 2007; DFO 2007). Throughout the Northwest Atlantic, the Strait of Belle Isle is unparalleled in terms of the number of piscivorous marine mammals present, and large cetaceans are found in high numbers (DFO 2007). The local bathymetry of the Strait results in large concentrations of zooplankton, which provide excellent feeding conditions for many species of marine mammals. It is also the only area known to be frequented by Killer Whales in the Gulf of St. Lawrence, and supports the largest numbers of Humpback Whales in the Gulf. Endangered Blue Whales are also believed to congregate here in relatively large numbers (Lesage et al 2007).

The ice-free months are the most important period for most marine mammal and sea turtle species in the SEA Update Area. In the northern part of the region, at the Strait of Belle Isle, at least 13 marine mammal species occur more or less regularly (Lesage et al 2007), whereas during the rest of the year, only three species (Fin Whale and Harp and Hooded Seals) occur regularly. At St. Georges Bay, Blue Whales and Killer Whales may use the area during the winter months, while nine species may be found there in the ice free months (Lesage et al 2007). The southern Gulf shelf is considered important to pinnipeds (Grey, Hooded and Harp Seals) during the ice-covered period, as it provides an important whelping and breeding area for these species.

Sea turtles are highly migratory and occur infrequently in the overall region, and they are not found in the Gulf of St. Lawrence during the winter months.

In summary, the above sections provide information on marine mammals and sea turtles within and near the SEA Update Area that will be relevant to future planning and decision-making related to offshore oil and gas activities in the region. Clearly the region is inhabited by marine mammals and sea turtles at various times of the year, a number of which are considered to be at risk, with species moving in and out of the area utilizing its marine environment for various activities at different periods. Several areas within the SEA Update Area have also been identified as being of overall ecological and biological significance for various reasons, including their use by and importance for marine mammals as noted by DFO (2007) and Lesage et al (2007).

The presence of these species, location and times should be considered in planning, proposing, reviewing and implementing any future oil and gas exploration projects and activities in the SEA Update Area. This, in combination with the general mitigation measures outlined above, including in particular the implementation of project specific marine mammals monitoring activities and avoidance protocols, will help to avoid or reduce any potential direct interactions with, and effects on, these species during individual projects. Project-specific planning and associated regulatory processes may therefore address potential environmental effects, through the identification and implementation of project and activity-specific mitigation and monitoring measures.

5.3.4 Cumulative Environmental Effects

The potential effects of oil and gas exploration structures and activities on marine mammals and sea turtles relate primarily to noise. As a result of existing marine activities in the SEA Update Area (e.g., fishing vessels, general marine traffic) and naturally occurring sounds, the region's underwater environment is currently quite noisy.

The anticipated level of any future exploration in the SEA Update Area, and the likely spatial and temporal distribution and short term nature of such projects, would limit the potential for interaction between the effects of these relatively isolated and intermittent sources of noise. Seismic activities would also likely be conducted sequentially rather than concurrently, although again the often spatially extensive nature of these geophysical surveys (especially in the case of 2D), increases the potential for interactions between the effects of individual programs. In addition, good sound propagation may occur in portions of the SEA Update Area (especially the deeper channel areas), which would have to be assessed and evaluated through project-specific analyses. The additional noise created as a result of one or more future seismic surveys and drilling programs will, however, add to overall underwater noise levels in the region.

Based on previous studies, most potential effects to marine mammals and sea turtles as a result of seismic surveys and drilling programs occur within relatively close proximity to the noise source. Avoidance of an area

by marine mammals or other effects as a result of a single project would likely therefore be somewhat localized (meters or kilometers) and temporary in nature. An area may not, however, be reoccupied if intense activity occurs concurrently and/or continues repeatedly over the long-term, and any such disturbance is of particular concern if it involves species at risk, important and rare habitats, and/or disrupts animal movements, communication or other activities during key periods such as reproduction. Any future petroleum production activity in the region would create a longer-term source of noise and other potential disturbances.

Any potential for cumulative effects will, therefore, depend on the eventual intensity and spatial and temporal distribution (and duration) of any future oil and gas related activities in the region. Avoiding or reducing such overlap can be considered in planning and reviewing individual projects and activities as they are defined and proposed.

Marine mammals and sea turtles may also be affected by natural factors and processes, as well as the disturbances which may be associated with other types of human activities in the marine environment. These include general vessel traffic and commercial fishing activity, which may result in effects due to entrapment and entanglement in fishing gear, collisions with marine vessels, and through pollution and other environmental effects. The widespread and migratory nature of marine mammals and sea turtles increases the potential for individuals and populations to be affected by multiple environmental disturbances, and therefore, for cumulative environmental effects to occur.

5.3.5 Information Availability and Requirements

For the purposes of the SEA Update and the scale of its associated analysis, there is existing and available information on the occurrence and distribution of marine mammals and sea turtles in the region which will be relevant to future licencing decisions, as well as to the planning and conduct of any future petroleum activities. Much of this information is, however, quite regional and somewhat general in nature. A lack of specific information and knowledge regarding biologically essential behaviour for marine mammals (in the Gulf of St. Lawrence and in general) and associated areas and times has been identified as an issue. This, along with an incomplete understanding of the specific effects of certain activities and disturbances (such as seismic energy) on marine animals was identified as a data gap in the original SEA for the Western NL Offshore Area (LGL Limited 2005), and as there remain various areas of on-going uncertainty around some issues and therefore, a need for further research and evaluation.

As noted previously in Section 5.1, although the application of several of the mitigative measures outlined above has become somewhat standard in the approval and conduct of oil and gas exploration and/or development projects in the NL Offshore Area, the overall effectiveness of particular measures for certain effects and in specific circumstances is not always clear. Some such measures have not been the subject of a great deal of scientific study or follow-up, and it has been noted, for example, that the effectiveness of 500 m marine mammal safety zones and ramp up procedures as mitigation has yet to be confirmed empirically (Compton et al 2008; DFO 2004, 2010). Although the 500 m safety zone radius, for example, is common in Canadian, US and UK jurisdictions as it is the distance at which cetaceans may be reliably observed (JNCC 2004), some studies have documented behavioural disturbances up to several kilometres away (see Table 5.3). In addition, environmental factors can often reduce the effectiveness of marine mammal observers, including light and sea-state conditions and the presence of precipitation or fog (Harwood and Joynt 2009; Moulton et al 2009). Moreover, the usefulness of Passive Acoustic Monitoring for marine mammals is considered to be limited to those species that are known to vocalize and to spend much time below the water surface (e.g., dolphins, sperm whales, northern

bottlenose whales) (DFO 2007, 2010). As a result, there have been calls for the effectiveness of all such mitigation measures to be further evaluated and documented (DFO 2004).

Operators may also develop and implement operational monitoring programs during offshore programs, which have included marine mammal monitoring during exploration activities off Newfoundland and Labrador. Marine mammal monitoring and reporting protocols are outlined in Environmental Studies Research Fund (ESRF) Report #156 (2004), and a report on any such monitoring program and its results is submitted to the C-NLOPB within one year of its completion.

Any past, on-going and future operational monitoring programs for marine mammals and sea turtles will, over time, contribute to the overall knowledge base regarding the presence, abundance and spatial and temporal distribution of these species in the SEA Update Area. The use of qualified and experienced marine mammal observers and procedures will further increase the quality and utility of the resulting information. Given the considerable scientific and stakeholder interest in these species, other government and industry-funded research programs may also consider focussing on marine mammals and sea turtles in the general region in the future (e.g., those conducted through the ESRF, the Panel on Energy Research and Development (PERD), or Petroleum Research Newfoundland and Labrador (PRNL)).

5.4 Protected and Sensitive Areas

A number of marine and coastal areas within the SEA Update Area have been designated as protected under provincial, federal and/or other legislation and processes, due to their ecological, historical and/or socio-cultural characteristics and importance. This is also the case for various other locations throughout the larger Gulf of St. Lawrence. These areas were identified, mapped and described in Section 4.2.4, and the potential for interactions with and effects on them resulting from future oil and gas activities in the Western NL Offshore Area are given particular attention in the SEA Update.

This VEC focuses primarily on marine and coastal areas that have existing and formal designations as being protected, as well as any other particularly important and sensitive locations that have been identified from a societal perspective through the available information and/or the consultation processes carried out for the SEA Update. It also includes general consideration of other sites and areas that are important and/or particularly relevant to the potential interaction of offshore petroleum activities with the human environment, including communities and other areas which are used and/or valued by people.

Areas that have been identified as being particularly important or sensitive from an ecological perspective (such as fish spawning areas, bird colonies, etc) or for fishing activity have been considered and assessed integrally within the Fish and Fish Habitat, Water Birds, Marine Mammals and Sea Turtles and/or Marine Fisheries VECs themselves.

5.4.1 Potential Environmental Interactions and Effects

Environmental interactions between offshore petroleum activities and protected and sensitive areas may again be both direct and indirect in nature and cause. The conduct of oil and gas exploration activities directly within or near such areas may, for example, have adverse implications for these locations and their important and defining ecological and socio-cultural characteristics and integrity. These interactions may occur through the possible presence of equipment, personnel and activities in the area as well as the associated noise, visual

intrusions, and routine emissions and resulting disturbances that may occur in nearby environments. Any resulting decrease in the real or perceived integrity or value of these sites in the short or long term may also affect their value, enjoyment and thus visitation levels. This may, in turn, have important implications for the communities and economies that depend on these areas and their associated tourism activities and recreational opportunities.

Any biophysical effects resulting from offshore, inshore or on-land oil and gas or other human activities may also "spread" to adjacent protected and sensitive areas in the SEA Update Area or elsewhere in the Gulf of St. Lawrence by affecting the marine fish, birds, mammals or other environmental components that move to and through the area. Although unlikely to occur, any large oil spill in the marine environment may, depending upon its magnitude, location and oceanographic conditions, also extend to other areas and coastlines in the region, potentially affecting protected areas and their associated environmental components and characteristics.

Hydraulic fracturing (also at times referred to as "fracking") is a stimulation process that may be performed on oil and gas wells, which involves pumping high pressure fluid down the well to create a network of fractures in the reservoir rock. This establishes a series of pathways that allow the hydrocarbons to move more freely from the rock pores to the wellbore. The potential for hydraulic fracturing activities in the SEA Update Area was a subject of some considerable interest and discussion during the 2012 SEA Update consultations. The primary questions and environmental issues raised included the potential for hydrocarbons and/or the chemicals used in fracturing to reach and contaminate groundwater sources (including public drinking water sources). Questions have also been raised about the amount and sources of water used, as well as the potential for chemical spills into the environment and for local geological movements to occur during fracturing activities.

The potential for, and proactive management of, any potential interactions between on-going and possible offshore oil and gas activities and protected and sensitive areas in the region and beyond is therefore a key consideration in future planning and decision-making offshore petroleum activities in the region.

5.4.2 Environmental Mitigation Measures

Potential restrictions or other measures may be taken to help reduce the potential for negative effects resulting from oil and gas activities and any nearby protected or sensitive locations. A number of standard environmental protection measures and procedures are typically used in the NL Offshore Area to avoid or reduce the possible adverse effects of offshore oil and gas activities on the marine (biophysical) environment, including both planned activities and potential accidental events. These have been listed and described in previous sections, and their implementation would also serve to help address any associated effects on adjacent protected and sensitive areas. These and/or other required mitigation measures would be determined on a project-specific basis, through the individual regulatory reviews of proposed exploration (seismic or drilling) and/or production projects.

With particular reference to hydraulic fracturing, on-going discussion and debate around the use of this technology worldwide has resulted in numerous news stories, publications and films on the subject (Beckwith 2010). Although the potential issues and perceived risks associated with hydraulic fracturing have been looked at from a variety of perspectives, most concerns relate to the possible contamination and use of water resources (Rahm and Riha 2012; Hatzenbuhler and Centner 2012). Research conducted on the five pathways of possible water contamination (transportation spills, well casing leaks, leaks through fractured rock, drilling site discharge, and wastewater disposal), found that the potential contamination risk associated with hydraulic fracturing

wastewater disposal was higher than for other pathways (Rozell and Reaven 2012). A recent study, however, found no evidence of contamination of drinking-water due to fracturing fluids (Osborn et al 2011), although others have also stated that there is currently a lack of information to make generalizations or conclusions on the lack of such effects (Saba and Orzechowski 2011). Ongoing water quality monitoring and analysis during fracturing programs will continue to provide additional information and insights on this issue. The United States Environmental Protection Agency is currently conducting a study to better understand the effects of hydraulic fracturing on drinking water and ground water, which is expected to be released for public review in 2014 (USEPA 2012). The Province of Nova Scotia is also currently undertaking an extensive review of the potential environmental effects of hydraulic fracturing during onshore petroleum exploration, which they also plan to release in 2014 (Government of Nova Scotia 2012).

Hydraulic fracturing has recently been proposed in Western Newfoundland. The public interest around hydraulic fracturing and its possible effects and applicable regulatory requirements are certainly not unique to the SEA Update Area, nor are they specifically or exclusively related to offshore exploration licencing decisions by the C-NLOPB in the Western NL Offshore Area. This activity is considered in the SEA Update, however, given the degree of attention it received during the recent consultations.

Again, any individual, proposed petroleum exploration or production projects that may involve hydraulic fracturing will also require the receipt of applicable (project-specific) permits and authorizations from all relevant federal and provincial regulatory departments and agencies. Chapter 4 provided a regional overview of communities and existing water supply areas (including groundwater supplies and wells) in the SEA Update Area. Should hydraulic fracturing be formally proposed in the region, appropriate planning, design and analysis to ensure that these activities do not interact with or otherwise negatively affect the quality and availability of safe drinking water in these communities or other aspects of human health and well-being will be a key aspect of any project-specific regulatory reviews. Also, given the current degree of public interest and concern around this issue, and the relative newness of this technology in Newfoundland and Labrador, clearly there is a need for further consultation and discussion with interested and potentially affected communities, individuals and organizations regarding hydraulic fracturing and its potential (and perceived) effects, particularly if future projects involve the proposed use of this technology in the SEA Update Area.

5.4.3 Environmental Planning Considerations

A number of protected and sensitive areas are present in the SEA Update Area, including the following that were identified and highlighted in the available information and through the consultation process for the SEA Update:

1) Port au Choix National Historic Site;
2) Table Point Ecological Reserve;
3) Arches Provincial Park;
4) Gros Morne National Park (UNESCO World Heritage Site);
5) Blow Me Down Provincial Park;
6) Codroy Valley Provincial Park; and
7) J.T. Cheeseman Provincial Park

Each of these protected areas is located on-land, on the Island of Newfoundland coastline section that extends along the SEA Update Area (although in several cases their boundaries extend into the marine environment). Several of these, including Gros Morne National Park, are situated along segments of coastline that are already

adjacent to existing exploration licences in the region. As previously noted, these past licences are not directly within the scope of this SEA Update, which is intended to help inform future licencing decisions and actions in the SEA Update Area.

It is also important to again note that the issuance of an exploration licence for a particular portion of the NL Offshore Area does not, in and of itself, authorize the licence holder to carry out physical exploration activities (fieldwork) within that licence area. The drilling of an exploration well, for example, requires various project-specific regulatory approvals and authorizations, through which the operator must present detailed information on its planned exploration activities, and in doing so, demonstrate that they can undertake such work in a manner that is in keeping with applicable requirements and standards for safety and environmental protection. Any proposed exploration activities within and pursuant to these existing exploration licences either have been or will be subject to project-specific reviews and approvals, through which project-specific environmental effects and required mitigation and protection measures will be defined and required.

A key concern raised during public and stakeholder consultations for the SEA Update was around the potential for visual aesthetic issues resulting from the presence of oil and gas equipment, personnel and activities within or immediately adjacent to Gros Morne National Park (a UNESCO World Heritage Site) or other protected and sensitive areas along the Western Newfoundland coastline. Although it was recognized that offshore exploration programs tend to be relatively short-term in nature and localized in extent, people did raise concerns that these visual intrusions and/or any associated noise, dust or other interactions may detract from the quality, use and enjoyment of these areas, and thus, the important socioeconomic benefits which are derived from them. Any future petroleum production activity in the region would create a longer-term source of visual intrusions, noise and other potential disturbances. It was therefore suggested by some that, either on a generic or a site-/ project-specific basis, guidelines and procedures be established and implemented regarding the location / distance and timing at which oil and gas activities could take place in proximity to protected areas, to help avoid or reduce the potential for such interactions.

In addition to those in Newfoundland and Labrador, there are numerous other existing protected areas located throughout the Gulf of St. Lawrence. These include protected areas of various types, including National Parks, Provincial Parks and Protected Areas, Marine Parks, Marine Protected Areas (MPAs) or Areas of Interest (AOI), and others (Section 4.2.4) Given the locations of these protected areas elsewhere in the Gulf of St. Lawrence, and their overall distances from the SEA Update Area, there is limited potential for direct interaction between any future offshore petroleum activities that may occur within the SEA Update Area and these locations. One of the main concerns raised during the SEA Update consultations, however, related to the potential effects of a large accidental oil spill, which could conceivably extend to coastal (including protected) areas in other provinces that border on the Gulf of St. Lawrence.

Again, the probability of such an event occurring is very low, with the actual environmental “zone of influence” and resulting effects of any such accidental oil spill being dependent on various factors such as the time of year, sea conditions, the volume and type of material spilled, and type of spill (i.e., surface or sub-surface). The regulatory reviews of proposed drilling programs include a detailed analysis of possible spill types and probabilities, as well as modelling of the likely fate and behaviour of hypothetical oil spills based on project and site specific factors such as hydrocarbon types and properties, water depths and characteristics, currents and other oceanographic conditions. This information can therefore be considered in the project-specific regulatory reviews, to assess (and attempt to avoid) any possible environmental effects on protected areas in the Gulf of St. Lawrence, including in eventual decisions around whether and how such a drilling project should proceed.

5.4.4 Cumulative Environmental Effects

The potential environmental effects of offshore seismic surveys and drilling programs in the SEA Update Area may interact with each other and/or with other projects and activities in the region to result in cumulative environmental effects. Existing (and any future) protected areas in Western Newfoundland and elsewhere will not be subject to direct effects by such activities, given the prohibition of such activities within their boundaries. They could, however, be affected by any offshore oil and gas activities that may occur in and affect adjacent areas and resources, such as through associated visual, noise or other disturbances.

Although the specific nature, number and spatial and temporal distribution of potential offshore oil and gas activities in the region cannot currently be known, the anticipated level of exploration and the relatively localized and short-term nature of these activities and many of their effects reduces the potential for any protected or sensitive areas to be affected by multiple petroleum projects or activities within the next decade or so. Protected area may also be subject to other types and levels of stressors, however, both on-going and potential.

Consideration of potential cumulative environmental effects resulting from multiple stressors affecting protected or sensitive areas would be part of the planning and decision-making regarding any future offshore petroleum activities in the region, in order to reduce the potential for overlap and interaction between individual seismic surveys and/or drilling programs in the area and their effects, as well as the effects of these activities in combination with those of other unrelated projects and activities in the region.

5.4.5 Information Availability and Requirements

For those areas that are formally designated as protected under federal or provincial government legislation or other means, there is information available regarding their presence, location, size and important ecological and/or socioeconomic features and value, for consideration and planning, assessing and implementing any future oil and gas or other human activities in the region. Most of these areas have also been subject to considerable study and analysis as part of the processes that led up to their designation as well as since their formal protection. Although, as illustrated and described in earlier sections, a number of other areas have also been identified as being of special interest or sensitivity, comparable types and levels of information on the locations and characteristics of these sites is often not readily available, although this varies considerably between locations.

5.5 Marine Fisheries

Marine fisheries are an important component of the socioeconomic environment of Newfoundland and Labrador and other parts of Canada, including the various communities and regions which surround the Gulf of St. Lawrence. The fishery has played a key role in the region's history, and thus in shaping its people, communities and overall culture. It continues to be an essential element of the economy and lifestyles of the people that live in these areas. Numerous individuals and organizations depend on fish harvesting and its associated processing and spin-off industries, with many residents participating in recreational and subsistence fishing as an important aspect of their culture and overall way of life. Aboriginal people and communities throughout the Gulf of St. Lawrence also continue to undertake fishing activities for commercial or traditional purposes, and many groups have depended on the resources of the sea to sustain their people and cultures for generations.

5.5.1 Potential Environmental Interactions and Effects

As a result of the nature, location, timing and intensity of marine fishing activity in the SEA Update Area and surrounding marine environments, the potential exists for interactions between fisheries and offshore oil and gas activities. These may again be both direct and indirect in nature, resulting from possible interactions between, and damage to, fishing equipment during offshore petroleum activities, or through necessary restrictions on fishing activity at certain locations and times for safety reasons. These interruptions may, in turn, have economic implications for fishers, both in terms of the direct costs of replacing or repairing any fishing gear affected, as well as possible lost or reduced fishing income due to required changes in the location and timing of their fishing activity (such as reduced fishing activity, lower catch rates, increased cost and time to travel to and fish at alternate locations, etc). Also, any environmental effects resulting from oil and gas activities that have implications for the presence, abundance, distribution or health of fish resources in an area may also have indirect implications for the fishers that depend on these resources for their livelihoods.

Most of the available information and insights regarding potential interactions between marine fisheries and the offshore oil and gas industry has been gathered through consultations with fishers and other individuals and organizations that are involved in the fishing industry. This includes the public and stakeholder consultation and Aboriginal engagement activities undertaken as part of this SEA Update (as described in Chapter 2 and Appendix A), as well as in other SEAs and project-specific EAs for petroleum exploration and development projects off Newfoundland and Labrador and elsewhere. These consultations have identified damage to gear, loss of access, reduced fish catches (quantity and/or value), biophysical effects on fish (including real or perceived tainting) and subsequent reductions in fish landings and value, and oil spills as the primary issues of concern, with the latter being the most prevalent issue raised in the SEA Update consultation activities to date.

Offshore petroleum exploration and production activities have been occurring in the NL Offshore Area and elsewhere for decades. The views and insights of those involved in the fishing industry as a result of their experiences to date, therefore, provide an important source of "existing knowledge" regarding potential issues and effects, mitigation measures and their effectiveness, and other factors relevant to the planning and possible conduct of future offshore petroleum activities in the SEA Update Area.

The main potential interactions between offshore petroleum activities and marine fisheries may therefore be summarized as follows:

- Damage to fishing gear or vessels as a result of direct interactions with oil and gas related equipment, activities and/or environmental discharges;

- Loss of access to preferred fishing areas during offshore exploration or production activities, and possible resulting decreases in fishing success and overall efficiency;

- Indirect effects on fish landings and values due to possible biophysical effects on fish resources and their habitats (including fish abundance, distribution, or quality); and

- The potential effects of offshore oil spills on fishing activity, equipment and fish resources and the resulting implications for fishers and their livelihoods and communities.

Damage to fishing gear or vessels can result from physical contact with seismic vessels, drill rigs, production platforms or equipment and vessels supporting oil and gas exploration or production. Project-related discharges into the marine environment, such as small spills and materials lost from vessels or drill rigs can also damage or foul fishing gear. In addition to the direct costs of fixing or replacing any damaged fishing vessels or gear, further economic loss might also result from any associated reduction in fishing times or catches.

Loss of access to fishing grounds can occur when safety zones are required and established around exploration drilling activities or during similar periods of disruption during active seismic survey work. The nature, spatial extent, duration and possible implications of any such restrictions depends on the type, location, timing and other characteristics of the offshore petroleum project or activity in question, as well as the nature and scale of fishing activity that currently occurs in the area. The safety (no-fishing) zones that are typically established around offshore drilling operations are usually quite small in size (approximately 0.5 km^2), although for certain fisheries that use longline gear or others the exclusion zone may have to be larger. The requirement to fish in alternative areas during these periods can have implications for catch rates and the cost and efficiency of fishing activity as well.

The possible biophysical effects of offshore oil and gas activities on fish resources (Section 5.1) may also indirectly affect fishing activity. The potential effects of seismic surveys on the presence, abundance and distribution (spatial and temporal) of commercial fish species has been raised as a concern, and the scientific literature and anecdotal reports have not always provided consistent and conclusive results on this issue. Drilling operations may also affect fish and fish habitat through behavioural effects, fish health, taint, toxicity and bioaccumulation and the smothering of benthic habitats, as discussed earlier in Section 5.1.1. Any such biophysical effects to fish and fish habitat could result in a subsequent loss of fish catch or catch value. Even where there is a low potential for, or occurrence, of such effects, perceived effects by the public (fish quality, taint) can affect economic returns from the fishery (although this is much more likely to occur after a large oil spill than as a result of routine offshore activities).

The most important potential effects from major oil spills in the marine environment are extended loss of access to fishing grounds, damage to fishing equipment, fish mortality and tainting, and associated economic effects due to loss of industry value and markets.

In addition to the potential negative effects on marine fisheries discussed above, the fishing industry can also at times benefit from any increased communications and emergency response capabilities that may result from the further development and growth of an offshore petroleum industry (exploration and/or production) in a region.

5.5.2 Environmental Mitigation Measures

A number of procedures and other measures have been used in the NL Offshore Area and elsewhere to avoid or reduce interactions between offshore oil and gas activities and marine fisheries and the possible negative effects of same.

Ensuring the safety of offshore personnel and equipment working in both the fishing and petroleum industries is clearly a primary concern and objective. The establishment of safety (no-fishing) zones around offshore petroleum installations and in areas of high vessel traffic helps to minimize the potential for negative interactions between oil and gas activities and the fishing industry. Typically, no-fishing zones are relatively small in size, but this depends on the nature of the installation and activity and the adjacent fisheries. If a series of

wells are to be drilled in a given area, a sequential approach to drilling is often used for logistical reasons (such as rig availability and mobilization), which also helps minimize the total area affected through loss of access to fishing grounds at any one time.

Consultation and communication between offshore oil and gas operators, government departments and agencies and the fishing industry in planning and implementing offshore seismic surveys and drilling programs is by far the most important and effective mechanism for avoiding interactions. Notices to Mariners and other methods have been used to get timely information about offshore petroleum activities to fishers and other organizations. Fisheries Liaison Officer (FLO) positions have also been established by oil and gas operators to serve as an essential link for on-going communication with the fishing industry during offshore programs. These FLOs are often local fishers who are hired and placed on-board offshore oil and gas installations and vessels, whose responsibilities include communicating with fishing vessels to warn of potential dangers, as well as proposing alternative routes to operator to avoid important fishing areas and activities. The use of established and common marine traffic routes by support and supply vessels where possible can also help minimize disturbances to and effects on the fishing industry. Oil and gas related vessels are typically made aware of the nature of, and key locations and times for, fishing activity in the region, as a further precaution and for planning purposes to potentially use alternate routes around fishing grounds at peak times.

In the province of Newfoundland and Labrador, a unique model has been developed to facilitate effective communication between the offshore fishing and petroleum sectors. In 2002, One Ocean was established as a voluntary, inter-industry liaison organization providing a neutral and practical medium for information exchange. The model promotes mutual awareness and understanding of industry operational activities and its proactive approach to address areas of potential concern is enhanced though its commitment to cooperation and transparency. The organization consists of a Chairperson, Director, Industry Board and Working Group. The One Ocean Industry Board is a core component of the organization and is comprised of equal, senior-level representation from the two industry sectors. Fishing industry members are represented by the Fish, Food and Allied Workers (FFAW) union and the Association of Seafood Producers (ASP). Petroleum industry members are affiliates of the Canadian Association of Petroleum Producers (CAPP). Official Observers on the Board include the C-NLOPB, DFO, the Fisheries and Marine Institute of Memorial University of Newfoundland and Labrador and the CCG. Additional information can be obtained from the One Ocean website, at *http://www.oneocean.ca*

The C-NLOPB's *Geophysical, Geological, Environmental and Geotechnical Program Guidelines* (C-NLOPB 2012) include various requirements and other measures related to environmental planning, mitigation, monitoring and reporting which are intended to help avoid or reduce the potential for interactions with other ocean users, including associated secheduling, operational planning and communications, gear and/or vessel damage compensation programs, and incident documentation and reporting. The various mitigation measures to avoid or reduce the potential environmental (biophysical) effects of offshore oil and gas activities on fish and fish habitat that were highlighted previously (Section 5.1.2) can also serve to help address any indirect effects on marine fisheries.

A key concern raised throughout the consultation program for the SEA Update related to the effects of a large oil spill on the marine environment, and thus, on fishing activity and the livelihoods of fishers and communities. The prevention of oil spills has been and is a major priority for the C-NLOPB and other agencies and organizations, as well as for offshore drilling operators who are required to develop plans which outline procedures for preventing and effectively responding to such spills.

The regulatory reviews of proposed offshore drilling programs typically include an analysis of possible oil spill types and probabilities, as well as detailed modelling of the likely fate and behaviour of hypothetical spills based on project and site specific factors, including hydrocarbon types and properties, water depths and characteristics, currents and other oceanographic conditions and patterns. This information and analysis is then used in assessing and evaluating the potential for, and likely nature and magnitude of, interactions between any such spill and fishing activities, for use in project planning and associated regulatory decisions around whether and how the particular drilling program in question may proceed.

As part of the regulatory review and approval process that apply to offshore drilling activities in the NL Offshore Area, operators are also expected to demonstrate that they have the ability and capacity to undertake such activities in a safe and environmentally responsible manner. This includes the development and implementation of systematic and comprehensive oil spill prevention plans and procedures, as well as ensuring that they have the ability to respond to a spill event in an effective and timely manner, should one occur. As noted, the C-NLOPB is also currently completing an overall review of the spill response capability of operators working in areas under its jurisdiction, including the SEA Update Area (C-NLOPB 2013).

Should the above measures be unsuccessful in preventing adverse environmental effects to marine fisheries or other components of the socioeconomic environment (such as gear damage due to interference with seismic streamers, or in the unlikely event of a large offshore oil spill in the area), a variety of processes and measures exist to compensate fishers and others for losses or damages related to offshore petroleum activity. These are listed in the C-NLOPB's *Compensation Guidelines Respecting Damages Relating to Offshore Petroleum Activity* and elsewhere, and were described in some detail in Section 3.2 of this report.

5.5.3 Environmental Planning Considerations

As illustrated and described in Section 4.3.5 and Appendices C to F, a variety of marine fisheries occur within and throughout the SEA Update Area and adjacent regions throughout the year, and the region is characterized by a somewhat complex spatial and temporal pattern of fishing activity. This, along with the rather dynamic nature of the fishery over time, has both necessitated this SEA Update, but at the same time, also makes it somewhat difficult to generalize about particular locations and times which should be avoided or in which activities should be restricted.

As indicated, on-going communication between offshore oil and gas operators and the fishing industry, through the various processes and forums described above, has been and remains the most effective means for ensuring that such activities are carried out in a safe and environmentally responsible manner, avoiding or reducing adverse interactions between the petroleum and fishing sectors. Notices to Mariners and other communications, the use of FLOs, the representation of Newfoundland fishers by the FFAW and the One Ocean initiative have been particularly useful in creating and maintaining open and on-going dialogue between these two industries, and in fostering a proactive and cooperative approach to identifying and addressing any issues or concerns.

5.5.4 Cumulative Environmental Effects

Cumulative effects on marine fisheries can occur as a result of the combined effects of offshore oil and gas exploration and/or production activities, general marine traffic and other human activities and associated disturbances within the marine environment. Each of these may result in, for example, direct disturbance to

fishing activity, damage to fishing equipment, effects on fish resources and/or other effects on fisheries in the SEA Update Area, and these effects may overlap in space and time to result in cumulative environmental effects. As also discussed previously and documented in the SEA Update Consultation Report (Appendix A), it is also clear that recently observed natural and/or anthropogenic changes in the environment of the Gulf of St. Lawrence, such as water temperature changes and associated differences in the presence, location and timing of fish species and populations in the region, are likewise having an effect upon the nature and distribution of fishing activity.

This anticipated level of exploration in the region and the likely spatial and temporal distribution and short term nature of potential drilling and seismic survey projects will limit the potential for interaction between the effects of these activities themselves. Again, however, the at times spatially extensive nature of seismic surveys, along with the somewhat widespread nature of some fishing activities, increases the potential for fishing enterprises to be affected by multiple environmental disturbances, and therefore, for cumulative environmental effects to occur. The establishment of safety zones around drill sites is an important mitigation measure to prevent potential effects, and typically does not interfere greatly with fishing activity given the relatively small size of these zones. Any potential for cumulative effects will, however, depend on the eventual intensity and spatial and temporal distribution of these activities, and avoiding or reducing such effect overlap can be considered in planning and reviewing individual projects and activities if and as they are defined and proposed.

The potential for interference with fishing activity due to the presence of drill rigs and seismic and supply vessels as well as general marine traffic to and through the region can be mitigated through good communication between these various industries, as well as standard measures such as the issuance of Notices to Mariners. Wherever possible, seismic surveys are to be planned to coordinate program activities with the fishing industry to reduce potential conflict with commercial fishing activity during peak fishing times. In addition, routing supply vessel traffic to avoid the more active fishing aggregations in a region is a practice generally used for activities in the marine environment, with common routes used where possible. Although an unlikely and relatively infrequent occurrence, damage to gear or vessels would be managed through applicable compensation policies and procedures.

5.5.5 Information Availability and Requirements

An information base is available regarding fishing activity in the SEA Update Area and in the larger Gulf of St. Lawrence, particularly for the commercial fisheries which are managed, regulated and monitored by DFO and other organizations.

Although the resulting information and datasets are not always entirely complete or comprehensive for all fisheries and species, they do provide a regional picture of fishing activity in the region that is considered adequate and appropriate for the purposes of the SEA Update and for informing future licencing decisions and the design and review of individual offshore petroleum projects. It is imperative that this information continue to be made available in a useful format and timely manner to government agencies and offshore operators.

These existing data sets and other available information, supplemented by continued dialogue and information-sharing involving fishers and their representative organizations and other industry groups, provide useful information for such planning and decision-making.

5.6 Potential Effects of the Environment on Oil and Gas Activities

The physical environmental setting of an area is also an important consideration in the planning, review and conduct of oil and gas exploration and development activities. An appropriate understanding, and careful consideration, of environmental characteristics and phenomena such as winds, waves, currents, ice, precipitation and other factors is required so that offshore activities can be designed and implemented appropriately, and in a manner that helps ensure that human health and safety, equipment and infrastructure and the environment are protected. This includes avoiding or reducing the potential for any incidents and accidents that may occur as a result of unplanned interactions between petroleum operations and the physical environment of the marine area in question.

Physical environmental conditions typically influence various key elements of the design and conduct of offshore petroleum activities, including the selection of type and size of the drill rig, seismic vessel and other equipment, which are often determined based on water depth, likely weather and sea state conditions and sea ice and icebergs and associated mobility requirements. Oil and gas activities in the marine environment also have specific operational parameters and restrictions which require that they only be commenced and completed during particular environmental conditions. These include, for example, the sea state thresholds under which seismic equipment can be deployed, used and retrieved. The potential for, and occurrence of, extreme meteorological and oceanographic conditions may also affect other program and project components, activities and schedules, including the timing of associated vessel movements and drilling activity.

An updated, regional overview of the physical environment of the SEA Update Area was presented in Section 4.1 of this report, including its overall characteristics and the potential for and occurrence of adverse operating conditions and extreme events. As indicated, the region is considered to be of quite low seismic potential. As exploration drilling programs are typically of short-term duration (one to several months), the probability that large scale geological events and movements will occur during any program is relatively low. Risk-based earthquake design is routinely used in engineering and design work for offshore structures, particularly for more permanent (production) infrastructure in seismo-tectonic environments.

Although icebergs (particularly smaller ones) do occasionally enter into the SEA Update Area, they are far less common here than in other portions of the NL Offshore Area, particularly off Eastern Newfoundland where the scale of offshore oil and gas activity has been considerably greater. Forecasting and monitoring the presence and movements of icebergs is part of routine operational procedures during offshore operations in areas which are subject to such seasonal intrusions of ice. Appropriate safety measures can then be taken, including moving a drilling unit if required. The presence, timing and duration and thickness of sea ice in the marine areas off Western Newfoundland and throughout the Gulf of St. Lawrence will certainly be an important consideration in planning and implementing any future offshore oil and gas activities in the region, both for routine and planned activities and as well as when developing and evaluating effective and timely responses for potential accidental events and malfunctions, such as oil spills. Sea ice conditions are also typically monitored prior to and during offshore operations as applicable. The sea ice climatology in the Gulf of St. Lawrence has been extensively documented, and current conditions, 48-hour ice forecasts, 30-day ice outlooks and seasonal outlooks are prepared by the Canadian Ice Service of Environment Canada on an ongoing basis. It is deemed that there is sufficient knowledge available within the SEA Update Area to form the basis for project-specific ice management.

The collection and analysis of detailed and site-specific information on climatic and meteorological conditions (winds, waves, precipitation and temperatures) and oceanographic characteristics (including waves, currents, sea ice and icebergs) are typically part of an operator's overall planning and design of an offshore program and its associated regulatory review and approval requirements. Appropriate design and planning based on this information, such as in program scheduling, equipment selection and the development and implementation of appropriate operational procedures, helps to ensure the safety of personnel, equipment, vessels and the natural environment during the execution of seismic surveys and exploration drilling programs in offshore environments. In addition to pre-commencement analysis and planning, meteorological and oceanographic monitoring programs are often implemented during offshore programs to forecast and respond to any severe environmental conditions.

Fog conditions are also a common occurrence in the region, and can be dangerous for drilling and vessel operations, particularly when ice or other hazards and human activities are present. The freezing of salt spray results when the air temperature is below -1.8°C, sea temperature is below 6°C and wind speeds are greater than 10 m/s, and freezing precipitation is likewise an important consideration. These issues need to be considered and addressed in the selection of equipment and the development of appropriate operational procedures to ensure that these can operate safely and effectively under these conditions.

Depending on the nature, location and timing and duration of specific offshore programs, the potential effects of the biological environment may also be a consideration in planning and undertaking such programs. These may include, for example, possible biofouling (or, the colonization of offshore structures by epibenthic communities), plankton blooms and possible interference with visual inspections of structures; etc.

The planning, design and regulatory review and approval of any future individual seismic surveys and exploration drilling programs in the region will therefore be based upon the compilation and analysis of detailed information on physical environmental conditions in the area to help to ensure the safety of personnel, equipment, vessels and the natural environment. The *Guidelines Respecting Physical Environmental Programs during Petroleum Drilling and Production Activities on Frontier Lands* provide a detailed overview of requirements for the operators of petroleum drilling or production installations regarding the observing, forecasting, and reporting of physical environmental data. The objective of these physical environmental monitoring programs is to ensure that the necessary weather, oceanographic and ice information is available during an offshore exploratory or production program to support the safe and prudent conduct of operations, emergency response, and spill counter-measures.

Finally, the biophysical and human environments also often affect and influence oil and gas activities, through the analysis and consideration of environmental components and issues in the planning, regulatory review, and (if approved) conduct of such exploration and development projects and activities. The information and results of the initial (2005 and 2007) SEA, this SEA Update and any past, on-going and future project-level assessments allow for such environmental components and considerations to influence the nature, planning and conduct of past and future programs, in order to attempt to avoid or reduce potential adverse environmental effects.

6 STRATEGIC ENVIRONMENTAL ASSESSMENT UPDATE: SUMMARY AND CONCLUSIONS

C-NLOPB Note: *The Draft SEA Update Report has identified sensitive areas, data gaps and planning considerations for the SEA Update Area. Following the conclusion of the regulatory and public comment period for the draft SEA Update, recommendations and conclusions regarding the issuance of rights and any requirement on the restriction of offshore oil and gas activities in the SEA Update Area will be finalized for inclusion in the Western Newfoundland and Labrador Offshore Area SEA Update Report.*

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APPENDIX A

Western NL Offshore Area SEA Update – Consultation Report

WESTERN NEWFOUNDLAND & LABRADOR OFFSHORE AREA
Strategic Environmental Assessment Update

Consultation Report

Draft

Submitted to:

Canada-Newfoundland and Labrador
Offshore Petroleum Board
5th Floor TD Place, 140 Water Street
St. John's, Newfoundland & Labrador
Canada A1C 6H6

Submitted by:

AMEC Environment & Infrastructure
A Division of AMEC Americas Limited
133 Crosbie Road, PO Box 13216
St. John's, Newfoundland & Labrador
Canada A1B 4A5

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1 INTRODUCTION

The Canada-Newfoundland and Labrador Offshore Petroleum Board (C-NLOPB) is responsible, on behalf of the Government of Canada and the Government of Newfoundland and Labrador, for petroleum resource management in the Newfoundland and Labrador (NL) Offshore Area.

The C-NLOPB has been undertaking Strategic Environmental Assessments (SEAs) of marine areas in which the issuance of exploration licences could be contemplated and which have not previously been subject to substantial levels of environmental assessment (EA). SEA is a relatively broad-based, regional approach to EA that examines the environmental issues that may be associated with a plan, program or policy proposal, and therefore allows for the identification, analysis and incorporation of environmental considerations at the earliest stages of planning and decision-making.

The C-NLOPB has conducted a number of SEAs for various portions of the NL Offshore Area, which provide information on the regional environmental setting and associated environmental considerations, and which then help to inform subsequent regulatory decisions regarding offshore petroleum activities in that area. This has included the preparation of an SEA for the Western NL Offshore Area, which was initially completed in 2005 and subsequently amended in 2007.

The C-NLOPB has also committed to regularly review its SEAs every five years and to update them as required, and is currently updating the Western NL Offshore Area SEA. This includes the identification, review and presentation of any new and relevant information on the existing environment in the area that has become available since the initial SEA Reports were completed, as well as a further and updated analysis of any key potential environmental issues and effects which may be associated with future petroleum exploration and/or development activities in the area. The results of the SEA Update will be considered in future licensing decisions regarding offshore petroleum activities by the C-NLOPB.

An important and integral component of the SEA Update is public and stakeholder consultation and Aboriginal engagement. These initiatives have been undertaken in order to identify any associated questions or concerns regarding future oil and gas exploration and/or development activities in the area and their potential environmental effects, so that these issues can be considered in the assessment update and in future planning and decisions.

This Consultation Report provides an overview of the nature and key outcomes of this consultation program.

2 CONSULTATION METHODS AND ACTIVITIES

Consultation is the cornerstone of the EA process, and public, stakeholder and Aboriginal engagement often take place at various stages of an assessment. In this way, potential issues can be identified early to help inform, shape and focus the analysis, as well as inform eventual and associated planning and regulatory decisions. It is generally accepted that consultation is also an essential component of the SEA process, and is a key contributor to its overall effectiveness. As a forum for information-sharing and dialogue, SEA consultation can help identify the various issues and interests that may be associated with a proposed policy, plan or program, thereby allowing these to be known and considered early in and throughout an SEA.

The SEA Update has included discussions with government departments and agencies, Aboriginal and stakeholder groups and the general public through a range of approaches, each of which have been designed and implemented from both an "*information out*" and an "*information in*" perspective. Various mechanisms have been used to provide interested groups and individuals with information on the SEA objectives and process, and on past and potential oil and gas licensing and activities in the region, as well as allowing them to review and consider this information and formulate and provide their questions and views. The key purpose of the SEA consultation program to date has therefore been to identify questions, concerns and issues related to potential oil and gas exploration and development in the Western NL Offshore Area and the potential environmental effects of these activities which require consideration in the SEA Update.

The nature and conduct of the various consultation activities that have been carried out to date as part of the SEA Update are described and summarized in this chapter.

2.1 SEA Update: Scoping Document

The planning and preparation of the SEA Update is being guided by a *Scoping Document*, which outlines the factors to be considered, the scope of those factors and other guidelines for preparing the SEA Update Report.

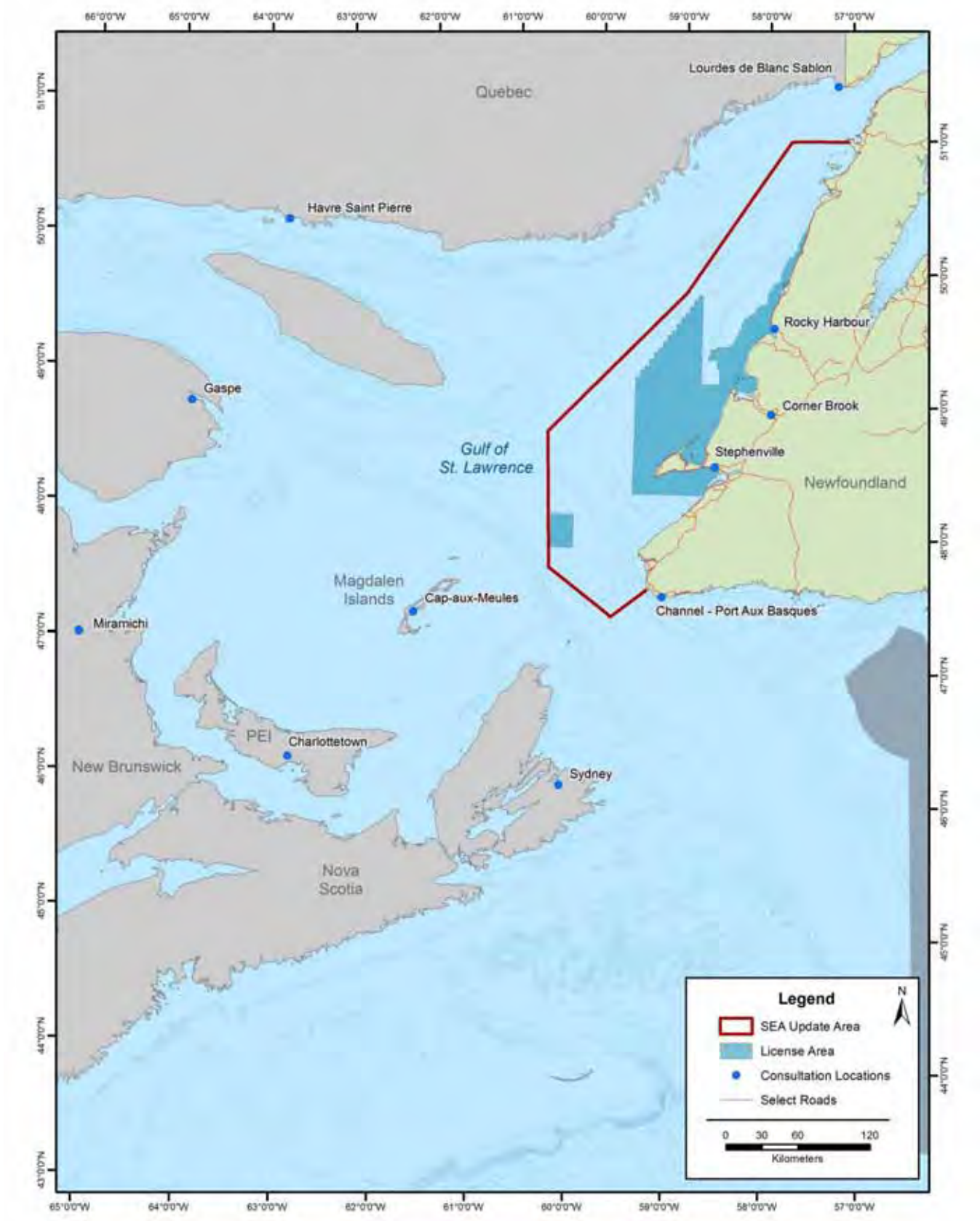
A Draft Scoping Document was initially prepared by C-NLOPB staff with the assistance of a Working Group comprised of 17 members representing various federal and provincial government agencies and non-governmental organizations. This draft document was released for public comment in December 2011 for an approximately one month period, during which time 11 submissions were received from interested organizations and individuals.

A Final Scoping Document was eventually prepared and released by the C-NLOPB in February 2012, along with the Board's responses to each of the comments received on the Draft. This document eventually formed the basis for the C-NLOPB's request for proposals for the preparation of the SEA Update.

2.2 Public Open Houses

The consultation program for the SEA Update included a series of public open houses in 11 locations throughout Eastern Canada in September and October 2012, as follows (Figure 2.1):

Figure 2.1: Western NL SEA Update: Public Consultation Session Locations



1) Port aux Basques, NL: September 30, 2012
2) Stephenville, NL: October 1, 2012
3) Corner Brook, NL: October 2, 2012
4) Rocky Harbour, NL: October 3, 2012
5) Lourdes de Blanc Sablon, QC: October 4, 2012
6) Miramichi, NB: October 9, 2012
7) Charlottetown, PEI: October 10, 2012
8) Sydney, NS: October 11, 2012
9) Cap-aux-Meules, Îles-de-la-Madeleine, QC: October 24, 2012
10) Havre-Saint-Pierre, QC: October 25, 2012
11) Gaspé, QC: October 29, 2012

The public open houses took the form of an evening "drop in" session, held from 5 – 9 pm at the identified venue in each community.

This format was selected by the SEA Update study team, in discussion with the C-NLOPB and its SEA Working Group, for various reasons. Firstly, it allows all interested parties to come to the sessions on their own time, and to proceed to receive information, ask questions and provide input at their own pace and in whatever manner and format that they felt most comfortable (see Attachment A for presentation of the main open house materials). By adopting this open house format, the SEA Update study team attempted to establish a relatively informal and relaxed environment, where participants could provide input and ask questions through one-on-one conversations, and/or in small groups, however they preferred.

As described later, representatives of the C-NLOPB and its SEA Update study team (AMEC) were on hand to provide information and clarification and answer questions, and to record any and all questions, issues and perspectives raised verbally. Participants were also given the option of providing written input, either at or following the open house session. This informal public open house format was also selected and used given its overall familiarity to many of the communities and stakeholders involved, as it is by far the most common type of public consultation mechanism used for EAs and similar processes in Newfoundland and Labrador and in various other jurisdictions.

These public consultations intentionally occurred at a very early stage of the process, before the completion of the SEA Update Report itself. The initial (2005 and 2007) SEA Reports have been publicly available since their completion, and were intended to form a basis for initial public consultation and input regarding the SEA Update. The intended purpose of the consultation program was therefore not to present the results of the SEA Update, but rather, to provide the SEA Update study team with early (and updated) input and understanding regarding the key public and stakeholder questions, issues and perspectives related to potential future oil and gas activities in the region, so that this information could help inform and shape the nature and content of the SEA Update. The Draft SEA Update Report will eventually be made available for public review and comment later in the process.

The consultation sessions were advertised extensively through newspaper ads providing details on the purpose, location and timing of the sessions (Attachment B), as well as through local radio and TV station(s) and other means, as outlined in the Table below:

Table 2.1: Advertising for SEA Consultation Sessions

Public Open Houses	Newspaper Advertisements	Other Advertising
Series #1 (September 30 – October 4, 2012) • Port aux Basques, NL • Stephenville, NL • Corner Brook, NL • Rocky Harbour, NL • Lourdes de Blanc Sablon, QC	*The Western Star* (Corner Brook and Western NL region, daily): Saturday Sept 22, Saturday Sept 29, Monday Oct 1, Tuesday Oct 2 *The Gulf News* (Port aux Basques, weekly): Monday Sept 24 *The Georgian* (Stephenville, weekly): Monday Sept 24 and Monday Oct 1 *The Northern Pen* (Northern Peninsula and Southern Labrador / Québec): Monday Sept 24 and Monday Oct 1 *The Telegram* (St. John's, NL wide distribution): Saturday Sept 29	C-NLOPB News Release, Sept 21, 2012 CBC Fisheries Broadcast CBC Radio (Corner Brook NL) CFCB Radio (Corner Brook NL) CSFX Radio (Stephenville NL) VOBB Radio (Bonne Bay Area of NL) CFBS Radio (Blanc Sablon QC) Rogers Cable Television (Corner Brook NL) Rogers Cable Television (Port aux Basques NL)
Series #2 (October 9-11, 2012) • Miramichi, NB • Charlottetown, PEI • Sydney, NS	*The Miramichi Leader*: (Miramichi and region, several editions per week): Monday Oct 1 and Friday Oct 5 (Ads in both English and in French) *The Telegraph* (NB wide, daily): Monday Oct 1 (Ads in both English and in French) *The Guardian* (PEI wide, daily): Saturday Oct 6 and Tuesday Oct 9 *The Cape Breton Post* (Cape Breton region, daily): Saturday Oct 6 and Wednesday Oct 10	C-NLOPB News Release, Sept 28, 2012 CFAN Radio (Miramichi NB) Miramichi Online (Miramichi NB) Rogers Cable Television (Miramichi NB) CBC Radio (Charlottetown PEI) CFCY Radio (Charlottetown PEI) Ocean 100 Radio (Charlottetown PEI) 1055 FM Radio (Charlottetown PEI) Radio UPEI (Charlottetown PEI) Q93 Radio (Charlottetown PEI) Eastlink Television (Charlottetown PEI)

Public Open Houses	Newspaper Advertisements	Other Advertising
		CBC Radio (Cape Breton NS) 101.9 Radio (Cape Breton NS) 94.9 Radio (Cape Breton NS)
Series #3 (October 24 - 25, 2012) • Cap-aux-Meules, Îles-de-la-Madeleine, QC • Havre-Saint-Pierre, QC	*Le Radar* (Îles-de-la-Madeleine wide, weekly): Thursday Oct 18 (in English and in French) *Journal le Nord Est* (QC North Shore, weekly): Wednesday Oct 17 and Wednesday Oct 24 (In French)	C-NLOPB News Release, Oct 16, 2012 CFIM Radio (Îles-de-la-Madeleine, QC) CILE Radio (Havre Saint Pierre QC)
Series #4 (October 29, 2012) • Gaspé, QC	*Journal le Pharillon* (Gaspésie, weekly): Wednesday Oct 24 (In French) *The Spec* (Gaspésie, weekly): Wednesday Oct 24 (in English)	C-NLOPB News Releases, Oct 2 and Oct 23, 2012 CJRG Radio Gaspesie (Gaspé QC) CHNC Radio (New Carlisle QC)
Newspapers and local radio and television stations were identified through an internet search and suggested by local contacts. The C-NLOPB news releases and Québec newspaper and radio ads were posted in both English and French.		

The consultation sessions were also covered extensively by local media, both before and following the open houses themselves.

Upon arrival at the open house sessions, participants were greeted by a SEA Update study team representative at a sign-in table, who provided them with an overview of the open house purpose and format and a number of handouts (including a map showing the SEA study area and existing exploration licences, general information about the C-NLOPB). The open house included five information stations arranged within the meeting venue, consisting of tables and/or stands with information panels that focused on the following themes:

1) *C-NLOPB Overview* (purpose, role, mandate)

2) *Western NL Offshore Area* (study area, existing licences, oil and gas activities to date)

3) *SEA Overview* (SEA objectives, initial Western NL SEA, nature and purpose of the SEA Update)

4) *Offshore Oil and Gas Exploration* (overview of exploration activities that may be undertaken)

5) *Environmental Setting and Considerations* (components of the existing environment being addressed in the SEA Update, issues often associated with marine oil and gas activities, standard mitigation measures)

The purpose of the information panels was to provide some general background information, recognizing that participants would have varying types and levels of knowledge regarding the nature and purpose of the SEA Update, as well as on past and potential oil and gas activities in the region and on environmental components and possible effects. The information panels were therefore intended primarily to serve as a basis for prompting dialogue and the sharing of information and input by participants. At each of the consultation locations in Québec and in New Brunswick the information panels and other materials were displayed in both English and French, and bilingual SEA Update study team members were present at all sessions.

Copies of the open house information panels were also posted on the C-NLOPB website, and are provided in Attachment A of this report.

Figure 2.2 Public Open House Layout and Format (Some Representative Photos, For Illustration)

SEA Update study team members were clearly identified through name tags, and were positioned at and/or between stations to answer questions and gather feedback and information from participants. A key focus was on obtaining and recording information and input related to:

- Questions, issues or concerns regarding offshore oil and gas activities and their potential effects;
- Suggestions for any measures or other means through which these issues could be addressed in future planning and decisions or actions;
- Local knowledge regarding the existing biophysical environment in the SEA Update Area, and

- Information on fisheries or other marine activities and components in the region.

The SEA Update study team members were involved in continuously taking notes and otherwise recording any and all input received throughout the open house, and at the end of each session the consultation team met as a group to have a detailed debriefing and to further record and compile all information and input received.

In the case of the final three public consultation sessions in Québec (Îles-de-la-Madeleine, Havre-Saint-Pierre and Gaspé), a large number of participants arrived at the open house venues at the commencement of the sessions. Therefore, and to respect the stated wishes of the participants, the format of these sessions were altered somewhat to include an initial, verbal overview (in French) of the SEA process and the purpose of the consultation sessions by the SEA Update study team to all participants, followed by a general question and answer session involving all attendees. This open discussion format proceeded for the first 1.5 – 2 hours of the consultation sessions, during which detailed notes were taken by a bilingual SEA Update study team member. Following the conclusion of these group discussions, participants were then also able to stay and participate in the traditional open house format, view the information panels, and speak individually with SEA team members if they desired.

All open house attendees were also provided with a copy of a feedback form, through which they could provide additional or subsequent information or input, either at the session or through later submission by mail, fax or email (see Attachment A). It was reiterated to all participants upon arrival that they could provide their input verbally to the SEA Update study team at the session itself and that it would be recorded by them, and that they could also provide any input in writing (using the feedback form as a general guide, or in any other format they wished), either at the session or at any time prior to the eventual public release of the Draft SEA Update Report. These feedback forms were also posted on the C-NLOPB website (in both English and French, in pdf and ms word formats) so that participants or others could also access and complete them electronically for submission.

2.3 Stakeholder Meetings

As part of the SEA Update consultation program, a series of stakeholder meetings were also arranged and conducted with identified organizations and agencies in each area. These meetings were similar to the overall consultation approach that was adopted for the initial Western NL SEA (2005), and in this case were intended to supplement the larger public open house sessions. In particular, they provided a further opportunity to meet with identified stakeholder groups while the SEA Update study team was in the local area, during the daytime "working hours" for these organizations.

Relevant groups who would potentially have an interest in the subject matter being addressed by the SEA Update were identified by the SEA Update study team through a general search process, using the internet, telephone directories, the study team's knowledge and experience in working in these areas as well as their existing contacts and networks, and with the advice and input of the C-NLOPB and its SEA Working Group. Based on these searches and discussions, an initial list of local stakeholder organizations in each consultation location was developed, each of which were sent an invitation to the stakeholder meeting(s) in their area by email or fax (see Attachment D).

Given the number of communities and regions being visited and the sheer number of potentially relevant stakeholder groups involved, the challenges of identifying and reaching all relevant organizations were recognized at the onset. Therefore, the invitations also asked those contacted to identify and recommend any

other stakeholder groups that they felt would have an interest and who should thus also be contacted and invited to attend. Through this "snowball" process, a number of additional groups were identified and invited, and in some cases organizations received the invitation through other means of direct and indirect distribution and were able to attend these meetings.

The stakeholder meetings were not in any way planned to be closed or exclusive, and attempted to reach the largest number of groups possible, and at very least, to include a good cross section of the various types of groups and interests that may be interested in the SEA update – including local communities, fishers groups, environmental and social interest groups, industry and business associations, and others. Any and all organizations that requested an invitation or who otherwise chose to attend a meeting were permitted to do so and were welcomed at the meetings.

These stakeholder meetings took place at each consultation location either in the afternoon immediately before the public open house or the following morning (depending on travel times and logistics). The format involved an approximately two hour meeting at the open house venue, which began with a short presentation by the SEA Update study team outlining the nature and purpose of the SEA Update, followed by a general round table discussion. Notes were again taken by the SEA Update study team at each meeting, highlighting the various questions, issues and perspectives raised by participating stakeholders.

In addition to the planned stakeholder meetings at each consultation location, on the evening of Tuesday October 23, 2012 the SEA Update study team also met with a group of community and stakeholder representatives in Cap-aux-Meules, Îles-de-la-Madeleine as requested and arranged by the local Mayor. This meeting included short presentations by the C-NLOPB and by a participating environmental organization, followed by a round table discussion and question and answer period, again with notes taken by bilingual study team members.

2.4 Correspondence and Meetings with Aboriginal Groups

On September 26, 2012, the C-NLOPB wrote to a number of Aboriginal communities and organizations in Newfoundland and Labrador, the Maritime Provinces and Québec, as identified by the SEA Update study team with the input of the C-NLOPB and its SEA Working Group. Through that correspondence, the C-NLOPB provided the following:

- A general overview of the C-NLOPB and its role and mandate;
- A description of the SEA process, the Western NL Offshore Area (including a map), and the initial SEA and its planned update;
- An invitation to contact the C-NLOPB if the group had interests related to the SEA Update Area and scope, as well as to participate in future discussions and engagement with the Board as part of the SEA Update process (including through a future meeting, or other potential forums as suggested by the group itself); and
- Information on, and an invitation to, the upcoming public consultations being held for the SEA Update.

These letters were sent by fax and mail to each of the Aboriginal communities and organizations listed in the following Table.

Table 2.2: Aboriginal Groups Contacted by the C-NLOPB for the SEA Update

Province	Aboriginal Community or Organization
Newfoundland and Labrador	• Innu Nation • NunatuKavut Community Council
Nova Scotia	• Kwilmu'kw Maw-klusuaqn (Mi'kmaq Rights Initiative) • The Confederacy of Mainland Mi'kmaq • Native Council of Nova Scotia • Membertou First Nation • Eskasoni First Nation • Chapel Island First Nation • Wagmatcook First Nation • We'koqma'q First Nation • Paqtnkek Mi'kmaw Nation • Pictou Landing First Nation • Millbrook First Nation • Indian Brook (Shubenacadie) First Nation • Glooscap First Nation • Annapolis Valley First Nation • Bear River First Nation • Acadia First Nation • Union of Nova Scotia Indians
Prince Edward Island	• Mi'kmaq Confederacy of Prince Edward Island • Native Council of PEI • Lennox Island First Nation • Abegweit First Nation
New Brunswick	• Union of New Brunswick Indians • Mawiw Tribal Council • North Shore Micmac District Council • New Brunswick Aboriginal Peoples Council • Assembly of First Nation's Chiefs in New Brunswick • Eel River Bar First Nation • Pabineau First Nation • Esgenoopetitj First Nation • Metepenagiag Mi'kmaq Nation • Eel Ground First Nation • Indian Island First Nation • Elsipogtog First Nation • Bouctouche First Nation • Fort Folly First Nation • Oromocto First Nation • St. Mary's First Nation • Kingsclear First Nation • Woodstock First Nation • Tobique First Nation • Madawaska Maliseet First Nation
Québec	• Montagnais de Pakua Shipi • Conseil des Montagnais de Unamen Shipu

Province	Aboriginal Community or Organization
	• Conseil des Montagnais de Natashquan • Bande des Innus de Ekuanitshit • Innu Takuaikan Uashat Mak Mani Utenam • La Nation Innu Matimekush-Lac John • Montagnais du Lac St.-Jean • Conseil des Innus de Pessamit • Conseil de la Première nation des Innus Essipit • La Nation Micmac de Gespeg • Gesgapegiaq Micmac Band Council • Listuguj Mi'gmaq First Nation • Première Nation Malecite de Viger • Mi'gmawei Mawiomi Secretariat • Conseil Tribal Mamuitun • Regroupement Mamit Innuat Inc.

A sample copy of this letter is provided in Attachment C. Responses were received from a number of these Aboriginal groups.

As requested in a response letter received from the Innu Council of Ekuanitshit, representatives of the C-NLOPB and its SEA Update study team met with the Chief and various Band Council members on October 26, 2012 in that community. During that meeting an overview of the SEA process was provided and comments and perspectives were received regarding possible future oil and gas activities in the Western NL region and its potential environmental effects.

A similar and subsequent meeting was also held with the Mi'gmawei Mawiomi Secretariat on Monday November 26, 2012 in Gesgapegiag, QC.

3 CONSULTATION RESULTS

The following sections provide an overview of the results and key findings of the consultation program that has been carried out for the SEA Update to date, including meeting locations and times, attendance, key questions and issues raised and other outcomes, organized by individual consultation location and session.

The following sections are intended to provide an overview summary of these items, as reflected in the verbal and written comments provided to the SEA Update study team either during and/or following each meeting. These are presented in no particular order, although an attempt has been made to generally group these by key subject or theme. Also, of necessity and for the sake of brevity, the information has been summarized and in some cases coalesced to attempt to accurately but succinctly reflect the main issues and perspectives provided, rather than present a verbatim recount of all input received. It should also be noted that in many cases, consultation participants provided information and opinions regarding environmental components or phenomena, the perceived effects of oil and gas and other human activities, commentary on regulatory or policy matters and other issues, all of which have been summarized and presented here. No attempts have been made to authenticate or in any way refute any such anecdotal information, and the objective of this report is to present "what we heard".

This Consultation Report forms part of the SEA Update Report that is released for public review and comment, at which time participants can have an opportunity to provide any additional information or clarification to help ensure that their questions and issues are accurately and appropriately reflected herein.

3.1 Port aux Basques, NL: September 30, 2012

3.1.1 Public Open House

Location and Time:	Bruce II Sports Centre, Sunday September 30 2012 (5-9 pm)
Number of Attendees:	22
SEA Update Team Members Present:	E Young (C-NLOPB), M Conway (C-NLOPB), S Bonnell (AMEC), B Power (AMEC), D Cote (AMEC), L Campbell (AMEC)
Number of Feedback Forms or Other Written Submissions Received:	4

Summary of Questions and Comments

Environmental and Socioeconomic Setting

- A strong recognition of the ecological importance and value of the Western NL Offshore Area, and a statement that there are some 2,000 marine species found in the Gulf.
- The region is reportedly a primary source of krill, especially around the Old Harry site.
- Information was provided about the location of some important lobster areas in the region, including sites near Ramea, Port aux Basques and east, as well as north to Bay St. George.

- It was noted that water currents in this area are significant, complex and relatively poorly understood.

- Fishermen use seines in various areas, and fish for flounder from Cape Anguille to Cape George in the summer time. These seines go down 30 – 60 fathoms in depth.

Environmental and Socioeconomic Considerations and Possible Mitigation

- Concerns were stated and reiterated about the potential environmental and socioeconomic implications of an oil spill on the fishery in the region.

- Overall there is a significant amount of water movement in and through the area, and there is a concern that any petroleum spill in the area would almost certainly reach land eventually.

- References were made to a report produced by the David Suzuki Foundation on oil spill distribution modeling in the Gulf of St. Lawrence, noting that quite a lot of people on the coast are aware of this work. There is concern that the results of the various modelling studies that have been done and released are often quite conflicting.

- A need to ensure that appropriate and adequate accidental event and emergency response procedures and provisions are in place should an accidental event occur.

- There is a general concern about the nature and size of required financial assurances and compensation packages that must be posted by oil and gas operators in the area (perception that there is a maximum liability of $30 million), and a view that this would be inadequate. It was stated, for example, that the Îles-de-la-Madeleine fishery was itself worth over $40 million in 2012.

- Sentiments were expressed about the size and financial viability of some of the oil and gas exploration companies that are active in the Western NL Offshore Area.

- Some of the fishers present reported that they harvest flounder and are concerned about how these may be affected by oil and gas exploration (including planned activities and any accidental events).

- People are aware that much of the previous and planned exploration activity is on or near shore, and there is a concern that there is quite a lot of risk involved.

- It was noted that all fishermen are not necessarily opposed to oil exploration and development, including drilling and seismic activities, but they remain very concerned about what would occur in the event of a spill.

- The local area has infrastructure, skills and a work force that can support the oil and gas sector, as well as a training institution.

- One municipality stated that it fully supported the development of the oil and gas sector in Western Newfoundland, and reiterated that this must proceed in a safe and environmentally responsible manner. The community is committed to work with oil and gas operators, through the provision of services and other support, and wished to see local and provincial benefits optimized.

- It was noted that safety zones were required around oil and gas exploration facilities and activities. The SEA and/or project EAs should present information on their sizes, location, duration and communication.

- A statement that oil and gas activities should go ahead in the region, as long as environmental issues are addressed and regulations are adhered to.

- One participant noted that he has experience with oil and gas operations off South America, in which independent inspectors board and inspect oil platforms. These third party inspectors give the oil companies report cards based on their performance and any deficiencies and report back to the government. This system appears to be working well, and it was recommended that a similar approach be adopted in Canada.

Regulatory, Policy and Procedural Issues

- Interest and questions about the nature and purpose of the SEA process, how it compares and relates to project-level EAs, and the C-NLOPB's role and exploration licensing and approval processes.

- Questions about access to information obtained by oil and gas companies that have completed previous exploration in Western Newfoundland and associated business confidentiality considerations.

- A statement that the Gulf of St. Lawrence cannot support an oil play, and that all petroleum activities should be stopped immediately.

- A stated preference that the SEA consultations should have included detailed technical presentations and a "hearing" type format once the SEA is completed, rather than these early and general open houses.

- A comment was made that a similar consultation session should take place in the Gaspé area of Québec.

3.1.2 Stakeholder Meeting

Location and Time:	Bruce II Sports Centre, Sunday September 30 2012 (1-3 pm)
Number of Attendees and Groups:	0
SEA Update Team Members Present:	E Young (C-NLOPB), M Conway (C-NLOPB), S Bonnell (AMEC), B Power (AMEC), D Cote (AMEC), L Campbell (AMEC)
Summary of Questions and Comments:	n/a

3.2 Stephenville, NL: October 1, 2012

3.2.1 Public Open House

Location and Time:	Holiday Inn, Monday October 1 2012 (5-9 pm)
Number of Attendees:	24

SEA Update Team Members Present: E Young (C-NLOPB), M Conway (C-NLOPB), S Bonnell (AMEC), B Power (AMEC), D Cote (AMEC), L Campbell (AMEC)

Number of Feedback Forms or Other Written Submissions Received: 1

Summary of Questions and Comments

Environmental and Socioeconomic Setting

- Numerous wildlife species depend on the Gulf of St. Lawrence being healthy in order to survive. This includes fish, marine mammals and numerous species of birds, including the endangered piping plover.

- There are various species of marine mammals that occur in the area and in the bays, including beluga whales, dolphins, porbeagle sharks, blue whales, etc. Have seen over a hundred dolphins in Port au Port Bay feeding on mackerel. The presence of these is a good indication of the current health of these waters.

- Lobster are typically found in a relatively narrow strip of water near the shoreline, out to approximately 16 fathoms in depth.

- The value of the commercial fisheries in the Gulf of St. Lawrence was noted to be worth approximately at $1.5 billion a year.

- A fisher who works in the Shoal Point – Shag Point area said that the amount of fish being caught and the effort required has changed quite a lot in recent years. For example, 10 years ago there were 25 fishermen hauling in about 13,000 lbs, whereas now there are just 6 catching 4,000 lbs with more time and effort involved.

- A comment was made that because there are fracturing concerns, the SEA should have a strong geological component when it is released.

- SEAs and EAs are far too focussed on and preoccupied with the biophysical environment. It is very important that the human environment be fully considered, and there is a need to recognize the people and communities exist in the region and will be affected.

- Concerns about how employable much of the local population will be for an oil and gas company considering their current skill sets and lack of experience in this sector.

Environmental and Socioeconomic Considerations and Possible Mitigation

- Concerns about the potential effects of marine based seismic activity on marine life (especially lobster) and the fishing industry, including effects on lobster in nearby pots. Questions and concerns about how close any seismic activity occurs to the shoreline.

- Concern about the potential for, and the possible environmental and socioeconomic effects of, an accidental oil spill, particularly given the circulation patterns of the waters in the Gulf of St. Lawrence.

- Concerns about the potential for fracturing activity to occur in the region, and its potential effects. There is reportedly quite a lot of discussion of this issue including in the newspapers.

- Concerns were expressed about the amount of freshwater consumption that is often associated with fracturing activity and the possible environmental effects of this.

- A perception amongst some that there is more of an acceptance of onshore drilling as it does not affect people and their activities and livelihoods as much as offshore oil and gas activities would.

- A view that there is far too much uncertainty around the possible environmental effects of oil and gas activities at present to allow it to occur.

- Concerns about how these activities and their environmental effects will affect Gros Morne National Park (a UNESCO World Heritage Site), both ecologically and in terms of the tourism revenues that it generates.

- The potential effects of an oil spill, as well as the environmental issues and effects associated with the use of dispersants in the event that one occurs.

- Concerns about how oil and gas activity off Western Newfoundland could affect the recovery of the cod stocks in this region.

- The effects of any proposed hydraulic fracturing on Shoal Point, and its possible effects on the whole of the Port au Port Peninsula.

- The proximity of drilling activity to shore, and the rate at which any oil spill would reach shore given the prevailing westerly winds. Perception that the waters in the Gulf only empty into the Atlantic once every year.

- A comment was made that not there are not enough local economic benefits that occur as a result of oil and gas exploration activity. Local residents are asked to accept and assume the risks, with little or no reward.

Regulatory, Policy and Procedural Issues

- Interest in and questions about the nature and purpose of the SEA process, how it compared and related to project-level EAs, and the C-NLOPB's role and exploration licensing and approval processes.

- A statement that there was far too much government regulation of exploration and development projects. This includes a lot of duplication in the SEA and project-specific EA processes.

- There was a comment about the origins and accuracy of local anecdotal statements that there may be billions of barrels of oil in the region, which is unsubstantiated information being shared in the community.

- A suggestion that fracturing activity be banned entirely, especially given how dangerous it is.

- A question as to whether a request for a moratorium on all oil and gas activity in the area would be considered by the C-NLOPB if people want to see it occur.

- Recognition that this issue is relevant to not only those who live in Western Newfoundland, but also all of the other Atlantic Provinces and Québec.

- A call for a complete moratorium on all oil and gas activity in the Gulf of St. Lawrence, including while the SEA is occurring.

3.2.2 Stakeholder Meeting

***Location and Time**:* Holiday Inn, Monday October 1 2012 (1-3 pm)

Number of Attendees and Groups: 3 (Fish, Food and Allied Workers (FFAW) representatives)

SEA Update Team Members Present: E Young (C-NLOPB), M Conway (C-NLOPB), S Bonnell (AMEC)

Summary of Questions and Comments

Environmental and Socioeconomic Setting

- The Western NL Offshore Area as a whole is very sensitive, with significant biodiversity. This is especially true for places where the main food organisms for key fish species are found.

- The bays along the west coast of Newfoundland are very biologically productive and sensitive.

- Crab, lobster and cod are important species – economically and environmentally - that need to be protected. They are the backbone of the local fishery right now.

- Local fishers have been seeing important changes in fish species and populations in recent years in this area.

- Many fish species are found in deeper waters than where they have traditionally been fished in. The water temperatures have increased by about 2 ^{o}C, which is changing the depths at which many fish species live at various times of the year.

- There has been an especially big shift in fish spawning times and locations. Not seeing as many spring spawners as before, this is occurring mostly in the fall of the year now.

- Mackerel distributions and movements are also changing, and they are coming through the area much later in the year than before.

- Local fishers are also seeing different fish species occurring in the Gulf now than used to be the case, including more hake, sharks and others, which is probably due to water temperature changes as well.

- The SEA Update Report should include updated water temperature information, as available.

- Bay St. George has been an important area for cod. This species moves through the Western NL Offshore area at various times of the year.

- The SEA Update Report should present a map showing the locations of any drill sites to date in the Western NL Offshore Area.

- The report should also include a focus on general vessel traffic information and data since 2005. There is a lot of vessel traffic to and through the area.

Environmental and Socioeconomic Considerations and Possible Mitigation

- There is a perception that although the Bay St. George area was once very productive for fish, this has decreased since they did seismic work in the area.

- Lobster are especially sensitive to human activities, as is the near shore environment in which they live and where fishing occurs.

- An observation that lobster occurrences and catches have been decreasing in recent years, except it seems in areas where no seismic activity has ever occurred.

- The need to ensure that appropriate and adequate emergency response procedures and provisions are in place should an accidental event occur.

- Operators must have to demonstrate that they are capable to responding to any spill, and appropriate and adequate financial compensation measures must be guaranteed.

- Sentiments were expressed about the size and financial viability of some of the junior oil and gas exploration companies that are active in the Western NL Offshore Area, including their ability to respond to spills and offer adequate compensation.

- Given the relatively undeveloped state of the oil industry off Western NL at present, oil spill response capabilities are far lower than on the east coast, and response times will likely be much greater.

- Fishers are often asked to accept and assume the risks associated with offshore oil and gas activity, with little or no reward or even, no guarantee that their livelihoods and incomes will be protected if anything goes wrong (due to oil spills etc).

- If any oil and gas activity were to occur, it will be important to try and avoid bays and nearshore areas.

- There are reports that crude oil particles have been found on beaches in the local area in recent times, which may be from natural seepage or from past drilling.

Regulatory, Policy and Procedural Issues

- One participant stated that there should not be any oil drilling in the area, as not enough is known about the environmental effects of these activities.

3.3 Corner Brook, NL: October 2, 2012

3.3.1 Public Open House

Location and Time: Pepsi Centre, Tuesday October 2 2012 (5-9 pm)

Number of Attendees: 87

SEA Update Team Members Present: E Young (C-NLOPB), M Conway (C-NLOPB), S Bonnell (AMEC), B Power (AMEC), D Cote (AMEC), L Campbell (AMEC)

Number of Feedback Forms or Other Written Submissions Received: 20

Summary of Questions and Comments

Environmental and Socioeconomic Setting

- Both commercial and non-commercial marine species need to be considered in the SEA Update.
- The krill populations along with other marine life in the Gulf are important. The Laurentian Channel has the largest krill population in the North Atlantic, and is a significant breeding ground for many marine species.
- Currents run in a clockwise fashion and it has been said that the Gulf only empties into the ocean once a year.
- It was questioned how is it possible to identify a particular sensitive area when the whole Gulf of St. Lawrence should be considered sensitive.
- There is a need for good baseline scientific data on the multitude of species in the Gulf ecosystem as a whole.
- It has been stated that the value of commercial fisheries in the Gulf of St. Lawrence is $1.5 billion / year.
- Concerns were expressed about data shortages; how do we know enough about this very complex environment?
- What gaps are currently present in the environmental information on this area? Is there enough baseline information out there to do this report properly?
- A perception that the commercial fishery and tourism in the Western NL region outweigh the benefits of oil.
- A view that traditional oil recapturing methods often do not work in the NL Offshore Area because the waves are far too variable.
- A suggestion that comprehensive socio-cultural research be conducted on how offshore oil activity will affect fishers and their culture in Western Newfoundland.

Environmental and Socioeconomic Considerations and Possible Mitigation

- Some felt that companies can safely drill for oil and gas in the Gulf, given that Canada has a robust regulatory regime, and as there are less weather and environmental factors to contend with compared to drilling in harsher environments such as the Grand Banks.
- Concern about the possible effects of oil and gas activity on Gros Morne National Park and its UNESCO status.

- The possibility that oil and gas activity may affect cod recovery efforts and other species at risk, and questions around how the C-NLOPB can ensure that oil activity does not affect stocks.

- This is a very fragile area with many unique species, some of which are endangered.

- The Bay of Islands is already polluted by sewage, any further pollution (i.e. an oil spill), would be disastrous.

- Concerns about the potential for hydraulic fracturing activity to occur in the region, and its potential effects. It was also noted that this activity has been carried out throughout Canada and elsewhere without incident.

- Concerns raised about a lack of resources and equipment available for oil spill clean-up in the region.

- Salmon are an important species in the area, and there are concerns about seismic activity occurring at the wrong time which could disrupt salmon runs (especially in the Bay of Islands all up to Gros Morne).

- People want to know more the effects of offshore seismic activities on lobster. For instance, does seismic activity have an effect on the abundance and distribution of this or other species?

- A comment about the good and productive relationships between the petroleum industry and fishers, as evidenced by the presence of fisheries liaison officers on seismic vessels to maintain communications and avoid disruptions of fishing.

- It was suggested that, should oil and gas exploration take place in the region, the end of August is a good time to do work in the offshore area as there is little fishing in many areas at that time.

- There would have to be a further investment in clean-up technologies, including a recovery centre on the west coast of Newfoundland. How long would current oil recapture methods take in the rough waters of the Gulf?

- Questions and concerns were expressed about clean-up procedure in the event of an oil spill - who would be responsible for it, and who will actually conduct it?

- What would be the response time for the west coast, and what is the feasibility of having an oil response centre on this part of the Island of Newfoundland?

- There is a general concern about the nature and size of required financial assurances and compensation packages that must be posted by oil and gas operators in the area (perception that there is a maximum liability of $30 million), and a view that this would be inadequate.

- In the Sally's Cove area the existing Exploration Licence hugs the coastline and may have implications for people and their properties.

- Concerns were expressed about the near shore fishery in general, including lobster and crab, and the possible effects of offshore oil and gas exploration and development activities on these.

- A possible mitigation may be to use lights that are shaded to avoid attracting migrating songbirds.

- A key issue in this region is around salmon migration routes and how they might be affected.

- There is a need for further study on the effects of seismic surveys and the effect of petroleum activity on the environment (even without an oil spill).

- A view that there needs to be a western shore oil response center, as the area currently has no capacity to handle an oil spill.

- A view that offshore oil and gas operators need to be held fully accountable for any required compensation or recovery efforts.

Regulatory, Policy and Procedural Issues

- Concerns about the recent changes to the federal EA legislation and process, and a general sentiment that the public is losing faith in the process and its effectiveness and impartiality

- There is a requirement for more emphasis and efforts around educating people about the impacts associated with offshore oil development.

- There was an impression that fracturing activity is already occurring in Western Newfoundland, and there are reports that some companies have already been talking about it.

- A view was expressed that the Old Harry area should be renamed as Cape Ray or Burgeo so it can be more directly connected to the people and places of Newfoundland and Labrador.

- Questions were raised about the boundaries between the Newfoundland and Labrador Offshore Area and the marine area jurisdiction of Québec and the other Atlantic Provinces.

- Quite a number of questions were again asked about the nature and purpose of the SEA process, how it compared and related to project-level EAs, and the C-NLOPB's role, composition and exploration licensing and approval processes. Composition of the SEA Working Group and potential problems with this.

- Concerned that offshore exploration activity is planned and continuing while the SEA Update is in progress.

- A view that any potential petroleum activity in the Gulf needs to be approved by all five provinces, especially as a spill would affect all provinces.

- Further information and understanding is needed on fracturing, including the chemicals used in the process. Some calls for this activity to be banned.

- Concerns about the role of the Board and other government departments in approving projects and EAs.

- Suggestion that the Board become more proactive when dealing with the environment critics, highlight the fact that the Board is a legitimate regulator for western NL offshore and reference safety of east coast.

- A view that an SEA needs to be completed for the Gulf of St. Lawrence as a whole, not just the Western NL Offshore Area.

- The SEA information needs to be available for public comment and there should be time for an independent science review.

- Ensure a full set of agreements with and between the five provinces about mitigation and clean-up measures. Water currents do not observe political boundaries.

- A view that there should be a moratorium on oil and seismic activity until it can be made safe.

- A view that the composition of the SEA Working Group should have included representatives from academic institutions and Aboriginal groups.

- A stated preference that the SEA consultations should have included detailed technical presentations and a question and answer panel in a "public hearing" format, rather than these early and general open houses.

- A view that there is a conflict of interest in that the Board grants licenses but also oversees the EA process, and a call to stop ongoing licensing activities while the SEA Update is in progress.

3.3.2 Stakeholder Meeting

Location and Time:	Pepsi Centre, Tuesday October 2 2012 (1-3 pm)
Number of Attendees and Groups:	7, with representation by the: • Fish, Food and Allied Workers (FFAW) • Qalipu Mi'kmaq First Nation • College of the North Atlantic • NL Department of Tourism, Culture and Recreation • Corner Brook Board of Trade • Newfoundland & Labrador Oil & Gas Industries Association • Western NL Oil and Gas Steering Committee
SEA Update Team Members Present:	E Young (C-NLOPB), M Conway (C-NLOPB), S Bonnell (AMEC), B Power (AMEC)

Summary of Questions and Comments

Environmental and Socioeconomic Setting

- It was noted that the previous (2005 / 2007) SEA Reports had a primarily biophysical focus, and there is a need for more of a socioeconomic dimension to the SEA Update and associated planning.

Environmental and Socioeconomic Considerations and Possible Mitigation

- Important to recognize that the benefits of east coast oil and gas activities have been felt all over the province and has lead to our people being involved in oil and gas all over the world.

- There are local questions and concerns about potential fracturing activity in Western Newfoundland especially on the Northern Peninsula. It was noted that this is a new process and technology for this region, and people are curious and have concerns, although it was also noted that it has occurred safely in other areas of Canada and elsewhere.

- There is a local interest in being involved in oil and gas activity on the west coast, driven by desire to have leading edge technology and skills in this region and to help educate the community.

- There is an opportunity to create and grow a model industry here, with good strategic planning. There has been previous work done on the business development opportunities that could be associated with oil and gas development on the west coast.

- Relevant education and training initiatives need to be developed related to this industry, and at present there are no local training programs. Can draw on east coast experience here.

- As an early planning tool, the SEA can help stakeholders to become informed, determine what education skills are required and available, and work on bridging the gaps.

Regulatory, Policy and Procedural Issues

- Questions about the SEA process, including the timing for the SEA report, public review, and the size and availability of the 2005 / 07 SEA reports.

- Questions about the overall regulatory processes for offshore and on-shore oil and gas activities.

- There are complex inter-provincial and federal jurisdictions and issues involved in oil and gas activity in the Gulf of St. Lawrence, which has relevance to the future development and growth of the Western Newfoundland industry.

- A range of groups and individuals need to be reflected in the SEA public consultation program, and it is important that input is received from a good blend of people and interests (and not just the loudest).

3.4 Rocky Harbour, NL: October 3, 2012

3.4.1 Public Open House

***Location and Time*:**	Community Hall, Wednesday October 3 2012 (5-9 pm)
***Number of Attendees*:**	44
***SEA Update Team Members Present*:**	E Young (C-NLOPB), M Conway (C-NLOPB), S Bonnell (AMEC), B Power (AMEC), D Cote (AMEC), L Campbell (AMEC)
Number of Feedback Forms or Other Written Submissions Received:	7

Summary of Questions and Comments

Environmental and Socioeconomic Setting

- There are very rich fishing grounds in the areas covered by the existing exploration licences off Western Newfoundland. Sally's Cove, for example, is one of the best lobster grounds along the coast.

- A local fisherman referenced an important area called Green Point Banks, a shallow inshore area between Trout River and Sally's Cove which is a very important area ecologically for certain fish species (including mackerel).

- Bonne Bay is a sensitive marine area next to a UNESCO World Heritage Site and needs to be protected. There is a need for more marine protected areas.

- Important lobster grounds are located off Sally's Cove and between Rocky Harbour and Cow Head. Crab and cod populations are fragile.

- There are various species at risk and shorebirds that nest along the coastlines of Gros Morne National Park or which move through the area. Piping plovers nest on Western Brook Pond.

- The environment is already under stress from pollution and other disturbances. Already seeing unusual patterns in marine wildlife, and caution is advised against adding further stressors to the marine ecosystem.

- A variety of species occur in the area throughout the summer, including whales, seals, dolphins, porpoises, mackerel, herring, cunners, cod, lobster, snow crab, sea stars, sand dollars, blue mussels, scallops, kelps and seaweed, seabirds, river otters, mink, moose.

- Bonne Bay is also used for a variety of human activities, such as recreational boating, recreational and commercial fishing, picnicking, tour boat operators, water taxi services, walkers and hikers.

- The Gros Morne area has developed a sustainable tourism industry, and this is dependent upon a healthy marine environment.

- There is a need for better and additional information on the existing environment in the Bonne Bay area to assess environmental impacts, as well as on-going environmental monitoring.

Environmental and Socioeconomic Considerations and Possible Mitigation

- It was noted that some people have seen some fish stocks decline during and after previous seismic activity, but these are starting to come back now.

- Questions and concerns about the chemicals used in the offshore drilling processes, and their regulation.

- Concerns were expressed about the potential for marine seismic surveys in the area and the possible environmental effects of these. Concern that this could affect fish for miles around. Aware of reports of seismic effects from east coast fishers.

- There is concern about possible fracturing activity in the Sally's Cove area and elsewhere amongst local residents, especially possible groundwater contamination, chemical use, fish and fish habitat, health etc.

- Many people in Sally's Cove are fishers, and any drilling near that community, seismic testing or leaching of toxic chemicals could destroy the fishery.

- Consultation with communities will be very important if any land based fracturing activity is proposed.

- There was concern about the potential for fracturing on the geological transition zone in the area.

- There are drinking water wells in Sally's Cove that need to be considered if oil and gas activity is planned for this area. Leaching of chemicals could poison water wells, and discharge of chemicals into sensitive marine environments could cause effects such as ocean acidification which could weaken the shells of lobster.

- Further information is required regarding the plans for drilling from Sally's Cove. Will there be fracturing, and is that why land was bought in that community? Where will the associated water come from?

- There are also rumours that drilling would occur below the local Sally's Cove cemetery, which would be very disrespectful.

- Given the high levels of tourism in the area, concerned about viewshed impacts results from the presence of exploration equipment in the ocean. One of the current exploration licences stretches along a narrow band along the coastline that is near Gros Morne National Park and the Viking Trail Coastal Drive.

- Possible effects of noise pollution from activities occurring in and near the National Park.

- Effects of oil and gas activities on ecotourism in the area, as well as hunting and fish related tourism in the area north of Gros Morne National Park.

- Possible implications of oil and gas activity for Gros More National Park's UNESCO status.

- Have to ensure that appropriate measures are in place to protect the existing and sustainable industries and already diversified economies in the region. Controls and safeguards must be in place related to any oil and gas activity off our shores.

- People want to see detailed information on the economic argument for the development of oil and gas in this region.

- Additional information is also needed on what is being proposed, and the associated approval processes and steps.

- Concerned about the effects of oil spills, including the dispersion of toxic chemicals on marine biodiversity, especially shellfish and plankton. Who will pay for any oil spill cleanup?

- Concerns were raised that if a marine oil spill were to occur in this area it could mean the loss of Gros Morne's UNESCO status, the fishery, and the whole local economy.

- Concerns about a possible deep water blow-out with ocean currents then carrying the spilled oil onto the shores of Western Newfoundland. Possible negative effects to the fishery as a result.

- What contingencies will be in place for such a catastrophe? Feel that oil companies should have unlimited liability in the event of such a spill.

- Concern about the potential effects of oil exploration, especially drilling, on ocean chemistry as a result of the discharge of materials into sensitive environments and their dispersal by marine currents.

Regulatory, Policy and Procedural Issues

- Quite a number of questions were again asked about the nature and purpose of the SEA process and the C-NLOPB's role, composition and exploration licensing and approval processes.

- Questions about how overlapping regulatory and policy frameworks are being considered and how decisions will be taken given the overlapping jurisdictions and governments.

- Given that Gros Morne has a UNESCO status, it will be important for the C-NLOPB to consult outside of NL as part of the SEA process.

- View that there should be an agreement on oil and gas activity between the five provinces before anything occurs.

- View that EAs should be completed by environmental, not for profit organizations and not by oil companies or governments. Adequate environmental baseline information is required.

- Future SEAs and project EAs need to ensure adequate public consultation and debate. This needs to include Aboriginal people and communities. Also questioned the invitations to the earlier stakeholder meeting.

- Need to communicate the "worst case scenario" of such activities. Some have called for a full moratorium on oil and gas activity in the area, including no drilling from water or near coastal waters or fracturing, and particularly not near Gros Morne National Park.

- A stated preference that the SEA consultations should include a formal presentation and be conducted in a "public hearing" format advertised well in advance. Also questioned the invitations to the earlier stakeholder meeting.

3.4.2 Stakeholder Meeting

Location and Time: Community Hall, Wednesday October 3 2012 (1-3 pm)

Number of Attendees and Groups: 14, with representation by the:

- Town of Rocky Harbour
- Town of Woody Point
- Bonne Bay Marine Station, Memorial University of NL
- Gros Morne Co-op Association
- Oceanfront Landowners of Bonne Bay

- Parks Canada
- Fish, Food and Allied Workers (FFAW)
- NL Dept of Innovation, Business and Rural Development
- NL Rural Secretariat
- Corner Brook / Rocky Harbour Regional Council
- Individual Fisher
- Citizen

***SEA Update Team Members Present**:* E Young (C-NLOPB), M Conway (C-NLOPB), S Bonnell (AMEC), B Power (AMEC), D Cote (AMEC)

Summary of Questions and Comments

Environmental and Socioeconomic Setting

- There are times when sensitive fisheries occur (e.g. herring). There are a lot of sensitive areas in the Gulf – different fish species in different depths.

- It was noted that the Old Harry area is an important spawning ground for cod in the Gulf of St. Lawrence. Cod migration patterns pass through this area.

- There are a number of researchers and institutions that do work in this area (e.g., University of Maine, CURRA).

Environmental and Socioeconomic Considerations and Possible Mitigation

- Fishers are concerned about seismic activity in the area. Important to ensure that any seismic work is planned and designed around avoiding spawning and migrations times.

- Questions and discussion of the activities and chemicals associated with fracturing activity.

- It will be important to consider and address rural values. How do these relate to, and how would they co-exist with, an oil and gas industry in the area?

- This is a rural area, built on the fishery and tourism. Oil and gas development (especially, exploration) has traditionally not benefited rural areas, and so local residents are reluctant to accept the associated risks. We must refer back to the basic values of the area.

- Concerns about the infrastructure issues that may be associated with oil and gas activity in the region, including as a result of transporting large equipment to areas along the Northern Peninsula where the roads are already in poor condition in some places.

- It was noted that some areas on the Northern Peninsula have had a long history of interest in oil exploration and development, including historic oil sightings in the Port aux Choix area and elsewhere.

- Gros Morne is a UNESCO World Heritage site and the people do not want to gamble with this.

- Questions and comments around the requirements for environmental monitoring of the types of activities covered in the SEA, and a suggestion that the SEA plant the seed for more rigorous and transparent monitoring regimes for oil and gas activities.

- Environmental monitoring should be a key focus in project specific EAs, including independent monitoring, and the monitoring data should be made public and easily accessible.

- A comment that research is showing that there has been a decrease in female crab abundance in the Gulf of Mexico since the recent spill.

Regulatory, Policy and Procedural Issues

- Questions about the SEA process and its relationship to individual project-specific EAs, the availability of the 2005 / 2007 SEA documents, as well as how the SEA Update is being developed and its public input (scoping) and eventual review process.

- Questions and comments about the study area for the Western NL SEA Update, and its expanded focus to look closer at other aspects of the socioeconomic environment.

- Need to define "stakeholders" very broadly for this issue, and hear from a wide range of interests and perspectives.

- It was asked who would be responsible for and be able to make a decision to implement a ban on all oil and gas activity in the region.

- There are multiple and complex jurisdictional issues involved. Is this SEA Update going to look at the work completed in the Québec assessments which look at the adjacent area in the Gulf?

3.5 Lourdes de Blanc Sablon, QC: October 4, 2012

3.5.1 Public Open House

Location and Time:	Salle Municipal, Thursday October 4 2012 (5-9 pm)
Number of Attendees:	7
SEA Update Team Members Present:	E Young (C-NLOPB), M Conway (C-NLOPB), S Bonnell (AMEC), B Power (AMEC), D Cote (AMEC), L Campbell (AMEC)
Number of Feedback Forms or Other Written Submissions Received:	1

Summary of Questions and Comments

Environmental and Socioeconomic Setting

- Most of the ground fish in this area migrate to elsewhere in various times of the year and in doing so, they travel through the Western NL Offshore Area. These fish would therefore be affected by any offshore oil and gas activity there.

- Views were expressed that there often is not enough information available about the environment and potential effects upon which to base decisions. There is inadequate information on currents, marine animals, etc.

- Perception that there is insufficient baseline data on water currents and fish populations in the area.

Environmental and Socioeconomic Considerations and Possible Mitigation

- There were requests that the SEA consider not only the nature and value of oil and gas activity, but also compare this to other existing activities that could be affected.

- Perception that the emphasis for oil and gas exploration should be on land, rather than going out to sea.

- There was a perception that drilling has either occurred or would soon be occurring off the coast of Southeastern Labrador, near Mary's Harbour.

- There are concerns that any activity in the Gulf of St. Lawrence is an "accident waiting to happen", and that the entire Gulf is considered sensitive.

- There is a perceived lack of benefits to local communities and residents from oil and gas exploration, especially compared to the value of the fishery. People live all along the coasts surrounding the Gulf. Local residents are asked to accept and assume the risks, with little or no reward.

- Concern about the effects of any oil spill, which it is feared would spread throughout the Gulf very quickly.

Regulatory, Policy and Procedural Issues

- Quite a number of questions were again asked about the nature and purpose of the SEA process and the C-NLOPB's role, composition and exploration licensing and approval processes.

- This included questions and comparisons regarding the Québec SEA processes regarding oil and gas activity in the Gulf of St. Lawrence.

3.5.2 Stakeholder Meeting

Location and Time: Salle Municipal, Thursday October 4 2012 (1-3 pm)

Number of Attendees and Groups: 6 with representation by the:

- Coasters Association
- Association Des Pecheurs De La Basse Cote-Nord
- Municipalitie Blanc Sablon

- Neighbours Without Borders
- An individual fisher
- A resident of Fox Cove, Labrador

SEA Update Team Members Present: E Young (C-NLOPB), M Conway (C-NLOPB), S Bonnell (AMEC), B Power (AMEC), D Cote (AMEC), L Campbell (AMEC)

Summary of Questions and Comments

Environmental and Socioeconomic Setting

- It was noted that the Gulf of St. Lawrence is not considered "offshore" by Québec fishers. Almost all fishing in the Gulf is coastal to mid-shore (out to about 12 miles), and the Gulf is more like a 'pond' not an offshore area.

- The coastal area of the Québec North Shore is an area good for spawning for cod, halibut, mussels, and more. Areas closer to shore are prime locations for the spawning of cod and shrimp.

- Blanc Sablon is a major cod area. Cod migrate north to Port aux Choix then cross up to the Blanc Sablon area.

- There are herring, mackerel, and cod migrations all throughout the Strait of Belle Isle. We need to know when such migrations occur and schedule activity accordingly to avoid these. We should also monitor these migrations (when they occur and at what density).

- Mackerel biomass has been reduced by a third from previous years, probably related to temperature changes (too warm).

- The halibut stock in the area is increasing.

- Some changes in fish distributions are being seen. For example, lobster are showing up off Southern Labrador. Capelin showed up in July along the North Shore this year, which is late.

- The Strait of Belle Isle is a good location to observe the migrations patterns of birds. From April – mid July there are many ducks, both migrating north and living in the area. There have been changes in fish and bird distributions resulting from recent temperature changes.

- People are seeing gannets, tuna, and swordfish recently, which had not been seen in previous years. Perhaps there are alterations in their cycles due to environmental changes.

- It is important that the full economic value of the fishing industry is considered, both direct jobs and value, as well as spin-off effects such as fish processing, buying fuel and bait, etc. It is also necessary to account for the fishing industry in the whole Gulf, and not just within the Western NL SEA Update Area.

- St. Augustine QC and north has some of the best kelp beds in the world, and local organizations are trying to use local renewable resources to sustain them economically. For example, berry picking and processing.

- Concerns about iceberg presence and movement in the Gulf and it was stressed that it is very different then the east coast of Newfoundland.

Environmental and Socioeconomic Considerations and Possible Mitigation

- Any oil and gas development in the Gulf should be done smartly, and must respect the fishing industry.

- All fishers are not against all development, but they must survive economically and oil and gas activity and its potential effects are of concern for their industry.

- People depend on the fishery, if a catastrophic spill were to happen all the communities would be gone.

- SEAs and/or project EAs need to look at how migration patterns would change with drilling.

- Concerned about the BP Gulf of Mexico spill, what happened to the sea floor? Is the oil residue still there? People are nervous about a similar situation unfolding in this region. There are new technologies available, but what is the success rate? Where is the follow-up information from the Gulf of Mexico spill?

- The SEA must cover the full extent of the potential effects of a possible oil spill. We should consider the worst case scenario of oil spills and effects on fish.

- It was suggested that a joint association between the oil industry and fisheries like One Ocean should be created for this region.

- A suggestion that monitoring of wildlife and their migratory patterns be conducted before conducting exploration activities (i.e. seismic surveys).

Regulatory, Policy and Procedural Issues

- Questions about the SEA process, the organizations which are included, and the SEA Working Group.

- It was recognized that the issue of oil and gas activity in the region has inter-jurisdictional interests, and it was suggested that there needs to be discussions with other provinces and a regional government network to expedite information flow and planning of projects.

- In the 1980s, fishers could catch 80 – 100 k tonnes of cod, now down to apx 3,000 tonnes. There is a sentential fishery happening, while DFO is closing down fisheries. Fishers are worried that the closing down by government bodies is to allow for oil and gas development, which causes great tension, and fishers feel frustrated.

3.6 Miramichi, NB: October 9, 2012

3.6.1 Public Open House

Location and Time: Kinsmen Club, Tuesday October 9 2012 (5-9 pm)

Number of Attendees: 23

SEA Update Team Members Present: E Young (C-NLOPB), S Bonnell (AMEC), J Paynter (AMEC), C Tiller (AMEC)

Number of Feedback Forms or Other Written Submissions Received: 2

Summary of Questions and Comments

Environmental and Socioeconomic Setting

- The movement of migratory fish passes through the SEA Update Area as they move to and from the Strait of Belle Isle and Cabot Strait at various times of the year, and these are very important considerations. Activity off Western Newfoundland could affect fish populations as they migrate to and from other areas.

- It was reiterated that salmon migrate through the SEA Update Area at various times of the year.

- It was reported that there is an important herring area near the Old Harry site.

Environmental and Socioeconomic Considerations and Possible Mitigation

- Concerns about the potential effects of seismic activities in the area on salmon migrations. Nature and effectiveness of "soft start" procedures. Scheduling and timing of activities is a key mitigation.

- The Gulf of St. Lawrence is characterized by significant and complex water currents, which would see any oil spills spreading out quickly. Interested in detailed future modelling of oil spills and potential impacts on New Brunswick during a major event.

- Concerned about possible operator response to oil spills should they occur. Important to ensure that there is sufficient liability and compensation to fully address any impacts to fishers and their livelihoods.

- It is felt that economic and industrial benefits from any resulting oil and gas activity should extend beyond Newfoundland and Labrador.

- There are a number of New Brunswick watershed groups who are concerned about the potential effects of oil and gas activities in the Gulf of St. Lawrence on coastal zones and riverine areas.

Regulatory, Policy and Procedural Issues

- Questions about the SEA process, associated stakeholder meetings, timing of the report and its review, and the manner in which comments received will be incorporated into the SEA Update.

- There are inter-provincial and federal jurisdictions and interests involved in oil and gas activity in the Gulf of St. Lawrence, which has relevance to any activity in the Western Newfoundland area

3.6.2 Stakeholder Meeting

Location and Time: Kinsmen Club, Tuesday October 9 2012 (1-3 pm)

Number of Attendees and Groups: 0

SEA Update Team Members Present: E Young (C-NLOPB), S Bonnell (AMEC), J Paynter (AMEC), C Tiller (AMEC)

Summary of Questions and Comments: n/a

3.7 Charlottetown, PEI: October 10, 2012

3.7.1 Public Open House

Location and Time: Best Western Hotel, Wednesday October 10 2012 (5-9 pm)

Number of Attendees: 32

SEA Update Team Members Present: E Young (C-NLOPB), S Bonnell (AMEC), J Paynter (AMEC), C Tiller (AMEC)

Number of Feedback Forms or Other Written Submissions Received: 8

Summary of Questions and Comments

Environmental and Socioeconomic Setting

- The Gulf is an environmentally sensitive area, with fish populations, marine mammals etc that could be affected. It has already been affected by pollution and climate change.

- Have to take a holistic view of the Gulf of St. Lawrence. There are complex (counter clockwise) currents in the Gulf, which will mean that any oil spill will affect all coastlines. Have to consider water movements in multiple layers of the water column.

- The SEA should consider and include the Royal Society of Canada report on the health of the oceans / Gulf of St. Lawrence.

- Have to look at and consider the effect of global warming on species at risk in the Gulf of St. Lawrence.

- The previous SEA Reports contained very little geological information on the Carboniferous Maritimes Basin, but was focussed on the Anticosti Basin. The SEA Update should address this.

- Are the NAFO fishing zones being considered in the SEA process and in the associated analyses?

- Water sources in the region are vulnerable to degradation because there is only one supply.

Environmental and Socioeconomic Considerations and Possible Mitigation

- Concerned about the effects of seismic activities, and the amount of research that has been done about the effects of seismic activity on whales and other marine life.

- It was asked whether and why permitted sound levels during seismic programs were higher in Atlantic Canada than in other places.

- Especially concerned about an oil spill in winter, when there is ice in the Gulf, and whether such a spill could be addressed.

- Have to consider the potential effects of offshore oil and gas activity on Gros More National Park.

- Concerned about the possible effects of a spill on PEI estuaries, in which oil would travel in-land and affect these areas as well.

- Have to consider the specific risks on tourism, the fishery, recreation and the overall marine ecosystem.

- What will be the effect of this industry on fossil fuel consumption / GHG emissions and what measures will help address global warming?

- Possible effects of future, ancillary infrastructure such as pipelines, etc.

- Have to consider the relatively short-term implications of offshore petroleum exploration / exploitation vs. the long term health of the Gulf.

- Local labour groups have passed resolutions supporting a ban on proposed oil and gas exploration projects.

- The SEA Update should help show that petroleum activities can be conducted safely in the Gulf of St. Lawrence.

Regulatory, Policy and Procedural Issues

- Questions about the SEA process and its relationship to individual project-specific EAs. Nature and status of on-going project EAs, including Old Harry.

- The SEA Update Area and projects such as Old Harry are close to other provinces, and these people need to be consulted as well.

- Some calls for a full moratorium on all oil and gas activity in the Gulf of St. Lawrence. Environmental protection and fishing interests should be the main priority.

- PEI has been heavily affected by global warming, and so we all need to look at other energy sources and types, including wind, solar and tidal power.

- Need full EA review of any proposed projects. Concerned about recent changes to the federal EA process and cancellation of recent EA processes and hearings.

- The SEA and associated consultations should involve the direct participation of all provinces affected by oil and gas activity in the Gulf, not just Newfoundland and Labrador.

- A view that this question should go directly to the legislatures of all affected provinces for debate and government decisions.

- The information provided through the SEA and associated consultations needs to be simpler and more focussed, as it is confusing to lay people.

- A stated preference that the SEA consultations should have included detailed technical presentations and a "hearing" type format, rather than these public open houses. Also questioned the invitations to the earlier stakeholder meeting.

- A view that society should pursue more renewable energy resources instead of oil and gas, such as wind, solar, and tidal.

- A perception that provincial legislatures should make the regional decisions about oil and gas development.

- It was stated that the Gulf ecosystem is already fragile and the Board should not risk further degradation by continuing to promote oil exploration and drilling within the region.

3.7.2 Stakeholder Meeting

Location and Time: Best Western Hotel, Wednesday October 10 2012 (1-3 pm)

Number of Attendees and Groups: 6 with representation by the:
- PEI Department of Environment
- PEI Department of Fisheries, Aquaculture and Rural Dev
- PEI Fishermen's Association
- PEI Aquaculture Alliance
- MP for Charlottetown (and Assistant)

SEA Update Team Members Present: E Young (C-NLOPB), S Bonnell (AMEC), J Paynter (AMEC), C Tiller (AMEC)

Summary of Questions and Comments

Environmental and Socioeconomic Setting

- Four species (mackerel, herring, halibut and tuna) all migrate through the area and are fished in all the Maritime Provinces and affect the whole food chain. The effects on their population need to be monitored.

- Need to provide updated fisheries data in the SEA Update. Overview of the importance and value of the fisheries and aquaculture industries.

Environmental and Socioeconomic Considerations and Possible Mitigation

- Spawning activities and times and migration should be considered, as well as lower food chain effects and their mitigation.

- Is there a requirement for an Environmental Management Plan to be submitted on a project basis?

- Key issue will be oil spills and how they will be addressed, including compensation for affected fishers.

- It was asked whether sound levels during seismic programs were higher in Atlantic Canada than in other places.

- Especially concerned about an oil spill in winter, when there is ice in the Gulf.

Regulatory, Policy and Procedural Issues

- General questions about the SEA purpose, process and eventual content and its relationship to on-going project EAs as well as on the C-NLOPB and its role and mandate, and the nature and composition of the SEA Working Group.

- The geographic extent of the SEA should not be limited to a specific area when permits for seismic or other exploration activities are granted, but rather should consider a larger regional area.

- What further consultation activities will be held after these public and stakeholder open houses? Are there opportunities for public comments to be submitted besides the Public Open Houses? What is the timeline for the release of the Draft Report? Is public input "weighted" according to provincial jurisdiction?

- Clarification of the types of "local knowledge" being sought.

- Would any information or changes in the upcoming SEA Report affect changes to currently operating Projects in the area?

3.8 Sydney, NS: October 11, 2012

3.8.1 Public Open House

Location and Time:	Holiday Inn Waterfront, Thursday October 11 2012 (5-9 pm)
Number of Attendees:	19
SEA Update Team Members Present:	E Young (C-NLOPB), S Bonnell (AMEC), J Paynter (AMEC), M Cameron-MacMillan (AMEC)
Number of Feedback Forms or Other Written Submissions Received:	3

Summary of Questions and Comments

Environmental and Socioeconomic Setting

- The Gulf of St. Lawrence is considered a unique marine ecosystem which features complex oceanographic processes, bathymetry, and maintains a high level of biodiversity, including 2,000 species that spawn, nurse and migrate in the area. This includes macro-algae and plants, plankton, invertebrates, reptiles, fish, birds and mammals, many of which are protected.

- Tidal drift in the Gulf of St. Lawrence is dominant in the southerly direction or at times southeast (apx 98 percent of the time, other times being circular around the Îles-de-la-Madeleine).

- Nova Scotia fishers harvest crab, lobster, halibut and other ground fish, including in an area just between Port aux Basques NL and Cape Breton NS, as well as crab along Cape Breton.

- The SEA Update needs to report on and consider the total value of the fishery in the Gulf of St. Lawrence.

- The recreational tuna catch and release fishery is reportedly growing in the area, with associated direct economic and spin off benefits.

Environmental and Socioeconomic Considerations and Possible Mitigation

- It is important that there is safe sanctuary available for all marine species, especially in nursery areas.

- It was felt that there is insufficient knowledge about lobster larvae, lobster and krill to adequately predict and mitigate effects on them, and that any oil and gas activity would negatively affect the food chain in the Gulf.

- Seismic activity has reportedly affected fish populations in the past around Nova Scotia. Crab went away for a year after seismic and did not fully return for 5-6 years.

- It was felt that should an oil spill occur, it would be impossible to completely clean it up or fully address its environmental effects.

- Include information on how drilling muds are treated and disposed of, and the known environmental effects of these.

- Concerned about salmon in the Gulf of St. Lawrence which could be affected through their movements to and through the Strait of Belle Isle and the Cabot Strait / Laurentian Basin.

- Concerned about the risks and effects of a catastrophic oil spill and the remedial measures that could be taken to address these.

- Possible vessel strikes during offshore oil and gas activities could seriously injure marine mammals and reptiles.

- Potential introduction of invasive species from ballast water exchange.

- There is a general concern about the nature and size of required financial assurances and compensation packages that must be posted by oil and gas operators in the area (perception that there is a total maximum liability of $30 million).

- Statements that such compensation should be available for all affected fishers, not just those in Newfoundland and in Québec, and this should address effects on fish populations not just direct damages.

- Questions around how the Board could move forward with oil exploration given that there are gaps in the knowledge of marine species, making it difficult to determine effects and required mitigation.

- A suggestion that where there is scientific uncertainty and the threat of harm the precautionary approach must be applied.

- Concerns regarding the harmonization of the conservation efforts of fishers to rebuild fish stocks and the activities of the offshore oil industry.

Regulatory, Policy and Procedural Issues

- Questions and comments about the choice of Sydney NS as the location of the public consultation, as it was maintained that Sydney is not in the Gulf of St. Lawrence.

- Questions and comments about the SEA process, including the appropriateness of having it completed by the C-NLOPB and its consultant. Questioned the impartiality of consultants who also work with the oil and gas industry.

- Recommendation for an integrated management planning framework process for the Gulf of St. Lawrence, for organizing and defining environmental information, establishing interrelationships, and communicating with participants and stakeholders, with a federal agency responsible for monitoring any future oil and gas activity.

- A stated preference that the SEA consultations should have included detailed technical presentations and a "hearing" type format, rather than these public open houses. Also questioned the invitations to the earlier stakeholder meeting.

- A suggestion for a full moratorium on offshore oil and gas development in the Gulf of St. Lawrence.

3.8.2 Stakeholder Meeting

Location and Time: Holiday Inn Waterfront, Friday October 12 2012 (9-11 am)

Number of Attendees and Groups: 4, with representation by the:

- Area #19 Crab Association
- Gulf NS Fleet Planning Board
- Parks Canada Agency

SEA Update Team Members Present: E Young (C-NLOPB), S Bonnell (AMEC), J Paynter (AMEC)

Summary of Questions and Comments

Environmental and Socioeconomic Setting

- It was noted that this region and its SEA are different than the ones for other areas such as the Grand Banks. The Gulf of St. Lawrence is a very different environment, near-shore dimension, inter-jurisdictional issues for one ecosystem.

- The entire Gulf of St. Lawrence is considered sensitive, and many people work in the region and depend on the Gulf and its resources for their livelihood.

- It was noted that the Gulf NS Fleet Planning Board has a shrimp allocation in the Laurentian Channel.

- Northwest Cape Breton has a National Park which is a very important protected area.

- Some of the whales migrating through the Gulf are species at risk.

- The Gulf of St. Lawrence is a relatively closed system, and the effects of any accidental event will linger for a long time. The Gulf cleanses itself every 3 weeks, unlike Georges Bank which is twice per day.

Environmental and Socioeconomic Considerations and Possible Mitigation

- Questions around whether the C-NLOPB has ever refused to approve previous exploration projects and/or has imposed environmental restrictions on them.

- Oil and gas companies should establish long-term baseline data now for Western NL and Cape Breton so we can avoid problems in the future by comparing impacted situation to baseline, including baseline sediment quality for pre-drilling conditions.

- Concerns that an exploration license has been issued near Gros Morne National Park, which could result in visual intrusion impacts. It was noted that in NS an operator cannot position a drill rig within 10 miles of the western Cape Breton shore.

- Compensation for fishers in the event of lost income is not clear. What is the compensation for removing land / habitat out of fish production? Concerns about accessing compensation because of difficulties proving cause and effect.

- There are concerns about how drift ice and major storms would affect accidents and malfunctions, including how an oil spill would be cleaned-up under ice.

- Concerns about junior oil and gas companies working in the Gulf of St. Lawrence, and their overall financial strength and ability to address any accidental events.

- Concerns that the fishing industry has a very small voice compared to oil and gas industry. All organizations need to be actively involved, not just one. Fishers want their questions answered, and cannot just move to another location but rather will suffer long-term consequences.

- An oil “boom” can trigger negative socioeconomic issues, and it is not clear how oil and gas companies will address this.

- Include information about what drilling materials are used and permitted, and how these are disposed of.

- The need to establish more / better trust between fishers and the oil and gas industry, perhaps using collaborative research efforts as an avenue.

Regulatory, Policy and Procedural Issues

- The role, mandate and powers of the C-NLOPB, as well as composition of the SEA Working Group and its workings and records.

- Need a holistic approach with wide-ranging consultation since the implications of an accident would affect an area beyond the delineated SEA Update Area.

- Questions and comments about the provincial boundaries in the Gulf and associated inter-jurisdictional interests and issues.

- Questions about the SEA Update process, including the availability of the 2005 and 2007 SEA Reports.

- Concerns about the recent changes to the federal EA process and its current inapplicability to oil and gas exploration. It was wondered whether there is renewed interest in the Gulf because approvals might be easier. It was noted that Project EAs are required and also need to include consultation in other provinces.

- Questions about the nature, timeline and review process for the Draft SEA Update report, and then how it will be used by the C-NLOPB.

- People want meaningful consultation; need to understand the process so that they can provide appropriate input. It is difficult to always know what is being looked for at the SEA level.

3.9 Cap-aux-Meules, Îles-de-la-Madeleine, QC: October 24, 2012

3.9.1 Public Open House

Location and Time:	Galerie-Bar-Spectacles Les Pas Perdus, Wed Oct 24 (5-9 pm)
Number of Attendees:	289
SEA Update Team Members Present:	E Young (C-NLOPB), S Kelly (C-NLOPB), S Bonnell (AMEC) J Paynter (AMEC), L Campbell (AMEC)
Number of Feedback Forms or Other Written Submissions Received:	*27*

Summary of Questions and Comments

Environmental and Socioeconomic Setting

- It was stated that the Gulf region is too fragile and there is not enough knowledge on the complexity of the ecosystem to allow for oil and gas activities. The region should be considered as a compete entity, and these activities are simply too dangerous.

- Important to consider the importance of fragility of the Gulf region. We do not have the technology to adequately assess the risks.

- The Gulf has important ecological estuaries.

- It cannot be known whether there are even sufficient oil resources available in the area.

- A comment was made from a local fisherman, who said that all of his ancestors have been fishermen in this region. His three main concerns were for job security, the livelihood of the local community, and for the livelihood of coastal communities around the Gulf. The matter of oil activity is of utmost importance to the people of his community.

- It was noted that the Les rochers aux Oiseaux is home to sensitive, delicate bird colonies, and that this area should be recognized.

- It was stated that 33 percent of the local economy relies on tourism and that no one will visit the region should an oil spill occur.

- A request for environmental studies conducted by independent researchers who specialize in all aspects of the Gulf of St. Lawrence ecosystem.

- A suggestion to consider the Gulf as a whole is a sensitive zone and to consider the ocean currents in the study of baseline environmental conditions.

- The two main industries in the region are tourism and fishing. Tourism reportedly contributes the order of $50 million annually to the economy.

Environmental and Socioeconomic Considerations and Possible Mitigation

- A fisherman of 45 years wondered why the NL fishermen have not expressed more discontent over the oil activity in their region. These are important fishing areas.

- Concerns were expressed over the pursuit of non-renewable resources when the risks are so high. A suggestion was made to use the oil and gas exploration resources to develop alternative energies, such as offshore wind.

- There is reportedly a strong opposition to oil and gas development in this region.

- A comment was made that $30 million in recovery funds should an oil spill occur is inadequate, and that an oil spill response centre should be in closer proximity.

- Approximately 14,000 people live on the Îles-de-la-Madeleine, and the population wants a healthy quality of life and to not live in fear of an environmental disaster.

- Questioned why is it only the west coast of NL that is part of the study area when the Îles-de-la-Madeleine region will be affected as well, and which is closest to Old Harry.

- A concern was expressed about the effects of fracturing on potable water.

- There is little faith in the industry's ability to respond oil spills and that unfortunately it is the citizens that will have to live with the consequences.

- Questions around the depth at which the oil located and when an oil spill modeling study will be completed.

- A view that the main economic activities of the Îles-de-la-Madeleine, fishing and tourism, will be compromised if there are petroleum activities in the Gulf.

Regulatory, Policy and Procedural Issues

- People want to know who is ultimately responsible for deciding whether to allow oil and gas activity in the region.

- Questions around the role, mandate and powers of the C-NLOPB, as well as composition of the SEA Working Group and its workings and records.

- A comment was made that as guardians of the Gulf, the community denounces this SEA consultation, the lack of transparency of the process, and this meeting.

- A comment was made about the series of events that led to the meeting; from a request for federal environmental assessment to an update of the SEA for Western Newfoundland. It is thought that an SEA Update for the Western NL region is inadequate to capture the depth of information required for such a complex ecosystem, or to effectively consult the coastal communities of five provinces. It was noted that the community is unhappy with the SEA and this forum.

- All five provinces should cooperate to govern the future of the Gulf of St. Lawrence. There are crucial commercial fishing areas to consider.

- A view that the federal government needs to be leading this process, an additional request needs to be sent for their support. Is the C-NLOPB prepared to reissue their request to the federal Minister for a Review Panel?

- A comment was made that the presentation of SEA data gives the impression that the decision is already made on whether or not oil exploration should occur in the Gulf.

- A question about why the federal government has not yet made the whole Gulf of St. Lawrence a protected area.

- Multiple comments were made that there should be a complete moratorium on oil and gas exploration in the Gulf of St. Lawrence.

- A position that there should be no further permits to companies wishing to pursue oil exploration in the Gulf of St. Lawrence.

- No one province owns the Gulf, it is a shared resource. All five provinces should take part in making management decisions.

- It was suggested that a further and subsequent consultation be held in which all the scientific information was presented, and that all five provinces be included in the process. Until this is possible it was suggested that a complete moratorium be placed on oil activity in the Gulf.

- Concerns were expressed about the time frame to conduct the study, given the breadth of analysis and review required. The issue was raised that the last SEA update had only 11 pages on the public consultation, and that the current SEA should be much more thorough.

- A comment was made that there should be no further permits granted to explore or develop oil in the Gulf. The region is a shared heritage and decision-making should be cooperative among all five provinces involved.

- A number of concerns were expressed over inadequate translation, given the primary language of the people of the Îles-de-la-Madeleine is French. Requests were made to have the document entirely translated into French.

- It was suggested to abandon this activity and invest in alternative energies, as exploring for oil is like going back in time.

- The role, mandate and powers of the C-NLOPB, as well as composition of the SEA Working Group and its workings and records.

- A view that the risks of oil and gas development in the Gulf of St. Lawrence will surpass the benefits.

- A question about compensation should local businesses loose sales over an oil spill.

- Concern about possible contamination of potable water as a result of fracturing activity.

- A stated preference that the SEA consultations should have included detailed technical presentations and a "hearing" type format, rather than these public open houses, with simultaneous translation and bilingual documentation.

- A statement that the heritage of the region is fragile and sensitive, and will never repair itself if harmed.

- A suggestion to have a joint Newfoundland and Labrador and Quebec consultation process.

- A view that the jurisdictional boundary in the Gulf outlined between Newfoundland and Labrador and Quebec is not accurate.

3.9.2 Stakeholder Meeting

Location and Time: Galerie-Bar-Spectacles Les Pas Perdus, Wed Oct 24 (1-3 pm)

Number of Attendees and Groups: 38, including representation by the:

- Association des pêcheurs des Îles-de-la-Madeleine (APPIM)
- Corporation culturelle des Îles-de-la-Madeleine

- Opinion Nationale
- Association of Pelagic and Groundfish Fishermen of the Îles-de-la-Madeleine (RPPUM)
- Îles-de-la-Madeleine Association for Professional Fishermen (RPPIM)
- Attention Frag'Îles
- Coalition Saint-Laurent
- Cape Dolphine Fishermen's Corp
- Le ministère du Développement durable, de l'Environnement, de la Faune et des Parcs
- Energie Alternative
- Chambre de Commerce des Îles-de-la-Madeleine
- SADC des Iles
- Forum intersectoriet sur les resources et le terrotiore
- Tourisme Îles-de-la-Madeleine
- Société de conservation des Îles-de-la-Madeleine
- Municipalité des Îles
- CFIM Radio - Îles-de-la-Madeleine
- Comite vert Campus des Îles
- Office of the MP for Gaspésie— Îles-de-la-Madeleine
- Comité ZIP des Îles
- La Conférence régionale des élus Gaspésie-Îles-de-la-Madeleine Ministere de l'Agriculture, des Pecheries et de l'Alimentation du Québec
- Parcs Canada
- L'Université du Québec à Rimouski
- Le Bon Goût Frais des Îles-de-la-Madeleine
- Regroupement québécois des intervenantes et intervenants en action communautaire
- Radio-Canada
- Zone F Fishers
- One individual fisher
- Three unidentified organizations

SEA Update Team Members Present: E Young (C-NLOPB), S Kelly (C-NLOPB), S Bonnell (AMEC) J Paynter (AMEC), L Campbell (AMEC)

Summary of Questions and Comments

Environmental and Socioeconomic Setting

- There is a cod spawning area within the Strait of Belle Isle that was identified in the 2005 SEA update.

- There is an on-going study to look at potential marine protected areas in the region that covers a total area of about 15,000 kms.

- A suggestion was made that all sensitive areas be included in the SEA update, including important birding areas.

- A suggestion that the whole Gulf of St. Lawrence should be considered when compiling fishery data for the SEA Update.

Environmental and Socioeconomic Considerations and Possible Mitigation

- Concerns were expressed about the proximity of possible exploration licences and activity to fishing grounds.

- There are concerns about the lack of post-seismic environmental studies in the Port aux Port area.

- People are curious about the mitigation measures associated with seismic exploration and their effectiveness. Is the Board allowed to disallow seismic activity entirely as opposed to only during a set time frame?

- Suggestions were made that the study be extensive and include climate change. Research should be done by credited scientists. For instance, we need to know the effects of seismic activity on lobster.

- What happens to a drill once it is abandoned, what is the required follow-up period?

- Further information is needed on the process and capacity of oil clean-up should an accident occur and what the effect of dispersal would be.

- A comment was made about the importance of the Gulf to the industries of the region, which are primarily tourism and commercial fishing. Covering the loss of these industries and their importance to the culture of the region is considered inconceivable, including lost revenue.

Regulatory, Policy and Procedural Issues

- Given that there are existing oil exploration licences in the Gulf, it is thought that the decision has already been made to proceed with oil activity in the Gulf.

- A question was asked about whether a recommendation was ever made in an SEA to prevent or to cease activity in a sensitive area.

- A question was raised around whether or not the SEA can reach a conclusion that a moratorium on oil and gas activity be recommended for the Gulf.

- Concerns were expressed about the format of the consultation and the lack of detailed information presented. A suggestion was made to come back to the community and share the results of the study once available.

- Participants wondered whether exploration drilling and seismic projects would required their own specific EAs. How will recent changes to the federal *CEAA* affect this process?

- Will the SEA Update Consultation Report and the whole SEA Update, be translated and available in French? In addition, how can the public provide comment on this draft? Will there be another round of consultations?

- It was noted that the 2005 SEA public consultation chapter was comprised of only 11 pages, and it was stated that this update must have a more thorough chapter and that all comments will be integrated.

- Concerns were expressed about the composition of the SEA Working Group, given that the majority of the members represent the natural resources sector and not the environment sector.

- A comment was made about the perceived insufficient budget for the SEA Update.

- A question was asked about seismic activity planned to be conducted off Western Newfoundland and it was suggested that all activities should be on hold while the SEA is being updated.

- It was noted that there is a strong opposition to oil and gas development in this region and the population wants a complete moratorium.

- A comment was made about how the Gulf is a shared resource, and is part of our common heritage. It does not belong to the five provinces. Its fate should be decided by the cooperation of the fives provinces, as it is a unique and important ecosystem.

- Questions and comments about the SEA process, including the appropriateness of having it completed by the C-NLOPB and its consultant. Questioned the impartiality of consultants who also work with the oil and gas industry.

- A view that the Gulf of St. Lawrence is a unique shared ecosystem and that all Gulf coastal communities need to contribute to this process and that a Federal Review Panel should lead the process.

3.9.3 Meeting with Mayor's Committee, Îles-de-la-Madeleine

Location and Time: Community Centre, Cap-aux-Meules, Îles-de-la-Madeleine, Tuesday Oct 23 2012 (6-9 pm)

Number of Attendees and Groups: 22, including representation by the:

- Municipalité des Îles
- Inshore Fishermen Association
- Chargée de projet hydrocarbures, Municipalité des Îles
- Conférence régionale des Élus de la Gaspésie et des Îles
- Attention FragÎles et Coalition Saint-Laurent
- Centre de recherche sur les milieux insulaires et maritimes (CERMIM)
- Bureau de la députée provinciale Jeannine Richard
- Centre de santé et de services sociaux des Îles
- Office of the MP for Gaspésie—Îles-de-la-Madeleine

- Société d'aide au développement des collectivités (SADC)
- Cégep de la Gaspésie et des îles, campus des Îles
- Regroupement des pêcheurs professionnels des Îles
- Corporation culturelle des Îles - Arrimage
- Tourisme Îles-de-la-Madeleine
- Regroupement des palengriers et pétoncliers uniques madelinots (RPPUM)
- Zone d'intervention prioritaire des Îles – Comité ZIP des Îles
- Chambre de commerce
- Société pour la Nature et les Parcs

SEA Update Team Members Present: E Young (C-NLOPB), S Kelly (C-NLOPB), S Bonnell (AMEC) J Paynter (AMEC), L Campbell (AMEC)

Summary of Questions and Comments

Environmental and Socioeconomic Setting

- It was also noted that the study should consider the entire Gulf ecosystem, and not just the Western NL region. Marine life moves throughout the Gulf, and all coastal communities will be affected.

- The Gulf of St. Lawrence is like a lake, and marine life circulates throughout the whole region.

- In addition to the overall Gulf of St. Lawrence, the Laurentian Channel also has significant ecological importance and this should also be considered.

- A fisherman with 34 years of experience working in the Gulf said his concerns are with quality of the fisheries information that will be referenced. It was suggested that all pertinent fisheries information be included, and that it be comprehensive and thorough.

- A request that a comprehensive description of all fishing activities be included in the intervention plan in the event of an oil spill.

Environmental and Socioeconomic Considerations and Possible Mitigation

- Concerns were raised about the threat of the petroleum industry to the local economy of the region, which relies primarily on tourism and fishing. It was noted that tourism in the Îles-de-la-Madeleine generates $100 million annually, and it is not clear how this generated income would be covered should an oil spill occur.

- A suggestion was made to include consideration of climate change in the study, and to also consider the possible cumulative impacts associated with these issues.

- The importance of sound oceanographic science when performing oil spill modeling in order to accurately capture risks associated with a spill was emphasized.

- A question was raised about who is responsible for the monitoring of tanker traffic associated with the petroleum industry and clean-up in the event of an oil spill.

- To ensure the safety of the fishing industry, a request that all seismic activity avoid lobster and crab reproduction areas and times.

Regulatory, Policy and Procedural Issues

- If the C-NLOPB has the right to grant exploration permits, it can presumably also make a decision to not grant permits.

- The information and conclusions in the on-going Québec oil and gas related SEAs should also be included or at least referenced in the SEA Update.

- A comment was made that the consultation format would be more helpful if the results of the 2005 and 2007 SEA were presented. A suggestion was made for a follow-up visit to the community in which the results of the draft report are presented and available for comment.

- A question was asked about how the C-NLOPB and One Ocean was financed. What is AMEC's relationship with the oil industry?

- A comment was made that the SEA Update is focused on the Western NL region, but it should also be able to suggest and conclude that a review panel is needed to conduct a full SEA for the whole Gulf.

- It was noted that the community has high expectations of the SEA because they recognize there are many interactions within this ecosystem, and therefore they consider the Gulf SEA a federal responsibility.

- A number of comments were made suggesting that the Federal Government be involved in this SEA process, and that there should be cooperation among all five provinces surrounding the Gulf of St. Lawrence.

- Concern was raised about the scientific capacity issues of the SEA update given that federal science groups are enduring financial difficulties.

- A question was asked about the composition of the SEA Working Group for the study, and what their scientific credentials are.
- It was suggested that the C-NLOPB should wait until the SEA is complete before taking any further decisions or actions on oil activity in the Gulf of St. Lawrence.

3.10 Havre-Saint-Pierre, QC: October 25, 2012

3.10.1 Public Open House

Location and Time: Salle Communautaire, (5-9 pm)

Number of Attendees: 31

SEA Update Team Members Present: E Young (C-NLOPB), S Kelly (C-NLOPB), S Bonnell (AMEC) J Paynter (AMEC), L Campbell (AMEC)

Number of Feedback Forms or Other Written Submissions Received: 2

Summary of Questions and Comments

Environmental and Socioeconomic Setting

- It was noted that the Mingan Archipelago is an area of great ecological and socioeconomic importance.
- The necessity of completing a detailed ecological study of the region, and questions regarding what field studies have been done to date in the region of the Basse Côte Nord as well as the role of monitoring and follow-up studies.
- A comment was made about the complex water currents in the Gulf of St. Lawrence.
- A request for more information on the impact on fishing, birds, and marine mammals.

Environmental and Socioeconomic Considerations and Possible Mitigation

- In December 1999 there was reportedly an oil spill in Havre Saint Pierre. Due to harsh conditions the spill was difficult to contain and took three months to clean.
- A comment was made about the lack of information on oil spill modeling, and how the complex water currents in the Gulf would cause an oil spill to affect the region.
- A suggestion was made that the SEA Update should take into account all the risks to the socioeconomic characteristics of the region.
- Climate change and its implications need to be considered in the SEA Update.
- A question was raised about whether or not the update will include comparison studies to illustrate the trade off of the petroleum industry vs. the economic benefits of commercial fishing and tourism.

Regulatory, Policy and Procedural Issues

- It was suggested that the issue of oil and gas activity in the Gulf of St. Lawrence could be subject to a referendum in multiple provinces given the overall importance of this issue.
- A need for clarity on the jurisdictional boundary between Newfoundland and Labrador and Québec, similar to that with Nova Scotia.
- Concerns were expressed about the format of the consultation, advertising for the event was considered unclear and a formal presentation of information was requested. Questions around whether the SEA Update will be translated into French.

- A question was raised about how many scientists serve on the SEA Working Committee and who these are and their role in the study.

- A comment was made that the budget for the SEA update was insufficient for such a large region, and that a timeframe of 10 years is needed to adequately capture all the data.

- A statement was made that NL cannot dictate what happens in the Gulf, as it is a shared resource that belongs to all five provinces. The Gulf should be a federally-managed resource.

- A comment was made describing the setting for the public consultation and that the study will be an update of the original 2005 / 2007 SEA. A request was made to the federal government for a review panel, however it was decided that a SEA Update would be undertaken. It was felt that the Board is doing the job of the federal government, and it is recognized that they are doing the best they can with the resources and time they have.

- A comment was made that decisions are far too often economic, as opposed to ethical. A request was made for a thorough consultation.

- A comment was made about how $30 million is inadequate for compensation should an accident occur.

- A question was raised about the potential outcome of the SEA Update, and whether it is possible to reach the conclusion that oil and gas exploration and development in the Gulf should be prohibited.

- Comments were made about the oil exploration taking place on the Anticosti Island, which is actually onshore and therefore does not have the same parameters.

- A question whether the SEA Update Report will take into account information gathered in the Quebec SEAs.

- A question on who will be held accountable should an oil spill occur.

3.10.2 Stakeholder Meeting

A stakeholder meeting had been arranged at this location for 2-4 pm prior to the public open house, but this unfortunately had to be cancelled due to travel problems on the part of the SEA Update study team (aircraft mechanical issues), who were unable to arrive in Havre-Saint-Pierre until 4:30 pm that day.

Where possible, organizations who had responded positively to the invitation to the stakeholder meeting were contacted and informed of this, and were requested to meet with the SEA Update study team in the evening during the public meeting.

Additionally, a notice was placed on the door of the meeting venue site by a local contact to inform others who may not have responded to the stakeholder meeting invitation and/or who may not have received the notification of the required cancellation.

3.10.3 Meeting With Innu Council of Ekuanitshit

Location and Time:	Innu Council of Ekuanitshit Offices, Mignan QC Friday October 26 2012 (9:00 -10:30 am)
Number of Attendees:	Chief and 4 Band Councillors and Employees
SEA Update Team Members Present:	E Young (C-NLOPB), S Kelly (C-NLOPB), S Bonnell (AMEC) J Paynter (AMEC), L Campbell (AMEC)

Summary of Questions and Comments

- The Chief expressed various perspectives related to the health and prosperity of his community, who are the guardians of this region, and who value and use its marine and terrestrial resources.

- Their traditional use of the land is how they have been able to sustain themselves for many years, and will continue to do so in the future.

- There is little faith in the safety of the petroleum industry. A great deal of concern exists over the consequences that an oil spill would have on their community, their resources, and the local environment.

- A request was made for a comprehensive, complete consultation. Asked whether and how other Aboriginal communities and groups in Eastern Canada have been or will be contacted.

- The study must take into consideration the opposition to a petroleum industry in the Gulf.

- Asked to describe the relationship between the C-NLOPB and AMEC, and more precisely, who has the power to make the decision to cease oil exploration in the Gulf?

- A comment was made that the federal *CEAA* needs to be changed to shift responsibility, as provinces appear to be accelerating the EA process. Environmental assessment is meant to be used for environmental protection.
- Concerns were expressed over uncertainty; the impacts of the industry are largely unknown.

- A question was raised about the role of climate change in the study, and whether or not it will be considered.

- A comment was made about the different philosophies at play. Their vision is inherently linked to the land, in which is comprised of all living parts. This philosophy needs to be taken into account.

- Concerns were expressed on how decision-making often places economic development against ethics, and economic development has proven to be paramount.

- A comment was made that when oil and gas activity moves forward it is the community that will have to live with the consequences should an accident occur.

- They do not support conducting oil and gas activity off Western Newfoundland at this time.

3.11 Gaspé, QC: October 29, 2012

3.11.1 Public Open House

Location and Time:	Hôtel des Commandants, Monday, October 29, 2012 (5-9 pm)
Number of Attendees:	65
SEA Update Team Members Present:	E Young (C-NLOPB), S Kelly (C-NLOPB), S Bonnell (AMEC) J Paynter (AMEC), L Campbell (AMEC)
Number of Feedback Forms or Other Written Submissions Received:	5

Summary of Questions and Comments

Environmental and Socioeconomic Setting

- A view that the knowledge of the Gulf ecosystem is insufficient.
- The connectivity of the multiple habitats and species need to be recognized.
- A comment was made about the whale watching industry in the region, which is part of the region's two primary industries of fishing and tourism. The beach was also noted as an important local resource.
- The natural beauty of the region was recognized by *National Geographic Magazine*, listing the Gaspésie as one of the top worldwide destinations to visit.

Environmental and Socioeconomic Considerations and Possible Mitigation

- A suggestion was made to identify sensitive zones and to put in the mitigative measures to protect them.
- A question was asked about the impact of marine life in the event of an oil spill. Would the mussels in the region still be edible with oil activity in the Gulf? How would whales be affected?
- A comment was made that the laws in relation to offshore oil exploration are inadequate.
- Have to consider the social impacts to the quality of life of coastal communities around the Gulf of St. Lawrence, including the economic dependence that these communities have on a healthy marine environment through the industries of tourism and fishing.
- Concerns were expressed about fracturing activity, and while it was noted that not all forms of development should be stopped, this one is of particular concern.
- A suggestion was made to include climate change in the study, and to ensure that the forecast is long term.

- There is a concern that offshore oil development will make the region less of a desirable place to live, thus driving the youth away. It was suggested that future generations be considered.

- Concerns were expressed about the impact of multiple platforms in the Gulf, and the requirement to monitor cumulative impacts in the future.

- It was noted that the Gulf of St. Lawrence is many times smaller than the Gulf of Mexico, and that a spill in the Gulf would be greatly augmented by the complex ocean currents. An oil spill in one area would not stay behind an imaginary line on a map.

- Concerns were expressed over the insufficiency of $30 million in compensation should an accident occur. There will never be enough money to buy an ecosystem. The extent of the damage in other major oil spills, such as the Gulf of Mexico or from the Exxon Valdez, is vast.

- A comment was made that there needs to be well-developed technology to clean up after an oil spill in a worst case scenario before exploration activities are to occur.

- It was noted that there are still a number of concerns to address before moving forward with oil activity in the Gulf, i.e. the jurisdictional boundary between NL and QC needs to be clearly defined, the mitigation measures for seismic activity are considered insufficient, emergency response measures and the responsibility for damages remains unclear.

Regulatory, Policy and Procedural Issues

- The role of jurisdiction is important, and as there are five provinces that share the Gulf of St. Lawrence it is difficult for the C-NLOPB to itself adequately complete this study.

- There is a concern that Newfoundland and Labrador will make the decisions and therefore reap the benefits of an offshore oil industry that will in turn affect the whole Gulf.

- Concerns were expressed about a perceived inadequate budget and timeframe available to complete the study. A suggestion was made to have a full and federally-run SEA consultation.

- A comment was made about the composition of the SEA Working Group, and whether or not there are environmental scientists as participating members.

- A suggestion was made to seek alternative energies and reduce the exploration and development of oil and gas.

- A suggestion was made to be more proactive in promoting the SEA and its mission.

- It was noted that the community would like a moratorium on oil activity in the Gulf of St. Lawrence.

- It was felt that the Board is doing the job of the federal government, and it was recognized that they are doing the best they can with the resources and time they have.

3.11.2 Stakeholder Meeting

Location and Time: Hôtel des Commandants, Monday, October 29, 2012 (1-3 pm)

Number of Attendees and Groups: 18, with representation by the:

- Coalition Saint-Laurent
- Attention Frag'Îles
- Association chasse et pêche de Gaspé
- Amphibia-Nature
- Conseil régional de l'environnement Gaspésie-îles-de-la-Madeleine
- La société de conservation Zico de la Baie-de-Gaspé
- Regroupement des pêcheurs professionnels du nord de la Gaspésie
- Le Regroupement des pêcheurs professionnels du sud de la Gaspésie
- Ensemble pour l'avenir durable du grand Gaspé
- Ville de Gaspé
- Office of the MP for Gaspésie—Îles-de-la-Madeleine
- One other organization (unidentified)

SEA Update Team Members Present: E Young (C-NLOPB), S Kelly (C-NLOPB), S Bonnell (AMEC) J Paynter (AMEC), L Campbell (AMEC)

Summary of Questions and Comments

Environmental and Socioeconomic Setting

- A statement was made that the Gulf is complete ecosystem; it does not have the same features as the larger Atlantic Ocean. Offshore oil activities in the Gulf cannot be viewed in the same way as it is in the open ocean.

- It will be important to identify and consider the sensitive areas in the Gulf and the connectivity between these zones.

- It was noted that there is a great deal of scientific research on the Gulf housed at the Maurice Lamontagne Institute and that their work should be referenced in the SEA.

- A comment was made about the role of climate change as a factor in the SEA, and whether and how this would and could be addressed in the assessment update.

- Should the pursuit of oil continue, it is thought that climate change will cause wide-ranging effects. For instance, it was noted that climate change is forecasted to decrease fish stocks by 15 – 25 percent. Climate change issues must be considered in the SEA Update.

- A comment was made that a great deal of information is to be gathered before any further oil exploration permits are granted.

- Concerns were expressed about the potential effects of seismic activity on the marine environment.

Environmental and Socioeconomic Considerations and Possible Mitigation

- There is a need for greater cooperation between the oil industry and fishers.

- Concerns were expressed over the insufficiency of $30 million in compensation should an accident occur, and it was asked whether the C-NOLPB is able to change this amount.

- Need to consider not only environmental effects but also overall social acceptability as part of the decision-making process.

Regulatory, Policy and Procedural Issues

- On-going questions and uncertainties about the legal jurisdictional limit between Newfoundland and Labrador and Québec, and a view that this line needs to be clearly defined in order to move forward.

- Questioned why there is not a counterpart petroleum board in QC that has a similar responsibility as the C-NLOPB.

- A comment was made that all provinces that border the Gulf of St. Lawrence need to come together to manage this shared resource, as an oil spill in the Gulf would affect the whole region.

- Concerns were expressed about poorly constructed or a lack of oil spill modeling, and it was asked whether the SEA study include an oil spill simulation.

- A statement was made on the perceived inadequate timeframe and budget available to complete this SEA Update and the need to effectively capture the input of academics and scientists.

- A question was raised about the legal implications of the study, including its authority and whether there is an obligation to address the concerns raised.

- Concerns were expressed about the changes to the federal EA legislation (*CEAA*), and it was noted that the SEA should be able to recommend that the current laws are not enough.

- It was suggested that an additional request be made to the federal government for a federal EA review panel to allow for the involvement of all five provinces.

- A question was asked if there is forum for the interprovincial cooperation of citizens. There is a desire to form a suggestion committee.

- The question was asked if the C-NOLPB is continuing to grant exploration licenses while the SEA update is taking place, and if so this is concerning.

- A suggestion was made that the SEA Update Report be available in both official languages, and the Board should return to the area to present the SEA findings and seek further public input and comment.

3.11.3 Subsequent Meeting with the Mi'gmawei Mawiomi Secretariat (Nov 26 2012)

Location and Time:	Galgoasiet Natural Resources Building Gesgapegiag, Québec Monday November 26 2012 (10:30 am – 3 pm)
Number of Attendees and Groups:	12, with representation by the: • Gesgapegiag Council, • Listuguj Mi'gmag Government • Mi'gmawei Mawiomi Secretariat • Community of Gespeg • G.R.E.B.E. Inc. • St. Lawrence Coalition
SEA Update Team Members Present:	E Young (C-NLOPB), D Wells (C-NLOPB), B Power (AMEC), L Campbell (AMEC)

Summary of Questions and Comments

Environmental and Socioeconomic Setting

- Atlantic salmon migrate through Western NL Offshore Area, and need to be considered in the SEA Update.

- The report should include information on salmon migratory routes in the Gulf, and salmon rivers should be taken into account.

- While there is a concern for all interconnected species within the Gulf, Atlantic salmon are deeply-rooted in the local Mi'gmag culture. In addition to their economic importance, salmon are also of spiritual importance.

- According to the Mi'gmag, there are no provincial boundaries, and the Gulf is a saltwater lake.

Environmental and Socioeconomic Considerations and Possible Mitigation

- There is a concern about jeopardizing the local Mi'gmag way of life and that mitigation measures are insufficient to protect salmon.

- It was stated that the fishery alone in this region is worth $1.5 billion. Should an accident occur, there are concerns that the reputation of the commercial fishery would be damaged to the point at which no amount of compensation would allow it to recover.

- Questions about the safety regulations in the offshore oil and gas industry, and whether or not operators need to illustrate that they use modern, up-to-date drilling techniques. Concern was also raised about the companies working in the Gulf and their financial capabilities.

- There are concerns about plans for seismic activity in the Western Newfoundland region, and about possible compensation for seismic activity and its effects.

- Concerns were expressed about the ability to address and clean-up an oil spill, should a blow out occur. It was asked whether an oil spill modeling scenario will be developed as part of the SEA Update Report.

- It was stated that as a community, the Mi'gmag are not against development, but want responsible development. The communities cannot exist without natural resources and people are not willing to risk everything they have. Perhaps in time people will be comfortable that oil and gas activity can proceed, but it needs to be done responsibly.

Regulatory, Policy and Procedural Issues

- It was stated that the Gulf belongs to the local Mi'gmag communities, who have Aboriginal rights to a commercial fishery for snow crab and shrimp. It was also stated that there is a spiritual side to this fishery.

- Concerns were expressed about oil and gas projects in the Gulf, and a moratorium was requested until the environment is better understood (which may take 10 – 12 years). A moratorium resolution on offshore oil and gas in the Gulf of St. Lawrence was reportedly passed.

- Questions were raised about the role of governments and politicians in making these decisions, and whether there was an obligation to implement the results and recommendations of the SEA Update.

- A comment was made about the composition of the SEA Update Working Group, including that there are no members of Aboriginal or environmental organizations represented on it.

- The SEA Update Report should take into account the Quebec SEAs, including the comments that were made by the Mi'gmawei Mawiomi Secretariat.

- A suggestion was made to translate of the SEA Update Report into French, as the community of Gespeg is primarily French-speaking.

- It was asked whether and how other Aboriginal communities and groups in Eastern Canada have been or will be contacted.

- Concerns were raised about perceived inadequate timeframes and budget to appropriately study the Gulf in order to make informed decisions.

- Concerns were expressed about the inadequacy of financial compensation should an accident occur. It was noted that the amounts required would not cover the potential damage.

- A question was raised about the opportunities available for public comment in the SEA Update process and the appropriate forum for people to give their views about social acceptability.

- A recommendation that Aboriginal cultural and spiritual perspectives be included in the SEA Update Report.

- Questioned whether an additional request would be made to the federal government for a federal EA review panel to allow for the involvement of all five provinces.

3.12 Additional Written Submissions

In addition to the verbal comments and written submissions received at specific consultation sessions (as summarized above), a number of additional submissions were received by the C-NLOPB and/or the SEA Update study team that provided additional input to the SEA Update.

Approximately 60 written submissions were received from the time of the announcement of the SEA consultation sessions in September 2012 to the end of the year, and are summarized below.

Environmental and Socioeconomic Setting

- The Gulf is a semi-enclosed sea that area includes the coastal areas of five provinces with over 10,500 km of coastline and countless habitats of biological richness.

- The fishery is the most ancient coastal sea activity in the St. Lawrence Gulf. In 2008, the combination commercial fishing, aquaculture and fish processing contributed close to 8,000 jobs and generated approximately $300 million dollars in Quebec.

- The northern Gulf is an important corridor for several species of marine birds and various species of seals, while the Strait of Belle Isle is a well known passage for icebergs and heavy ice flows from the Labrador Coast in the spring.

- The Gulf of St. Lawrence and Strait of Belle Isle are home to more than 2000 species of fish and birds, some of which are of special conservation concern or endangered.

- It was noted that P.E.I. is already experiencing the effects of climate change, eutrophication of waterways, and acid rain.

- The Gulf has over 1900 species of vascular plants and nearly 400 species of birds are reported in the area, as well as hundreds of species of marine invertebrates and fish, three species of sea turtles, six pinniped species and 13 species of cetaceans.

- The vast majority of marine mammals in the St. Lawrence estuary and Gulf are migratory animals, and therefore may pass through the SEA Update Area.

- A total of 34 taxa (species of populations) at risk are known to be present in the Gulf of St. Lawrence, either as permanent residents or during some period of their life cycle (migration, winter resident, etc.). These include seventeen fish species, six marine mammals, one reptile and ten bird species.

- The Gulf ecosystem is an already fragile environment due to a wide variety of human uses and related stressors (i.e. overfishing, marine transportation, industrialization, some tourism-related pressures, toxic releases, bacterial contamination and climate change). This may be subject to further degradation should the Board continue to promote oil exploration and drilling within the area.

- The residents of the Îles-de-la-Madeleine, Newfoundland and Labrador and along the coastlines of the Gulf will be the first to feel the effects of climate change. Effects of climate change are already being felt by local fisherman in the Bonne Bay region and elsewhere.

- The Gulf has been sustainably used by humans for the last 12,000 years and by European descendants for the past 500 years.

- Cruise ship traffic is common along the west coast of Newfoundland, particularly in the Port of Corner Brook. This industry may be at risk due to offshore oil activity as a result of changes in the viewscape or in the event of a spill.

- Tourism and fishing are the main economic drivers in Western Newfoundland.

- The tourism industry on P.E.I. is noted to be worth $483 million annually, and is predicted to reach $500 million by 2015. An oil spill would cause this industry to suffer.

- Extreme winds, at times exceeded 150 km/h, are a regular occurrence along the along the western front of the Long Range Mountains in Gros Morne National Park, and should be taken into consideration when securing onshore and offshore industrial sites.

- Gros Morne National Park is one of the most important tourism destinations in NL, attracting upwards of 180,000 visitors each year, and brings an excess of $37 million to the local economy.

- It was noted that commercial fisheries in the Gulf are currently valued by DFO at $1.5 billion annually.

- A submission of post SEA 2005 data on the biology of the study area, including information on fish and shellfish, marine-associated birds, shorebirds, mammals, species at risk, and potentially sensitive areas.

- A view that the Gulf is one body of water that cannot be divided into five jurisdictions; and therefore impacts of offshore oil activities will cross the invisible borders the Gulf.

- A view that the capacity to contain or respond to an oil spill in the Gulf is inadequate, which poses a risk to the tourism and fishing industries that are major contributors to the P.E.I. economy.

- Suggestion that the SEA Update Report evaluate the impacts of oil development in the entire Gulf, not simply within the area covered by the Board's licensing jurisdiction.

- Commercial fishing is an important economic sector in the Ekuanitshit community, who have permits for snow crab and scallop fishing. In addition to commercial fishing licenses, they hold a permit for fishing for food, social and ceremonial purposes which ensures that members of the community has access to various marine species. All of these activities are subject to annual agreements with the Department of Fisheries and Oceans in the framework of the strategy relating to Aboriginal fisheries (AFS).

- Salmon is an important resource for the Innu of Ekuanitshit; it provides for the economy through the operation of an outfitter on the Mingan River and for its contribution as a food source for members of the community.

- Salmon that inhabit the rivers in the Quebec North shore spend their winter in the North Atlantic between Iceland and Greenland. They return to these rivers during their annual migration by passing through Strait of Belle Isle to spawn.

- Migratory birds are an important resource to the community of Ekuanitshit. Members of the community have hunted and collected the eggs from time immemorial over fifteen migratory bird species, of which the most important are the Canada goose and the eider duck. This activity is practiced in the spring and autumn, along the coast and in the Mingan Islands I'Archipel.

Environmental and Socioeconomic Considerations and Possible Mitigation

- Contamination as a result of oil and gas activities, not only in the case of a spill but also during routine operations which would include the use of synthetic drilling fluids, could have a major impact on the health of certain species, including the recovery of species at risk.

- A view that the proposed mitigation measures for phases of seismic exploration are outdated and incomplete. It is predicted that climate change will decrease the ability of water to absorb sound, causing noises in the Gulf to cover long distances and significantly affect marine mammals.

- Climate change experts predict that weather events are likely to increase in coming years, and therefore increase the risk of spills.

- Any elements associated with the development of the oil and gas that could negatively affect the experience of visitors to Gros Morne National Park are of concern to Parks Canada.

- The Gulf should be considered as a mosaic of ecosystems and analyzed as such, taking into account the principles of connectivity at all trophic levels, migration, production, dispersion and for all species that are found there, including humans and their activities.

- The SEA Update should take into account the deep currents in the Gulf, which are crucial for upstream dispersal (towards the St. Lawrence Estuary) of hydrocarbons that may migrate to the bottom during a spill.

- A map of sensitive areas should be developed that takes into account the principles of connectivity for species and human activity, as well as paired with an oil spill model to determine a rating for risk areas.

- A view that it is the role of government (opposed to private industry) to perform background research on the local and regional hydrogeology prior to fracturing activities as well as to continue to monitor the situation directly.

- Comment that $30 million in recovery funds in the event of an oil spill is inadequate given the fact that tourism is a major industry in all five provinces. Suggestion that there be a minimum $2 billion disaster relief fund to cover oil spill damages.

- Question on how the data gaps will be addressed in the SEA and whether or not environmental studies have been conducted. Concern for the ability to make informed and responsible decisions knowledge gaps and conflicting research.

- Concern that due to the currents in the Gulf, an oil spill would spread quickly.

- How do different types of oil react to sub-Arctic seawater? What research is available on the effects of oil dispersants and surfactants on cold water environments and marine life?

- Questions regarding the average lifespan of an onshore to offshore directional shale oil well and the industry record of reclaiming well sites.

- Questions regarding the local benefits of the oil industry in Western Newfoundland, including the types of jobs, their duration and typical wages. What are the potential health risks for workers at a well site?

- Concerns regarding the compensation for coastal communities along with the tourism and fishing industries should an oil spill occur; who would be held responsible, and for how long?

- Would fish sill be safe to eat if chemicals using in the fracturing process were to accumulate in the environment?

- Question regarding road maintenance and safety given the increased truck traffic required to supply the oil industry. Who will be held responsible for highway accidents involving hazardous road conditions created, or contributed to, by the volume of heavy truck and tanker traffic?

- Any increases in road traffic on highways through Gros Morne National Park as a result of potential oil and gas activity could have effects on the Park.

- What are the procedures for the storage, decontamination, and disposal of produced water and what measures are in place to ensure that fluids do not seep out onto the seafloor?

- What effects does produced water have on the fish and invertebrate nurseries of the fishing banks along the west coast of Newfoundland and on onshore freshwater and brackish environments?

- Concerns were expressed with regards to the use of fracturing to drill for exploratory wells, including the fracturing technology planned for use, the associated policies and regulations, the chemicals used and their safe disposal, as well as the nature of any gaseous by-products.

- Companies using fracturing are responsible for doing thorough baseline studies before any other contact with the property. How large an area (centred on the wellhead) will be covered by the baseline study? Who would perform the monitoring baseline studies on local water wells and soil?

- In the event of a polluted water well, who would pay to replace drinking and washing water?

- Concerns regarding the airborne pollutants associated with oil activities and development and the health implications for people, pets, livestock, fish, and wildlife. Who takes responsibility for health effects due to industry-produced air, dust, and contact with toxic substances?

- Question regarding how a loss in property value would be handled in the event of oil industry activities, regulatory violations, leaks or spills. How would sound and light pollution issues be addressed?

- A view that companies should make public their prevention and remediation plan before receiving their license from the C-NLOPB, and should have trained personnel on hand for immediate and decisive action should an oil spill occur.

- Questions regarding the amount of clean-up insurance that oil companies should hold in the event of a catastrophic blowout so that government would not have to cover the expense.

- Where are the present first responders situated and what is their response time?

- A view that companies should provide safety and rapid first response training to people in the local community.

- A suggestion that a conventional well must be twinned with another parallel well as a precaution in case of a blowout.

- Questions regarding the safety procedures that could eliminate the possibility of a (conventional and horizontal shale) well blowout or kickback.

- A view that companies must reclaim the area they used to its original state before leaving.

- Concerns regarding fracturing and the associated potential risks to public health, wildlife, and the natural environment. A perception that earthquakes related to fracturing could cause irreparable damage and possible tsunamis.

- A view that there are risks associated with the loss of long-term sustainable jobs in favour of an industry that supports fewer, less skilled and less sustainable jobs.

- A perceived minimal and questionable benefit of oil and gas development for local communities in terms of employment and quality of life.

- The potential effects on the migration of species of pelagic fish (capelin, herring and mackerel), as well as the migration of groundfish species, namely cod which is considered threatened at this time.

- Is there contingency fund for a potential disaster in the Gulf of St. Lawrence?

- Owner/operators should be required to provide proof they will have sufficient funds to pay for clean up, compensate stakeholders for losses, and fund economic recovery efforts.

- A request for further oil spill modeling that takes into account wind and ocean current direction changes driven by future climate change.

- A request for a comprehensive petrochemical geology analysis and flow rate analysis of the SEA Update Area in order to understand the probability of a blow-out that could result from drilling.

- A suggestion to remove the cap on the corporate liability for operational and accidental spillage and define liability broadly to include weather-related events.

- A view that toxicology tests conducted to monitor operations should be analyzed by government laboratories instead of laboratories sponsored by the owners and operators.

- The SEA Update should consider and address cumulative environmental effects caused by all anticipated oil and gas operations in the coming 10-20 years, together with the cumulative effects of all activities in the Gulf as whole.

- A recommendation that the SEA Update present information on all the potential effects of a significant oil spill on coastal industries, together with effects on health, quality of life, ecosystems and natural capital resources.

- A recommendation that the SEA Update adopt a risk management framework to help identify mitigation and monitoring measures that separates risks into “acceptable”, “tolerable” and “unacceptable” categories. Through such as risk management framework, the SEA Update could consider the special conditions in the Gulf that may affect emergency response capabilities, as well as the state of oil recovery technology and techniques, and the capacity of the surrounding communities to mobilize and emergency response.

- A recommendation the Board ensure the appropriate content and detail for the contingency and response plans that industry proposes, which should require extended oil spill trajectory models under a range of seasonal conditions (including the effects of sea ice), worst-case blowout scenarios, and relief wells.

- The SEA Update should consider the weather and ocean conditions and identify the risks this poses to emergency well-kill operations. Proponents must demonstrate that steps have been taken to reduce the risk of a multi-season blowout by scheduling drilling to allow ample time for the drilling of a same-season relief well.

- A request that the SEA Update recommend that oil and gas exploration only be permitted where the proponent can demonstrate a world-class emergency response plan prior to approval, identifying the resources that would be required to respond to possible emergencies, as well as commit to continually improving its response capacity and safety practices to reduce risk to the minimum practicable level.

- In order to ensure that mechanical recovery of oil would be possible in reality, a recommendation that the Board commission an independent study on response gaps and seek public input.

- A view that the values for which of Gros Morne have been chosen as a National Park and a UNESCO World Heritage Site should be given priority in planning for any future development.

- Suggestion that the effects on marine life from seismic surveys and drilling need to be considered in light of all other stressors that an ecosystem is facing (cumulative effects), both from other noise sources and also from climate change, ocean acidification, dead zones, toxins, overfishing, - all of which are already present in the Gulf of St. Lawrence.

- A view that oil exploration and production can be conducted safely and all risks appropriately mitigated.

- A request that the risks of offshore oil exploration and development on Common Eider and other waterfowl be thoroughly examined, including the effects of oiling on migratory birds.

- A request that SEA address the potential effects of offshore oil exploration and development on Stewardship Areas (Management Units) within the communities of Stephenville Crossing and Channel - Port aux Basques, as well as the Codroy Valley service district.

Regulatory, Policy and Procedural Issues

- Concerns with the language of the consultation and the difficulty of translation. Suggestion that a professional translator be present at each consultation.

- A comment that the Gaspe session went well logistically, with a translator on hand and seating available in the room.

- A request to have the previous (2005 and 2007) SEA reports made available in French.

- Questions and comments about the SEA process, including the appropriateness of having it completed by the C-NLOPB and its consultant. Questioned the impartiality of consultants who also work with the oil and gas industry.

- A view that the majority of concerns are not related to the study area, but on the legislative framework.

- It was felt that dialogue should be between the Board and the concerned citizens and not with consultants.

- Concern about responsibility should an oil spill occur, as oil spills do not respect jurisdictional boundaries. A suggestion that the establishment of an interprovincial Board might be appropriate.

- A suggestion that oil spill simulations be included in the SEA and not be completed by the oil companies themselves.

- Concern about the scientific resources available at the federal level.

- A view that in order to be able to take into account sustainable development, an economic study should take place on a scale longer than 10 years.

- Concern that although a monitoring committee is created for each project, there will be no committee to monitor all projects of exploration and exploitation for the entire Gulf of St. Lawrence.

- A request to have a federal review panel which would cover the whole of the Gulf of St. Lawrence and enable community consultation of the five provinces bordering the Gulf. A moratorium is proposed throughout the review process.

- What regulations are in place for fracturing and how are they enforced?

- Recommended moratorium until all interested parties and stakeholders are satisfied that oil exploration and production activities are safe, and that effective mitigation and appropriate regulations and penalties are in place and agreed to by all parties, including the general public.

- A stated preference that the SEA consultations should have included detailed technical presentations and a "hearing" type format, rather than public open houses. Also questioned the invitations to the earlier stakeholder meeting.

- A view that offshore oil exploration and production within the Western NL Offshore Area is a benefit only to NL, but also a liability to the tourism industry and fishery in that area of NL.

- Concern that due to the nature of the water currents in the Gulf, any oil pollution will be transported to all provinces that border the Gulf.

- A request that onshore to offshore drilling and well simulation through fracturing be included in the SEA Update.

- A view that the potential risks of oil and gas development in the Gulf of St. Lawrence are greater than the possible benefits to the people and communities that currently depend on this resource.

- A view that there should be a moratorium on any hydraulic fracturing anywhere in the Gulf until more reliable scientific evidence can demonstrate its safety.

- Questions regarding the insurance coverage required in order to assure fishers that they will be adequately compensated in the event of a problem.

- The harmonization of conservation efforts of fishers to rebuild fish stocks and the activities of the offshore oil industry. A suggestion to have more collaboration between the oil industry and the fishery.

- A recommendation to form a committee comprised of fishery representatives from all Gulf regions and government representatives.

- A view that without an appropriate democratic process, oil development in the Gulf will bring divisions and conflicts instead of the expected benefits. A request from fishers for collaboration in order to develop responsibly.

- A comment about the perceived insufficient budget and timeframe allocated for the completion of the SEA Update.

- The SEA Update Report should take into account the Quebec SEAs, as well as the scientific research on the Gulf housed at the Maurice Lamontagne Institute.

- A suggestion to submit the Gulf of St. Lawrence to the UNESCO's World Heritage Sites, as this organization recognizes ecologically fragile and endangered areas of the world.

- A view that if done safely, the future production of oil and gas in the Gulf will be the best way to save the P.E.I. economy.

- A concern that there is no way to guarantee an oil spill or blowout would never occur as a result of oil and gas activities.

- A view that instead of pursuing oil developing in the Gulf, we should transition to alternative energies.

- A recommendation to declare a permanent moratorium on offshore oil and gas activities in the Gulf of St. Lawrence as a whole.

- Concern that an oil spill would destroy fish stocks, beaches, and the coastal communities on P.E.I. and the rest of the Gulf region.

- The Gulf is an important long-term sustainable food source for all of the Atlantic Provinces and Quebec, and protecting it is a wise investment in Canada's social, economic and ecological future.

- A precautionary approach should be taken to oil and gas development in Western Newfoundland.

- A view that the 2005 SEA Report did not adequately consider the human dimension of offshore oil exploration and development, and therefore it should be better addressed in the upcoming SEA Update.

- A suggestion that the Board conduct additional public consultation efforts once the draft SEA Update is available for public review.

- A view that full regional consensus of stakeholders should be required to allow petroleum production in the Gulf.

- Concerns about junior oil and gas companies working in the Gulf of St. Lawrence, and their overall financial strength and ability to address any accidental events.

- A view that the study area for the QC SEA(s) cannot be considered a separate unit as the Western NL SEA Update Study Area.

- Questions regarding who would respond to an oil spill that would extend to Quebec given that the marine boundary between the two provinces is unclear.

- A recommendation that Board should halt the issuance of any further exploratory rights and the conduct of any project EAs (or other regulatory processes) for offshore exploration drilling or seismic programs until the SEA Update is complete and its findings are made public.

- Offshore oil and gas development off the Western Newfoundland coast must only be contemplated if, where, and when it can be established that the risks to the environment, the economy, and the public are acceptable, and the consequences of unintended worst-case accidents are manageable.

- A suggestion that the final SEA Update Report should recommend that all future offshore oil and gas exploratory activities, including drilling and seismic testing, be subject to a mandatory federal CEAA 2012 review.

- A recommendation that the Board agree to a detailed public accounting of how it will allocate the SEA budget to successfully obtain and assess all information required to conduct a thorough and rigorous SEA.

- A recommendation that in addition to the review by the Working Group, the SEA should be reviewed by an adequately funded, independent third-party. This group should include government and academic experts.

- A suggestion that the public consultation process should be extended, and more public consultations held, with increased publicity and notice periods. A perspective that if this does not take place, the consultation process will lack public credibility and legitimacy.

- Additional information was requested on the method of selecting chosen communities for public consultation. A suggestion that the Board encourage Gulf communities to request a public consultation session if interested.

- A recommendation that the Board should post additional information on its website (i.e. summaries or transcripts of sessions, follow-up on information requests.). If additional sessions are held, greater use of webcasting should be encouraged.

- A suggestion to set up separate sessions for Aboriginal groups. In addition, the SEA Update should dedicate a specific section to articulate how offshore development is perceived by, and may affect particular First Nations communities.

- A view that the SEA should identify portions of the Study Area in which oil and gas development should not occur due to environmental sensitivity and ecological value. Efforts should be made to identify and legally protect such areas, and no new exploration licences should be issued until ecologically important marine areas have received full legal protection.

- Questions and comments about the SEA process, including the appropriateness of having it completed by the C-NLOPB and its consultant. Questioned the impartiality of consultants who also work with the oil and gas industry.

- Questions regarding the safeguards in place to ensure that the scientific analysis in the SEA Update will be sound.

- A request for clarity on how the outcome of the SEA will influence future assessments of developments off Western Newfoundland given recent changes to *CEAA*.

4 CONSULTATION SUMMARY AND NEXT STEPS

The C-NLOPB is currently updating its SEA for the Western NL Offshore Area, and in doing so, has planned and implemented an extensive program of public and stakeholder consultation and Aboriginal engagement throughout Newfoundland and Labrador, the Maritime Provinces and Québec. This has, to date, included public input into a Scoping Document that is guiding the planning and development of the SEA Update, as well as a series of public open houses, stakeholder meetings, correspondence and meetings with Aboriginal communities, and the on-going provision of information, updates and opportunities to provide input through the Board's website and other means.

In recognition of the relatively high level of public interest regarding oil and gas activities in the Gulf of St. Lawrence in general, the C-NLOPB has expanded the nature and scope of these consultation initiatives as compared to those undertaken for previous SEAs, both geographically (throughout Atlantic Canada and Québec) and in terms of their approach and methods (involving public consultation sessions and Aboriginal engagement in addition to discussions with identified stakeholders). The initiatives that have been completed to date, and which are summarized in this report, have been undertaken at an early stage in the planning and development of the SEA Update itself. This has allowed for the obtaining of initial information and input related to the key questions, issues and views that are held by local communities, stakeholder groups and the general public regarding oil and gas licensing in the Western NL Offshore Area and the potential environmental effects of any associated activities, so that these can appropriately inform and influence the nature and focus of the SEA Update from the onset.

As is clear from the overview of the consultation program findings presented in the previous sections of this report, there is indeed a considerable level of public interest related to on-going and potential future oil and gas activities in the Western NL Offshore Area at present. The questions, concerns and perspectives that were raised by the individuals and organizations that participated in the consultation process to date were also found to be very wide ranging and certainly quite diverse – ranging from comments that offshore oil and gas can and will be conducted off Western NL in an environmentally acceptable and safe manner and has the potential to offer necessary and important socioeconomic benefits to the province and overall region, to calls for a prohibition of offshore oil and gas exploration and development activity in the entire Gulf of St. Lawrence due to the environmental and social risks that are believed to be associated with this industry.

Notwithstanding these diverse and often diverging perspectives on the part of consultation participants, a central and recurring theme that was stated and reiterated throughout the sessions was the need to prevent damage to the marine environment - and to the fisheries and other human activities that depend on them - as a result of accidental oil spills. Clearly there is a heightened awareness of the potential for, and the adverse environmental implications of, such accidental events following the 2010 Gulf of Mexico oil spill, and much of the discussion during the SEA consultations focussed on the need to prevent such an incident from occurring in the Gulf of St. Lawrence, as well as the need to ensure that appropriate procedures and measures are in place to effectively respond to any such accidental event or malfunction should one occur.

In addition to that key issue, the SEA consultation process has also resulted in the collection and documentation of a variety of other information and perspectives related to potential oil and gas activity in the Western NL Offshore Area, as reflected in the details provided and summarized in preceding chapter. Although in some cases the questions and comments received were quite specific, and will be considered in that form in planning and preparing the SEA Update, it is also clear that many of these touch upon several principal and recurring

themes related to the existing environmental setting of the area, potential environmental and socioeconomic outcomes, and larger regulatory, policy and procedural issues.

The following sections therefore provide a concluding "roll up" summary of some of the key results and findings of the SEA consultation program to date:

Environmental and Socioeconomic Setting

- A widespread recognition of the Gulf of St. Lawrence as a relatively small and somewhat closed body of water, with significant and often complex water currents, exchanges (inputs and outputs) and other oceanographic characteristics and patterns.

- The associated ecological characteristics of the SEA Update Area and larger Gulf, which represents an area of biological productivity and diversity, and which contains important areas for fish, mammals, birds and other species, including various areas and times in which marine species feed, migrate, reproduce and otherwise exist. The need to consider the area in a holistic manner, including interrelationships between species and the human communities and activities which depend on this marine environment.

- The presence of various species at risk in and adjacent to the SEA Update Area, as well as protected and particularly sensitive areas and times (e.g., national parks, bays, bird colonies, lobster areas, krill and other food sources).

- The existence and usefulness of existing and available environmental information, as well some as identified gaps in environmental baseline data and human understanding of ecological systems and processes.

- The relevance of climate change, and observations that the marine environment is changing in recent years, including with respect to the presence and distribution of fish species and other marine biota (e.g., seasonality, water depths, new species) which some believe is linked to changes in water temperatures.

- The need to consider socioeconomic environments and issues in the SEA, in addition to biophysical components and effects.

- The importance of considering the presence and direct and indirect value of, and potential interactions with, other human activities and values in addition to the fishery, such as general vessel traffic, tourism, recreation, viewscapes, communities and infrastructure and others in the offshore and on-shore environments.

- The need to ensure adequate and appropriate environmental monitoring during and following offshore oil and gas activities.

Environmental and Socioeconomic Considerations and Possible Mitigation

- The potential for, and possible ecological and social effects of, and oil spill resulting from future

petroleum exploration or development activities in the region. Concerns that such a spill could reach the coastlines of one or more provinces due to the characteristics of the Gulf.

- A need for adequate environmental analysis and reviews for proposed oil and gas projects, including oil spill modelling based on sound information and science.

- The need to ensure that adequate and appropriate measures are in place to first avoid a potential oil spill as a result of these activities, and then to respond quickly and effectively to any such accidental event, should one occur. This would include adequate compensation for affected fishers. Concerns with the potential for an effective oil spill response during the winter months when there is ice in the Gulf of St. Lawrence.

- The possibility of having independent monitors on oil and gas units, as is the case in some other jurisdictions, was also raised as a possible measure that could be considered.

- A reminder by some that oil and gas exploration and development activities have been occurring safely throughout the Newfoundland and Labrador Offshore Area and elsewhere for decades, without a large spill or evidence of other environmental damage.

- Should offshore oil and gas activities be planned, a key mitigation is considered to be the avoidance of sensitive areas and times in licensing and in the planning and implementation of specific projects.

- Recognition of the important economic and social benefits that often results from oil and gas activity, for workers, businesses, communities, governments, technology and training institutions, infrastructure and others.

- An interest in creating these economic and community opportunities and optimizing local benefits. Concerns about the potential for “take up” of such economic benefits by local persons and businesses, and the need to plan better to take advantage of these.

- A degree of uncertainty and concern around hydraulic fracturing activity and its potential effects, particularly as this is a new and as yet unknown technology in Newfoundland and Labrador (although it was noted that it has and is occurring safely in many other areas). A perceived need for further information and discussions on this issue.

- The need for adequate, clear and well communicated safety zones around any oil and gas installations in the marine environment.

- The possible implications of any offshore oil and gas activities on Gros Morne National Park.

- The cultural and economic importance of the fishing industry in Newfoundland and Labrador and throughout the Gulf of St. Lawrence, and the importance of avoiding potential for adverse effects on this industry. The need for good communication and cooperation between the fishing industry and the oil and gas sectors to indentify and avoid issues as proactively as possible.

- Concerns about seismic activity, associated sound levels, and effects on fish distributions and potential longer-term effects on fish populations. There is uncertainty around this due to noted variation in local observations and also within the scientific research.

- The potential environmental effects of vessel traffic, lights, noise, the use of chemicals and other components and activities associated with offshore oil and gas exploration and development. Possible visual aesthetic issues where oil and gas units are near to, and visible from, the coastline.

Regulatory, Policy and Procedural Issues

- Comments and questions about the nature and purpose of the SEA process, its relationship to project EAs, and the C-NLOPB's role, mandate, composition and licensing and permitting procedures.

- The need to ensure that environmental standards and regulations are adhered to, while at the same time avoiding unnecessary regulatory duplication.

- A perceived need for clarity and certainty around offshore jurisdictions in Eastern Canada, particularly between Newfoundland and Labrador and Québec.

- Various opinions and perspectives about the SEA process and its utility, including a perceived need for an integrated planning framework and a larger, multi-jurisdictional review and decision-making process related to oil and gas activity in the Gulf of St. Lawrence as a whole.

- Similarly, differing opinions and perspectives about the nature and format of the SEA consultation, with some agreeing with and appreciating the open house format and its early and relatively informal nature, whereas others demanded a more formal and "hearing like" process that presented the SEA results (particularly in Québec).

- Questions around whether oil and gas activity can and should be on-going while the SEA Update process is on-going.

- Suggestions that further public involvement is required once the draft SEA Update is available.

The information and input gathered through the consultation process has and will inform and shape the nature and focus of the SEA Update, by helping identify key information requirements and issues that require consideration in the report.

ATTACHMENT A

Public Open House Materials

Sign in Sheets

Information Panels

Feedback Forms

CANADA-NEWFOUNDLAND and LABRADOR OFFSHORE PETROLEUM BOARD

WESTERN NEWFOUNDLAND & LABRADOR OFFSHORE AREA
Strategic Environmental Assessment Update
Public Consultation Sessions

Location: _____

NAME	COMMUNITY / ORGANIZATION

CANADA-TERRE-NEUVE et LABRADOR
L'OFFICE DES HYDROCARBURES EXTRACÔTIERS

ZONE EXTRACÔTIÈRE DE L'OUEST DE TERRE-NEUVE-ET-LABRADOR

Mise à jour de l'Evaluation Environnementale Stratégique

Séances de Consultation Publique

Région: _____

NOM	COMMUNAUTÉ / ORGANISATION

WESTERN NEWFOUNDLAND & LABRADOR OFFSHORE AREA: STRATEGIC ENVIRONMENTAL ASSESSMENT UPDATE

CANADA – NEWFOUNDLAND AND LABRADOR OFFSHORE PETROLEUM BOARD

- The Canada-Newfoundland and Labrador Offshore Petroleum Board (C-NLOPB) was created in 1985 through the *Atlantic Accord*

- Responsible, on behalf of the Governments of Canada and Newfoundland and Labrador, for the regulation of the oil and gas industry in the Newfoundland and Labrador Offshore Area. Reports to the Federal and Provincial Ministers of Natural Resources

Mandate

- To interpret and apply the provisions of the *Atlantic Accord* and the *Atlantic Accord Implementation Acts* to all activities of operators in the Newfoundland and Labrador Offshore Area, and to oversee operator compliance with those statutory provisions

Role

- To facilitate the exploration for and development of the hydrocarbon resources in the Newfoundland and Labrador Offshore Area in a manner that conforms to the statutory provisions for:

    - Worker safety
    - Environmental protection
    - Effective management of land tenure
    - Maximum hydrocarbon recovery and value, and
    - Canada / Newfoundland & Labrador benefits

Objectives

Safety

- To verify that Operators have appropriate safety plans in place
- To verify, through audits and inspections, that Operators follow their safety plans and applicable statutory requirements
- To verify, through compliance actions, that deviations from approved plans and applicable statutory requirements are corrected

Environmental Protection

- To verify that Operators assess and provide for effects of the environment on the safety of their operations
- To verify that Operators perform an environmental assessment pursuant to Canadian regulations, of the effects of their operations on the environment, and prepare a plan and provide for mitigation where appropriate
- To verify, through compliance actions, that Operators comply with their environmental plans

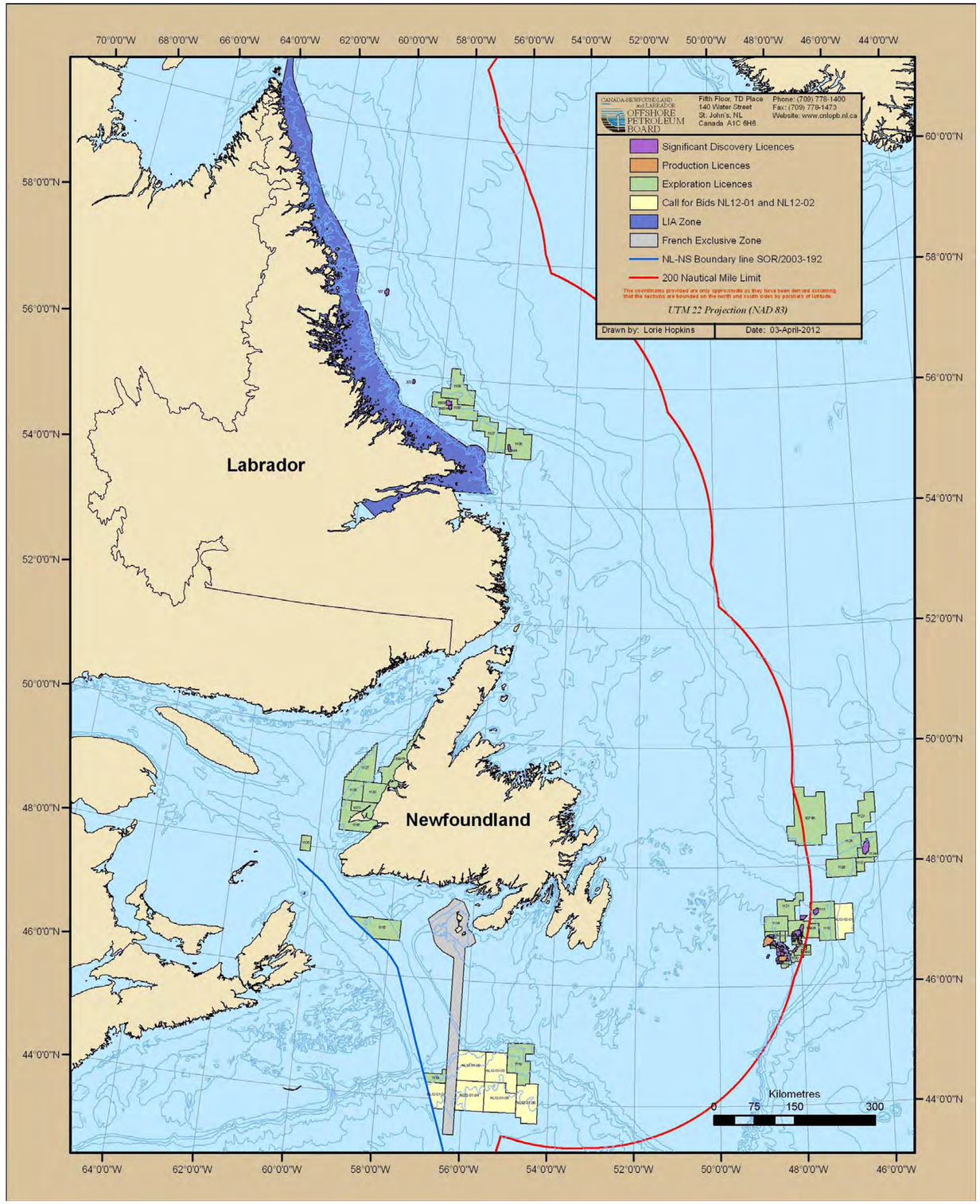
Resource Management

- To effectively and efficiently administer land tenure
- To oversee production activities for consistency with maximum recovery, good oilfield practice, production accounting and approved plans
- To build a knowledge base for the Newfoundland & Labrador Offshore Area through the acquisition and curation of samples and data from exploration and production activity

Industrial Benefits

- To verify Operators have an approved Canada / Newfoundland & Labrador Benefits Plan that addresses their statutory obligations

CANADA-NEWFOUNDLAND and LABRADOR OFFSHORE PETROLEUM BOARD



WESTERN NEWFOUNDLAND & LABRADOR OFFSHORE AREA: STRATEGIC ENVIRONMENTAL ASSESSMENT UPDATE

WESTERN NEWFOUNDLAND AND LABRADOR OFFSHORE AREA
Overview of Previous Oil and Gas Exploration Licensing and Activities

- Strategic Environmental Assessment (SEA) Update Area encompasses an area of approximately 36,000 km^2 offshore Western Newfoundland

- There are currently 7 Exploration Licenses (ELs) in the SEA Update Area. An EL confers:

  1) The right to explore for, and the exclusive right to drill and test for, petroleum

  2) The exclusive right to develop those portions of the offshore area in order to produce petroleum, and

  3) The exclusive right, subject to compliance with the other provisions of the *Accord Acts*, to apply for a production license

- Activities associated with an EL may include:

  a) *Exploration Well Drilling*: An exploratory well drilled in an area where petroleum has not been found previously

  b) *Delineation Well Drilling*: A well drilled after a petroleum discovery to determine the extent of a reservoir

  c) *Seismic and Other Geophysical Surveys*: Searching and mapping the subsurface structure of the earth's crust using geophysical methods (e.g. seismic) to locate probable petroleum reservoir structures

- Past exploration in the area has included the drilling of 9 offshore wells, the most recent well being Shoal Point 3k-39 / 3k-39Z, spudded (commenced) on February 18, 2011

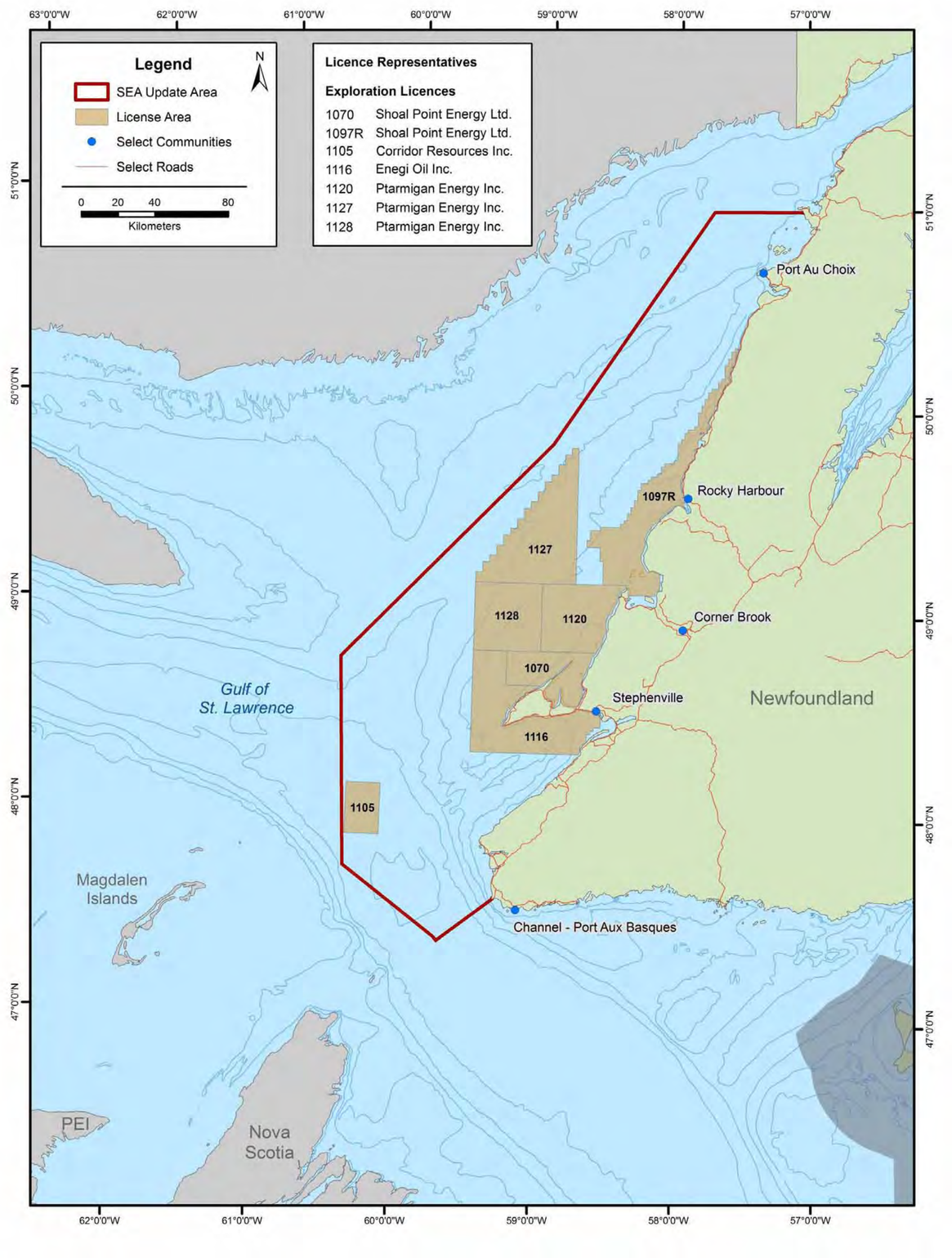
- A total of 14,906 line km of seismic survey data has also been acquired, between 1964 and 2010

- May 12, 2011: C-NLOPB announced a Call for Bids NL 11-01 (Area B – Western NL Offshore Region), offering two parcels

- Call for Bids closed on November 15, 2011 with two successful bids: Issuance of EL 1127 and EL 1128 in January 2012

- November 23, 2011: Former ELs 1097, 1098, 1103 and 1104 consolidated into a new EL 1097R

- Interests in several of the ELs in the area (1097R and 1102) have also been partially or entirely relinquished by their owners within the past year



CANADA-NEWFOUNDLAND and LABRADOR OFFSHORE PETROLEUM BOARD

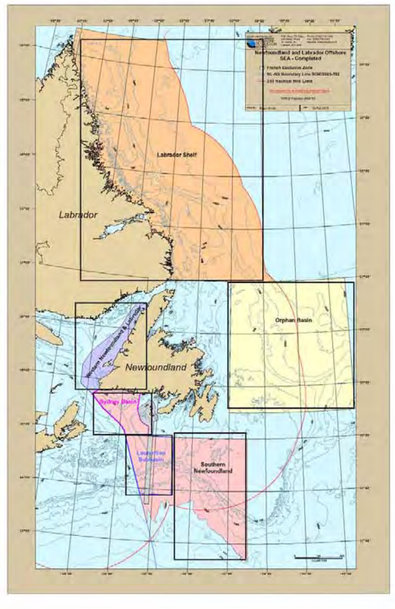
WESTERN NEWFOUNDLAND & LABRADOR OFFSHORE AREA: STRATEGIC ENVIRONMENTAL ASSESSMENT UPDATE

PROJECT-SPECIFIC ENVIRONMENTAL ASSESSMENT (EA)

- EA is a regulatory review process that is often applied to proposed projects
- Predicts and evaluates a project's potential environmental effects, so that these issues can be considered and addressed in project decision-making and design
- EA has traditionally been applied primarily to individual projects – including proposed oil and gas exploration activities

STRATEGIC ENVIRONMENTAL ASSESSMENT (SEA)

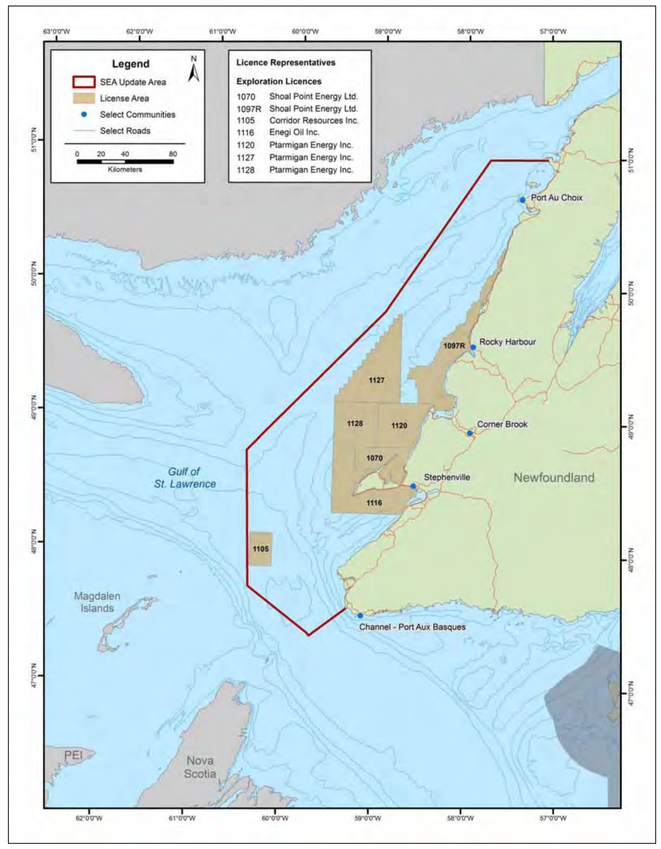
- SEA involves assessing the potential environmental effects of a proposed strategic initiative – such as a policy, plan or program - in order to consider such issues at the earliest stages of program planning
- SEA entails a relatively broad and "issues based" approach to EA, focusing on larger policy and planning decisions regarding an overall region
- SEAs often includes an:
  - Overview of the existing environmental setting
    - Biophysical (the natural environment)
    - Socioeconomic (human activities)
  - Early identification of important potential environmental issues and interactions
  - Evaluation of proposed / alternative strategic decisions (policies, plans, programs)
  - Consideration of environmental issues in strategic decisions



CANADA-NEWFOUNDLAND and LABRADOR OFFSHORE PETROLEUM BOARD

WESTERN NL OFFSHORE AREA SEA UPDATE

- Since 2002, the C-NLOPB has been undertaking SEAs of portions of the NL Offshore in which the issuance of exploration licences could be contemplated and which have not previously been subject to substantial levels of project EA
- This has included the preparation of an SEA for the Western NL Offshore Area, initially published in 2005 and amended in 2007 (to extend its geographic coverage)
- The SEA provides information on the regional environmental setting and key environmental issues and considerations, to inform the C-NLOPB's regulatory decisions regarding offshore petroleum activities in that area
- The C-NLOPB has also committed to regularly review its SEAs and to update them as required, and is currently updating the Western NL Offshore Area SEA. This will include:
  - Identifying and presenting any new environmental information that has become available since 2005 / 07, and
  - Further (updated) analysis of important environmental issues which may be associated with future petroleum exploration and/or development activities in the area
- An important component of the SEA will be consultation
- These open house sessions are being held to provide information and identify public issues and concerns that are relevant to the area and to the purpose and objectives of the SEA Update
- A Draft SEA Update Report will be released for public review and input



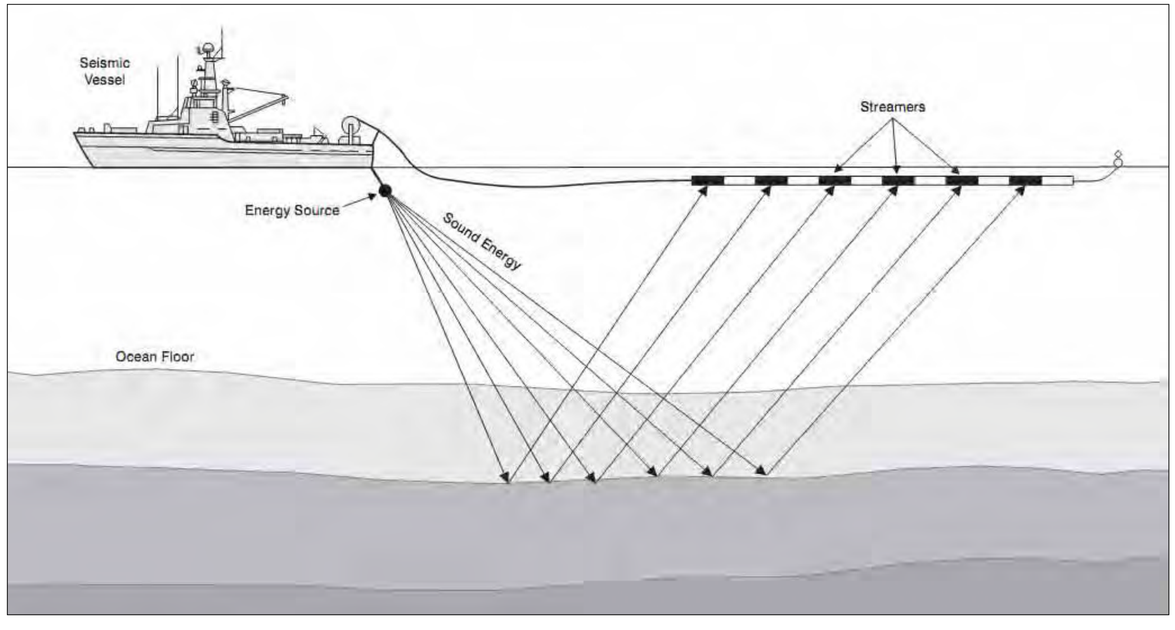
WESTERN NEWFOUNDLAND & LABRADOR OFFSHORE AREA: STRATEGIC ENVIRONMENTAL ASSESSMENT UPDATE

POTENTIAL OFFSHORE OIL AND GAS EXPLORATION ACTIVITIES

- Several types of petroleum exploration activities may occur in the Western NL Offshore Area following the issuance of Exploration Licences by the C-NLOPB, including:

Offshore Seismic Surveys

- Used to identify geological formations that may contain petroleum resources
- High-energy sound sources (airguns) towed behind a survey vessel at several meters below the water surface
- Vessel travels along a track line in a prescribed grid crossing suspected hydrocarbon prospects (~ 3 – 6 knots)
- Sound source fired at regular intervals (50 m), directs sound bursts toward the sea floor
- Reflected sound energy from below the seafloor recorded by sensitive hydrophones (streamers) towed behind the vessel (up to several kilometers in length)
- Data processing systems convert the reflected sound (acoustic signals) into seismic data used for mapping
  - *2D seismic surveys* typically cover larger areas with limited time at a location, with single sound source / streamer
  - *3D seismic surveys* typically cover smaller areas (narrower survey grid) for longer periods, with multiple sound sources and streamers that provide greater resolution



Well Drilling

- Offshore exploration and delineation wells are drilled to confirm the presence, or define the extent, of petroleum resources at particular locations (often as first identified through seismic surveys)
- Various types of offshore drilling installations can be used once a drill site or target is determined, including the following :

Semi-Submersible Drilling Installation

Drill Ship

- The drilling installation is often determined by physical environment characteristics, especially water depth and sea and ice conditions
- The main components of offshore wells include:
  - *Drill String* (piping which connects the rig to the drill bit)
  - *Drill Bit* (device that cuts through the seabed)
  - *Rotation Equipment* (turning mechanism), and
  - *Drilling Muds* (lubricates the drill bit, circulates cuttings and maintains pressure in the well)
- Offshore wells are usually drilled over a period of one to several months, in several stages:
  1) *Conductor Hole*: Drilling a large diameter hole at the beginning of the well (water-based drilling muds)
  2) *Casing Installation:* Removal of drill string, running and cementing of steel pipe, installation of blow-out preventer and drilling riser
  3) *Well Drilling*: Drill bit and riser lowered into the conductor hole, drilling begins, drill string sections added as drilling progresses, drilling riser allows muds and cuttings to travel back to rig for processing
  4) *Vertical Seismic Profile* (VSP): Stringing geophones down the drilled well to confirm well depth
  5) *Well Evaluation and Testing*: If significant hydrocarbons are found, formation fluids are obtained and tested
  6) *Well Abandonment:* Plugged using cement or mechanical devices, well casing and well head cut, inspection

CANADA-NEWFOUNDLAND and LABRADOR OFFSHORE PETROLEUM BOARD

WESTERN NEWFOUNDLAND & LABRADOR OFFSHORE AREA: STRATEGIC ENVIRONMENTAL ASSESSMENT UPDATE

ENVIRONMENTAL SETTING AND CONTEXT

- The SEA has and will provide information on the existing regional environment in the Western NL SEA Update Area, including the:

Physical Environment

- Geology
- Seismicity
- Coastal Environment
- Bathymetry
- Meteorology and Climatology
- Sea Ice and Icebergs
- Oceanography
- Unexploded Ordinances

Biological Environment

- Algae and Plankton
- Benthic Invertebrates
- Finfish and Habitat (Commercial, Non-commercial, Coastal)
- Water Birds
- Marine Mammals
- Sea Turtles
- Species at Risk
- Protected and Sensitive Areas

Human Activities

- Commercial, Recreational and Aboriginal Fisheries
- Aquaculture Activities
- Marine Recreation and Tourism Activities
- Traditional Use of the Coastal Environment
- Submarine / Underwater Cables
- Marine Commercial Traffic
- Canadian Naval Exercises

- The Western NL Offshore Area SEA Update will identify and present any new information that has become available since the initial SEAs were completed in 2005 / 2007

- Interested in obtaining Public, Stakeholder and Aboriginal information about the region

CANADA-NEWFOUNDLAND and LABRADOR OFFSHORE PETROLEUM BOARD

POTENTIAL ENVIRONMENTAL ISSUES AND MITIGATION

- Some of the environmental issues and considerations that may be associated with offshore oil and gas exploration activities include the following:

Seismic Surveys

- Possible avoidance of areas by marine fish, birds, mammals and turtles
- Attraction to or avoidance of seismic vessels (e.g., lights, noise)
- Potential accidental emissions or discharges (spills) and associated environmental effects
- Interference with fishing or other marine activities

Some Environmental Protection Measures

- Minimizing air gun energy / noise levels and seismic survey area and duration
- Use of seismic “soft start” procedures
- Avoidance of known sensitive areas and times
- Fishing industry communication and coordination
- Safety zones and fishing gear compensation plans
- Compliance with applicable legislation, regulations and guidelines

Well Drilling (Exploration and Delineation)

- Water quality and marine habitat effects from drill muds / cuttings or other discharges
- Air emissions (exhausts, flaring) and noise
- Avoidance of areas by marine fish, birds, mammals and turtles
- Marine wildlife attraction to drill rigs and vessels (lights, noise), disruption or mortality
- Potential accidental emissions or discharges (blowouts and spills) and associated environmental effects
- Interference with fishing or other marine activities

Some Environmental Protection Measures

- Avoidance of known sensitive areas and times
- Use of oily water separators and high efficiency burners
- Use of water-based muds (WBMs) and low toxicity synthetic based muds (SBMs)
- Treatment of SBM-associated drill cuttings to compliance with guidelines prior to discharge
- Collection and release of stranded birds
- Chemical screening, selection and management
- On-shore disposal of wastes
- Avoidance and reduction of emissions and discharges
- Compliance with environmental legislation, regulations and guidelines
- Oil spill prevention, preparedness and response procedures
- Use of existing and common vessel traffic routes
- Fishing industry communication and coordination
- Safety zones and fishing gear compensation plans

ZÔNE EXTRACÔTIÈRE DE L'OUEST DE TERRE-NEUVE-ET-LABRADOR : MISE À JOUR DE L'ÉVALUATION ENVIRONNEMENTALE STRATÉGIQUE

L'OFFICE CANADA-TERRE-NEUVE-ET-LABRADOR DES HYDROCARBURES EXTRACÔTIERS

- L'Office Canada-Terre-Neuve-et-Labrador des hydrocarbures extracôtiers (l'Office) a été créé en 1985 dans le cadre de l'*Accord atlantique.*. Il est chargé, au nom des gouvernements du Canada et de Terre-Neuve-et-Labrador, de la réglementation de l'industrie pétrolière et gazière dans la zone extracôtière de Terre-Neuve-et-Labrador. Il relève des ministres fédéral et provinciaux des Ressources naturelles.

Mandat

- Interpréter l'*Accord atlantique* et les *lois de mise en œuvre de l'Accord atlantique* et assurer la mise en application de leurs dispositions dans toutes les activités des entreprises qui exploitent les ressources pétrolières et gazières dans la zone extracôtière de Terre-Neuve-et-Labrador; il s'assure également que les exploitants se conforment aux dispositions légales.

Rôle

- Faciliter l'exploration et l'exploitation des ressources en hydrocarbures dans la zone extracôtière de Terre-Neuve-et-Labrador, dans le respect des dispositions législatives relatives :
    - À la sécurité des travailleurs;
    - À la protection de l'environnement;
    - À la gestion efficace du régime foncier;
    - À une récupération et une mise en valeur maximums des ressources en hydrocarbures;
    - Aux avantages pour le Canada et Terre-Neuve-et-Labrador.

Objectifs

Sécurité

- S'assurer que les exploitants possèdent et mettent en œuvre des plans appropriés de sécurité.
- Vérifier, au moyen d'inspections et de vérifications ponctuelles, que les exploitants respectent leurs plans de sécurité et les exigences législatives applicables.
- S'assurer, par le biais de mesures de conformité, que les dérogations aux plans approuvés et aux exigences législatives applicables sont corrigées.

Protection de l'environnement

- S'assurer que les exploitants évaluent les répercussions potentielles de l'environnement sur la sécurité de leurs activités et qu'ils en tiennent compte.
- S'assurer que les exploitants effectuent une évaluation des effets de leurs activités sur l'environnement, en vertu de la réglementation canadienne, et qu'ils établissent des plans et des mesures d'atténuation, s'il y a lieu.
- S'assurer, par le biais de mesures de conformité, que les exploitants se conforment à leurs plans environnementaux.

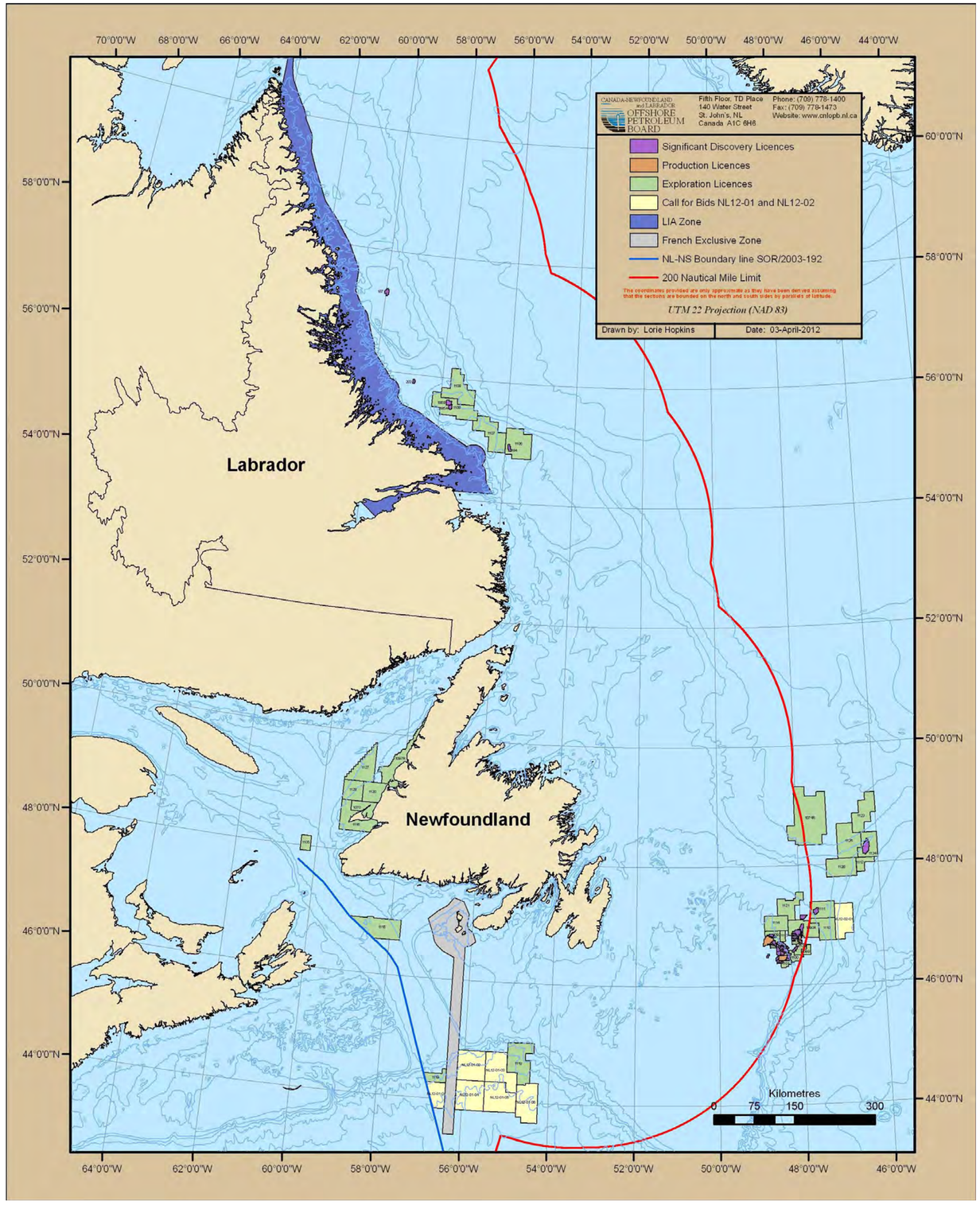
Gestion des ressources

- Assurer de manière efficace et efficiente la gestion du régime foncier.
- Superviser les activités de production pour assurer la conformité avec les principes de récupération maximum, les pratiques exemplaires d'exploitation de champ pétrolifère, les pratiques comptables d'exploitation et les plans approuvés.
- Mettre sur pied une base de connaissances sur la zone extracôtière de Terre-Neuve-et-Labrador par la collecte et la conservation d'échantillons et de données lors des activités de prospection et de production.

Avantages industriels

- S'assurer que les exploitants possèdent un plan approuvé, qui tienne compte de leurs obligations législatives, en ce qui concerne les avantages pour le Canada et Terre-Neuve-et-Labrador.

CANADA-TERRE-NEUVE et LABRADOR
L'OFFICE DES HYDROCARBURES EXTRACÔTIERS



ZÔNE EXTRACÔTIÈRE DE L'OUEST DE TERRE-NEUVE-ET-LABRADOR : MISE À JOUR DE L'ÉVALUATION ENVIRONNEMENTALE STRATÉGIQUE

ZONE EXTRACÔTIÈRE DE L'OUEST DE TERRE-NEUVE-ET-LABRADOR

Aperçu des permis déjà émis et des activités précédentes en matière d'exploration pétrolière et gazière

- La zone de mise à jour de l'évaluation environnementale stratégique (EES) correspond à un secteur extracôtier d'environ 36 000 km^2 situé à l'ouest de Terre-Neuve.

- Sept permis de prospection ont jusqu'à maintenant été accordés dans la zone de mise à jour de l'EES. Un permis de prospection accorde :

  1) Le droit de prospecter et le droit exclusif de procéder à des forages et à des essais à la recherche de pétrole;

  2) Le droit exclusif d'exploiter des secteurs de la zone extracôtière dans le but d'en extraire du pétrole; et

  3) Le droit exclusif, sous réserve de se conformer aux autres dispositions des *lois de mise en œuvre de l'Accord atlantique*, de déposer une demande de permis de production.

- Les activités associées à un permis de prospection peuvent comprendre :

  a) *Forage de puits d'exploration* : puits d'exploration foré dans un secteur où aucun pétrole n'a auparavant été trouvé;

  b) *Forage de puits de délimitation* : puits foré après la découverte de pétrole dans le but de déterminer l'étendue du gisement;

  c) *Levés sismiques et autres levés géophysiques* : analyse et mappage de la structure souterraine de l'écorce terrestre au moyen de méthodes géophysiques (notamment sismiques) dans le but de localiser la structure probable du gisement de pétrole.

- Par le passé, les activités de prospection dans le secteur comprenaient le forage de neuf puits en mer, dont le plus récent, Shoal Point 3k-39 / 3k-39Z, a commencé le 18 février 2011.

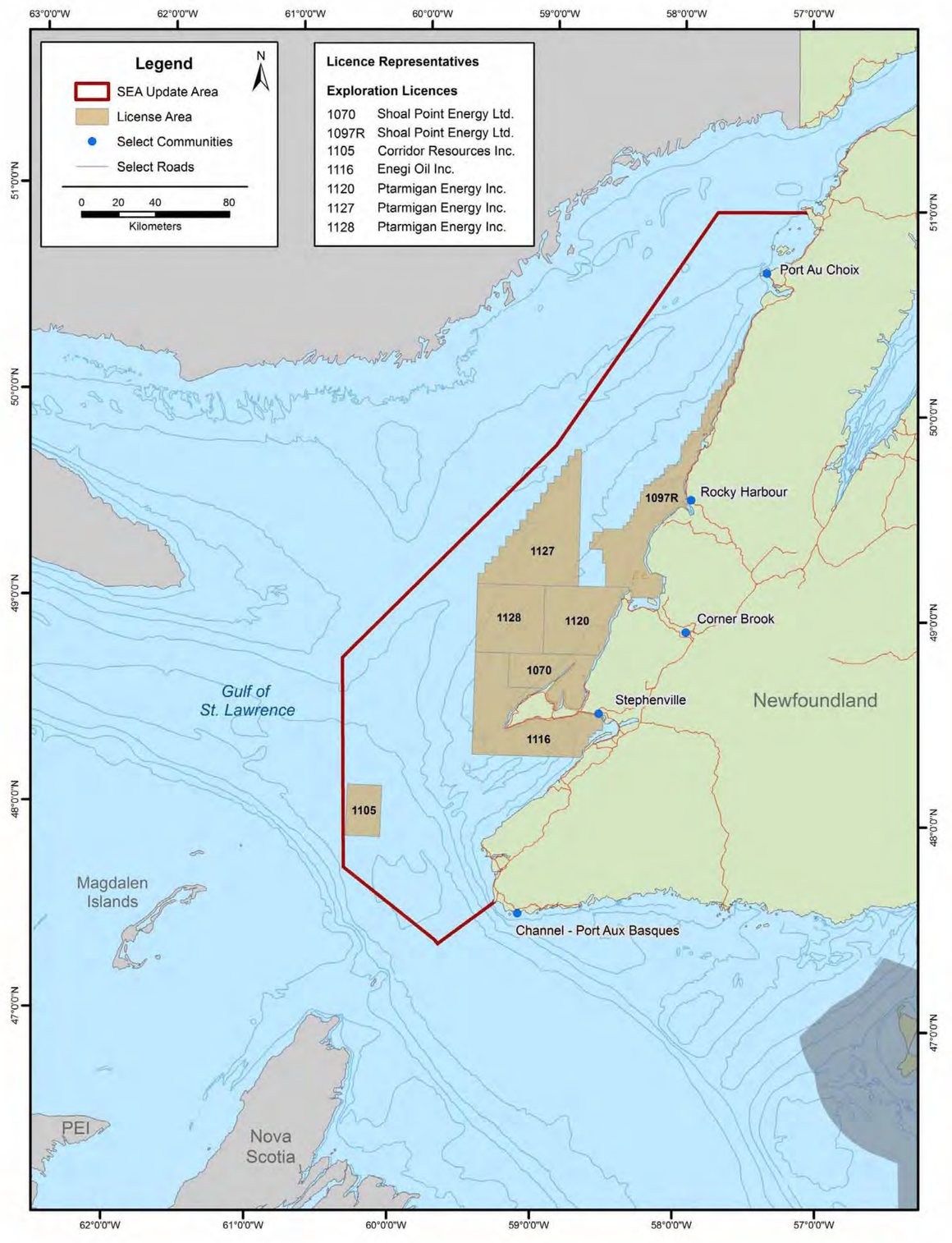
- En tout, des données portant sur 14 906 km linéaires de levé sismique ont été recueillies entre 1964 et 2010.

- Le 12 mai 2011, l'Office lançait l'appel d'offres NL 11-01 (secteur B – zone extracôtière ouest de TN), en proposant deux concessions.

- L'appel d'offres prenait fin le 15 novembre 2011 et a permis de retenir deux soumissions qui ont mené à l'établissement, en janvier 2012, des permis de prospection 1127 et 1128.

- Le 23 novembre 2011, les anciens permis de prospection 1097, 1098, 1103 et 1104 ont été regroupés en un nouveau permis, 1097R.

- Les titulaires de plusieurs permis de prospection du secteur (1097R et 1102) ont en outre partiellement ou entièrement renoncé à leurs intérêts au cours de la dernière année.



CANADA-TERRE-NEUVE et LABRADOR
L'OFFICE DES HYDROCARBURES EXTRACÔTIERS

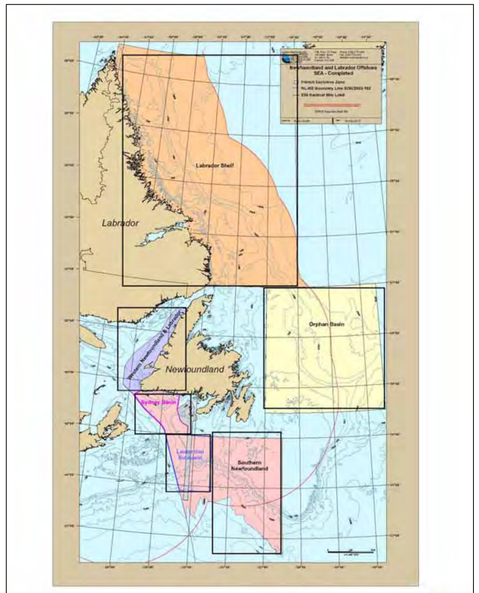
ZÔNE EXTRACÔTIÈRE DE L'OUEST DE TERRE-NEUVE-ET-LABRADOR : MISE À JOUR DE L'ÉVALUATION ENVIRONNEMENTALE STRATÉGIQUE

ÉVALUATION ENVIRONNEMENTALE (EE) PARTICULIÈRE AU PROJET

- L'EE est un processus d'examen réglementaire souvent appliqué aux projets proposés.
- Elle prévoit et évalue les effets potentiels d'un projet sur l'environnement, de sorte qu'on tienne compte des préoccupations soulevées dans le cadre des activités de conception et de prise de décision liées au projet.
- Depuis toujours, l'EE s'applique principalement à des projets individuels, notamment aux activités proposées d'exploration pétrolière et gazière.

ÉVALUATION ENVIRONNEMENTALE STRATÉGIQUE (EES)

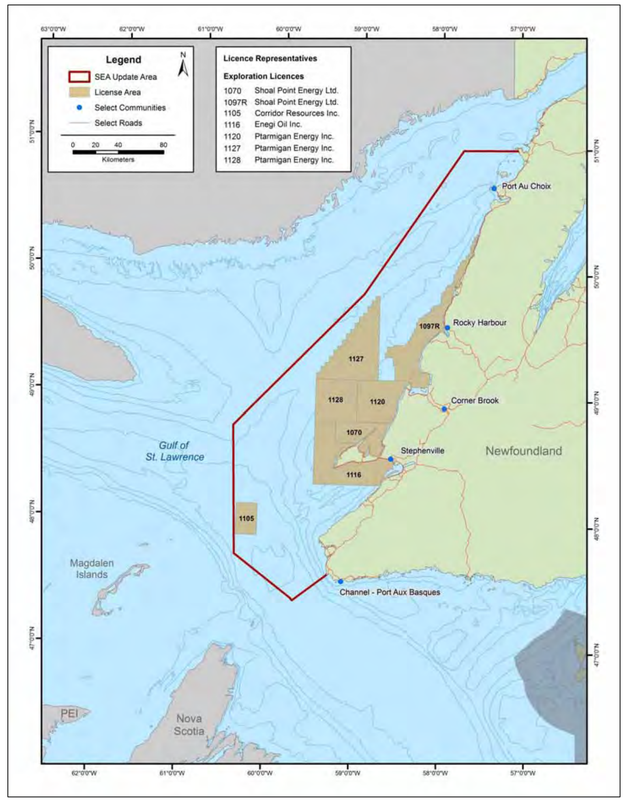
- L'EES vise à évaluer les effets potentiels sur l'environnement d'une initiative stratégique proposée, comme une politique, un plan ou un programme, dans le but de tenir compte des préoccupations soulevées aux toutes premières étapes de la planification de l'initiative.
- L'EES repose sur une méthode relativement générale d'EE, fondée sur les préoccupations, et porte sur des décisions de politique et de planification de grande envergure relatives à l'ensemble d'une région.
- L'EES comporte souvent :
  - Un aperçu du cadre environnemental actuel :
    - biophysique (environnement naturel);
    - socioéconomique (activités humaines).
  - La détermination rapide des importantes préoccupations et interactions environnementales potentielles;
  - L'évaluation des décisions stratégiques (politiques, plans ou programmes) proposées ou de rechange;
  - L'intégration des préoccupations environnementales à la prise des décisions stratégiques.



CANADA-TERRE-NEUVE et LABRADOR
L'OFFICE DES HYDROCARBURES EXTRACÔTIERS

MISE À JOUR DE L'EES DE LA ZONE EXTRACÔTIÈRE DE L'OUEST DE TERRE-NEUVE

- Depuis 2002, l'Office effectue des EES sur des parties de la zone extracôtière de Terre-Neuve pour lesquelles des permis de prospection pourraient être attribués et qui n'ont pas déjà fait l'objet d'EE de grande envergure.
- Les activités réalisées à cet égard comprenaient la préparation d'une EES pour la zone extracôtière ouest de Terre-Neuve, d'abord publiée en 2005, puis révisée en 2007 (pour en accroître la portée géographique).
- L'EES fournit de l'information sur le cadre environnemental régional et sur les principales préoccupations et considérations environnementales, dans le but de documenter les décisions réglementaires de l'Office en ce qui a trait aux activités pétrolières en mer dans ce secteur.
- L'Office s'est en outre engagé à revoir périodiquement ses EES pour les mettre à jour au besoin; il procède d'ailleurs actuellement à la mise à jour de l'EES visant la zone extracôtière de l'ouest de Terre-Neuve. Cette mise à jour permettra :
  - De déterminer et de présenter toute nouvelle donnée environnementale rendue disponible depuis 2005/2007; et
  - De pousser (mettre à jour) l'analyse des importantes questions environnementales pouvant être associées aux activités futures d'exploration ou d'exploitation pétrolières dans le secteur.
- La consultation constituera une importante partie de l'EES.
- Ces séances de type « portes ouvertes » ont pour but de diffuser de l'information et de déterminer les questions et les préoccupations publiques pertinentes à la zone, au but et aux objectifs de la mise à jour de l'EES.
- Un rapport préliminaire de mise à jour de l'EES sera publié aux fins d'examen et de commentaires par le public.



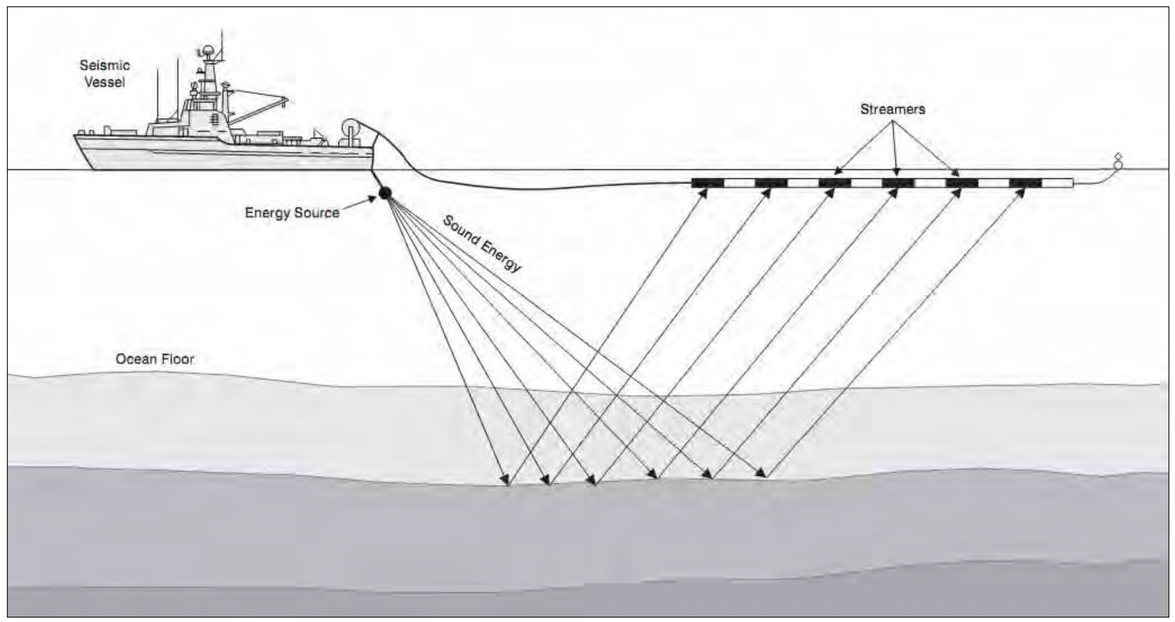
ZÔNE EXTRACÔTIÈRE DE L'OUEST DE TERRE-NEUVE-ET-LABRADOR : MISE À JOUR DE L'ÉVALUATION ENVIRONNEMENTALE STRATÉGIQUE

ACTIVITÉS DE PROSPECTION PÉTROLIÈRE ET GAZIÈRE POTENTIELLES EN MER

- Différents types d'activités de prospection pétrolière pourraient être menés dans la zone extracôtière de l'ouest de Terre-Neuve à la suite de l'émission de permis de prospection par l'Office, notamment :

Levés sismiques en mer :

- Utilisés pour déterminer les formations géologiques pouvant contenir du pétrole;
- Des dispositifs qui émettent à plusieurs mètres sous la surface des faisceaux sonores à haute énergie sont remorqués par un navire d'exploration;
- Le navire se déplace (à une vitesse de 3 à 6 nœuds) en suivant des lignes formant une grille qui recouvre les zones où l'on soupçonne la présence d'hydrocarbures;
- Les dispositifs émettent à intervalles réguliers (50 m) des faisceaux sonores dirigés vers le fond marin;
- L'énergie sonore réfléchie par les structures situées sous le fond marin est enregistrée par des hydrophones (flûtes sismiques), pouvant atteindre plusieurs kilomètres de longueur, remorqués derrière le navire;
- Des systèmes informatiques convertissent les ondes sonores (signaux acoustiques) réfléchies en données sismiques utilisées pour l'établissement de cartes :
  - *Les levés sismiques en deux dimensions couvrent* habituellement de très grands secteurs, consacrant peu de temps à une zone donnée, et sont réalisés au moyen d'une seule source sonore/flûte sismique.
  - *Les levés sismiques en trois dimensions couvrent* habituellement un secteur de taille inférieure (grille de levé plus étroite) pendant une période supérieure et au moyen de sources sonores et de flûtes sismiques multiples qui donnent une résolution supérieure.



CANADA-TERRE-NEUVE et LABRADOR
L'OFFICE DES HYDROCARBURES EXTRACÔTIERS

Forage de puits

- Des puits d'exploration et de délimitation sont forés en mer pour confirmer la présence des ressources pétrolières dans un secteur en particulier (souvent découvert au moyen de levés sismiques) ou déterminer leur étendue.
- Divers types d'installations de forage en mer peuvent être utilisés lorsqu'un site de forage ou une cible est déterminé, notamment :

Plateforme de forage semi-submersible

Navire de forage

- Le choix des installations de forage dépend souvent des caractéristiques environnementales physiques, p. ex. la profondeur de l'eau, l'état de la mer, la présence de glace, etc.
- Les principales composantes des puits en mer sont :
  - *Rame de forage* (tuyaux qui relient l'appareil de forage au trépan);
  - *Trépan* (dispositif qui perfore le fond marin);
  - *Équipement rotatif* (mécanisme rotatif); et
  - *Boues de forage* (lubrifient le trépan, évacuent les déblais de forage et conservent la pression dans le puits).
- Le forage des puits en mer exige habituellement d'un à plusieurs mois et comprend de nombreuses étapes :
  1) *Trou conducteur* : forage d'un trou de grand diamètre au début du puits (boues de forage à base d'eau);
  2) *Mise en place du tubage :* retrait de la rame de forage, mise en place et cimentation de tuyaux d'acier, installation du bloc obturateur de puits et de la colonne ascendante.
  3) *Forage de puits* : le trépan et la colonne ascendante sont descendus dans le trou et le forage commence; des sections de rame de forage sont ajoutées à mesure que progresse le forage. La colonne ascendante permet aux boues et aux déblais de remonter en surface pour y être traités.
  4) *Profil sismique vertical* (PSV) : des géophones sont mis en place dans le puits foré pour en confirmer la profondeur.
  5) *Évaluation et essai de puits* : lorsque la quantité d'hydrocarbures trouvée est importante, on récupère des fluides de formation pour les évaluer.
  6) *Fermeture du puits :* obturation du puits au moyen de béton ou de dispositifs mécaniques, coupure du tubage et de la tête du puits, inspection.

ZÔNE EXTRACÔTIÈRE DE L'OUEST DE TERRE-NEUVE-ET-LABRADOR : MISE À JOUR DE L'ÉVALUATION ENVIRONNEMENTALE STRATÉGIQUE

CADRE ET CONTEXTE ENVIRONNEMENTAUX

- L'EES a fourni et fournira de l'information sur le cadre régional actuel visé par la mise à jour de l'EES de la zone de l'ouest de Terre-Neuve, notamment :

Environnement physique

- Géologie
- Sismicité
- Environnement côtier
- Bathymétrie
- Météorologie et climatologie
- Glace marine et icebergs
- Océanographie
- Munitions non explosées

Environnement biologique

- Algues et plancton
- Invertébrés benthiques
- Poissons à nageoires et habitat (commercial, non commercial, côtier)
- Oiseaux aquatiques
- Mammifères marins
- Tortues de mer
- Espèces en péril
- Zones protégées et sensibles

Activités humaines

- Pêche commerciale, récréative et autochtone
- Activités d'aquaculture
- Activités récréatives nautiques et touristiques
- Utilisation traditionnelle de l'environnement côtier
- Câbles sous-marins
- Trafic maritime commercial
- Exercices navals militaires canadiens

- La mise à jour de l'EES pour la zone extracôtière de l'ouest de Terre-Neuve recueillera et présentera toute nouvelle information devenue accessible depuis la publication des EES initiales en 2005 et en 2007.

- Nous souhaitons obtenir de l'information sur la région de la part du public, des parties intéressées et des autochtones.

CANADA-TERRE-NEUVE et LABRADOR
L'OFFICE DES HYDROCARBURES EXTRACÔTIERS

PRÉOCCUPATIONS ENVIRONNEMENTALES ET MESURES D'ATTÉNUATION POTENTIELLES

- Voici certaines des préoccupations et des considérations environnementales pouvant être associées aux activités de prospection pétrolière et gazière extracôtières :

Levés sismiques

- Possibilité que les poissons, les oiseaux aquatiques, les mammifères marins et les tortues évitent les secteurs touchés;
- Possibilité d'attraction ou de répulsion (en raison des lumières, du bruit, etc.) par les navires effectuant les relevés sismiques;
- Possibilité d'émissions ou de déversements accidentels et effets possibles connexes sur l'environnement;
- Interférence avec les activités maritimes, notamment celles liées à la pêche.

Quelques mesures de protection de l'environnement

- Réduire au minimum l'énergie utilisée par les canons à air et leurs niveaux de bruits ainsi que la durée des levés sismiques et la zone touchée;
- Utilisation de procédures sismiques à « démarrage souple »;
- Évitement des zones et des périodes sensibles connues;
- Communication et coordination avec l'industrie de la pêche;
- Établissement de zones de sécurité et de plans de compensation pour l'équipement de pêche;
- Respect des lois, des règlements et des lignes directrices applicables.

Forage de puits (d'exploration et de délimitation)

- Effets des boues de forage, des déblais et des autres éléments rejetés sur la qualité de l'eau et sur l'habitat marin;
- Émissions aériennes (gaz d'échappement, brûlage de gaz à la torche) et sonores;
- Possibilité que les poissons, les oiseaux aquatiques, les mammifères marins et les tortues évitent les secteurs touchés;
- Attraction de la faune marine par l'équipement et les navires de forage (lumière, bruit), perturbation ou mortalité;
- Possibilité d'émissions ou de rejets accidentels (éruption de puits et déversement) et effets possibles connexes sur l'environnement;
- Interférence avec les activités maritimes, notamment celles liées à la pêche.

Quelques mesures de protection de l'environnement

- Évitement des zones et des périodes sensibles connues;
- Utilisation d'épurateurs d'eau mazouteuse et de brûleurs à haute efficacité;
- Utilisation de boues à base d'eau et de boues synthétiques à faible toxicité;
- Traitement des déblais découlant d'utilisation de boues synthétiques à faible toxicité conformément aux lignes directrices en vigueur avant leur rejet;
- Collecte et remise en liberté des oiseaux en détresse;
- Présélection, sélection et gestion des produits chimiques;
- Évacuation infracôtière des déchets;
- Évitement et réduction des émissions et des rejets;
- Respect des lois, des règlements et des lignes directrices en matière d'environnement;
- Prévention des déversements de pétrole et procédures de préparation et d'intervention;
- Utilisation des voies de trafic maritime existantes ou communes;
- Communication et coordination avec l'industrie de la pêche;
- Établissement de zones de sécurité et de plans de compensation pour l'équipement de pêche.

CANADA-NEWFOUNDLAND and LABRADOR OFFSHORE PETROLEUM BOARD

WESTERN NEWFOUNDLAND & LABRADOR OFFSHORE AREA
Strategic Environmental Assessment Update
Public Consultation Sessions

COMMENT / FEEDBACK FORM

The Canada-Newfoundland and Labrador Offshore Petroleum Board (C-NLOPB) is updating its *Strategic Environmental Assessment* (SEA) for the Western NL Offshore Area.

Through these consultations, we are interested in knowing about any questions or comments you may have regarding future petroleum activities in this area, as well as any other relevant information you may wish to share as input into the SEA Update.

What consultation session (location) did you attend?

Do you have any information about the existing environment in the area (oceanography, fish, birds, mammals, human activities) that you want to provide for the SEA Update?

Do you have any questions or comments regarding future petroleum activities in the region that you feel should be considered in the SEA Update?

Are there any specific measures that you think could be taken in relation to potential petroleum activities in the region that would help address your questions or comments?

Do you have any additional comments or information that you would like to provide related to the SEA Update and/or these open houses?

Thank you for participating in today's Public Consultation Session.

Please leave your completed comment form at the Reception Desk, or send it to:

Steve Bonnell, AMEC Environment & Infrastructure
133 Crosbie Road, St. John's NL PO Box 13216 A1B 4A5
Fax (709) 722-7353
Email *steve.bonnell@amec.com*

CANADA-TERRE-NEUVE et LABRADOR
L'OFFICE DES HYDROCARBURES EXTRACÔTIERS

ZONE EXTRACÔTIÈRE DE L'OUEST DE TERRE-NEUVE-ET-LABRADOR
Mise à jour de l'Evaluation Environnementale Stratégique
Séances de Consultation Publique

VOS COMMENTAIRES

L'Office Canada-Terre-Neuve-et-Labrador des hydrocarbures extracôtiers met à jour son évaluation environnementale stratégique (EES) pour la zone extracôtière de l'ouest de Terre-Neuve-et-Labrador.

À ces consultations, nous sommes intéressés à connaître des questions ou commentaires que vous pourriez avoir concernant les activités pétrolières futures dans ce domaine, ainsi que toute autre information pertinente vous souhaitez partager comme entrée dans la mise à jour EES.

Quelle séance de consultation (lieu) avez-vous visité?

Avez-vous des informations sur l'environnement existant dans la région (océanographie, poissons, oiseaux, mammifères, les activités humaines) que vous souhaitez ajouter à la mise à jour EES?

Avez-vous des questions ou des commentaires concernant les activités pétrolières futures dans la région que selon vous, devraient être inclus dans la mise à jour EES?

Y at-il des mesures spécifiques que vous pensez qui pourrait être fait en ce qui concerne les activités pétrolières potentielles dans la région qui aideraient à répondre à vos questions ou commentaires?

Avez-vous des commentaires ou des informations supplémentaires que vous souhaitez offrir concernant la mise à jour de l'EES et / ou de ces séances de consultation publique?

Merci d'avoir participé à la séance consultation publique aujourd'hui.

S'il vous plaît laissez votre formulaire de commentaires remplie à la réception, ou l'envoyer à:

Steve Bonnell, AMEC Environment & Infrastructure
133 Crosbie Road, St. John's NL PO Box 13216 A1B 4A5
Fax (709) 722-7353
Email *steve.bonnell@amec.com*

ATTACHMENT B

Newspaper Ads

CANADA-NEWFOUNDLAND and LABRADOR OFFSHORE PETROLEUM BOARD

WESTERN NEWFOUNDLAND & LABRADOR OFFSHORE AREA

Strategic Environmental Assessment Update

Public Consultation Sessions

The Canada-Newfoundland and Labrador Offshore Petroleum Board (C-NLOPB) is updating its Strategic Environmental Assessment (SEA) for the Western NL Offshore Area.

The SEA provides information on the regional environmental setting and associated environmental considerations, and will help to inform future regulatory decisions regarding offshore petroleum activities in this area.

Consultation sessions are being held to provide information and receive initial public input into the SEA Update, as follows:

Community	Date and Time	Location
Port aux Basques NL	Sun Sept 30 2012 (5-9 pm)	Bruce II Sports Centre
Stephenville NL	Mon Oct 1 2012 (5-9 pm)	Holiday Inn
Corner Brook NL	Tues Oct 2 2012 (5-9 pm)	Pepsi Centre
Rocky Harbour NL	Wed Oct 3 2012 (5-9 pm)	Community Hall
Lourdes de Blanc Sablon QC	Thurs Oct 4 2012 (5-9 pm)	Salle Municipal

These sessions are open to all interested members of the public. Representatives of the C-NLOPB and its SEA study team (AMEC) will be present to provide information and receive questions and other input into the SEA Update.

For further information about the sessions, please contact:

Steve Bonnell, AMEC Environment & Infrastructure
133 Crosbie Road, St. John's NL A1B 4A5
Tel (709) 722-7023, Fax (709) 722-7353, Email steve.bonnell@amec.com

Additional consultation sessions will also be held elsewhere in the Maritime Provinces and Quebec. Further opportunities for comment will include a period for public comment on the Draft SEA Update Report that will be posted on the C-NLOPB website and provided upon request. Written comments on the Draft SEA Update Report can be provided at any time for consideration during the process.

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CANADA-NEWFOUNDLAND and LABRADOR OFFSHORE PETROLEUM BOARD

WESTERN NEWFOUNDLAND & LABRADOR OFFSHORE AREA

Strategic Environmental Assessment Update

Public Consultation Sessions

The Canada-Newfoundland and Labrador Offshore Petroleum Board (C-NLOPB) is updating its *Strategic Environmental Assessment* (SEA) for the Western NL Offshore Area.

The SEA provides information on the regional environmental setting and associated environmental considerations, and will help to inform future regulatory decisions regarding offshore petroleum activities in this area.

In addition to recent consultation sessions in Newfoundland and Labrador and Quebec, the following open houses are being held in the Maritime Provinces to provide information and receive initial public input into the SEA Update:

Community	Date and Time	Location
Miramichi NB	Tues Oct 9 2012 (5-9 pm)	Kinsmen Club
Charlottetown PEI	Wed Oct 10 2012 (5-9 pm)	Best Western Hotel
Sydney NS	Thurs Oct 11 2012 (5-9 pm)	Holiday Inn Waterfront

These consultation sessions are open to all interested members of the public. Representatives of the C-NLOPB and its SEA study team (AMEC) will be present to provide information and receive questions and other input into the SEA Update.

For further information, please contact:

Steve Bonnell, AMEC Environment & Infrastructure
133 Crosbie Road, St. John's NL A1B 4A5
Tel (709) 722-7023, Fax (709) 722-7353, Email *steve.bonnell@amec.com*

Further sessions will also be held in the Magdalen Islands and the Quebec north shore. Additional opportunities for comment will include a period for public comment on the Draft SEA Update Report that will be posted on the C-NLOPB website and provided upon request. Written comments can be provided at any time for consideration during the process.

CANADA-TERRE-NEUVE et LABRADOR
L'OFFICE DES HYDROCARBURES EXTRACÔTIERS

ZONE EXTRACÔTIÈRE DE L'OUEST DE TERRE-NEUVE-ET-LABRADOR

Mise à jour de l'évaluation environnementale stratégique
Séances de consultation du public

L'Office Canada–Terre-Neuve-et-Labrador des hydrocarbures extracôtiers (l'Office) procède à une mise à jour de son évaluation environnementale stratégique (EES) de la zone extracôtière de l'Ouest de T.-N.-L.

L'EES fournit des renseignements sur les conditions environnementales de la région et les considérations qui y sont associées. Elle sera utilisée pour orienter les décisions futures en matière de réglementation des activités d'exploitation pétrolière en haute mer dans la région.

En plus des récentes séances de consultation qui ont eu lieu à Terre-Neuve-et-Labrador et au Québec, les séances portes ouvertes suivantes se tiendront dans les Maritimes pour renseigner le public sur la mise à jour de l'EES et solliciter ses premiers commentaires :

Localité	Date et heure	Endroit
Miramichi (N.-B.)	Mar. 9 oct. 2012 (17 h - 21 h)	Kinsmen Club
Charlottetown (Î.-P.-É.)	Mer. 10 oct. 2012 (17 h - 21 h)	Best Western Hotel
Sydney (N.-É.)	Jeu. 11 oct. 2012 (17 h - 21 h)	Holiday Inn Waterfront

Ces séances sont ouvertes à tous les intéressés. Des représentants de l'Office et de son équipe de mise à jour (AMEC) seront sur place pour fournir de l'information, répondre aux questions et solliciter des commentaires sur la mise à jour de l'EES.

Pour de plus amples renseignements, veuillez vous adresser à :

Steve Bonnell, AMEC Environment & Infrastructure
133 Crosbie Road, St. John's (T.-N.-L.) A1B 4A5
Tél. : 709-722-7023, téléc. : 709-722-7353
courriel : steve.bonnell@amec.com

Des séances de consultation seront aussi organisées aux Îles-de-la-Madeleine et sur la Côte-Nord, au Québec. D'autres occasions de donner son avis comprendront une période de commentaires du public sur l'ébauche de rapport sur la mise à jour de l'EES. Le texte de l'ébauche sera affiché sur le site Web de l'Office et fourni sur demande. Le public est également invité à soumettre ses commentaires par écrit en tout temps durant ce processus.

CANADA-NEWFOUNDLAND and LABRADOR
OFFSHORE PETROLEUM BOARD

WESTERN NEWFOUNDLAND & LABRADOR OFFSHORE AREA

Strategic Environmental Assessment Update
Public Consultation Sessions

The Canada-Newfoundland and Labrador Offshore Petroleum Board (C-NLOPB) is updating its *Strategic Environmental Assessment* (SEA) for the Western NL Offshore Area.

The SEA provides information on the regional environmental setting and associated environmental considerations, and will help to inform future regulatory decisions regarding offshore petroleum activities in this area.

In addition to recent consultation sessions in Newfoundland and Labrador and elsewhere in Eastern Canada, the following open house is being held to provide information and receive initial public input into the SEA Update:

Community	Date and Time	Location
Gaspé, QC	Monday Oct. 29 2012 (5-9 pm)	Hôtel des Commandants

These consultation sessions are open to all interested members of the public. Representatives of the C-NLOPB and its SEA study team (AMEC) will be present to provide information and receive questions and other input into the SEA Update.

For further information, please contact:

Steve Bonnell, AMEC Environment & Infrastructure
133 Crosbie Road, St. John's NL A1B 4A5
Tel (709) 722-7023, Fax (709) 722-7353, Email *steve.bonnell@amec.com*

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CANADA-TERRE-NEUVE et LABRADOR
L'OFFICE DES HYDROCARBURES EXTRACÔTIERS

Zone extracôtière de l'Ouest de Terre-Neuve-et-Labrador Mise à jour de l'évaluation environnementale stratégique

CONSULTATION PUBLIQUE

L'Office Canada-Terre-Neuve et Labrador des hydrocarbures extracôtiers (l'Office) procède à la mise à jour de son évaluation environnementale stratégique (EES) pour la Zone extracôtière de l'Ouest de Terre-Neuve-et-Labrador.

L'EES fournit de l'information sur le contexte environnemental régional et les considérations environnementales associées et aidera à éclairer les prises de décision réglementaires futures relativement aux activités pétrolières extracôtières de cette région.

En plus de séances de consultation à Terre-Neuve-et-Labrador et ailleurs dans l'Est du Canada, les séances portes ouvertes suivantes se dérouleront au Québec afin de fournir de l'information et recueillir les premiers commentaires du public relativement la mise à jour de l'EES.

COMMUNAUTÉ	DATE ET HEURE	LIEU
Cap-aux-Meules, Îles-de-la-Madeleine, Québec	Mercredi 24 octobre 2012 (17 h à 21 h)	Galerie-Bar-Spectacles Les Pas Perdus. 185, chemin Principal
Havre-Saint-Pierre, Québec	Jeudi 25 octobre 2012 (17 h à 21 h)	Salle Communautaire, 1028, des Fondateurs
Une séance de consultation supplémentaire est prévue pour Gaspé, Québec et sera annoncer bientot.		

Ces séances de consultation sont ouvertes à tous les membres du public intéressés d'y participer. Des représentants de l'Office et de son équipe d'étude EES (AMEC) seront présents afin d'offrir de l'information et recevoir des questions et commentaires concernant la mise à jour de l'EES.

Pour obtenir de plus amples renseignements, veuillez communiquer avec :

Steve Bonnell, AMEC Environment & Infrastructure
133 Crosbie Road, St. John's, (Terre-Neuve) A1B 4A5
Tél. (709) 722-7023, Téléc. (709) 722-7353
Courriel steve.bonnell@amec.com

Il sera également possible d'intervenir lors de la période de commentaires publics sur le projet de rapport de mise à jour de l'EES qui sera affiché sur le site Web de l'Office et fourni sur demande. Les commentaires écrits peuvent être formulés à tout moment pendant le processus.

CANADA-NEWFOUNDLAND and LABRADOR
OFFSHORE PETROLEUM BOARD

WESTERN NEWFOUNDLAND & LABRADOR OFFSHORE AREA Strategic Environmental Assessment Update

PUBLIC CONSULTATION SESSIONS

The Canada-Newfoundland and Labrador Offshore Petroleum Board (C-NLOPB) is updating its Strategic Environmental Assessment (SEA) for the Western NL Offshore Area.

The SEA provides information on the regional environmental setting and associated environmental considerations, and will help to inform future regulatory decisions regarding offshore petroleum activities in this area.

In addition to recent consultation sessions in Newfoundland and Labrador and elsewhere in Eastern Canada, the following open houses are being held in Quebec to provide information and receive initial public input into the SEA Update:

COMMUNITY	DATE AND TIME	LOCATION
Cap-aux-Meules, Magdalen Islands, Québec	Wed Oct 24 2012 (5-9 pm)	Galerie-Bar-Spectacles Les Pas Perdus 185, chemin Principal
Havre-Saint-Pierre, Québec	Thurs Oct 25 2012 (5-9 pm)	Salle Communautaire, 1028, des Fondateurs
An additional open house is being planned for Gaspé, Québec and will be announced shortly.		

These consultation sessions are open to all interested members of the public. Representatives of the C-NLOPB and its SEA study team (AMEC) will be present to provide information and receive questions and other input into the SEA Update.

For further information, please contact:

Steve Bonnell, AMEC Environment & Infrastructure
133 Crosbie Road, St. John's NL A1B 4A5
Tel (709) 722-7023, Fax (709) 722-7353, Email steve.bonnell@amec.com

Additional opportunities for comment will include a period for public comment on the Draft SEA Update Report that will be posted on the C-NLOPB website and provided upon request. Written comments can be provided at any time for consideration during the process.

ATTACHMENT C

Letter to Aboriginal Groups (Sample)

Canada-Newfoundland and Labrador Offshore Petroleum Board
5th Floor, TD Place, 140 Water Street
St. John's, NL A1C 6H6

September 26, 2012

RE: Western Newfoundland & Labrador Offshore Area - Strategic Environmental Assessment Update

Dear ----------

The Canada-Newfoundland and Labrador Offshore Petroleum Board (C-NLOPB) is responsible, on behalf of the Governments of Canada and Newfoundland and Labrador, for the regulation of petroleum exploration activities in the Newfoundland and Labrador (NL) Offshore Area. In the implementation of its mandate, the role of the C-NLOPB is to facilitate the exploration for and development of the hydrocarbon resources in the NL Offshore Area in a manner that conforms to the statutory provisions for worker safety, environmental protection, effective management of land tenure, maximum hydrocarbon recovery and value, and Canada / Newfoundland and Labrador benefits.

As part of its responsibility for ensuring that offshore oil and gas industrial activities proceed in an environmentally acceptable manner, the C-NLOPB has been undertaking Strategic Environmental Assessments (SEAs) of marine areas in which the issuance of exploration licences could be contemplated and which have not previously been subject to substantial levels of environmental assessment (EA). SEA is a relatively broad-based, regional approach to EA that examines the environmental issues which may be associated with a plan, program or policy proposal, and therefore allows for the incorporation of environmental considerations at the earliest stages of planning and decision-making.

Since 2002, the C-NLOPB has conducted a number of SEAs for various portions of the NL Offshore Area, which provide information on the regional environmental setting and associated environmental considerations, and which then help to inform future regulatory decisions regarding offshore petroleum activities in that area. This has included the preparation of an SEA for the Western NL Offshore Area (a portion of the Gulf of St. Lawrence, see attached Figure 1), which was initially published in 2005 and subsequently amended in 2007 to extend its geographic coverage to the southwest.

As part of its commitment to regularly review its SEAs, the C-NLOPB is currently updating the SEA for the Western NL Offshore Area. This includes the identification, review and presentation of any new information on the existing environment in the area that has become available since the initial SEA Reports were completed, as well as a further and updated analysis of any key potential environmental issues and effects which may be associated with future petroleum exploration and/or development activities in the area. The results of the SEA Update will be considered in future licensing decisions regarding offshore petroleum activities by the C-NLOPB.

An important component of the SEA analyses will be consultation with relevant Aboriginal communities and organizations, stakeholders and the general public to identify any questions or concerns regarding future exploration and/or development activities in the area and their potential environmental effects, so that these issues can be considered in the SEA Update.

Should your group have an interest in this marine area and in the future conduct and potential environmental effects of offshore petroleum exploration and/or development activities in it, the C-NLOPB would very much welcome and value the opportunity to discuss this further with you, and particularly, to provide further information and receive your input as part of the SEA Update. Please do feel free to get in touch with us through the contact person and information provided below:

Elizabeth Young
Environmental Assessment Officer
Canada-Newfoundland and Labrador Offshore Petroleum Board
5th Floor, TD Place, 140 Water Street
St. John's, NL Canada A1C 6H6
Tel (709) 778-4232
Email. *EYoung@cnlopb.nl.ca*

We would also certainly be open to discussing, and attempting to accommodate, whatever consultation means and processes would work best for your group, including written input and/or a meeting to discuss this further.

Please also be advised that the C-NLOPB will be holding a series of Consultation Sessions throughout Newfoundland and Labrador and elsewhere in Eastern Canada to provide information and receive initial input into the SEA Update. Information on the locations and times of these open houses will be advertised in local newspapers and through other means, and is provided below for your information:

Western NL SEA Update: Consultation Sessions		
Community	**Date and Time**	**Location**
Port aux Basques NL	Sun Sept 30 2012 (5-9 pm)	Bruce II Sports Centre
Stephenville NL	Mon Oct 1 2012 (5-9 pm)	Holiday Inn
Corner Brook NL	Tues Oct 2 2012 (5-9 pm)	Pepsi Centre
Rocky Harbour NL	Wed Oct 3 2012 (5-9 pm)	Community Hall
Blanc Sablon QC	Thurs Oct 4 2012 (5-9 pm)	Salle Municipal
Miramichi NB	Tues Oct 9 2012 (5-9 pm)	Kinsmen Club
Charlottetown PEI	Wed Oct 10 2012 (5-9 pm)	Best Western Hotel
Sydney NS	Thurs Oct 11 2012 (5-9 pm)	Holiday Inn Waterfront
Cap-aux-Meules Magdalen Islands QC	Wed Oct 24 2012 (5-9 pm)	Spectacles Les Pas Perdus
Havre-Saint-Pierre QC	Thurs Oct 25 2012 (5-9 pm)	(To be Determined and Announced)

You and other members of your community are cordially invited and encouraged to attend one or more of these sessions, which will be open to all members of the public. Should you be interested in meeting separately with the C-NLOPB representatives while they are in your area for the above described public information sessions, please let us know and we will also certainly do our best to facilitate this. Otherwise, we would be happy to meet with you at a later date, by teleconference or other means, as requested.

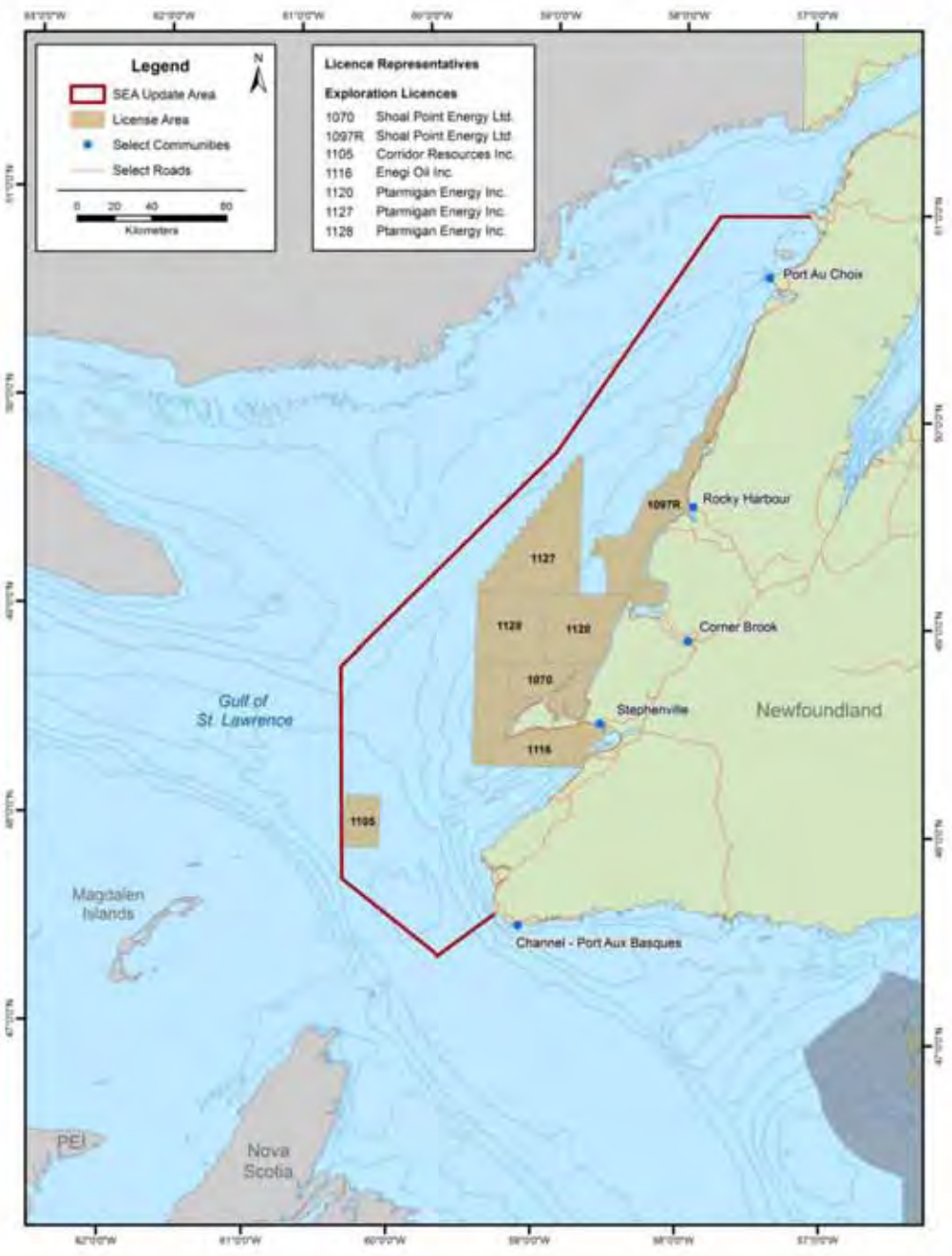
A Draft SEA Update Report will also be released for review and input by Aboriginal groups, stakeholders and the general public, once available.

Thank you very much for your time, and in advance for your participation and input.

Sincerely yours;

_____

Figure 1: Western Newfoundland & Labrador Offshore Area – SEA Update Area



ATTACHMENT D

Invitation to Stakeholder Meetings (Sample)

WESTERN NEWFOUNDLAND & LABRADOR OFFSHORE AREA: STRATEGIC ENVIRONMENTAL ASSESSMENT UPDATE
Stakeholder Meetings

[Sample Covering Email]

Dear Sir or Madam –

The Canada-Newfoundland and Labrador Offshore Petroleum Board (C-NLOPB) is updating its Strategic Environmental Assessment (SEA) for the Western NL Offshore Area. The Board will be holding a series of Public Consultation Sessions throughout Newfoundland and Labrador, the Maritime Provinces and Quebec over the coming weeks to provide information and receive initial public input into the SEA Update.

The C-NLOPB is also, however, hoping to meet with key organizations and other stakeholders in these areas, through a series of focussed workshop meetings just prior to or following the larger Public Consultation Sessions in each community.

Please find attached an invitation for your department or organization to attend a planned stakeholder meeting in your area.

Please reply to myself by email at your earliest convenience, indicating whether a representative of your organization will be attending (and if so, which meeting), as well as providing the name of and contact information for that person. If your organization has offices / representatives in multiple locations, and as relevant, please do feel free to respond concerning more than one session.

Finally, if you are aware of other agencies or organizations in your area who you feel would have an interest in subject matter being addressed in the SEA Update, please also feel free to suggest these to us in your reply.

Thank you for your time, and in advance for your response and participation in these stakeholder meetings for the Western NL Offshore Area SEA Update.

Sincerely yours;

Steve Bonnell

ZONE EXTRACÔTIÈRE DE L'OUEST DE TERRE-NEUVE-ET-LABRADOR : MISE À JOUR DE L'ÉVALUATION ENVIRONNEMENTALE STRATÉGIQUE
Réunions des parties intéressées

Madame, Monsieur;

L'Office Canada–Terre-Neuve-et-Labrador des hydrocarbures extracôtiers (l'Office) procède à la mise à jour de son évaluation environnementale stratégique (EES) pour la Zone extracôtière de l'Ouest de Terre-Neuve. L'Office organisera une série de séances de consultations publiques partout à Terre-Neuve et au Labrador et ailleurs dans les provinces maritimes et au Québec au cours des prochaines semaines

afin de fournir de l'information et recueillir les premiers commentaires du public relativement la mise à jour de l'évaluation environnementale stratégique (EES)

L'Office désire également rencontrer les organisations clés et autres parties intéressées par l'entremise d'une série d'ateliers ciblés avant ou après les séances de consultation publique dans chaque communauté.

Vous retrouverez ci-joint une invitation pour votre département ou votre organisation à participer une réunion des parties intéressées dans votre région.

Veuillez me répondre par courriel dans les meilleurs délais, en indiquant si un représentant de votre organisation sera présent (et si oui, à quelle réunion), tout en fournissant le nom et les coordonnées de cette personne. Si votre organisation compte des bureaux/représentants en de multiples lieux et, le cas échéant, n'hésitez pas à répondre pour plus d'une séance.

Enfin, si vous avez connaissance d'autres agences ou organisations dans votre région qui pourraient être intéressés par la matière abordée dans la mise à jour de l'EES, n'hésitez pas également de nous les proposer dans votre réponse.

Nous vous remercions de votre temps et, à l'avance, pour votre réponse et votre participation à ces réunions des parties intéressées pour la mise à jour de l'EES de la zone extracôtière de l'Ouest de Terre-Neuve.

Je vous prie d'accepter l'expression de mes sentiments distingués;

Steve Bonnell

WESTERN NEWFOUNDLAND & LABRADOR OFFSHORE AREA
Strategic Environmental Assessment Update

The Canada-Newfoundland and Labrador Offshore Petroleum Board (C-NLOPB) is updating its *Strategic Environmental Assessment* (SEA) for the Western NL Offshore Area. The SEA provides information on the regional environmental setting and associated environmental considerations, and will help to inform future regulatory decisions regarding offshore petroleum activities in this area.

The C-NLOPB will be holding a series of Public Consultation Sessions throughout Newfoundland and Labrador and elsewhere in Eastern Canada to provide information and receive initial public input into the SEA Update.

As part of its consultation program for the SEA Update, the C-NLOPB is also, however, hoping to meet with key agencies and organizations, through a series of focussed workshop meetings just prior to or following the larger Public Consultation Sessions in each community.

As a key organization in your region, you or another representative of your group are cordially invited to participate in a meeting with the C-NLOPB and other invited stakeholders in your area, at one of the following locations and times:

1) **Port aux Basques NL, Bruce II Sports Centre, Sunday September 30, 2012 (1-3 pm)**
2) **Stephenville NL, Holiday Inn, Monday October 1, 2012 (1-3 pm)**
3) **Corner Brook NL, Pepsi Centre, Tuesday October 2, 2012 (1-3 pm)**
4) **Rocky Harbour NL, Community Hall, Wednesday October 3, 2012 (1-3 pm)**
5) **Lourdes de Blanc Sablon QC, Salle Municipal, Thursday October 4, 2012 (1-3 pm)**

The meetings will include a short presentation by the C-NLOPB and its SEA study team (AMEC), followed by a round table discussion involving the invited participants.

Please RSVP to Steve Bonnell (*steve.bonnell@amec.com)* at your earliest convenience. Please note that each participating organization is invited to send one representative to a meeting, and that these meetings are by invitation only. Thank you in advance for your response and participation.

You and/or other members of your organization are also invited and encouraged to attend one or more of the larger Public Consultation Sessions, the locations and times of which will be advertised in local newspapers and through other means. These details are also provided below for your information.

Western NL SEA Update: Public Consultation Sessions (Open Houses)

Community	Date and Time	Location
Port aux Basques NL	Sun Sept 30 2012 (5-9 pm)	Bruce II Sports Centre
Stephenville NL	Mon Oct 1 2012 (5-9 pm)	Holiday Inn
Corner Brook NL	Tues Oct 2 2012 (5-9 pm)	Pepsi Centre
Rocky Harbour NL	Wed Oct 3 2012 (5-9 pm)	Community Hall
Lourdes de Blanc Sablon QC	Thurs Oct 4 2012 (5-9 pm)	Salle Municipal

Additional consultation sessions will also be held elsewhere in the Maritime Provinces and Quebec. Further opportunities for comment will include a period for public comment on the Draft SEA Update Report that will be posted on the C-NLOPB website or provided upon request. Also, written comments on the Draft SEA Update Report can be provided at any time for consideration during the process.

Zone extracôtière de l'Ouest de Terre-Neuve-et-Labrador
Mise à jour de l'évaluation environnementale stratégique

L'Office Canada-Terre-Neuve et Labrador des hydrocarbures extracôtiers (l'Office) procède à la mise à jour de son évaluation environnementale stratégique (EES) pour la Zone extracôtière de l'Ouest de Terre-Neuve. L'EES fournit de l'information sur le contexte environnemental régional et les considérations environnementales associées et aidera à éclairer les prises de décision réglementaires futures relativement aux activités pétrolières extracôtières de cette région.

l'Office organisera une série de séances de consultations publiques partout à Terre-Neuve et au Labrador et ailleurs dans les provinces maritimes et au Québec afin de fournir de l'information et recueillir les premiers commentaires du public relativement la mise à jour de l'EES.

Dans le cadre de son programme de consultation concernant la mise à jour de l'EES, l'Office désire également rencontrer les organisations clés et autres parties intéressées par l'entremise d'une série d'ateliers ciblés avant ou après les séances de consultation publique dans chaque communauté.

En tant qu'organisation clé dans votre région, vous et un représentant de votre groupe êtes cordialement invités à participer à une réunion avec l'Office et autres parties intéressées invitées de votre région, à l'un des endroits et heures suivants :

1) **Cap-aux-Meules, Iles de la Madeleine QC , Galerie-Bar-Spectacles Les Pas Perdus, Mer. 24 oct 2012 (13 h - 15 h)**
2) **Havre Saint Pierre QC, Salle communautaire, Jeu. 25 oct 25 2012 (14 h - 16 h)**

Les réunions comporteront une brève présentation de l'Office et de son équipe d'étude de l'EES (AMEC), suivi d'une table ronde des participants invités.

Veuillez confirmer votre participation à Steve Bonnell (*steve.bonnell@amec.com)* dans les meilleurs délais. Veuillez noter que chaque organisation participante est invitée à envoyer un représentant à une réunion, et que ces réunions sont sur invitation uniquement. Nous vous remercions à l'avance de votre réponse et votre participation.

Vous ou d'autres membres de votre organisation êtes également invités et encouragés à participer à l'une ou à plusieurs des plus importantes séances de consultation publique, dont les lieux et les heures seront publiés dans les journaux locaux et par d'autres moyens. Pour votre information, les détails ci-dessous vous sont fournis.

Mise à jour de l'EES de l'Ouest de Terre-Neuve : Séances de consultation publique (Portes ouvertes)		
Communauté	**Date et heure**	**Lieu**
Cap-aux-Meules, Iles de la Madeleine QC	Mer. 24 oct 2012 (17 h - 21 h)	Galerie-Bar-Spectacles Les Pas Perdus
Havre Saint Pierre QC	Jeu. 25 oct 25 2012 (17 h - 21 h)	Salle communautaire
Gaspe QC	À Être Déterminé	

Il sera également possible d'intervenir lors de la période de commentaire publique sur le projet de rapport de mise à jour de l'EES qui sera affiché sur le site Web de l'Office et fourni sur demande. Également, des commentaires écrits peuvent être formulés concernant le projet de rapport de mise à jour de l'EES à tout moment pendant le processus.

APPENDIX B

Common and Scientific Names of Species Referenced in the SEA Update Report

COMMON AND SCIENTIFIC NAMES OF SPECIES REFERENCED IN THE SEA UPDATE

MARINE FISH AND FISH HABITAT - INVERTEBRATES	
Common Name	**Scientific Name**
American lobster	*Homarus americanus*
Arctic lyre crab	*Hyas lyratus*
Arctic argid	*Argis dentata*
Arctic eualid	*Eualus fabricii*
Arctic surfclam	*Mactromeris polynyma*
Atlantic scallop	*Placopecten magellanicus*
Atlantic surfclam	*Spisula solidissima*
Barnacles	*Balanus balanoides*
Basket stars	*Gorgonocephalus*
Bay scallop	*Argopecten irradians*
Blue mussel	*Mytilus edulis*
Brittle stars	*Ophiuroidea*
Burrowing anemone	*Arachnanthus sarsi*
Circumpolar eualid	*Eulas gaimardi*
Clubbed tunicate	*Styela clava*
Coffin box bryozoans	*Membranipora membranacea*
Common periwinkle	Littorina littorea
Common softshell clam	Mya arenaria
Compound sea squirt	Diplosoma listerianum
Crimson pasiphaeid	*Pasiphaea tarda*
Deep sea King crab	*Paralomis granulose*
Doll eualid	*Eulas pusiolus*
European green crab	*Carcinas maenas*
Friendly blade shrimp	*Spirontocaris lilljeborgii*
Golden star tunicate	*Botryllus schlosseri*
Greenland shrimp	*Eulas macilentus*
Green sea urchin	*Strongylocentrotus droebachiensis*
Hermit crabs	*Pagurus*
Icelandic scallops	*Chlamys islandica*
Japanese skeleton shrimp	*Caprella mutica*
Lady crab	*Ovalipes ocelatus*
Lesser bobtail squid	*Semirossia tenera*
Mysid	*Boreomysis arctica*
Northern Atlantic octopus	*Bathypolypus arcticus arcticus*
Northern shrimp	*Pandalus borealis*
Norwegian shrimp	*Pontophilus norvegicus*
Ocean quahog	*Arctica islandica*
Oyster thief	*Codium fragile fragile*
Parrot shrimp	*Spirontocaris spinus*
Periwinkle	*Littorina littorea*
Pink glass shrimp	*Pasiphaea multidentata*
Polar lebbeid	*Lebbeus polaris*
Propeller clams	*Cyrtodaria siliqua*
Punctate blade shrimp	*Spirontocaris phippsii*

MARINE FISH AND FISH HABITAT - INVERTEBRATES	
Rock crab	*Cancer irroratus*
Sand shrimp	*Crangon septemspinosa*
Sars shrimp	*Sabinea sarsi*
Sculptured shrimp	*Sclerocrangon boreas*
Sea cucumber	*Holothuroidea*
Sea pens	*Pennatulacea*
Sevenline shrimp	*Sabinea septemcarinata*
Shortfin squid	*Illex illecebrosus*
Shrimp species	*Atlantopandalus propinquus*
Shrimp species	*Lebbeus microceros*
Shrimp species	*Sergestes arcticus*
Snow crab	*Chionoecetes opilio*
Spiny lebbeid	*Lebbeus groenlandicus*
Spiny crab	*Lithodes maja*
Spoonarm octopus	*Bathypolypus bairdii*
Starfish	*Asteroidea*
Stimpson's surf clams	*Spisula solida*
Striped Pink Shrimp, Aesop Shrimp	*Pandalus montagui*
Toad crab	*Hyas araneus*
Vase tunicate	*Ciona intestinalis*
Violet tunicate	*Botrylloides violaceus*
Whelks	*Buccinidae*

MARINE FISH AND FISH HABITAT - FINFISH	
Common Name	**Scientific Name**
Alewife	*Alosa pseudoharengus*
Acadian redfish	*Sebastes fasciatus*
Alligatorfish	*Aspidophoroides monopterygius*
American eel	*Anguilla rostrata*
American plaice	*Hippoglossoides platessoides*
Arctic shanny	*Stichaeus punctatus*
Atlantic argentine	*Argentina silus*
Atlantic bluefin tuna	*Thunnus thynnus*
Atlantic cod	*Gadus morhua*
Atlantic hagfish	*Myxine glutinosa*
Atlantic halibut	*Hippoglossus hippoglossus*
Atlantic Herring	*Clupea harengus harengus*
Atlantic mackerel	*Scomber scombrus*
Atlantic salmon	*Salmo salar*
Atlantic saury	*Scomberesox saurus*
Atlantic softpout	*Melanostigma atlanticum*
Atlantic sturgeon	*Acipenser oxyrinchus*
Atlantic wolffish	*Anarhichas lupus*
Banded killifish	*Fundulus diaphanus*
Black dogfish	*Centroscyllium fabricii*
Blackspotted stickleback	*Gasterosteus wheatlandi*
Blue shark	*Prionace glauca*

MARINE FISH AND FISH HABITAT - FINFISH	
Common Name	**Scientific Name**
Brown trout	*Salmo trutta*
Butterfish	*Peprilus triacanthus*
Capelin	*Mallotus villosus*
Cunner	*Tautogolabrus adspersus*
Cusk	*Brosme brosme*
Deepwater redfish	*Sebastes mentella*
Fourbeard rockling	*Enchelyopus cimbrius*
Fourspine stickleback	*Apeltes quadracus*
Goosefish	*Enchelyopus cimbrius*
Greater eelpout	*Lycodes esmarki*
Greenland halibut	*Reinhardtius hippoglossoides*
Greenland halibut	*Reinhardtius hippoglossoides*
Gulf stream flounder	*Citharichthys arctifrons*
Haddock	*Melanogrammus aeglefinus*
Longfin hake	*Urophycis chesteri*
Longhorn sculpin	*Myoxocephalus octodecemspinosus*
Lumpfish	*Cyclopterus lumpus*
Marlin-spike	*Nezumia bairdi*
Moustache sculpin	*Triglops murrayi*
Ninespine stickleback	*Pungitius pungitius*
Northern wolffish	*Anarhichas denticulatus*
Pollock	*Pollachius virens*
Porbeagle Shark	*Lamna nasus*
Radiated shanny	*Ulvaria subbifurcata*
Rainbow smelt	*Osmerus mordax*
Rainbow trout	*Onchorhynchus mykiss*
Roughnose grenadier	*Trachyrhynchus murrayi*
Sand lance	*Ammodytidae*
Sea raven	*Hemitripterus americanus*
Sea trout	*Salvelinus fontinalis*
Shortfin mako	*Isurus oxyrinchus*
Silver hake	*Merluccius bilinearis*
Spiny dogfish	*Squalus acanthias*
Spiny dogfish	*Squalus acanthias*
Spotted wolffish	*Anarhichas minor*
Striped bass	*Marone saxatilis*
Swordfish	*Xiphias gladius*
Thorny skate	*Amblyraja radiata*
Threespine stickleback	*Gasterosteus aculeatus*
White barracudina	*Notolepsis rissoi*
White hake	*Urophycis tenuis*
White shark	*Carcharodon carcharias*
Windowpane	*Scophthalmus aquosus*
Winter flounder	*Pseudopleuronectes americanus*
Winter skate	*Leucoraja ocellata*
Witch Flounder	*Glyptocephalus cynoglossus*

MARINE FISH AND FISH HABITAT - FINFISH	
Common Name	**Scientific Name**
Witch flounder	*Glyptocephalus cynoglossus*
Yellowtail flounder	*Limanda ferruginea*

WATER BIRDS	
Common Name	**Scientific Name**
American Black Duck	*Anas rubipres*
American Wigeon	*Anas americana*
Arctic Tern	*Sterna paradisaea*
Atlantic Puffin	*Fratercula arctica*
Bald Eagle	*Haliaeetus leucocephalus*
Bank Swallow	*Riparia riparia*
Barrow's Goldeneye	*Bucephala islandica*
Black Guillemot	*Cepphus grylle*
Black Scoter	*Melanitta americana*
Black-bellied Plover	*Pluvialis squatarola*
Black-headed Gull	*Chroicocephalus ridibundus*
Black-legged Kittiwake	*Rissa tridactyla*
Blue-winged Teal	*Anas discors*
Bobolink	*Dolichonyx oryzivorus*
Buff-breasted Sandpiper	*Tryngites subruficollis*
Canada Goose	*Branta canadensis*
Caspian Tern	*Hydroprogne caspia*
Common Eider	*Somateria mollissima*
Common Goldeneye	*Bucephala clangula*
Common Loon	*Gavia immer*
Common Merganser	*Mergus merganser*
Common Murre	*Uria aalge*
Common Tern	*Sterna hirundo*
Double-crested Cormorant	*Phalacrocorax auritus*
Dovekie	*Alle alle*
Eskimo Curlew	*Numenius borealis*
Eurasian Wigeon	*Anas penelope*
Gadwall	*Anas strepera*
Glaucous Gull	*Larus hyperboreus*
Gray Catbird	*Dumetella carolinensis*
Great Black-backed Gull	*Larus marinus*
Great Blue Heron	*Ardea herodias*
Great Cormorant	*Phalacrocorax carbo*
Great Skua	*Stercorarius skua*
Greater Scaup	*Aythya marila*
Greater Shearwater	*Puffinus gravis*
Greater Yellowlegs	*Tringa melanoleuca*
Green-winged Teal	*Anas carolinensis*
Harlequin Duck	*Histrionicus histrionicus*
Herring Gull	*Larus argentatus*
Iceland Gull	*Larus glaucoides*

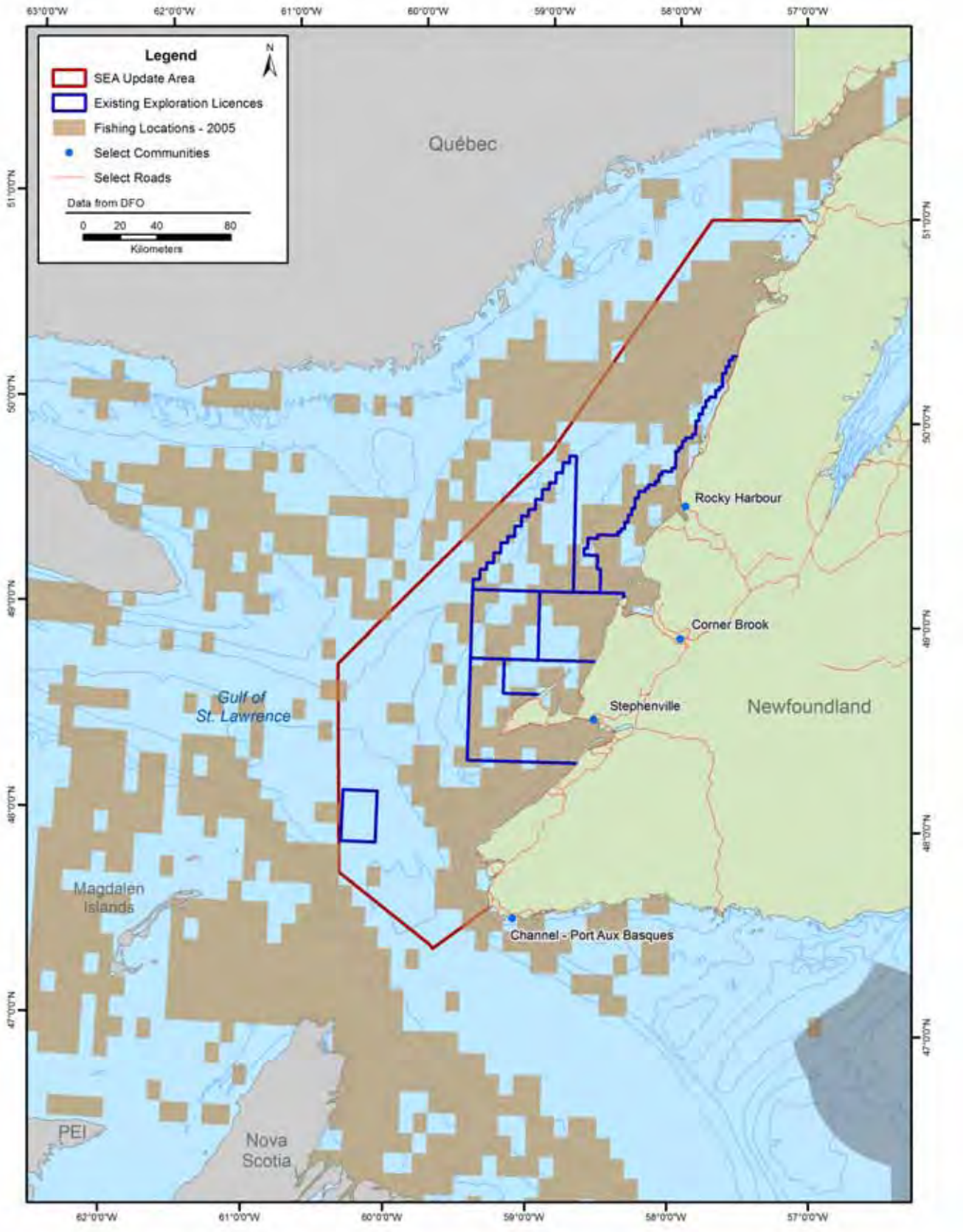
WATER BIRDS	
Common Name	**Scientific Name**
Ivory Gull	*Pagophila eburnea*
Killdeer	*Charadrius vociferus*
Leach's Storm-petrel	*Oceanodroma leucorhoa*
Least Sandpiper	*Calidris minutilla*
Lesser Scaup	*Aythya affinis*
Long-tailed Duck	*Clangula hyemalis*
Long-tailed Jaeger	*Stercorarius longicaudus*
Mallard	*Anas platyrhynchos*
Manx Shearwater	*Puffinus puffinus*
Northern Fulmar	*Fulmarus glacialis*
Northern Gannet	*Morus bassanus*
Northern Pintail	*Anas acuta*
Northern Shoveler	*Anas clypeata*
Ovenbird	*Seiurus aurocapilla*
Parasitic Jaeger	*Stercorarius parasiticus*
Peregrine Falcon	*Falco peregrinus*
Pied-billed Grebe	*Podilymbus podiceps*
Piping Plover	*Charadrius melodus*
Pomarine Jaeger	*Stercorarius pomarinus*
Purple Sandpiper	*Calidris maritima*
Razorbill	*Alca torda*
Red Crossbill	*Loxia curvirostra*
Red Knot	*Calidris canutus rufa*
Red Phalarope	*Phalaropus fulicaria*
Red-breasted Merganser	*Mergus serrator*
Red-eyed Vireo	*Vireo olivaceus*
Red-necked Phalarope	*Phalaropus lobatus*
Ring-billed Gull	*Larus delawerensis*
Ring-necked Duck	*Aythya collaris*
Roseate Tern	*Sterna dougallii*
Rose-breasted Grosbeak	*Pheucticus ludovicianus*
Ruby-throated Hummingbird	*Archilochus colubris*
Ruddy Turnstone	*Arenaria interpres*
Sabine's Gull	*Xema sabini*
Sanderling	*Calidris alba*
Savannah Sparrow	*Passerculus sandwichensis*
Semipalmated Plover	*Charadrius semipalmatus*
Semipalmated Sandpiper	*Calidris pusilla*
Short-eared Owl	*Asio flammeus*
Sooty Shearwater	*Puffinus griseus*
Sora	*Porzana carolina*
Surf Scoter	*Melanitta perspicillata*
Thick-billed Murre	*Uria lomvia*
Tufted Duck	*Aythya fuligula*
Western Reef Heron	*Egretta gularis*
Whimbrel	*Numenius phaeopus*

WATER BIRDS	
Common Name	**Scientific Name**
White-rumped Sandpiper	*Calidris fuscicollis*
White-winged Scoter	*Melanitta deglandi*
Willet	*Tringa semipalmata*
Wilson's Storm-petrel	*Oceanites oceanicus*
Wood Duck	*Aix sponsa*

MARINE MAMMALS AND SEA TURTLES	
Common Name	**Scientific Name**
Atlantic white-sided dolphin	*Lagenorhynchus acutus*
Bearded seal	*Erignathus barbatus*
Beluga whale	*Delphinapterus leucas*
Blue whale	*Balaenoptera musculus*
Fin whale	*Balaenoptera physalus*
Grey seal	*Halichoerus grypus*
Harbour porpoise	*Phocoena phocoena*
Harbour seal	*Phoca vitulina*
Harp seal	*Pagophilus groenlandica*
Hooded seal	*Cystophora cristata*
Humpback whale	*Megaptera novaeangliae*
Killer Whale	*Orcinus orca*
Long-finned pilot whale	*Globicephala melas*
Minke whale	*Balaenoptera acutorostrata*
North Atlantic right whale	*Eubalaena glacialis*
Northern bottlenose whale	*Hyperoodon ampullatus*
Ringed seal	*Phoca hispida*
River otter	*Lontra canadensis*
Sei whale	*Balaenoptera borealis*
Short-beaked common dolphin	*Delphinus delphis*
Sowerby's beaked whale	*Mesoplodon bidens*
Sperm whale	*Physeter macrocephalus*
White-beaked dolphin	*Lagenorhynchus albirostris*
Kemp's ridley turtle	*Lepidochelys kempii*
Leatherback turtle	*Dermochelys coriacea*
Loggerhead turtle	*Caretta caretta*

APPENDIX C

Commercial Fishing Locations (2005 – 2010)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Kilometers
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Corner Brook
Stephenville
Newfoundland
Gulf of St. Lawrence
Magdalen Islands
Channel - Port Aux Basques
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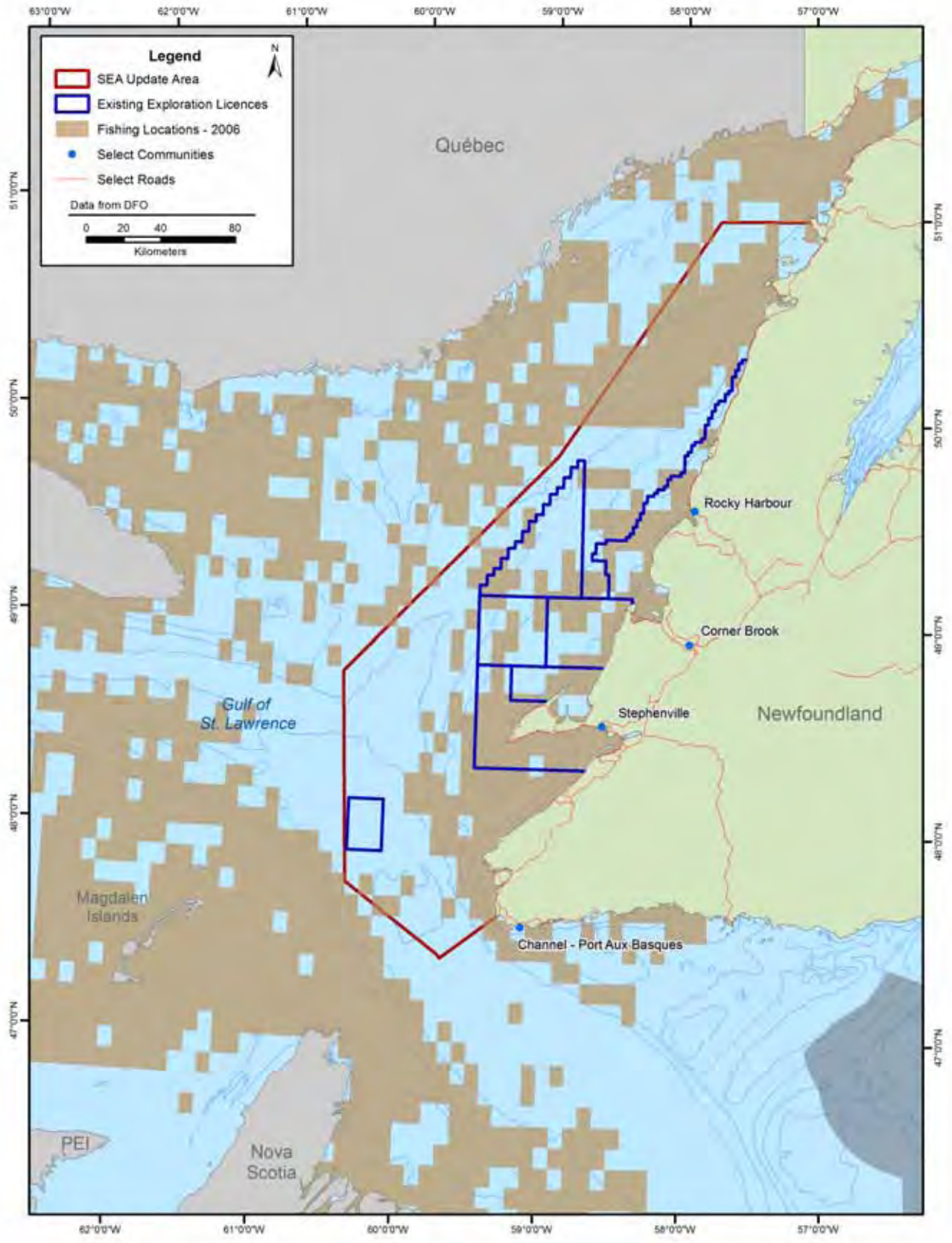
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Corner Brook
Stephenville
Newfoundland
Gulf of St. Lawrence
Magdalen Islands
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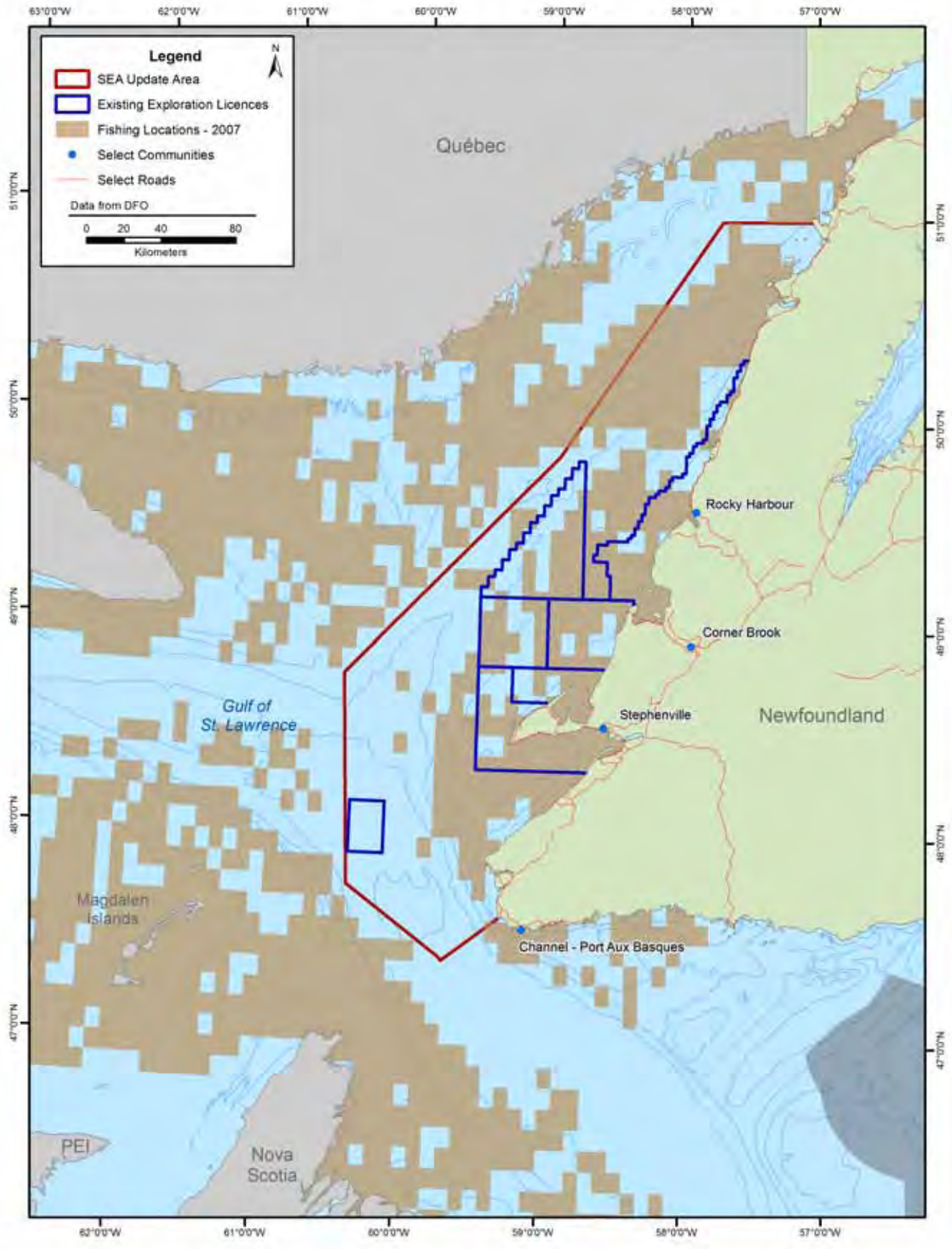
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Kilometers
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Rocky Harbour
Corner Brook
Stephenville
Newfoundland
Gulf of St. Lawrence
Magdalen Islands
Channel - Port Aux Basques
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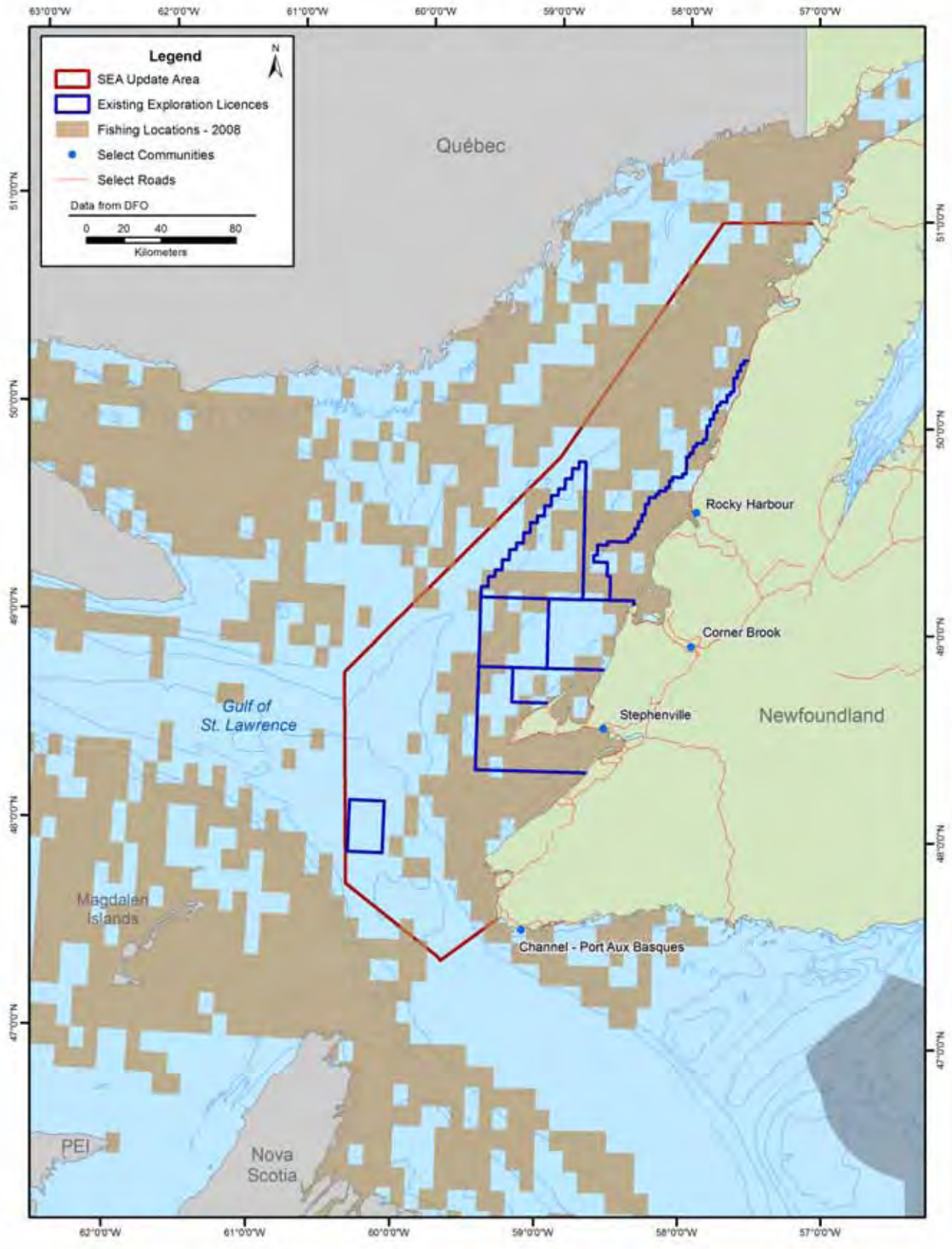
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Kilometers
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Rocky Harbour
Corner Brook
Stephenville
Newfoundland
Gulf of St. Lawrence
Magdalen Islands
Channel - Port Aux Basques
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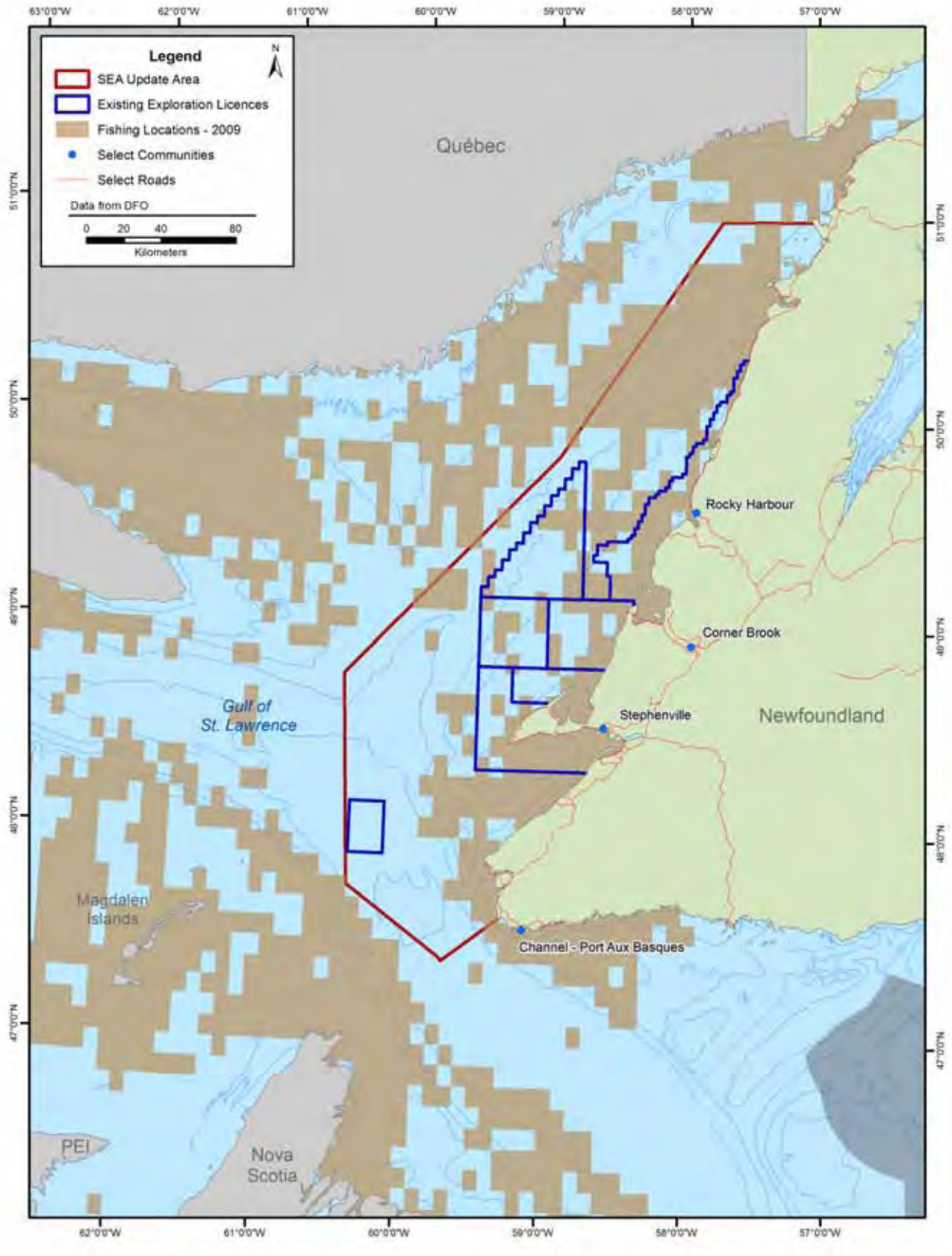
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Kilometers
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Rocky Harbour
Corner Brook
Stephenville
Newfoundland
Gulf of St. Lawrence
Magdalen Islands
Channel - Port Aux Basques
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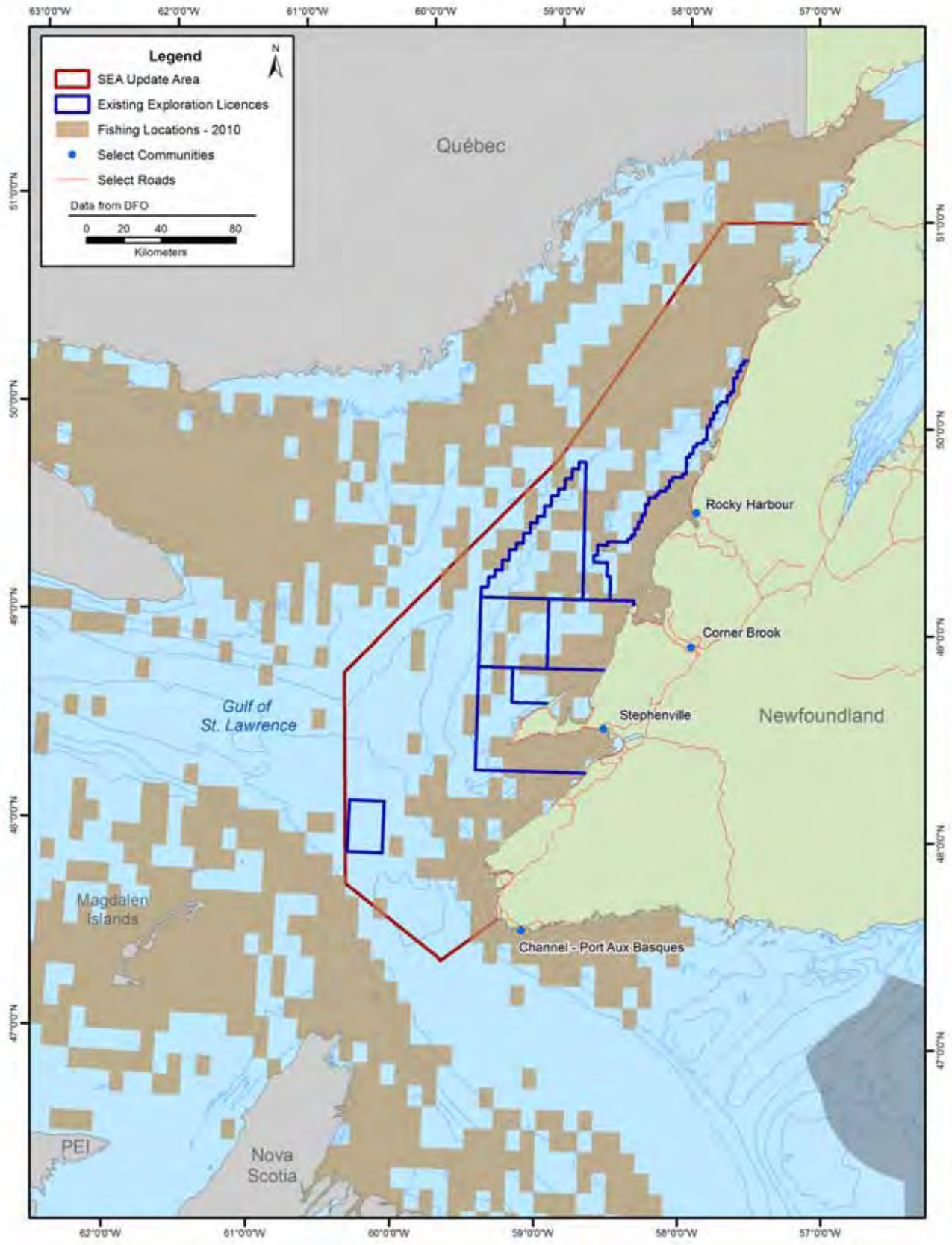
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Corner Brook
Stephenville
Newfoundland
Gulf of St. Lawrence
Magdalen Islands
Channel - Port Aux Basques
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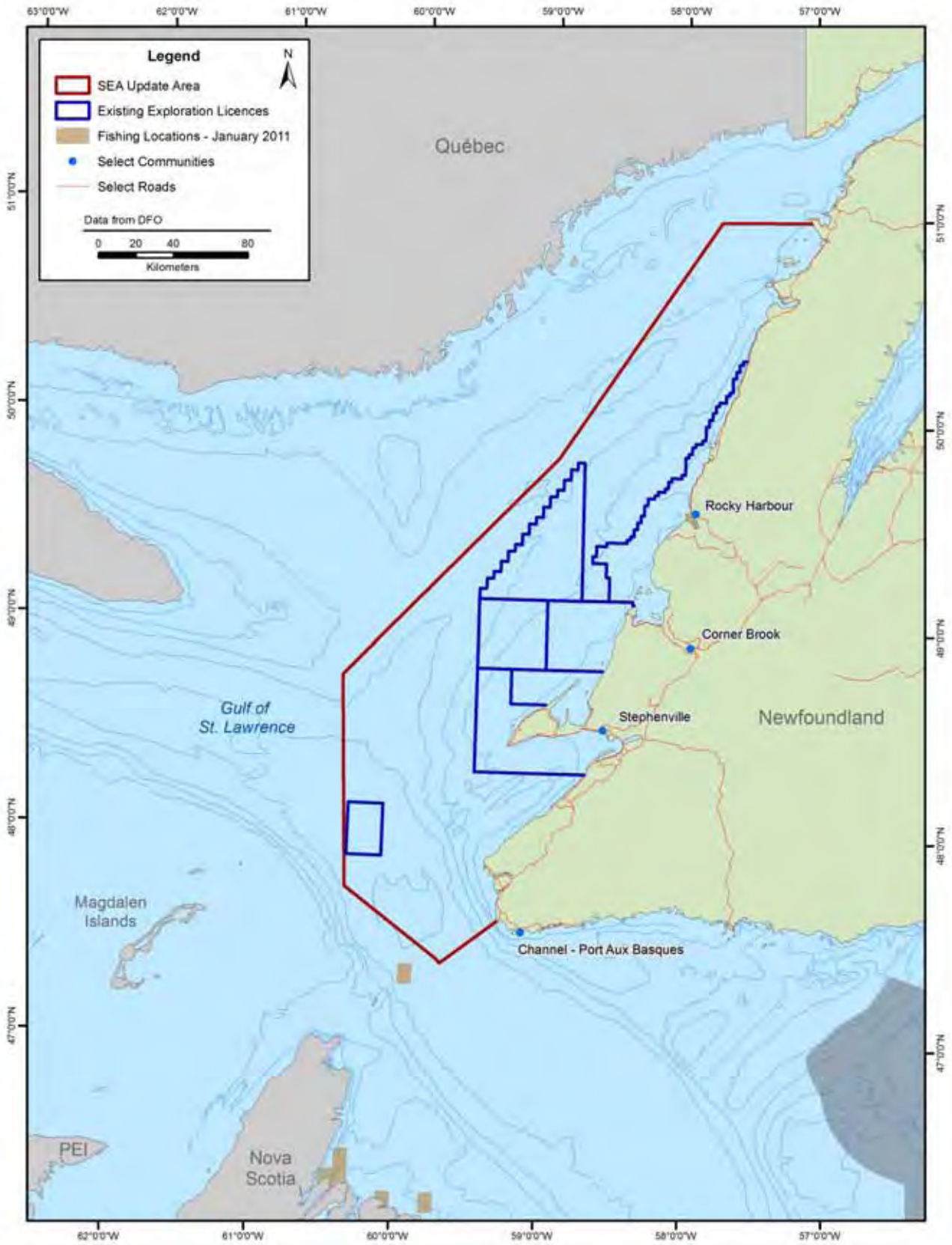
APPENDIX D

Commercial Fishing Locations by Month (2011 and 2005 – 2010)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Rocky Harbour
Corner Brook
Stephenville
Newfoundland
Gulf of St. Lawrence
Magdalen Islands
Channel - Port Aux Basques
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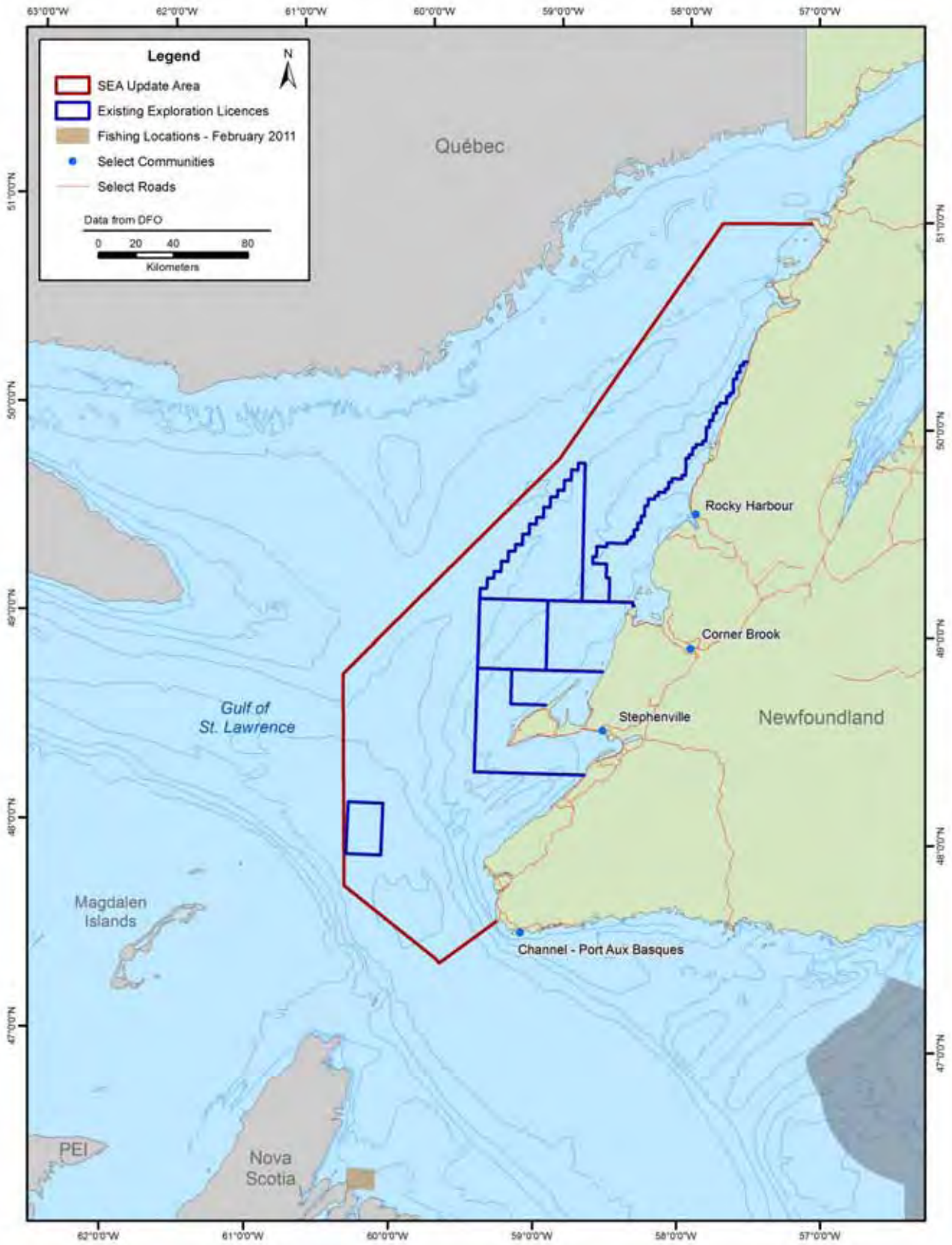
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Rocky Harbour
Corner Brook
Stephenville
Newfoundland
Gulf of
St. Lawrence
Magdalen
Islands
Channel - Port Aux Basques
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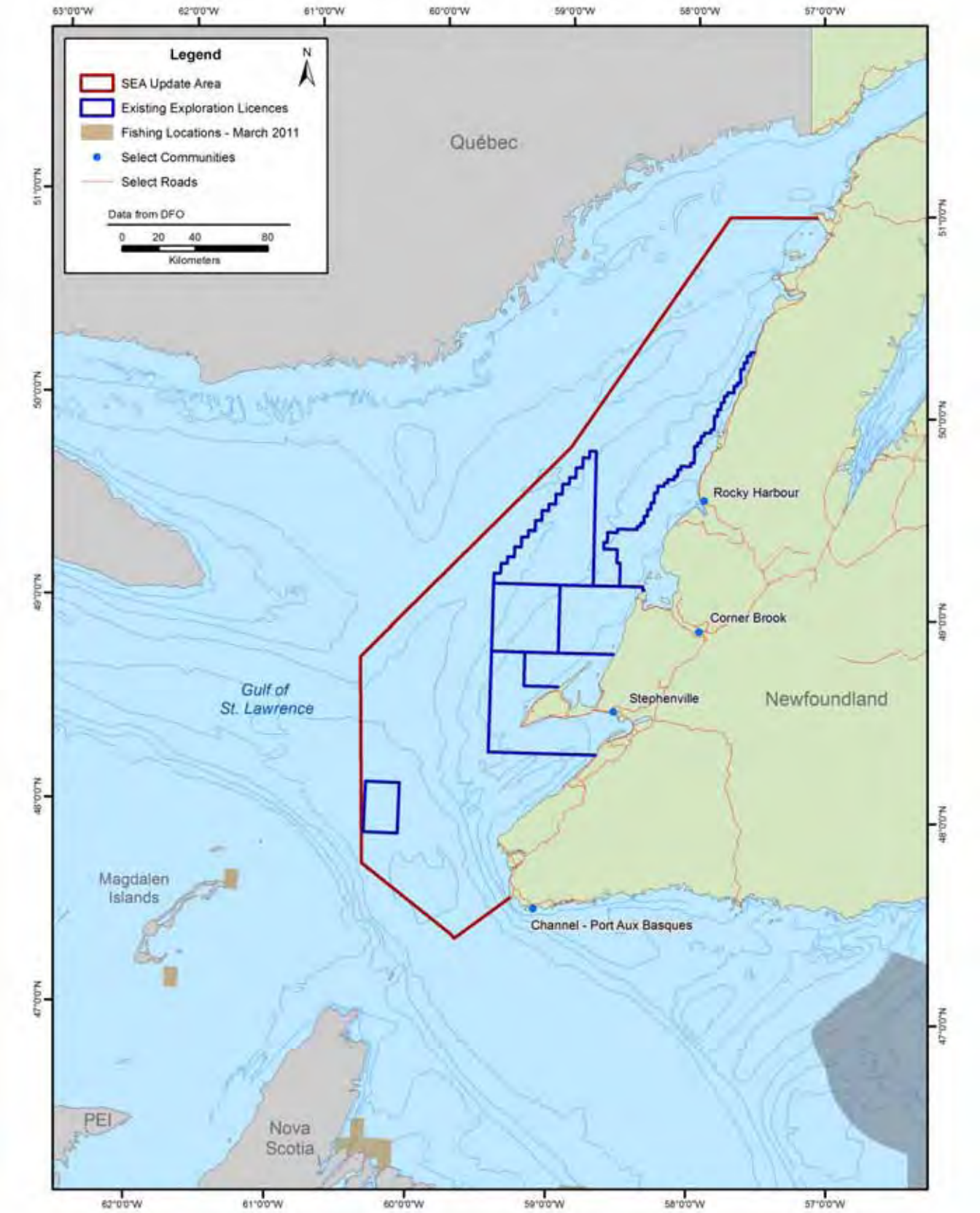
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Rocky Harbour
Corner Brook
Stephenville
Newfoundland
Gulf of
St. Lawrence
Magdalen
Islands
Channel - Port Aux Basques
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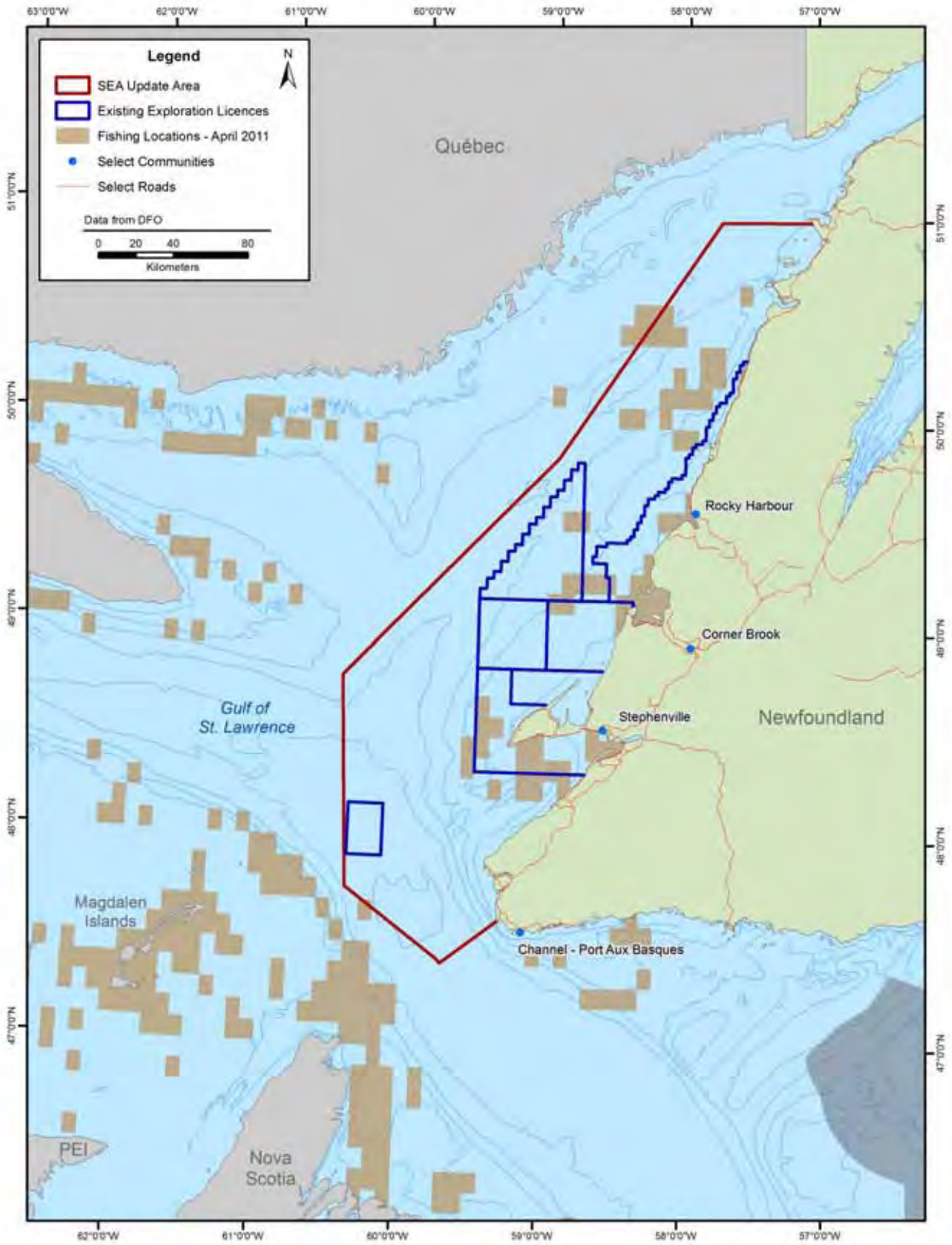
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Fishing Locations - April 2011
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Rocky Harbour
Corner Brook
Stephenville
Newfoundland
Gulf of St. Lawrence
Magdalen Islands
Channel - Port Aux Basques
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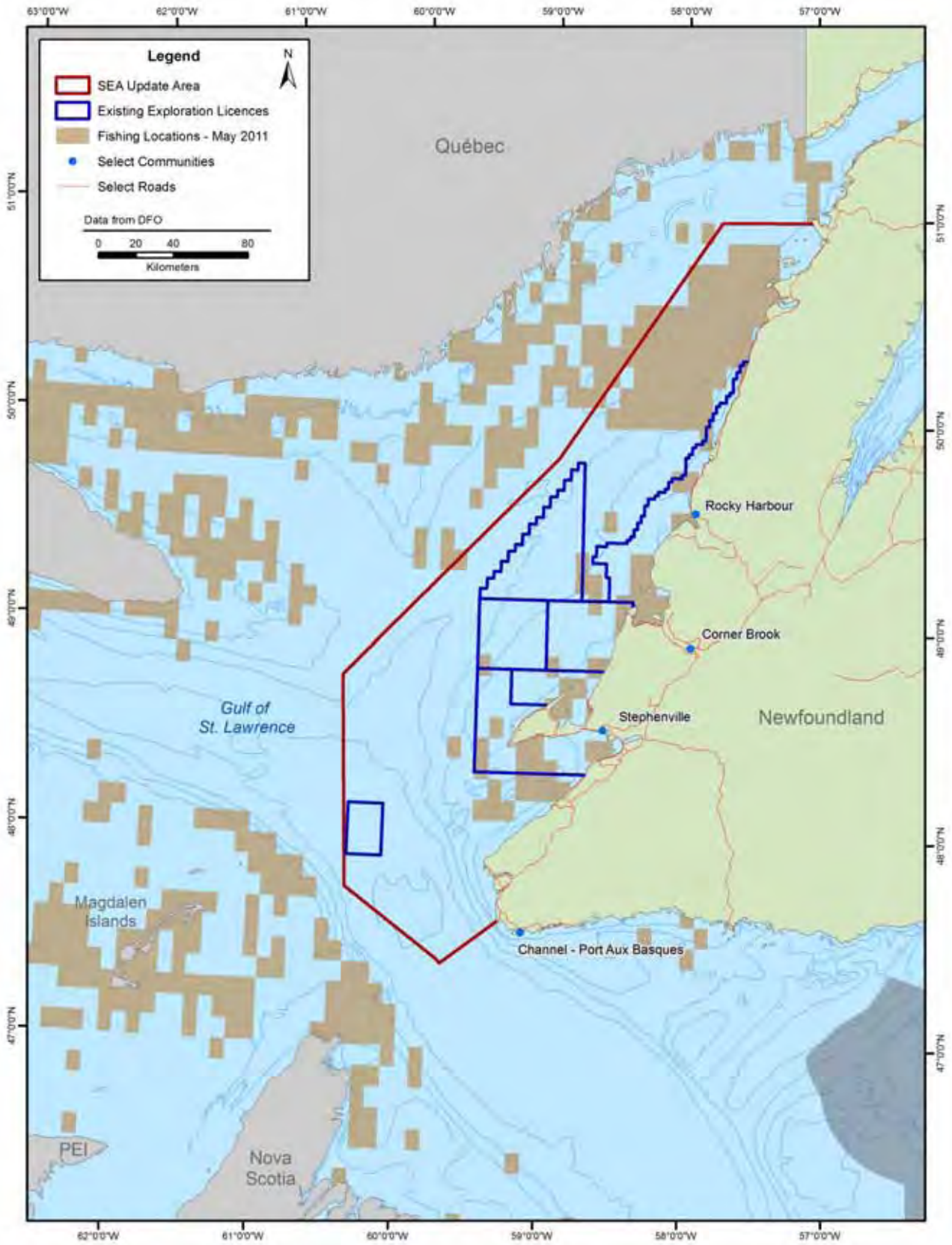
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Stephenville
Newfoundland
Gulf of
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Magdalen
Islands
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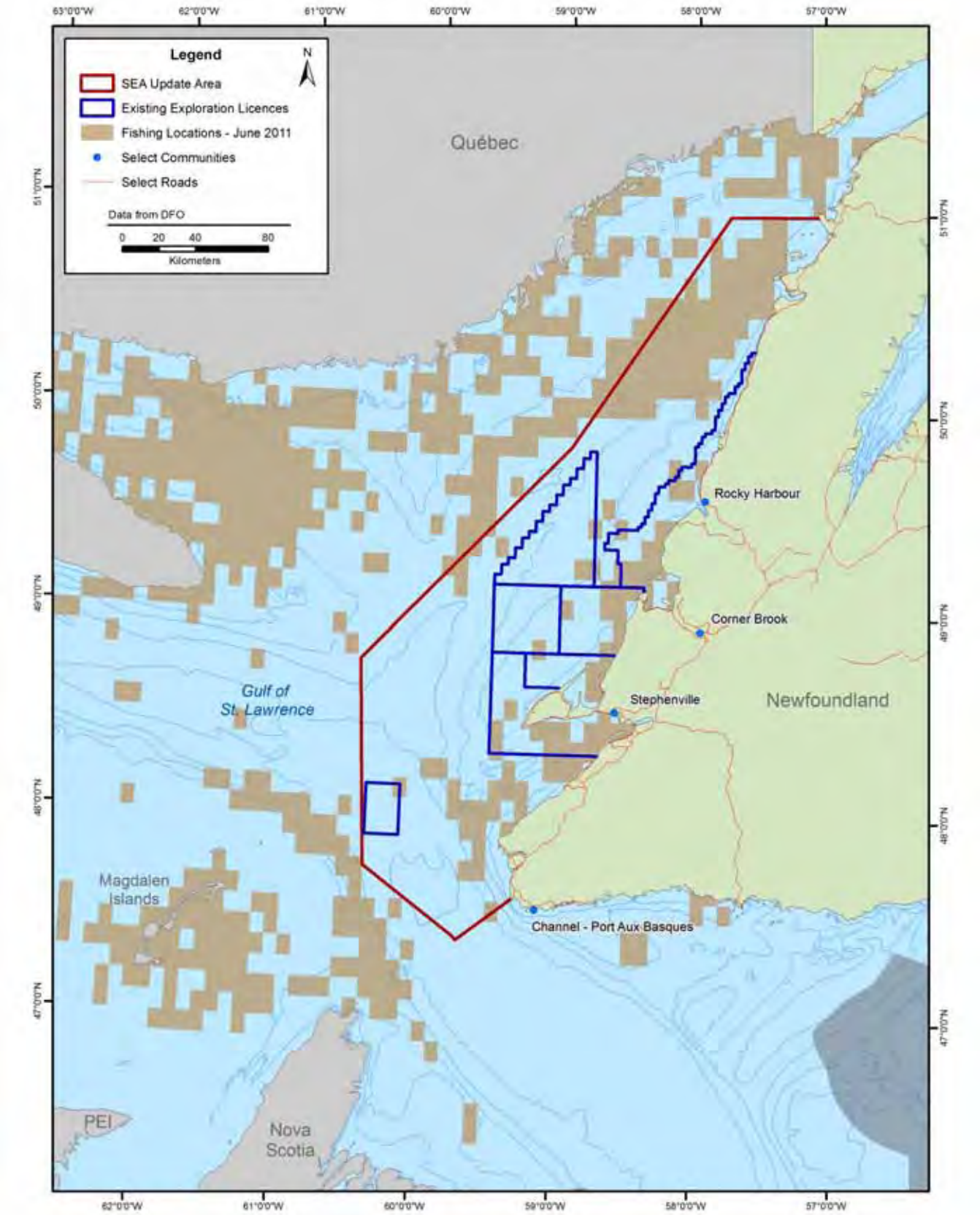
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Newfoundland
Gulf of St. Lawrence
Magdalen Islands
Channel - Port Aux Basques
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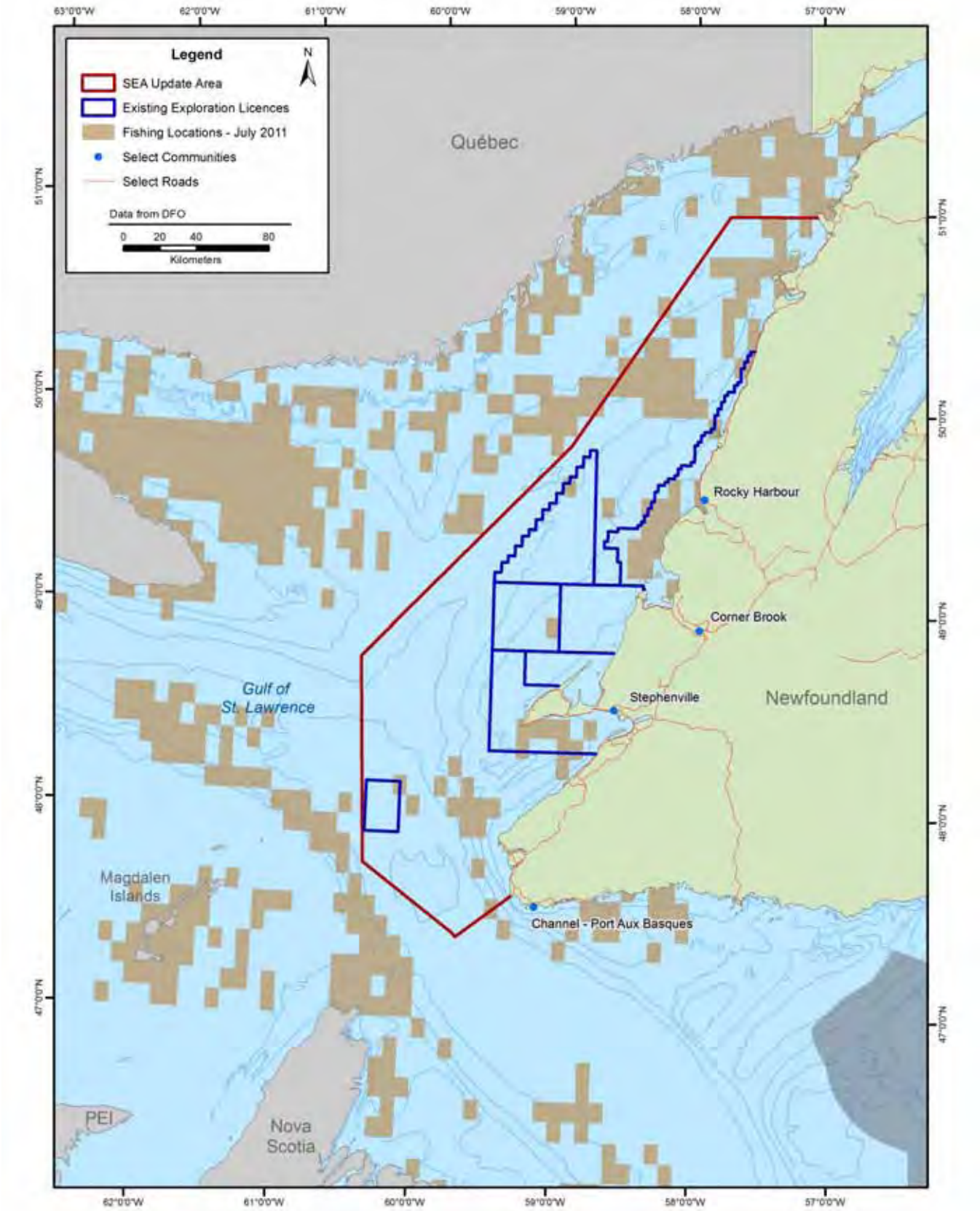
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Existing Exploration Licences
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Rocky Harbour
Corner Brook
Stephenville
Newfoundland
Gulf of St. Lawrence
Magdalen Islands
Channel - Port Aux Basques
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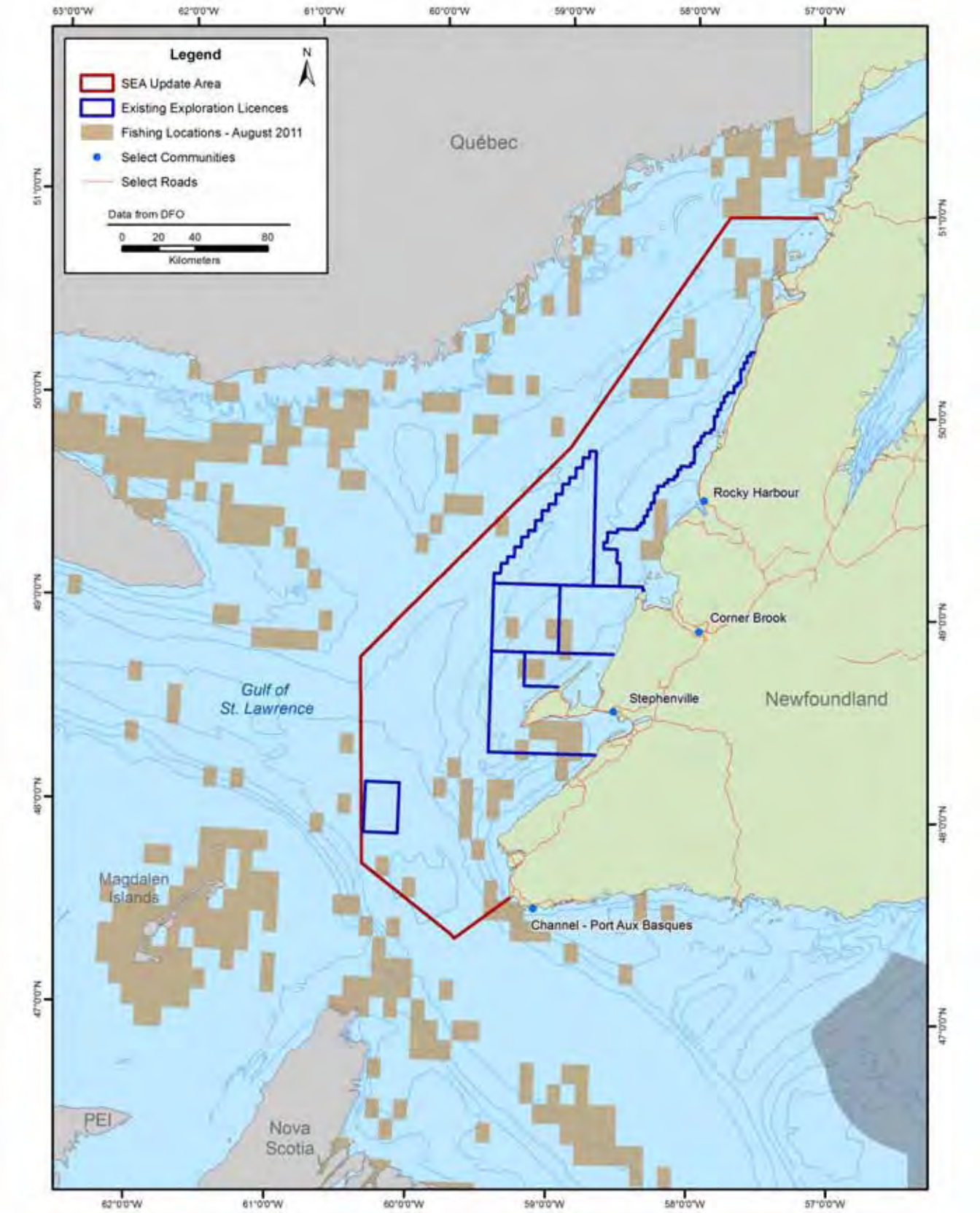
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Stephenville
Newfoundland
Gulf of St. Lawrence
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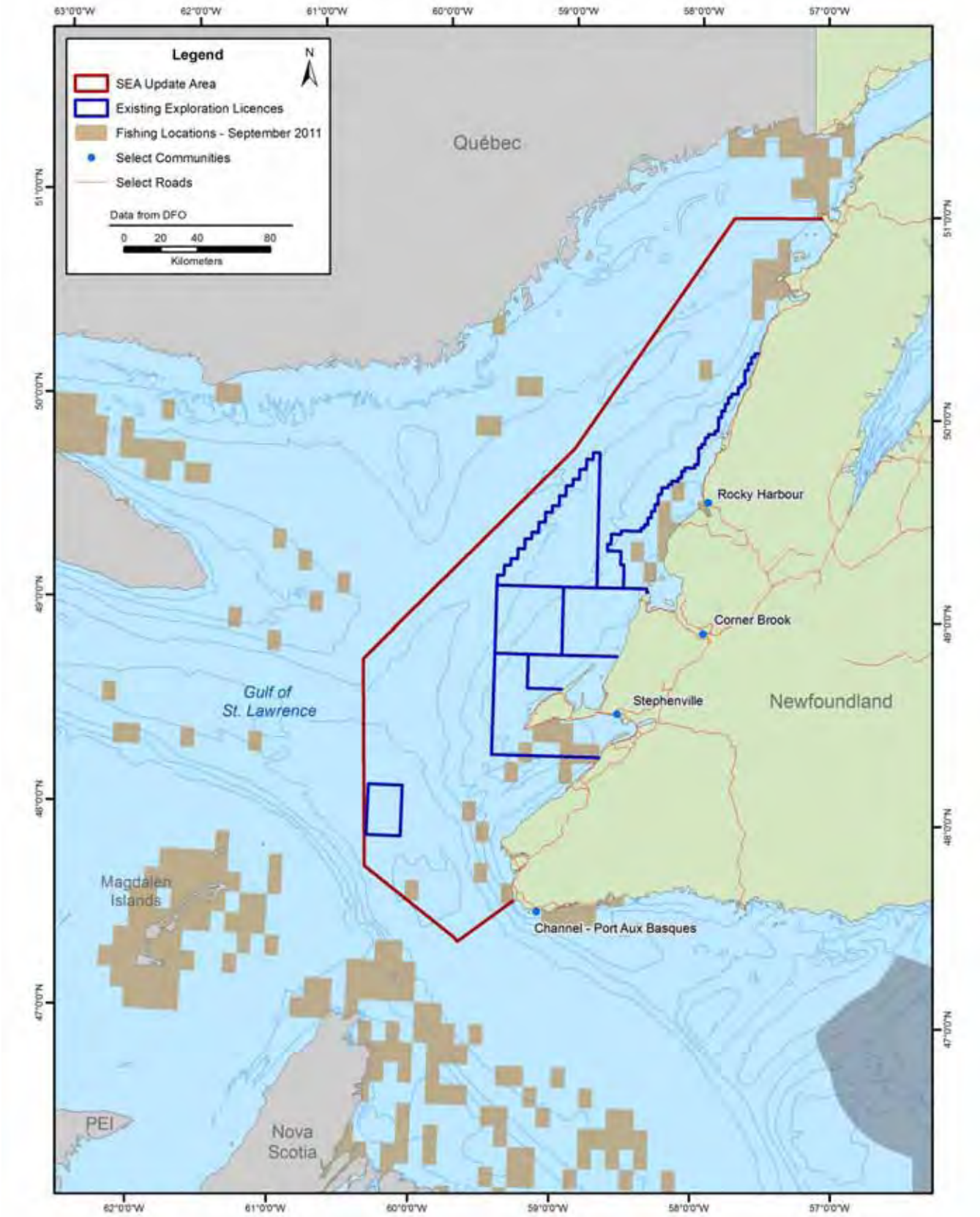
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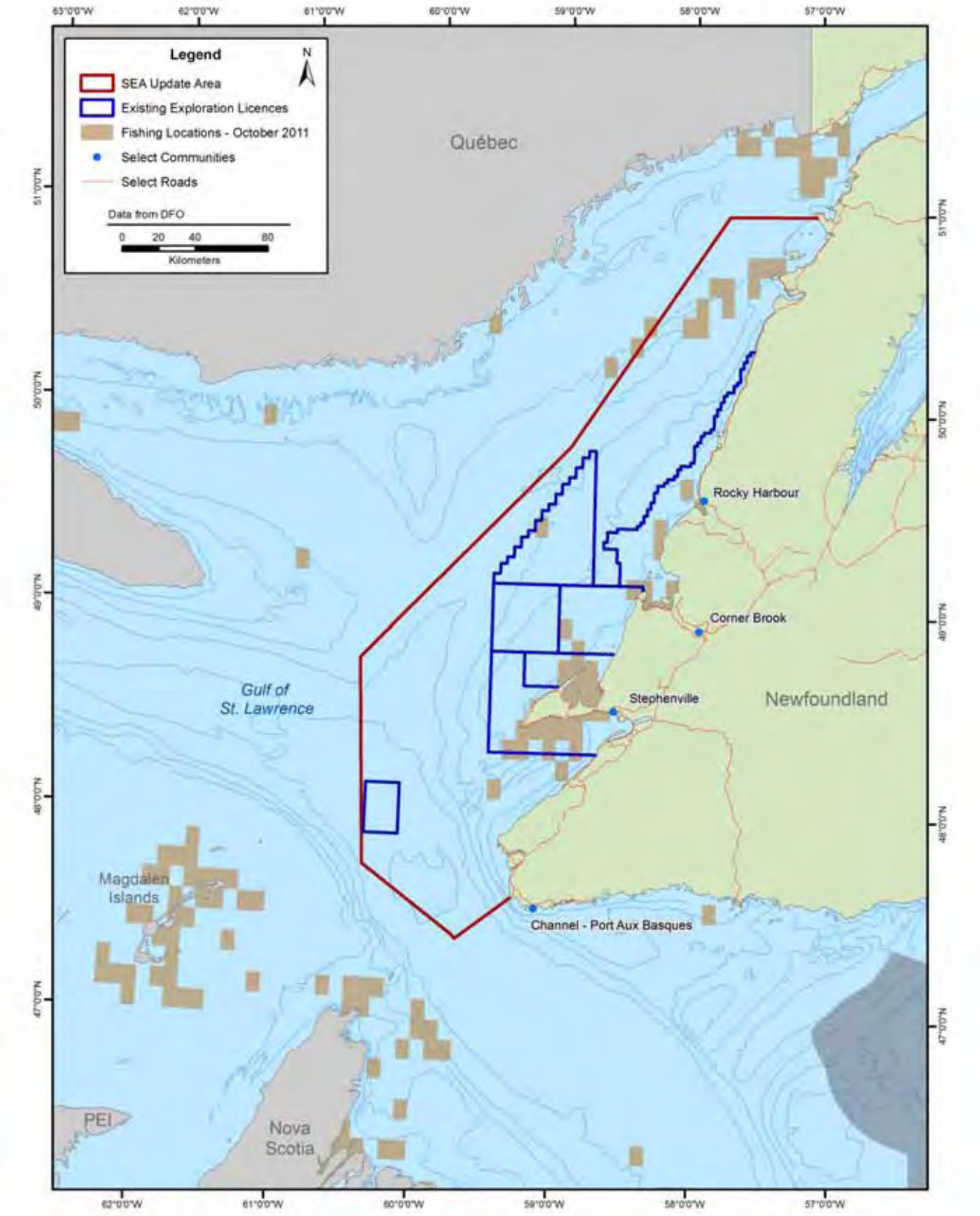
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Newfoundland
Gulf of
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Magdalen
Islands
Channel - Port Aux Basques
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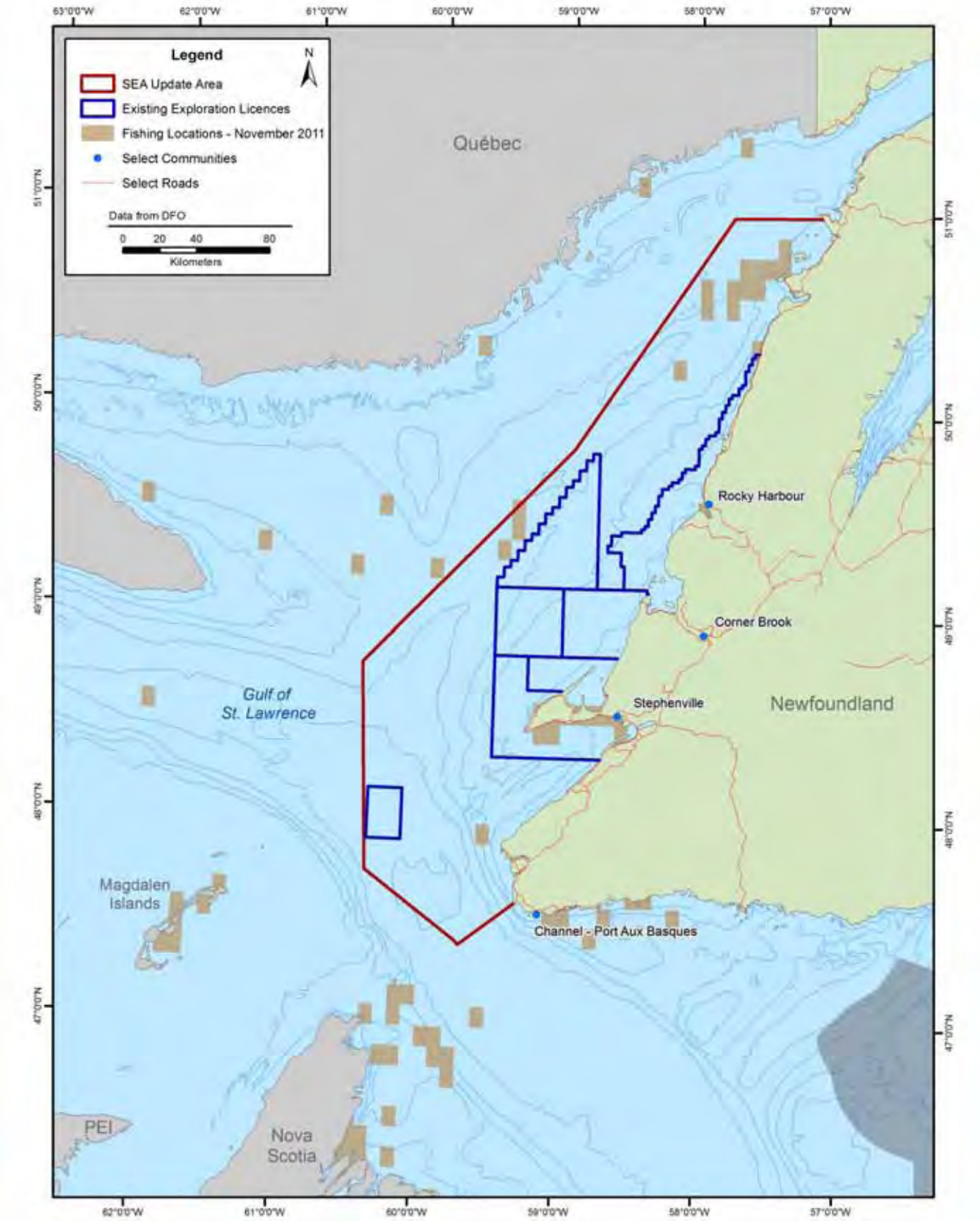
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Rocky Harbour
Corner Brook
Stephenville
Newfoundland
Gulf of
St. Lawrence
Magdalen
Islands
Channel - Port Aux Basques
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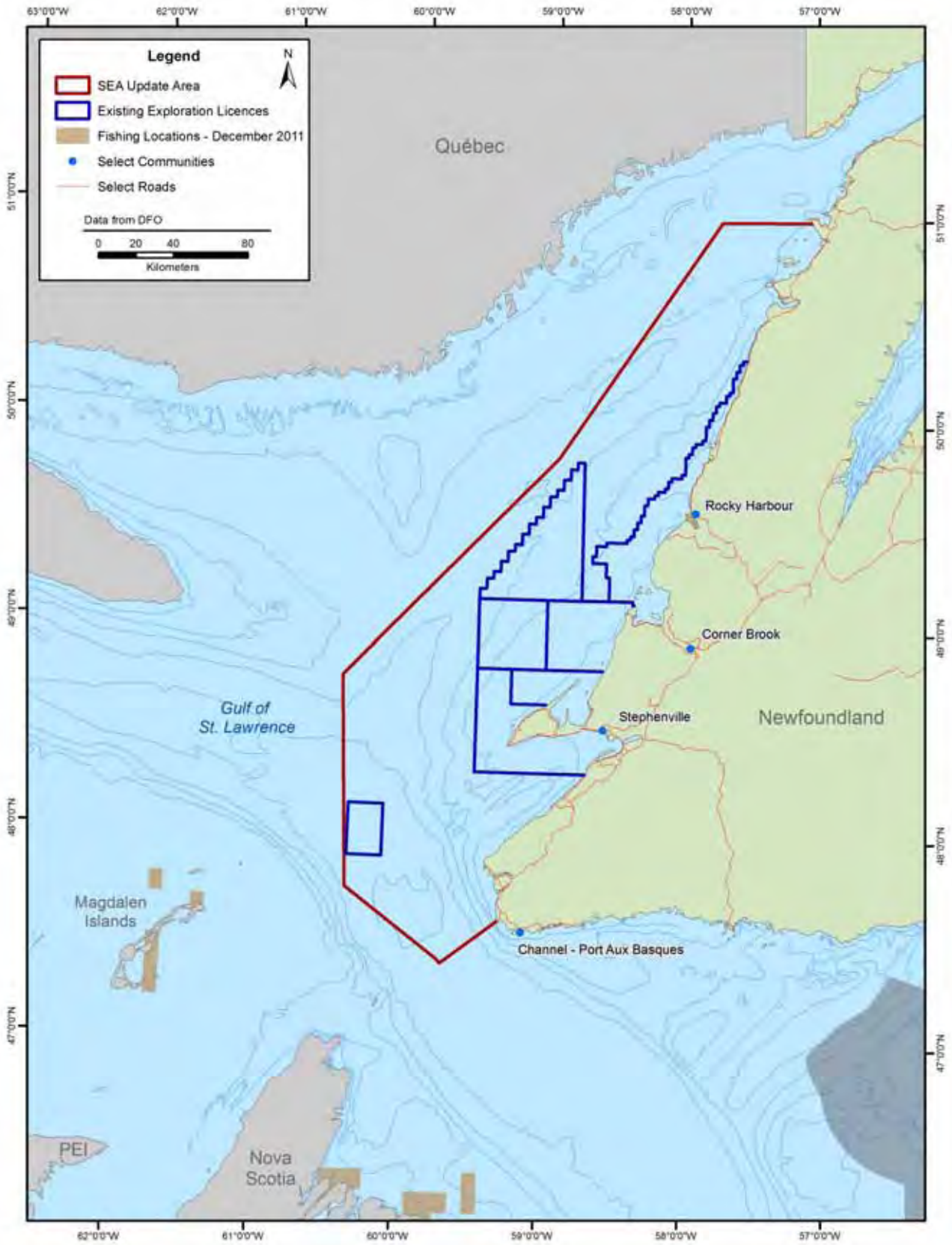
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Gulf of
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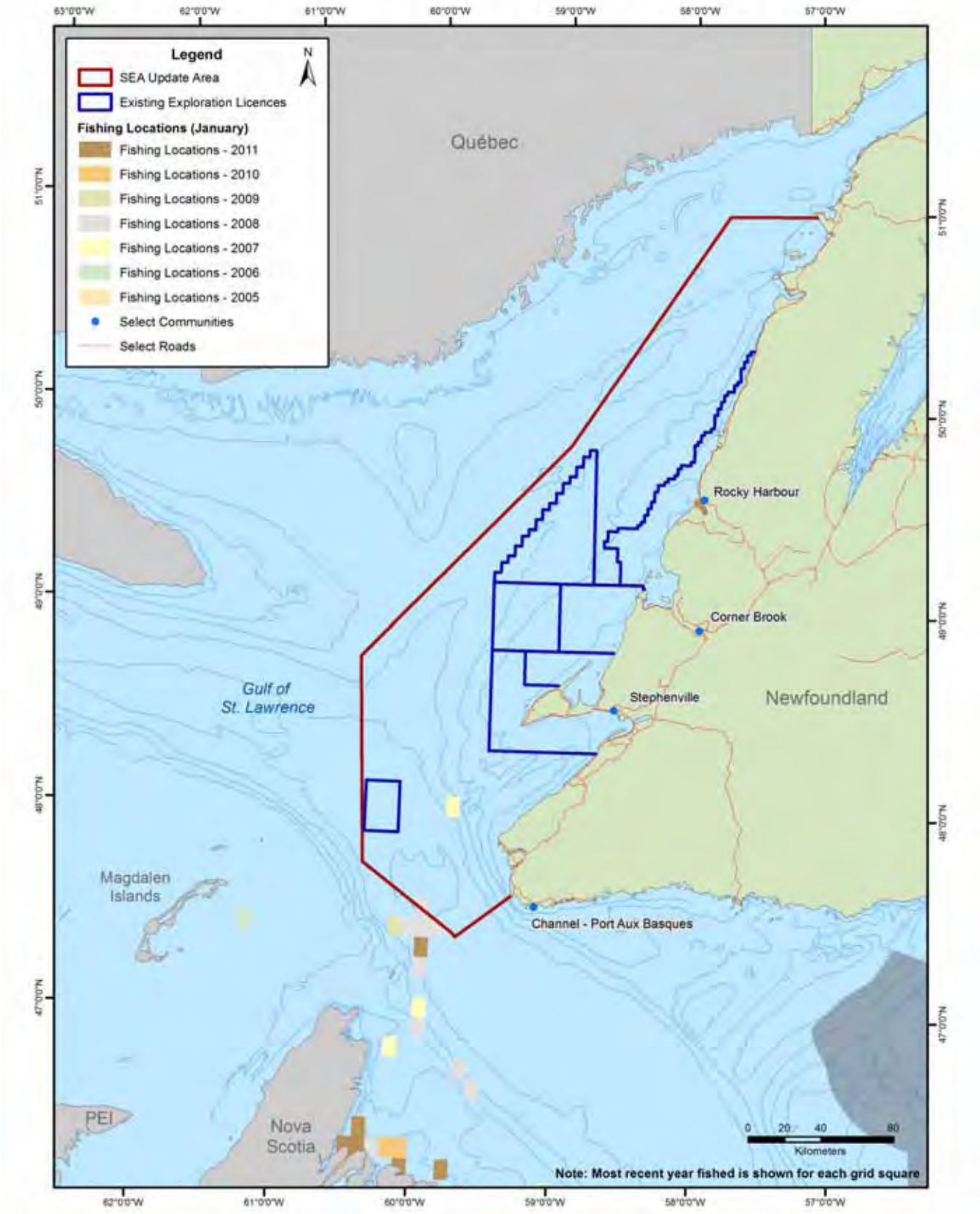
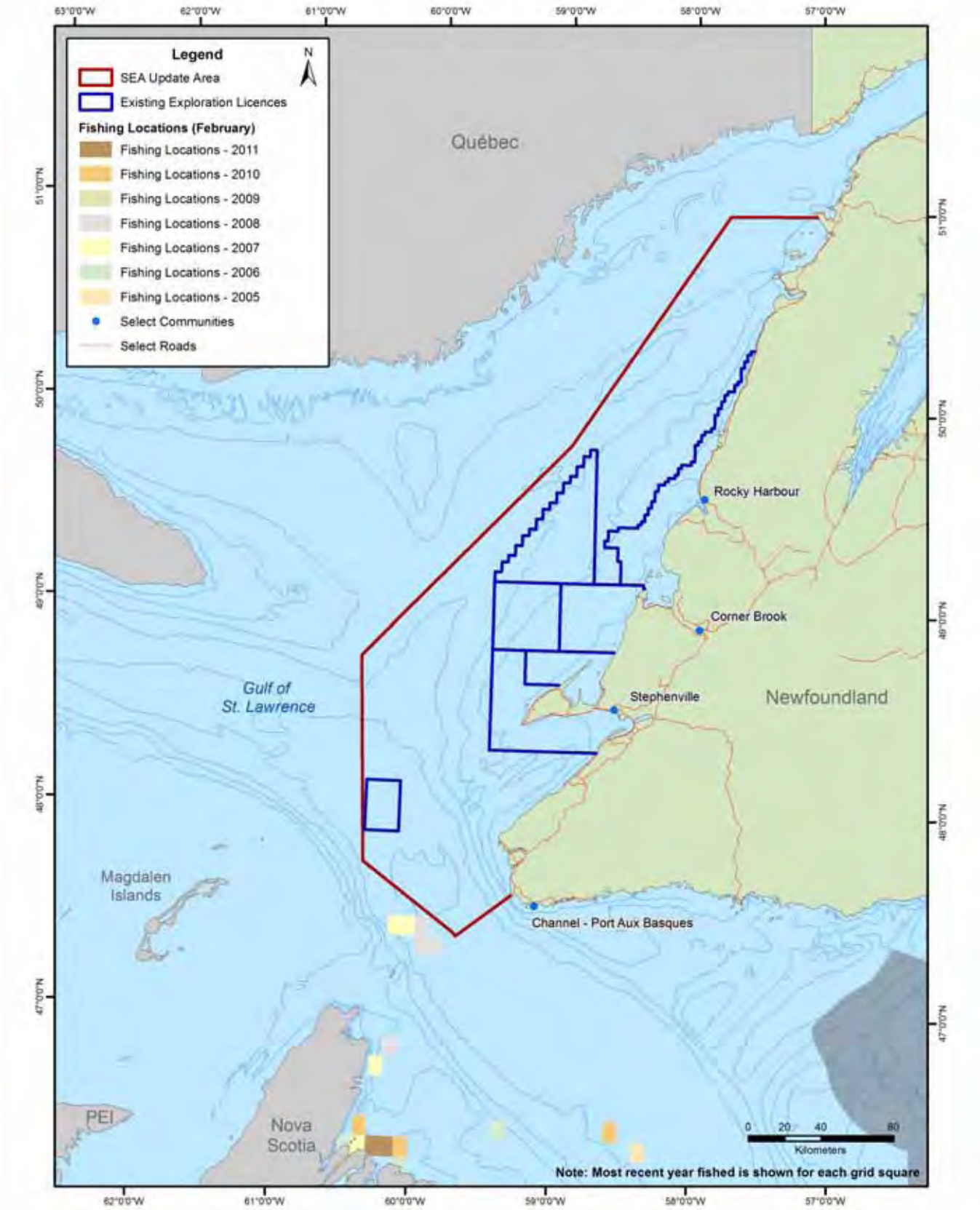
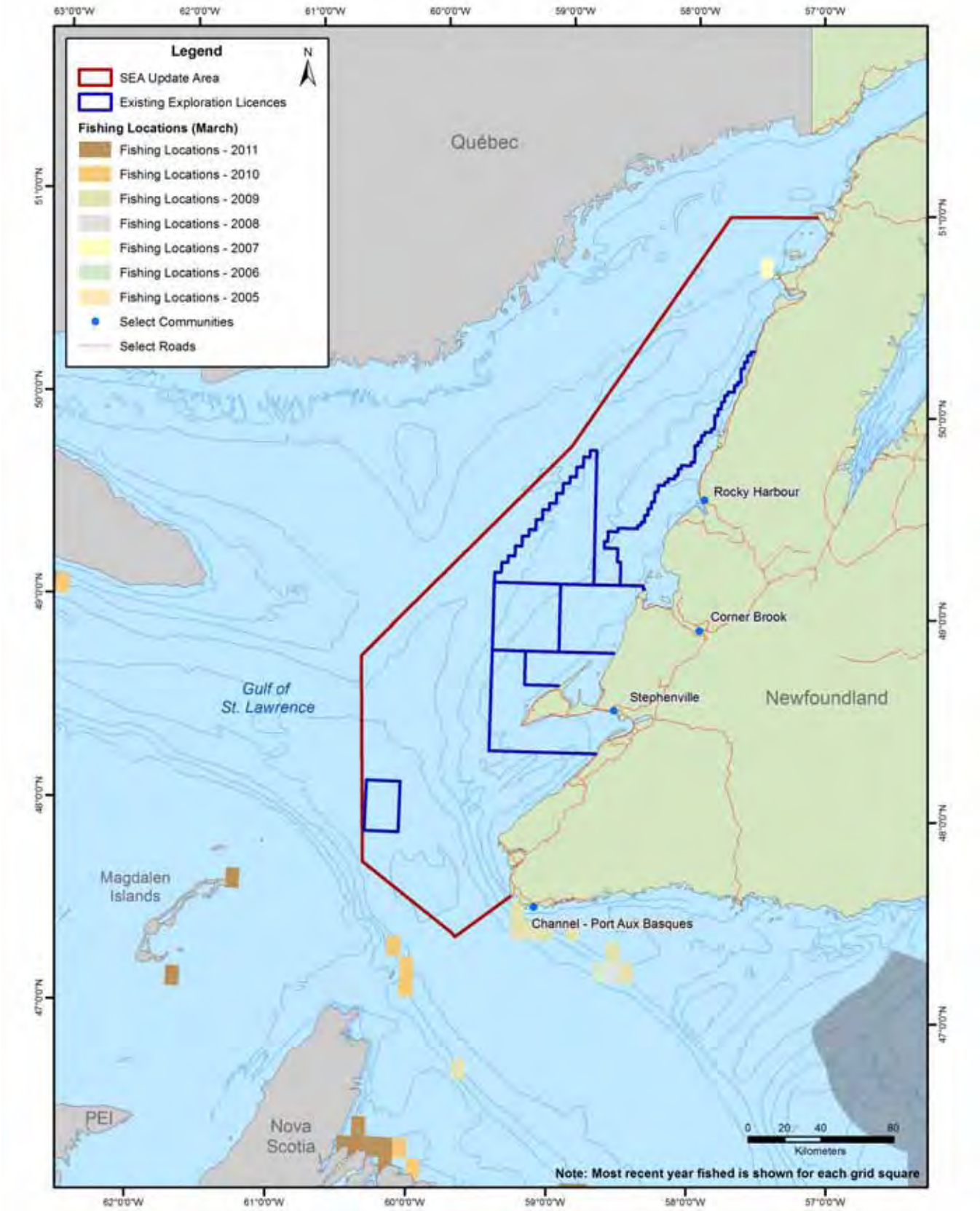
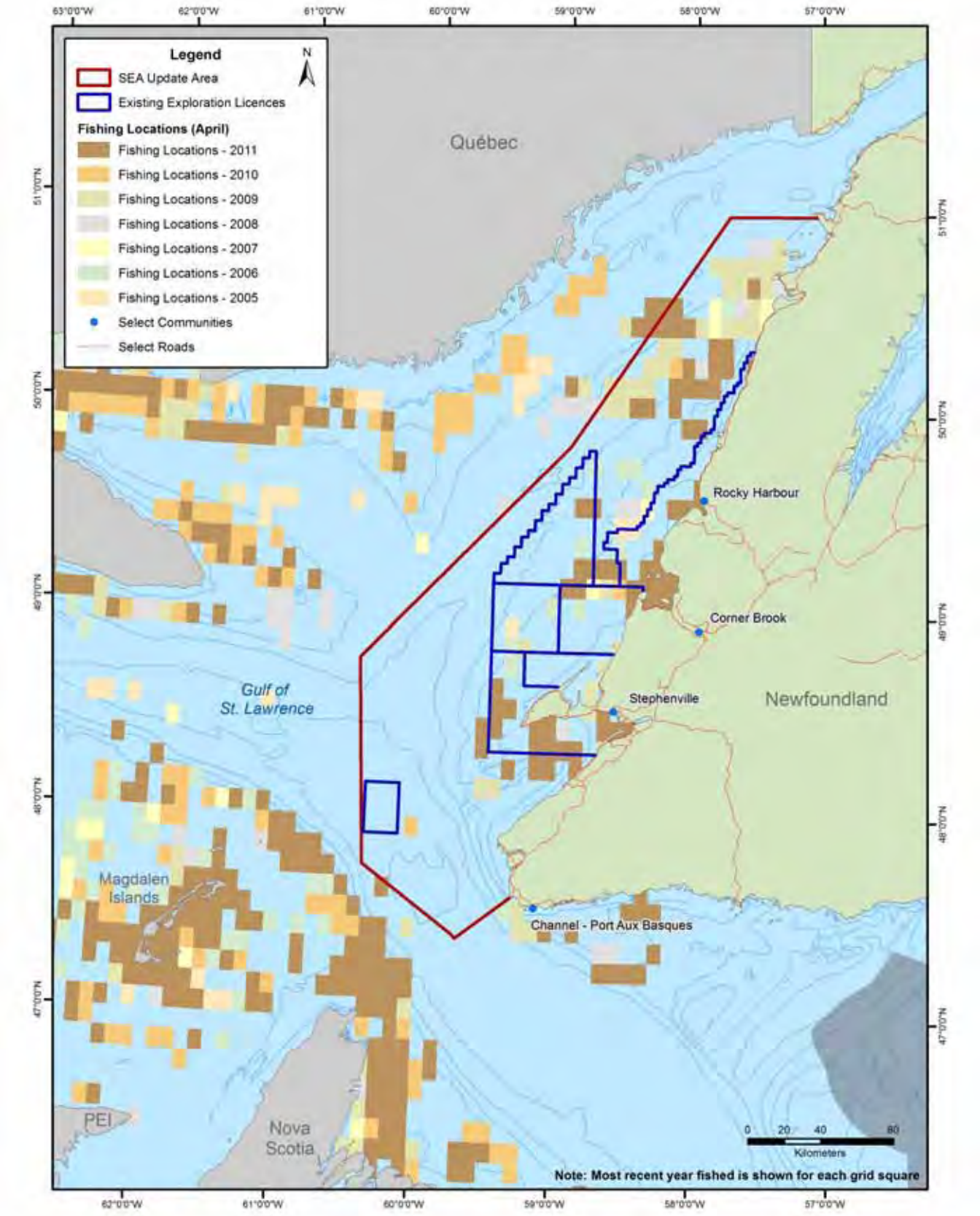
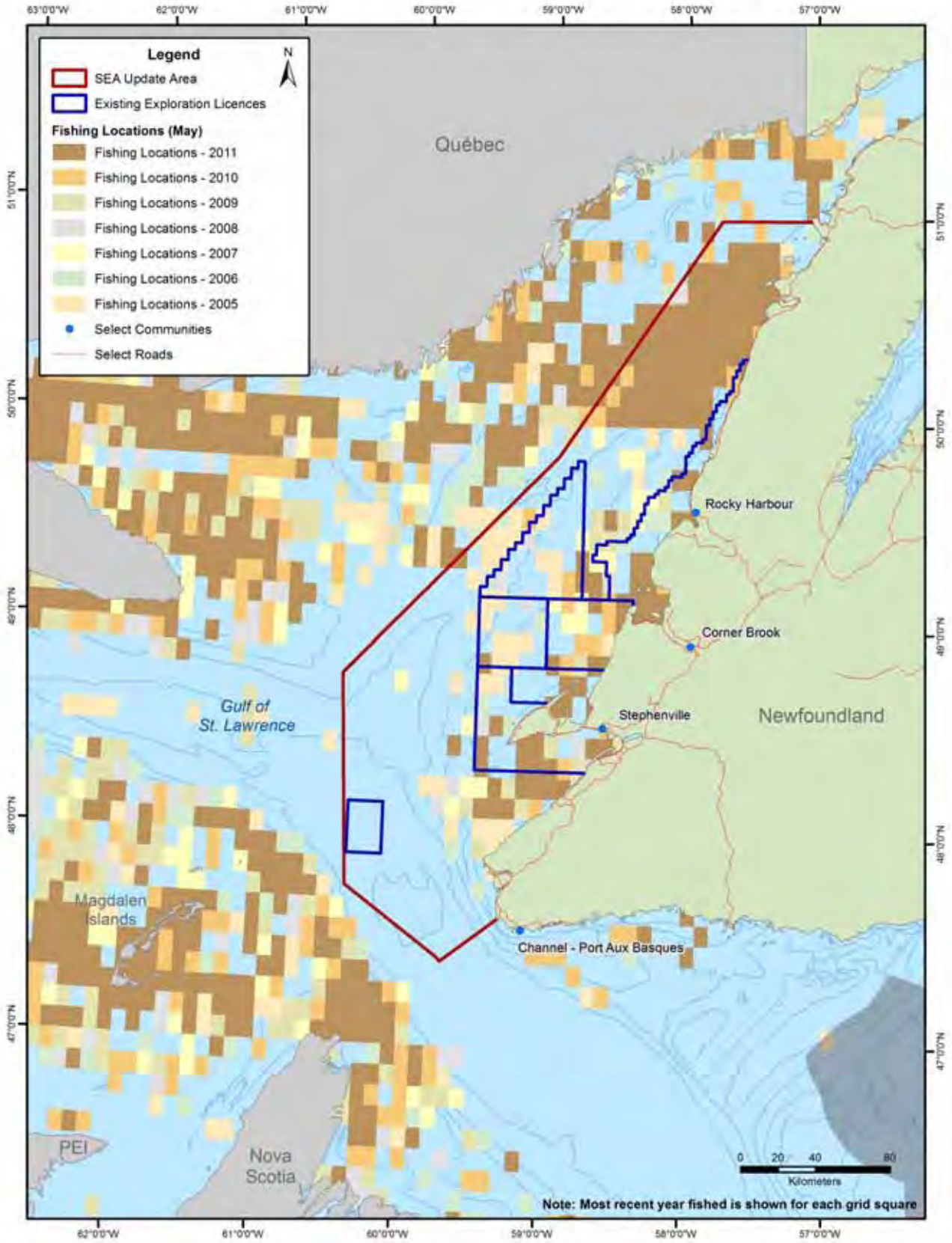
47°0'0"N

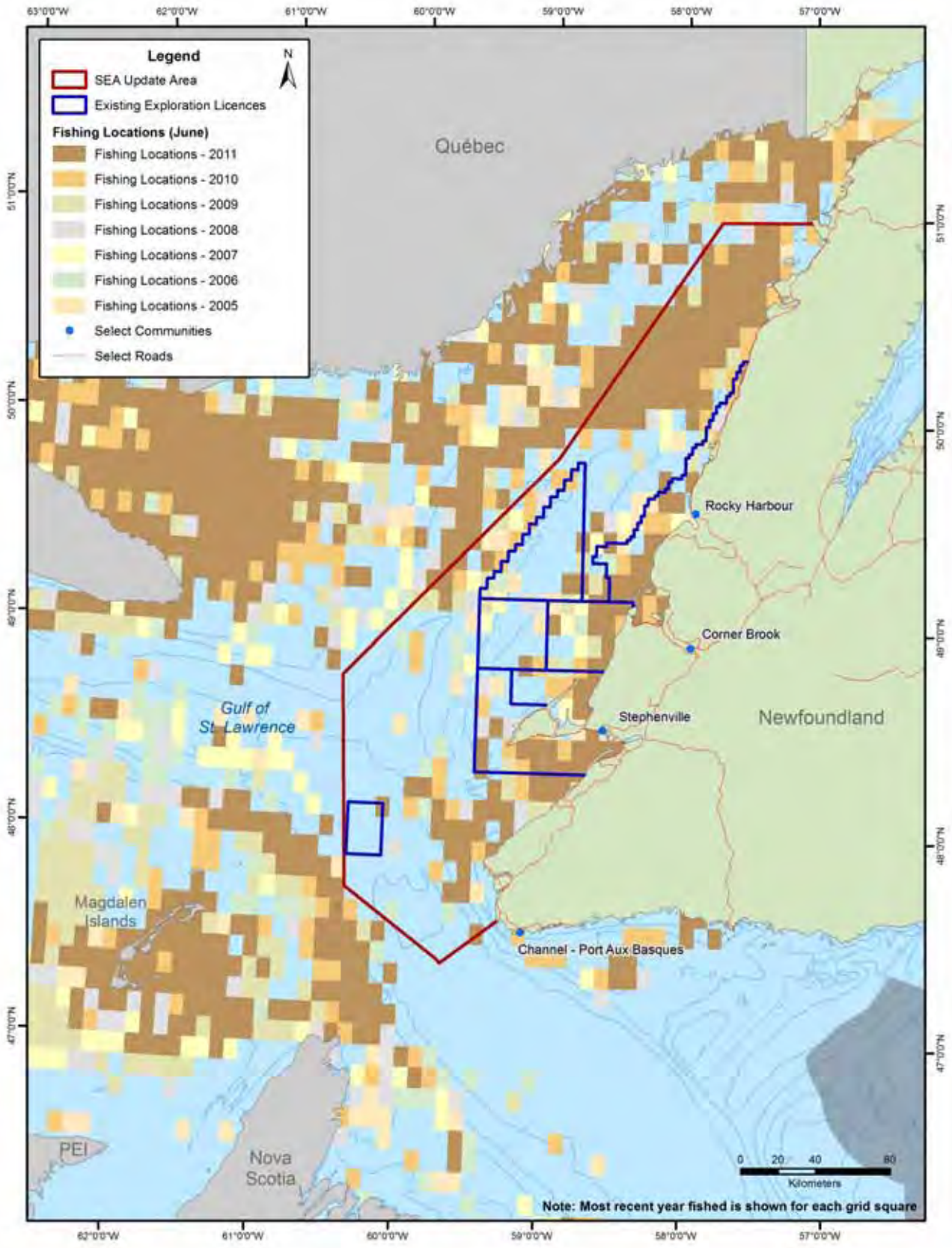

Legend
SEA Update Area
Existing Exploration Licences
Fishing Locations (January)
Fishing Locations - 2011
Fishing Locations - 2010
Fishing Locations - 2009
Fishing Locations - 2008
Fishing Locations - 2007
Fishing Locations - 2006
Fishing Locations - 2005
Select Communities
Select Roads
N
Québec
Rocky Harbour
Corner Brook
Stephenville
Newfoundland
Gulf of
St. Lawrence
Magdalen
Islands
Channel - Port Aux Basques
PEI
Nova
Scotia
0 20 40 80
Kilometers
Note: Most recent year fished is shown for each grid square

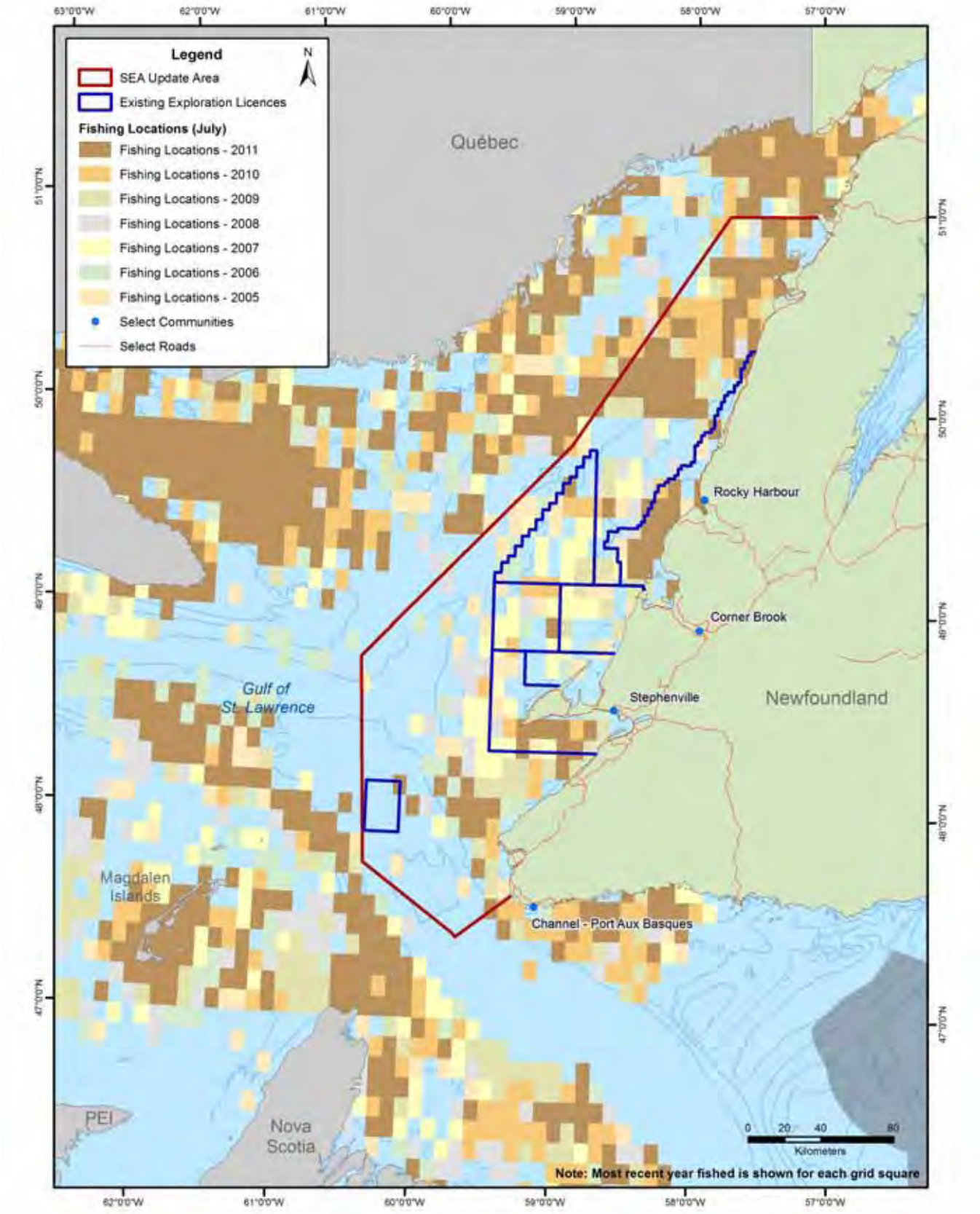

Legend
SEA Update Area
Existing Exploration Licences
Fishing Locations (February)
Fishing Locations - 2011
Fishing Locations - 2010
Fishing Locations - 2009
Fishing Locations - 2008
Fishing Locations - 2007
Fishing Locations - 2006
Fishing Locations - 2005
Select Communities
Select Roads
N
Québec
Rocky Harbour
Corner Brook
Stephenville
Newfoundland
Gulf of
St. Lawrence
Magdalen
Islands
Channel - Port Aux Basques
PEI
Nova
Scotia
0 20 40 80
Kilometers
Note: Most recent year fished is shown for each grid square

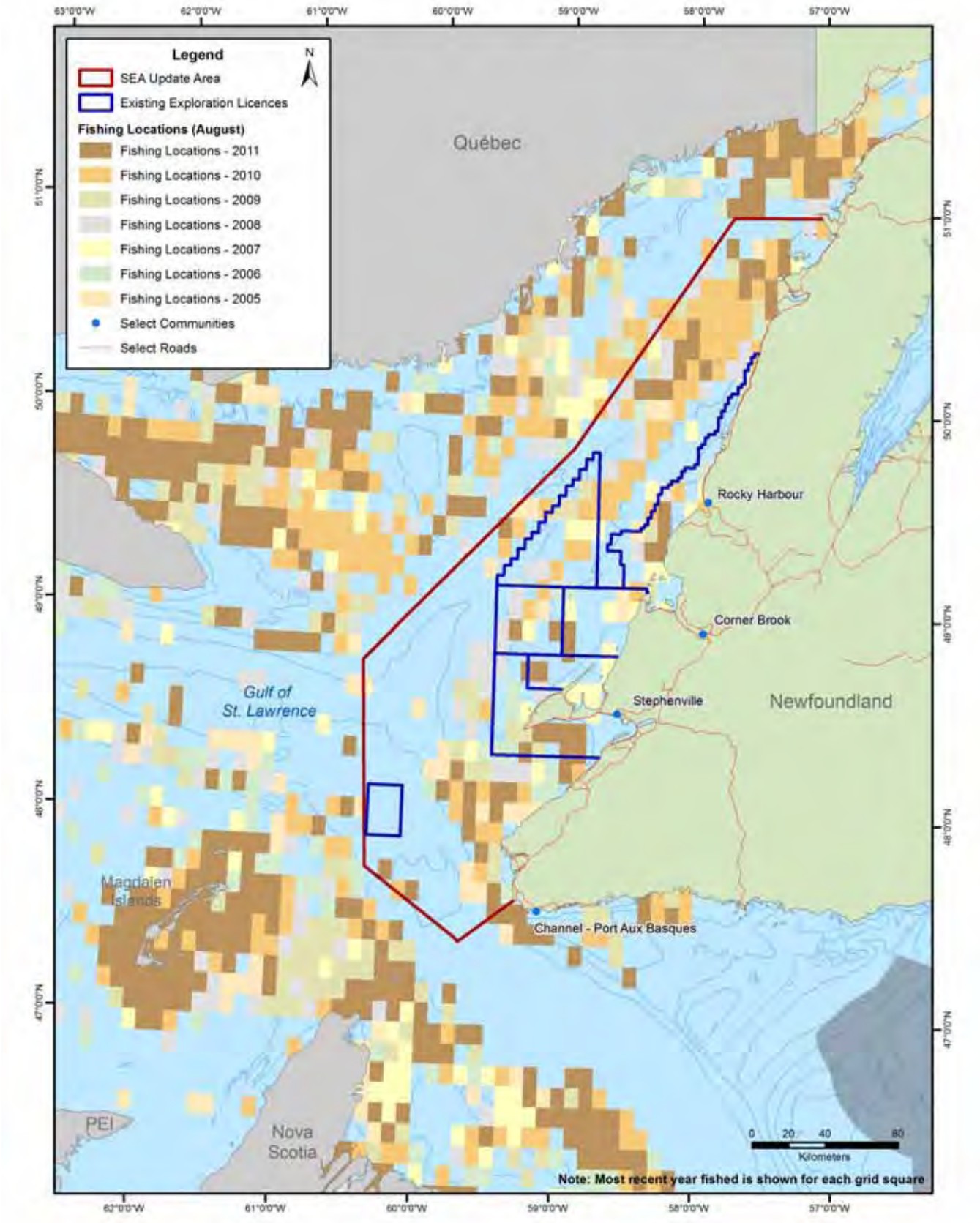

Legend
N
SEA Update Area
Existing Exploration Licences
Fishing Locations (March)
Fishing Locations - 2011
Fishing Locations - 2010
Fishing Locations - 2009
Fishing Locations - 2008
Fishing Locations - 2007
Fishing Locations - 2006
Fishing Locations - 2005
Select Communities
Select Roads
Québec
Rocky Harbour
Corner Brook
Stephenville
Newfoundland
Gulf of
St. Lawrence
Magdalen
Islands
Channel - Port Aux Basques
PEI
Nova
Scotia
0 20 40 80
Kilometers
Note: Most recent year fished is shown for each grid square

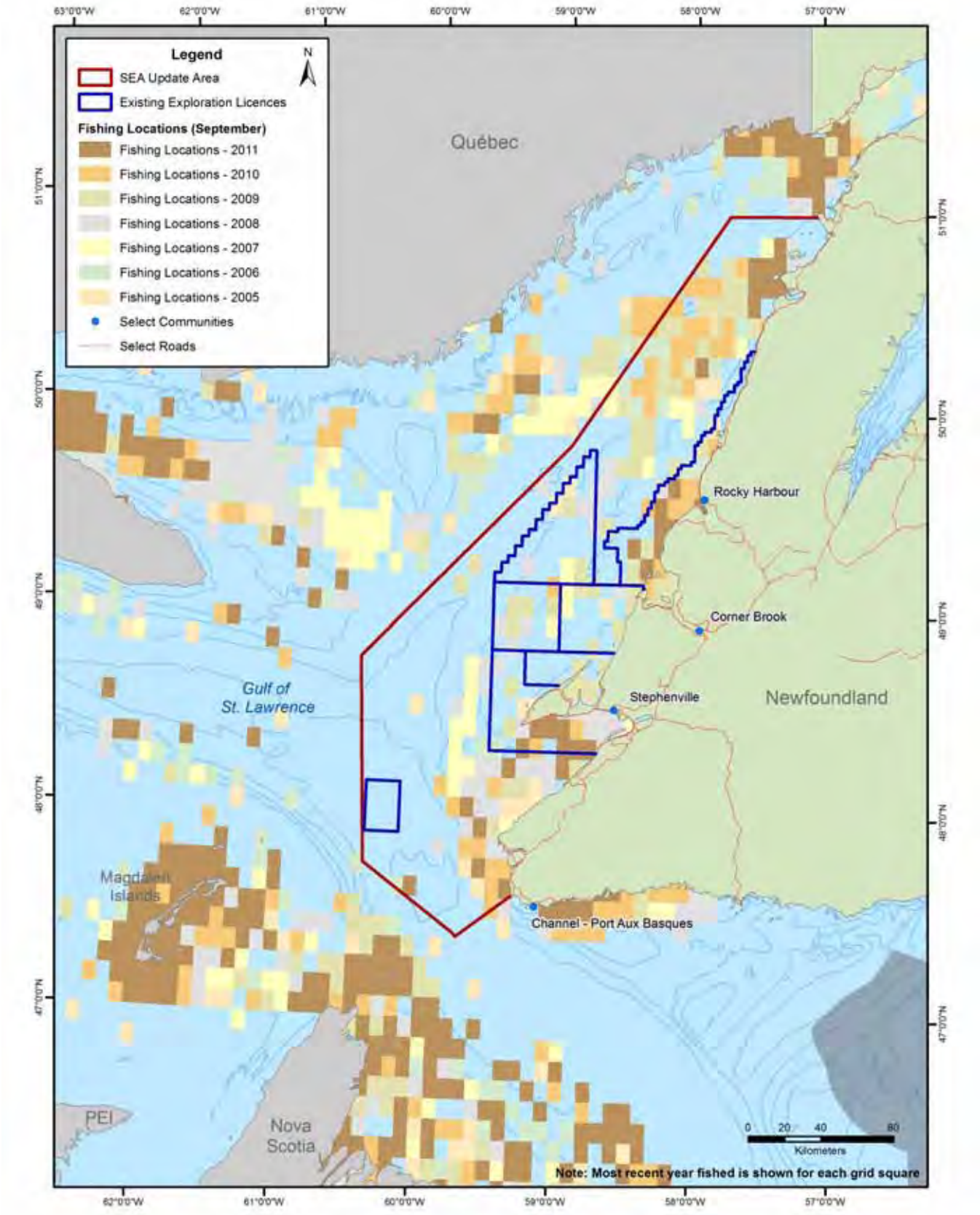

Legend
SEA Update Area
Existing Exploration Licences
Fishing Locations (April)
Fishing Locations - 2011
Fishing Locations - 2010
Fishing Locations - 2009
Fishing Locations - 2008
Fishing Locations - 2007
Fishing Locations - 2006
Fishing Locations - 2005
Select Communities
Select Roads
N
Québec
Rocky Harbour
Corner Brook
Stephenville
Newfoundland
Gulf of St. Lawrence
Magdalen Islands
Channel - Port Aux Basques
PEI
Nova Scotia
0 20 40 80
Kilometers
Note: Most recent year fished is shown for each grid square

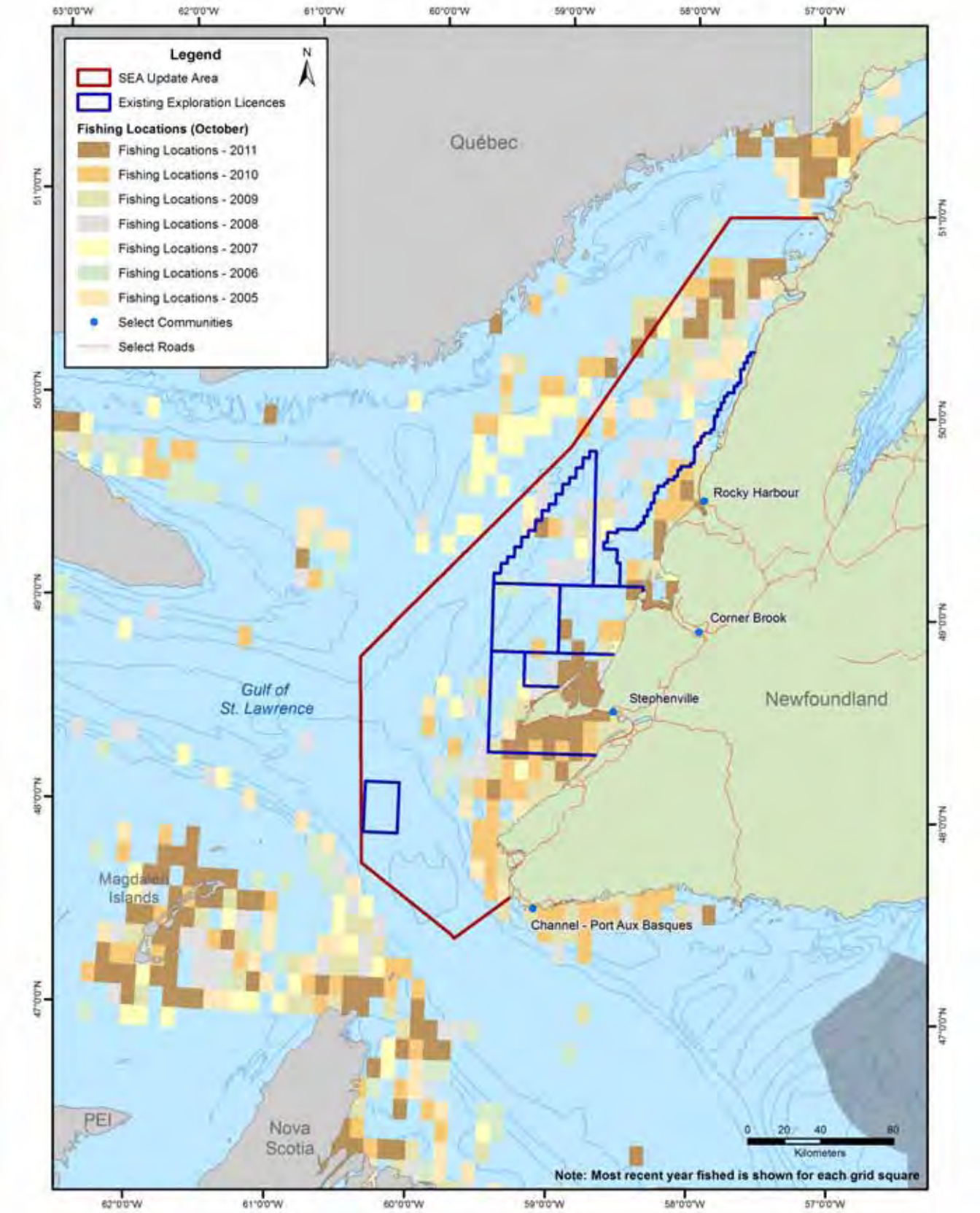

Legend
SEA Update Area
Existing Exploration Licences
Fishing Locations (May)
Fishing Locations - 2011
Fishing Locations - 2010
Fishing Locations - 2009
Fishing Locations - 2008
Fishing Locations - 2007
Fishing Locations - 2006
Fishing Locations - 2005
Select Communities
Select Roads
N
Québec
Rocky Harbour
Corner Brook
Stephenville
Newfoundland
Gulf of St. Lawrence
Magdalen Islands
Channel - Port Aux Basques
PEI
Nova Scotia
0 20 40 80
Kilometers
Note: Most recent year fished is shown for each grid square

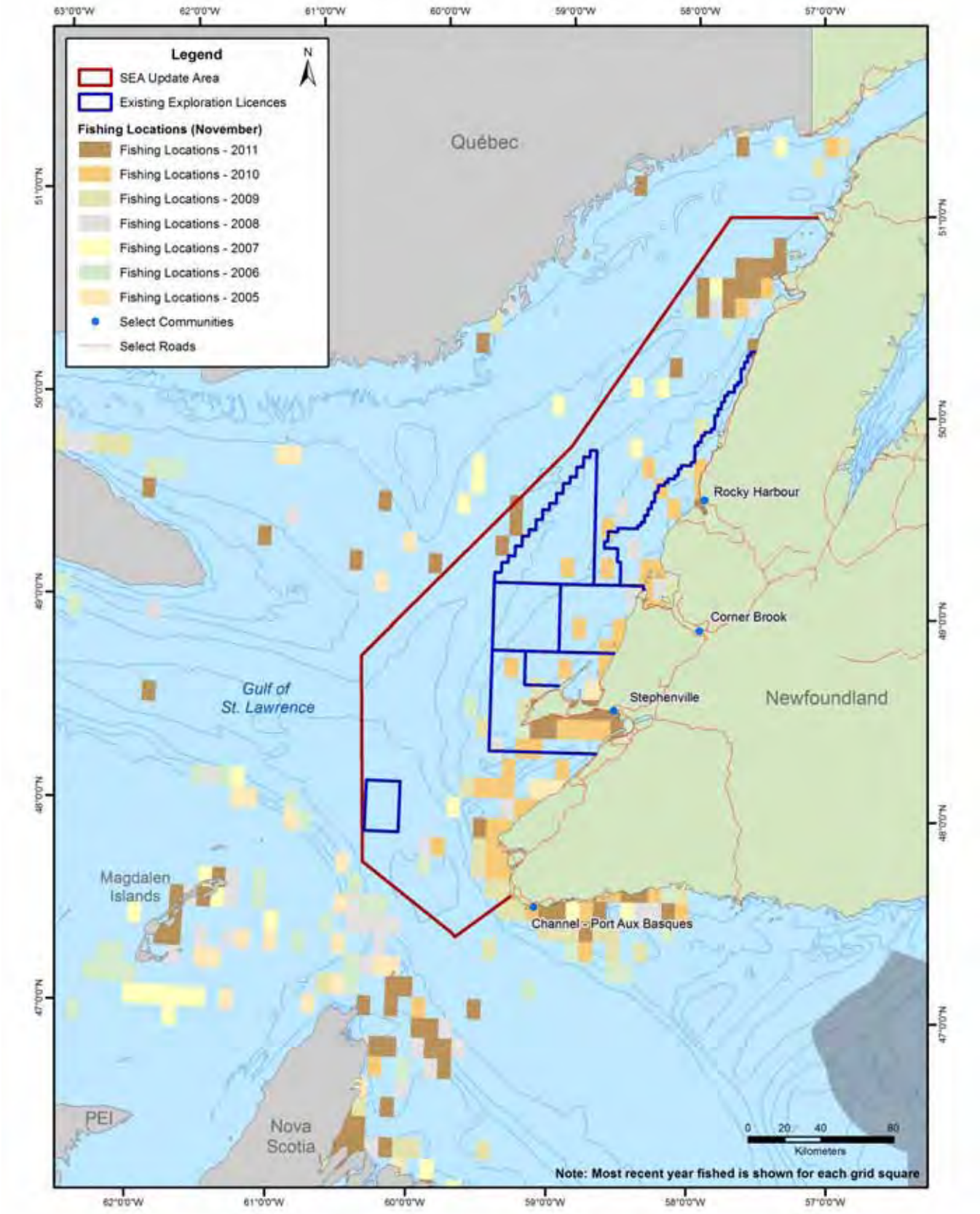

Legend
SEA Update Area
Existing Exploration Licences
Fishing Locations (June)
Fishing Locations - 2011
Fishing Locations - 2010
Fishing Locations - 2009
Fishing Locations - 2008
Fishing Locations - 2007
Fishing Locations - 2006
Fishing Locations - 2005
Select Communities
Select Roads
N
Québec
Rocky Harbour
Corner Brook
Stephenville
Newfoundland
Gulf of St. Lawrence
Magdalen Islands
Channel - Port Aux Basques
PEI
Nova Scotia
0 20 40 80
Kilometers
Note: Most recent year fished is shown for each grid square

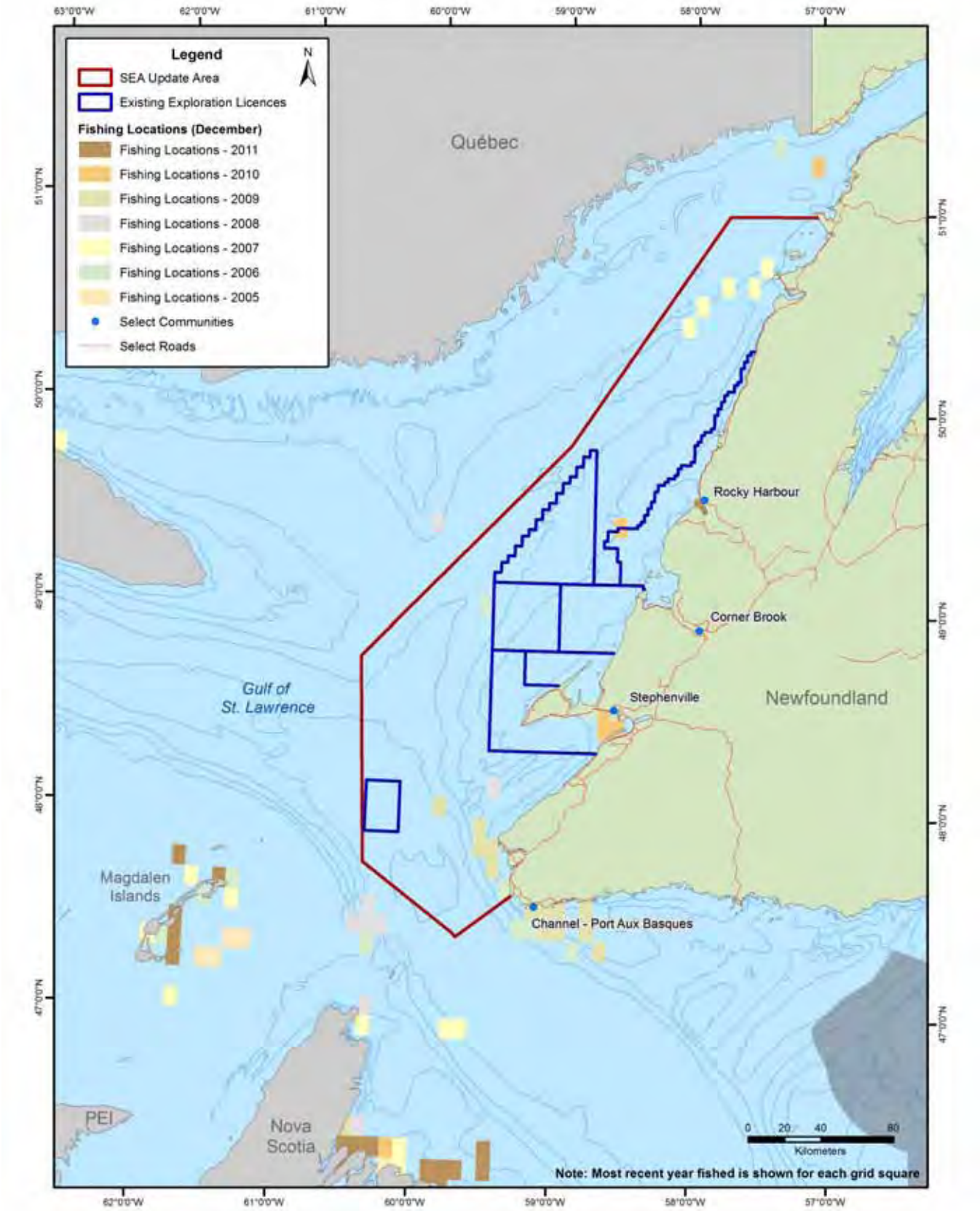

Legend
SEA Update Area
Existing Exploration Licences
Fishing Locations (July)
Fishing Locations - 2011
Fishing Locations - 2010
Fishing Locations - 2009
Fishing Locations - 2008
Fishing Locations - 2007
Fishing Locations - 2006
Fishing Locations - 2005
Select Communities
Select Roads
N
Québec
Rocky Harbour
Corner Brook
Stephenville
Newfoundland
Gulf of St. Lawrence
Magdalen Islands
Channel - Port Aux Basques
PEI
Nova Scotia
0 20 40 80
Kilometers
Note: Most recent year fished is shown for each grid square


Legend
SEA Update Area
Existing Exploration Licences
Fishing Locations (August)
Fishing Locations - 2011
Fishing Locations - 2010
Fishing Locations - 2009
Fishing Locations - 2008
Fishing Locations - 2007
Fishing Locations - 2006
Fishing Locations - 2005
Select Communities
Select Roads
N
Québec
Rocky Harbour
Corner Brook
Stephenville
Newfoundland
Gulf of St. Lawrence
Magdalen Islands
Channel - Port Aux Basques
PEI
Nova Scotia
0 20 40 80
Kilometers
Note: Most recent year fished is shown for each grid square


Legend
SEA Update Area
Existing Exploration Licences
Fishing Locations (September)
Fishing Locations - 2011
Fishing Locations - 2010
Fishing Locations - 2009
Fishing Locations - 2008
Fishing Locations - 2007
Fishing Locations - 2006
Fishing Locations - 2005
Select Communities
Select Roads
N
Québec
Rocky Harbour
Corner Brook
Stephenville
Newfoundland
Gulf of St. Lawrence
Magdalen Islands
Channel - Port Aux Basques
PEI
Nova Scotia
0 20 40 80
Kilometers
Note: Most recent year fished is shown for each grid square

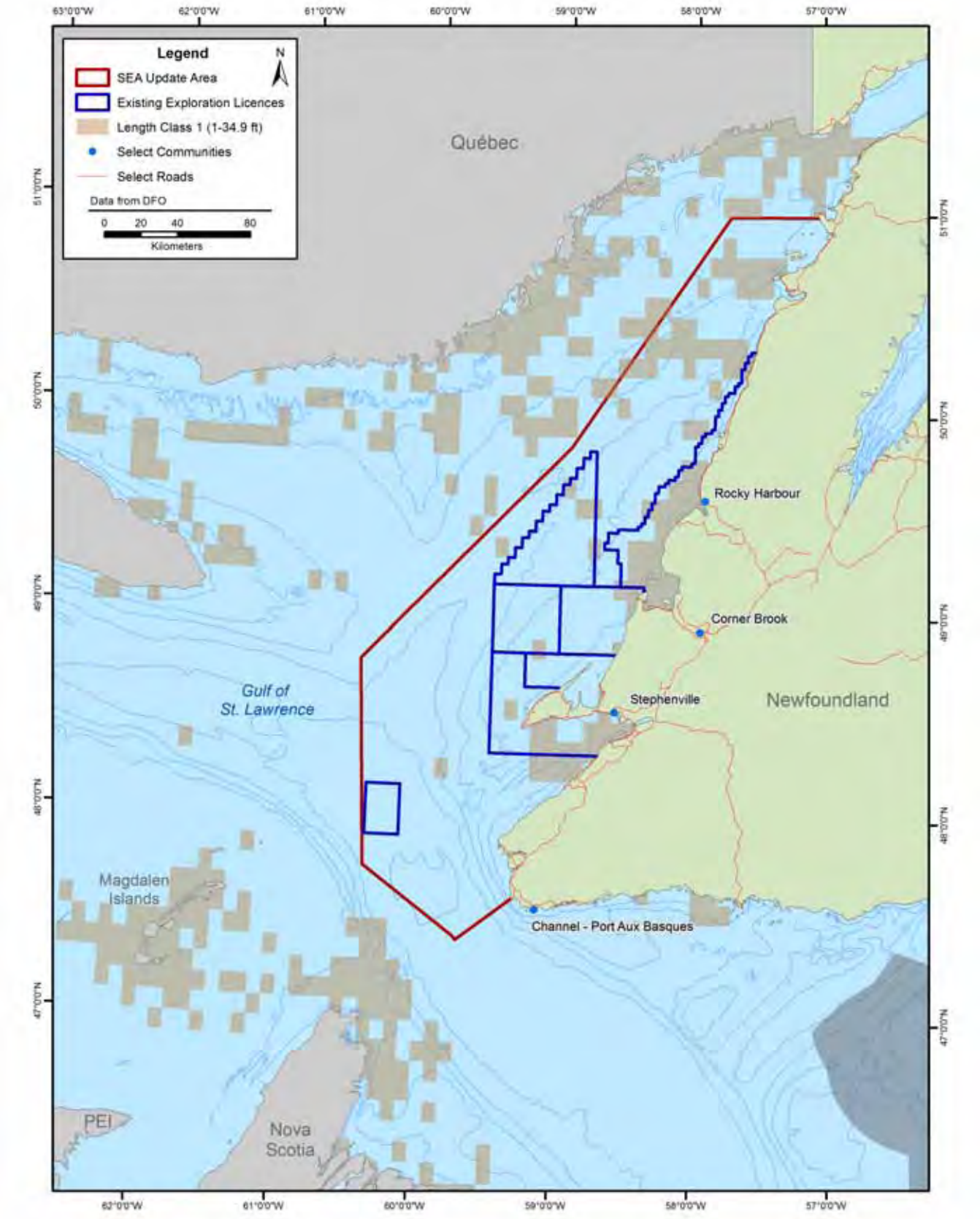

Legend
SEA Update Area
Existing Exploration Licences
Fishing Locations (October)
Fishing Locations - 2011
Fishing Locations - 2010
Fishing Locations - 2009
Fishing Locations - 2008
Fishing Locations - 2007
Fishing Locations - 2006
Fishing Locations - 2005
Select Communities
Select Roads
N
Québec
Rocky Harbour
Corner Brook
Stephenville
Newfoundland
Gulf of
St. Lawrence
Magdalen
Islands
Channel - Port Aux Basques
PEI
Nova
Scotia
0 20 40 80
Kilometers
Note: Most recent year fished is shown for each grid square

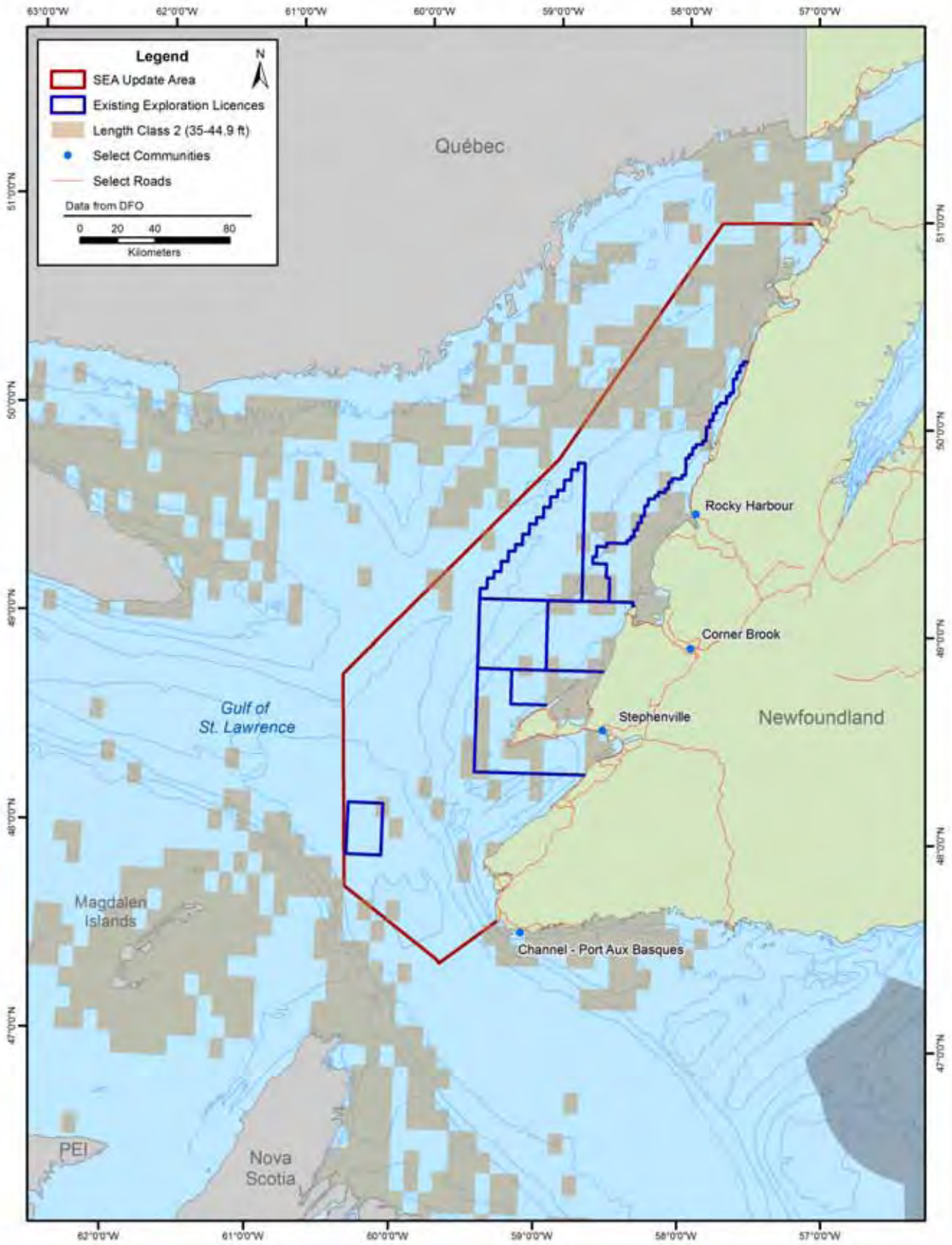

Legend
SEA Update Area
Existing Exploration Licences
Fishing Locations (November)
Fishing Locations - 2011
Fishing Locations - 2010
Fishing Locations - 2009
Fishing Locations - 2008
Fishing Locations - 2007
Fishing Locations - 2006
Fishing Locations - 2005
Select Communities
Select Roads
N
Québec
Rocky Harbour
Corner Brook
Stephenville
Newfoundland
Gulf of
St. Lawrence
Magdalen
Islands
Channel - Port Aux Basques
PEI
Nova
Scotia
0 20 40 80
Kilometers
Note: Most recent year fished is shown for each grid square

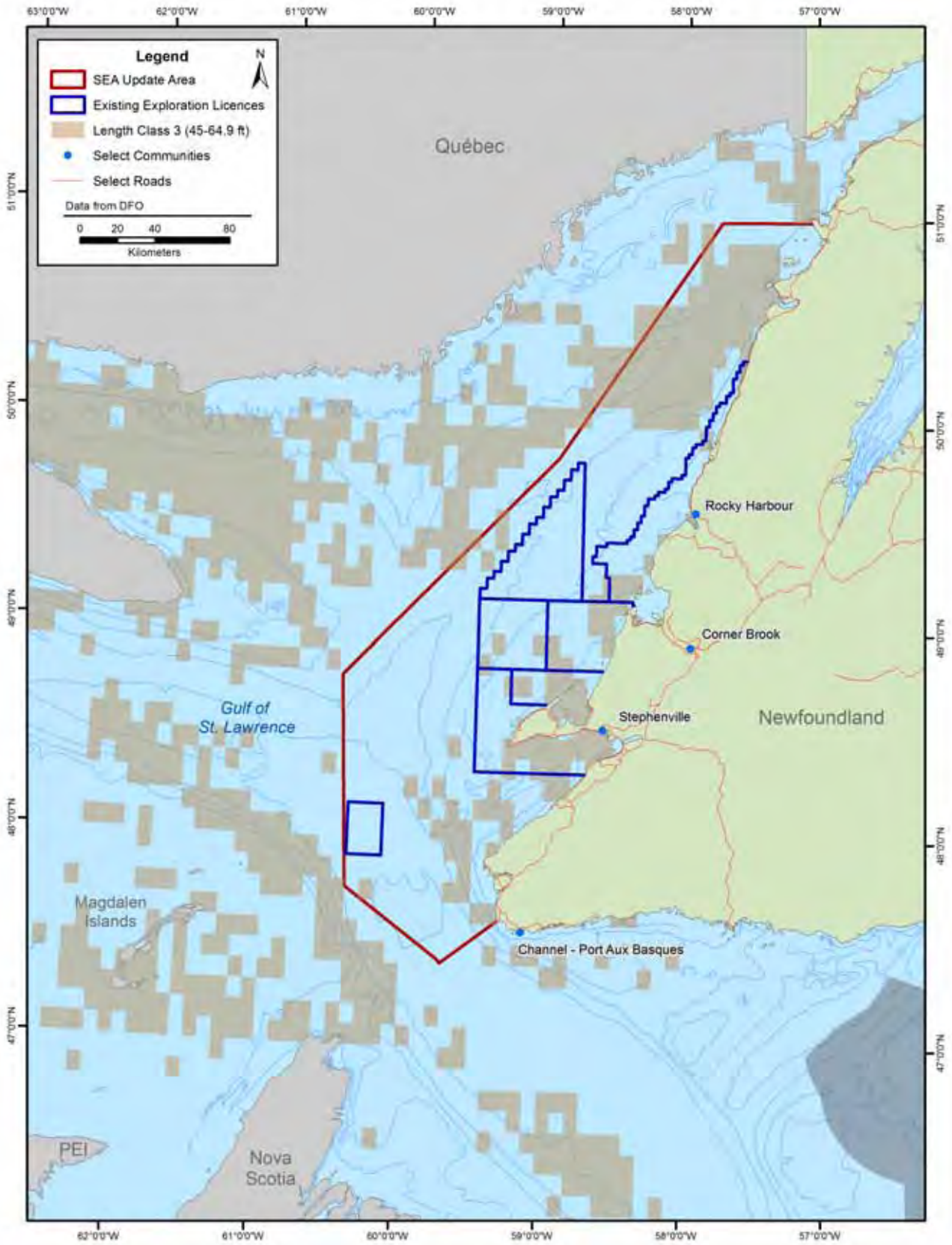

Legend
SEA Update Area
Existing Exploration Licences
Fishing Locations (December)
Fishing Locations - 2011
Fishing Locations - 2010
Fishing Locations - 2009
Fishing Locations - 2008
Fishing Locations - 2007
Fishing Locations - 2006
Fishing Locations - 2005
Select Communities
Select Roads
N
Québec
Rocky Harbour
Corner Brook
Stephenville
Newfoundland
Gulf of
St. Lawrence
Magdalen
Islands
Channel - Port Aux Basques
PEI
Nova
Scotia
0 20 40 80
Kilometers
Note: Most recent year fished is shown for each grid square

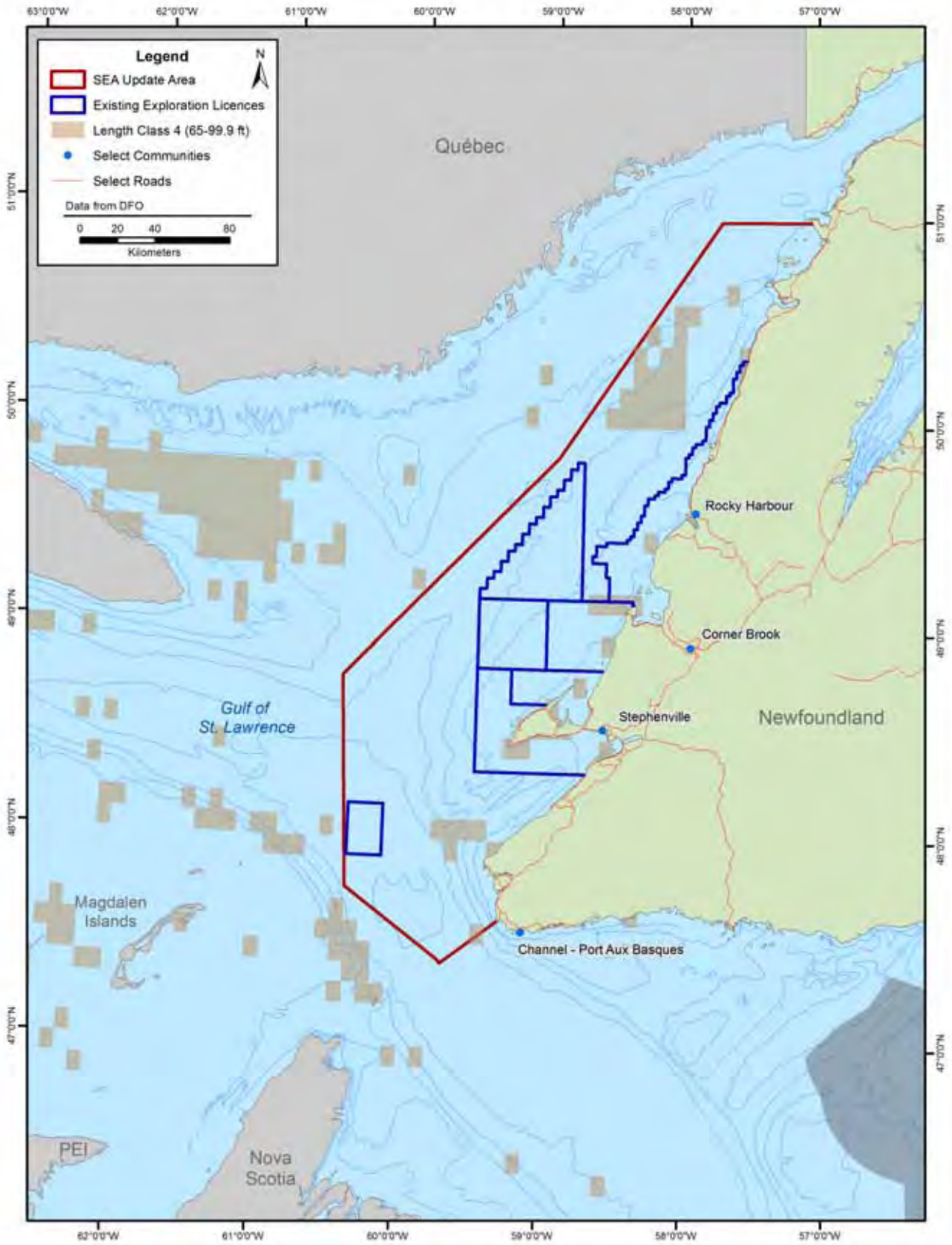
APPENDIX E

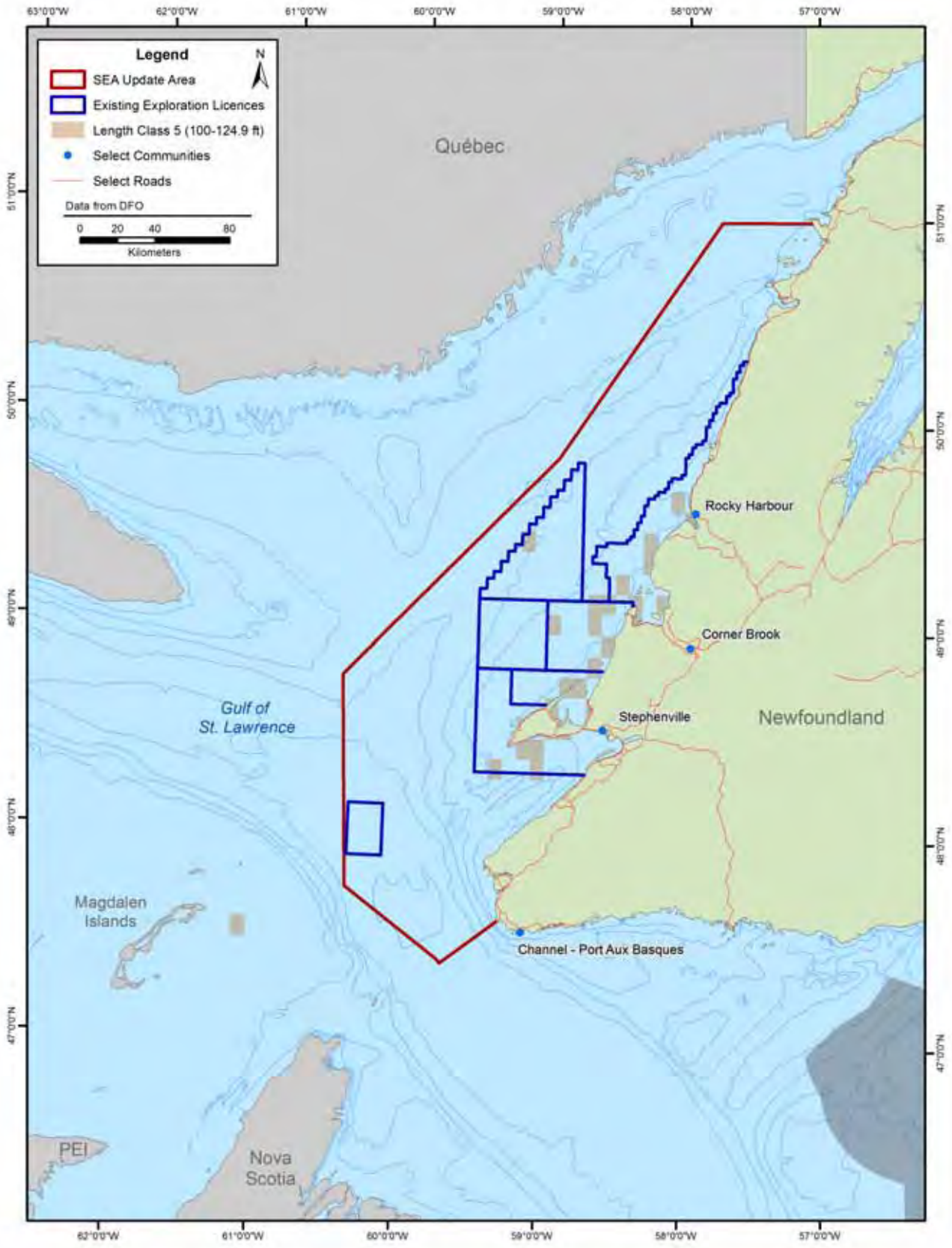
Commercial Fishing Locations by Vessel Size (Length Class)

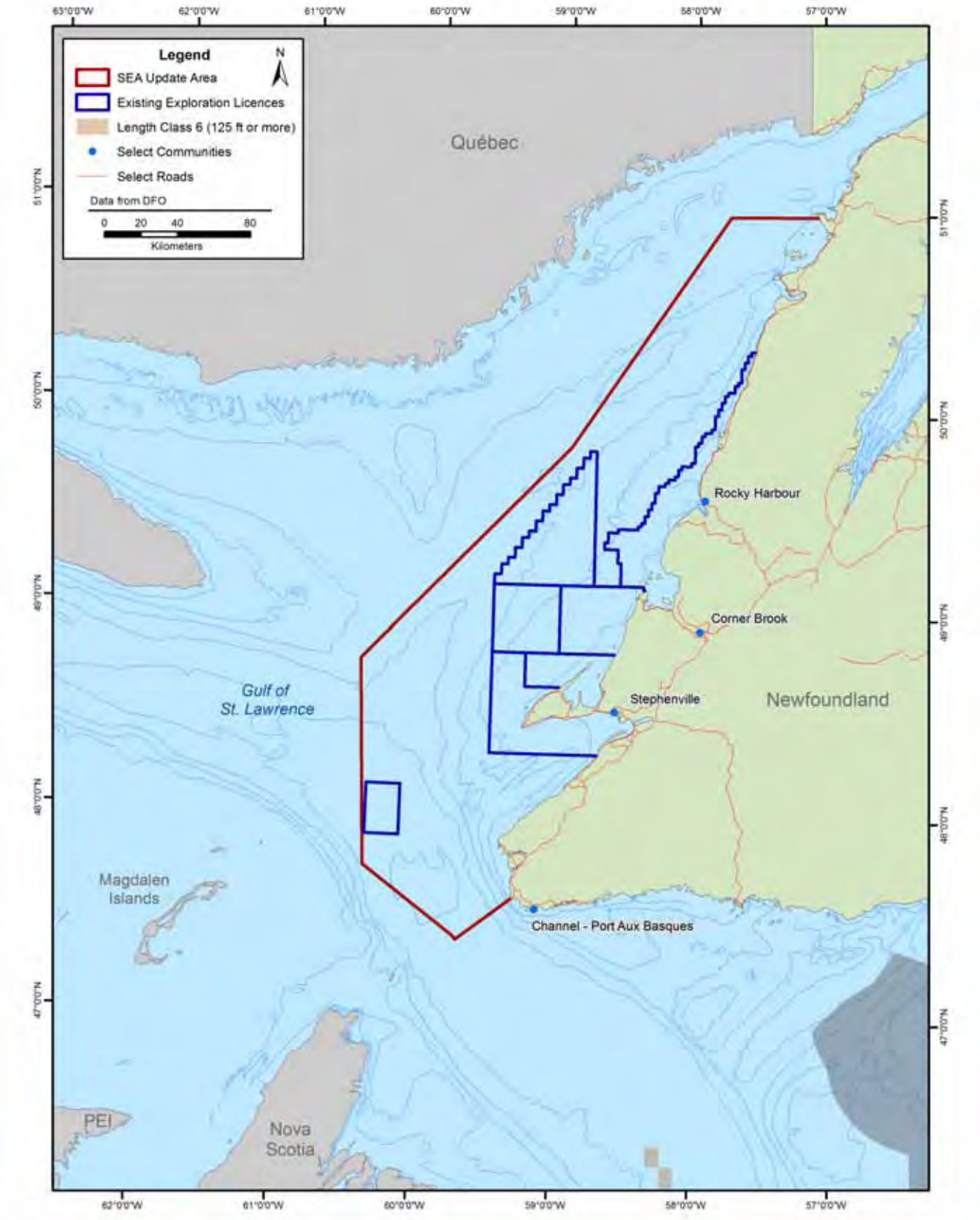

Legend
SEA Update Area
Existing Exploration Licences
Length Class 1 (1-34.9 ft)
Select Communities
Select Roads
Data from DFO
0 20 40 80
Kilometers
N
Québec
Rocky Harbour
Corner Brook
Stephenville
Newfoundland
Gulf of St. Lawrence
Magdalen Islands
Channel - Port Aux Basques
PEI
Nova Scotia
63°0'0"W
62°0'0"W
61°0'0"W
60°0'0"W
59°0'0"W
58°0'0"W
57°0'0"W
51°0'0"N
50°0'0"N
49°0'0"N
48°0'0"N
47°0'0"N


Legend
SEA Update Area
Existing Exploration Licences
Length Class 2 (35-44.9 ft)
Select Communities
Select Roads
Data from DFO
0 20 40 80
Kilometers
N
Québec
Rocky Harbour
Corner Brook
Stephenville
Newfoundland
Gulf of St. Lawrence
Magdalen Islands
Channel - Port Aux Basques
PEI
Nova Scotia
63°0'0"W
62°0'0"W
61°0'0"W
60°0'0"W
59°0'0"W
58°0'0"W
57°0'0"W
51°0'0"N
50°0'0"N
49°0'0"N
48°0'0"N
47°0'0"N


Legend
SEA Update Area
Existing Exploration Licences
Length Class 3 (45-64.9 ft)
Select Communities
Select Roads
Data from DFO
0 20 40 80
Kilometers
N
Québec
Rocky Harbour
Corner Brook
Stephenville
Newfoundland
Gulf of St. Lawrence
Magdalen Islands
Channel - Port Aux Basques
PEI
Nova Scotia
63°0'0"W
62°0'0"W
61°0'0"W
60°0'0"W
59°0'0"W
58°0'0"W
57°0'0"W
51°0'0"N
50°0'0"N
49°0'0"N
48°0'0"N
47°0'0"N

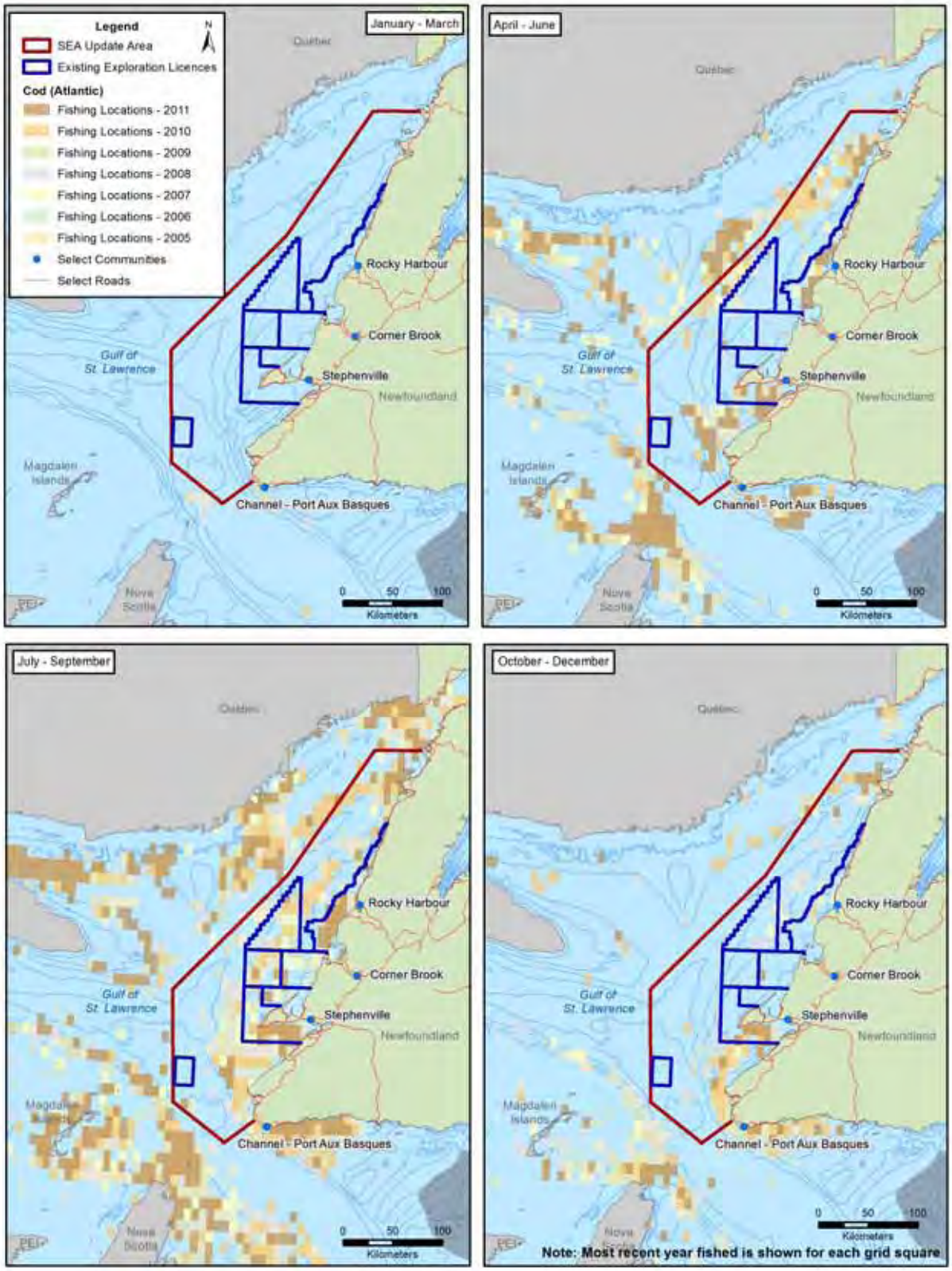

Legend
SEA Update Area
Existing Exploration Licences
Length Class 4 (65-99.9 ft)
Select Communities
Select Roads
Data from DFO
0 20 40 80
Kilometers
N
Québec
Rocky Harbour
Corner Brook
Stephenville
Newfoundland
Gulf of St. Lawrence
Magdalen Islands
Channel - Port Aux Basques
PEI
Nova Scotia
63°0'0"W
62°0'0"W
61°0'0"W
60°0'0"W
59°0'0"W
58°0'0"W
57°0'0"W
51°0'0"N
50°0'0"N
49°0'0"N
48°0'0"N
47°0'0"N

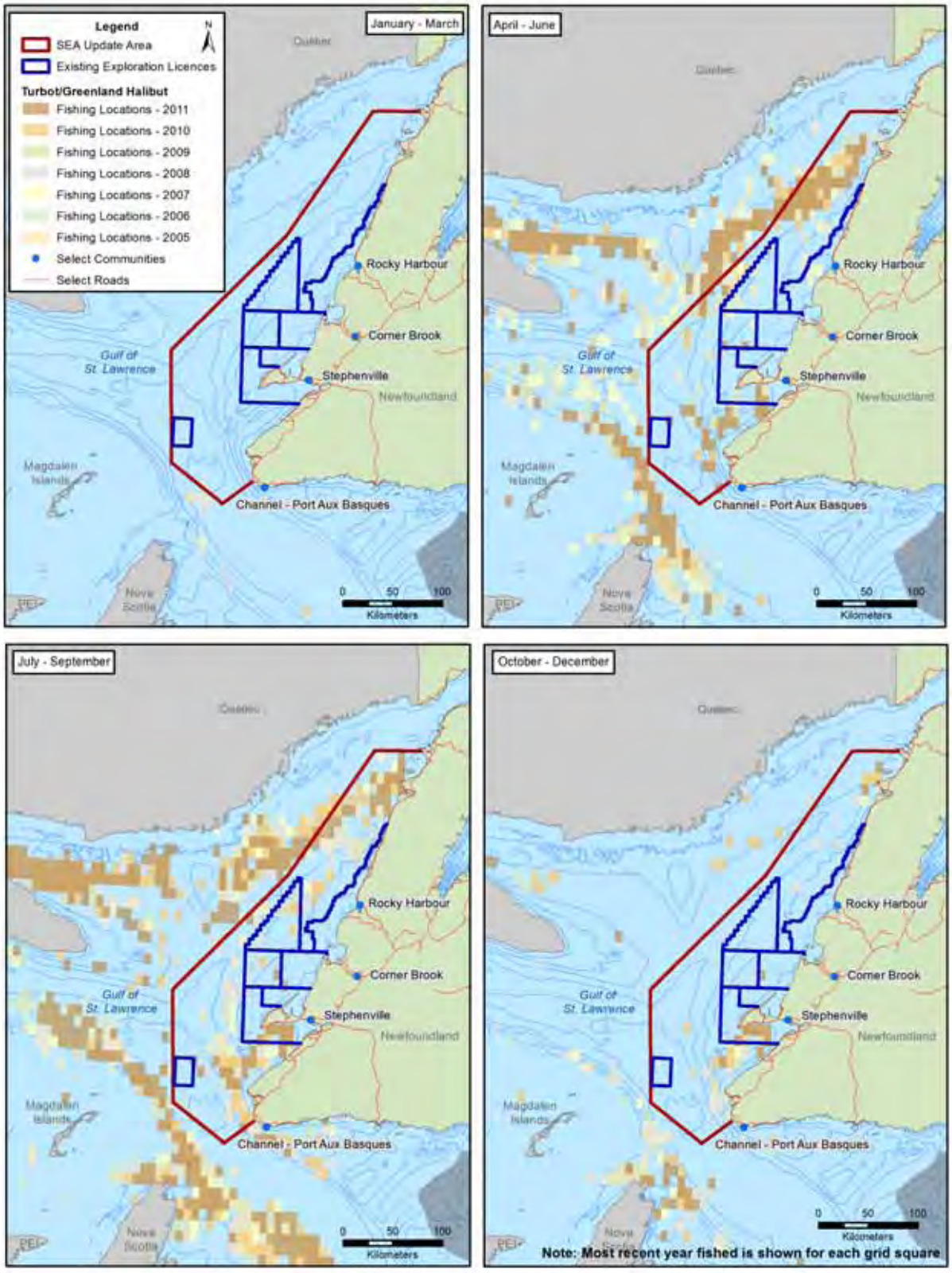

Legend
SEA Update Area
Existing Exploration Licences
Length Class 5 (100-124.9 ft)
Select Communities
Select Roads
Data from DFO
0 20 40 80
Kilometers
N
Québec
Rocky Harbour
Corner Brook
Stephenville
Newfoundland
Gulf of St. Lawrence
Magdalen Islands
Channel - Port Aux Basques
PEI
Nova Scotia
63°0'0"W
62°0'0"W
61°0'0"W
60°0'0"W
59°0'0"W
58°0'0"W
57°0'0"W
51°0'0"N
50°0'0"N
49°0'0"N
48°0'0"N
47°0'0"N

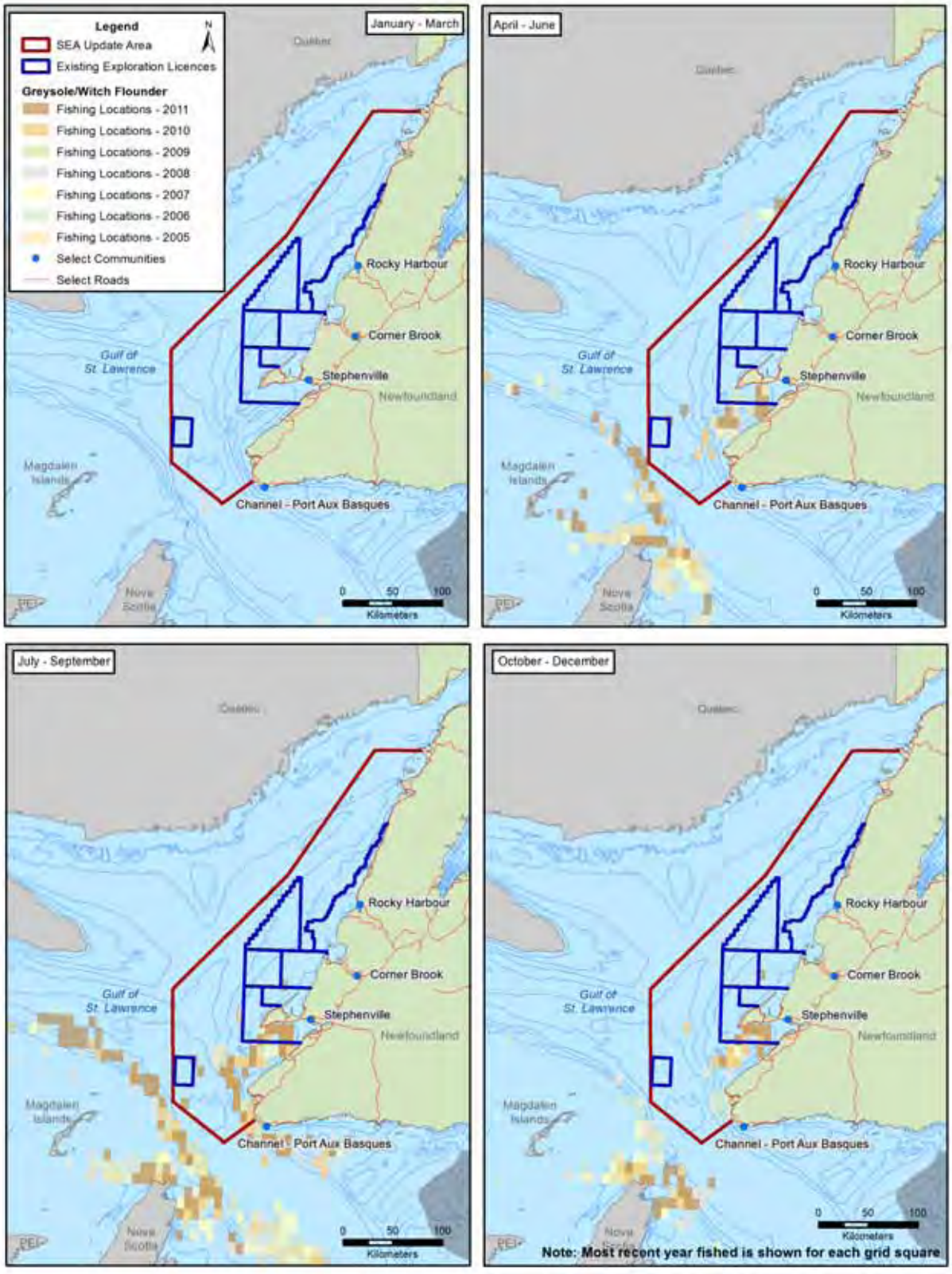

Legend
SEA Update Area
Existing Exploration Licences
Length Class 6 (125 ft or more)
Select Communities
Select Roads
Data from DFO
0 20 40 80
Kilometers
N
Québec
Rocky Harbour
Corner Brook
Stephenville
Newfoundland
Gulf of
St. Lawrence
Magdalen
Islands
Channel - Port Aux Basques
PEI
Nova
Scotia
63°0'0"W
62°0'0"W
61°0'0"W
60°0'0"W
59°0'0"W
58°0'0"W
57°0'0"W
51°0'0"N
50°0'0"N
49°0'0"N
48°0'0"N
47°0'0"N

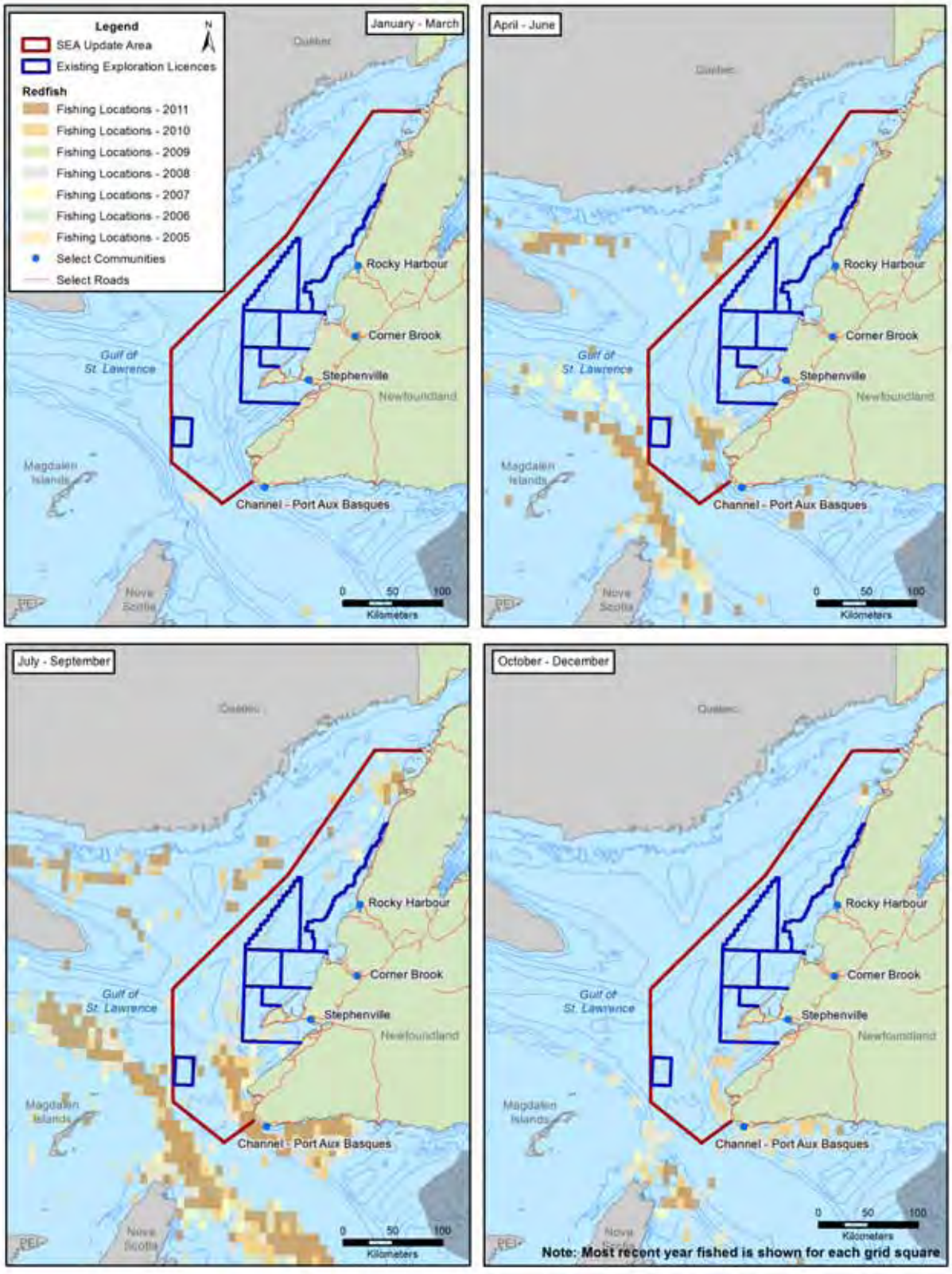
APPENDIX F

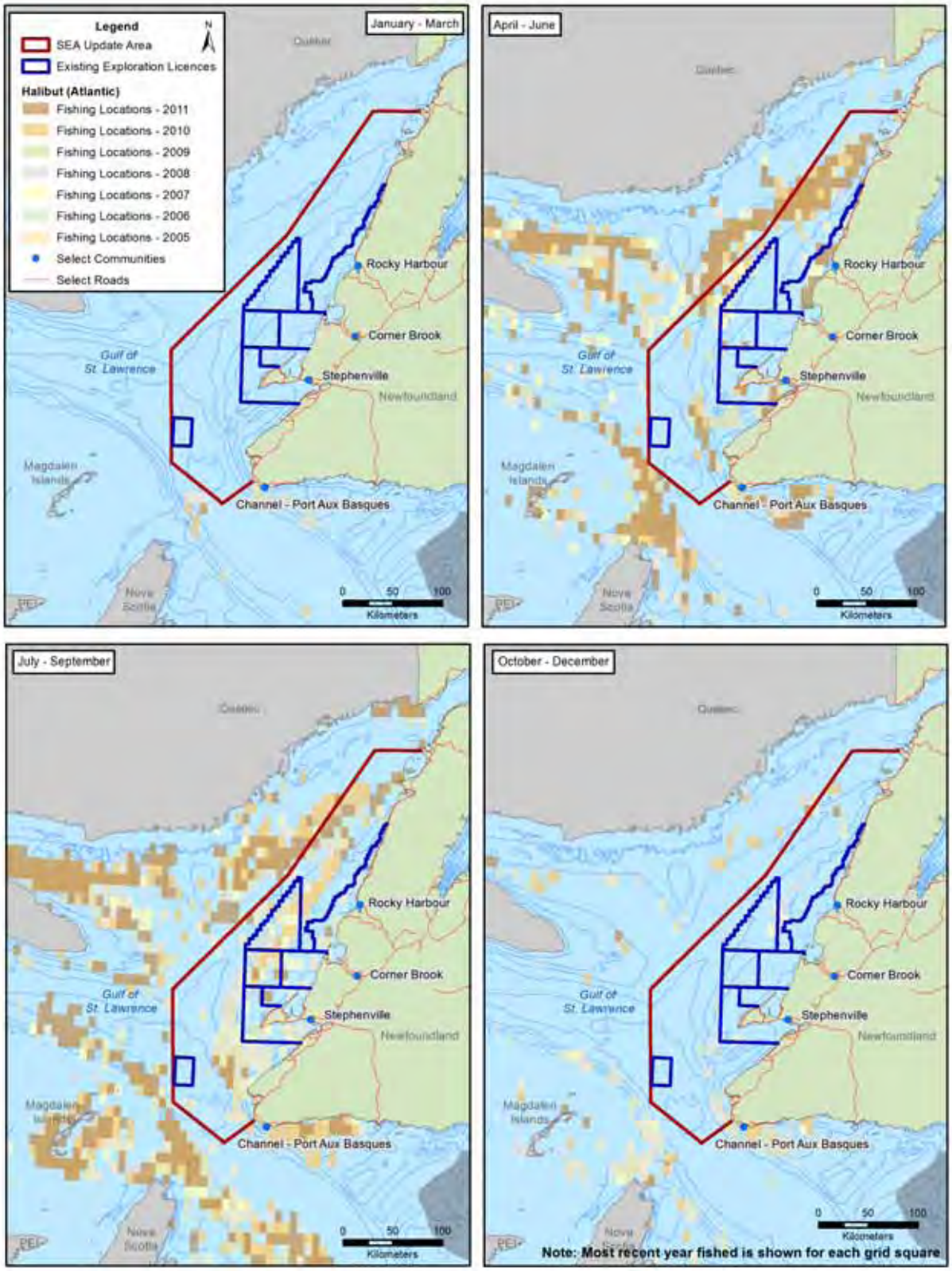
Commercial Fishing Locations by Season for Select Species (2005 – 2011)

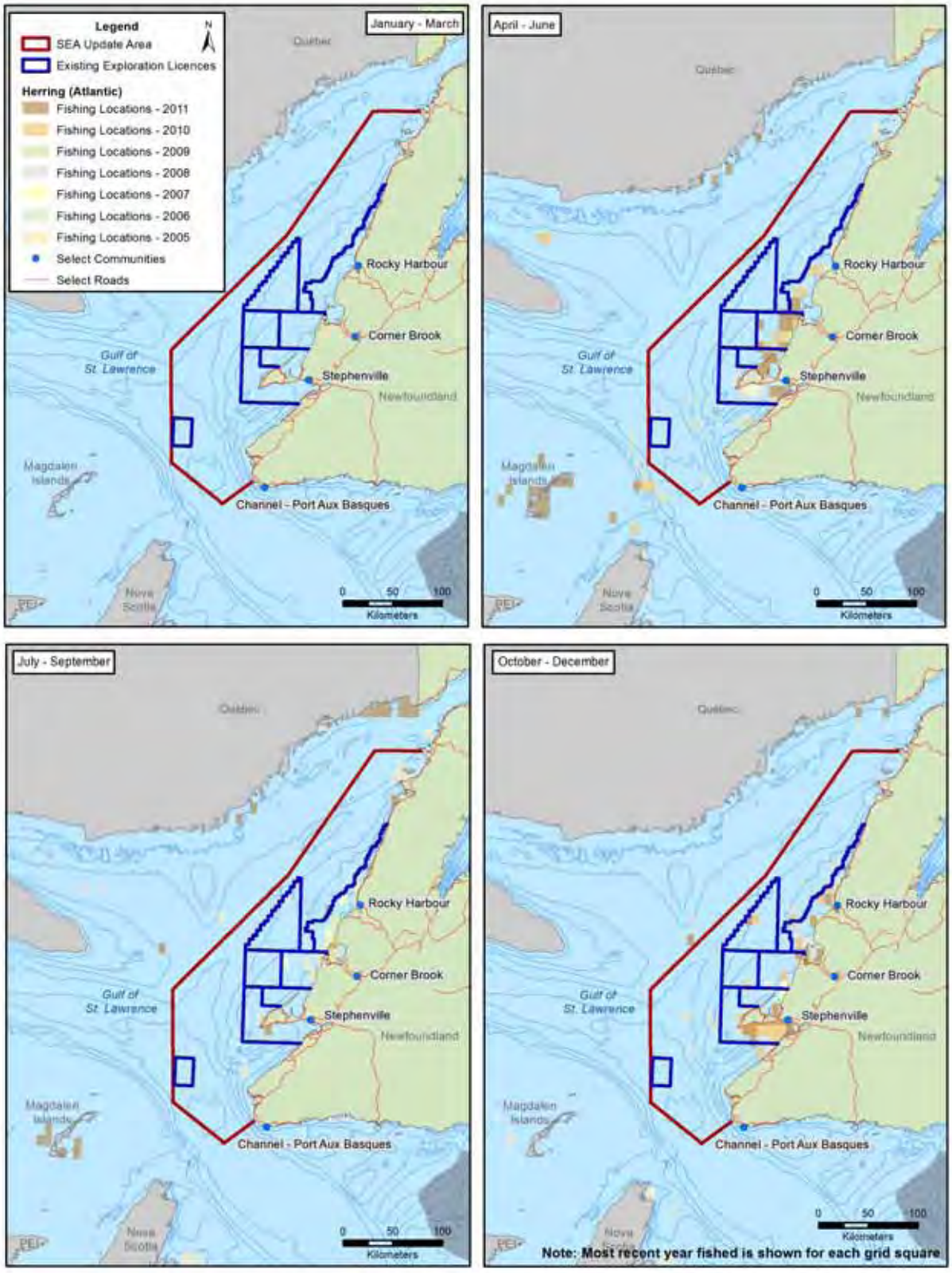

Legend
SEA Update Area
Existing Exploration Licences
Cod (Atlantic)
Fishing Locations - 2011
Fishing Locations - 2010
Fishing Locations - 2009
Fishing Locations - 2008
Fishing Locations - 2007
Fishing Locations - 2006
Fishing Locations - 2005
Select Communities
Select Roads
N
January - March
April - June
July - September
October - December
Québec
Rocky Harbour
Corner Brook
Stephenville
Channel - Port Aux Basques
Gulf of St. Lawrence
Newfoundland
Magdalen Islands
Nova Scotia
PEI
0 50 100
Kilometers
Note: Most recent year fished is shown for each grid square

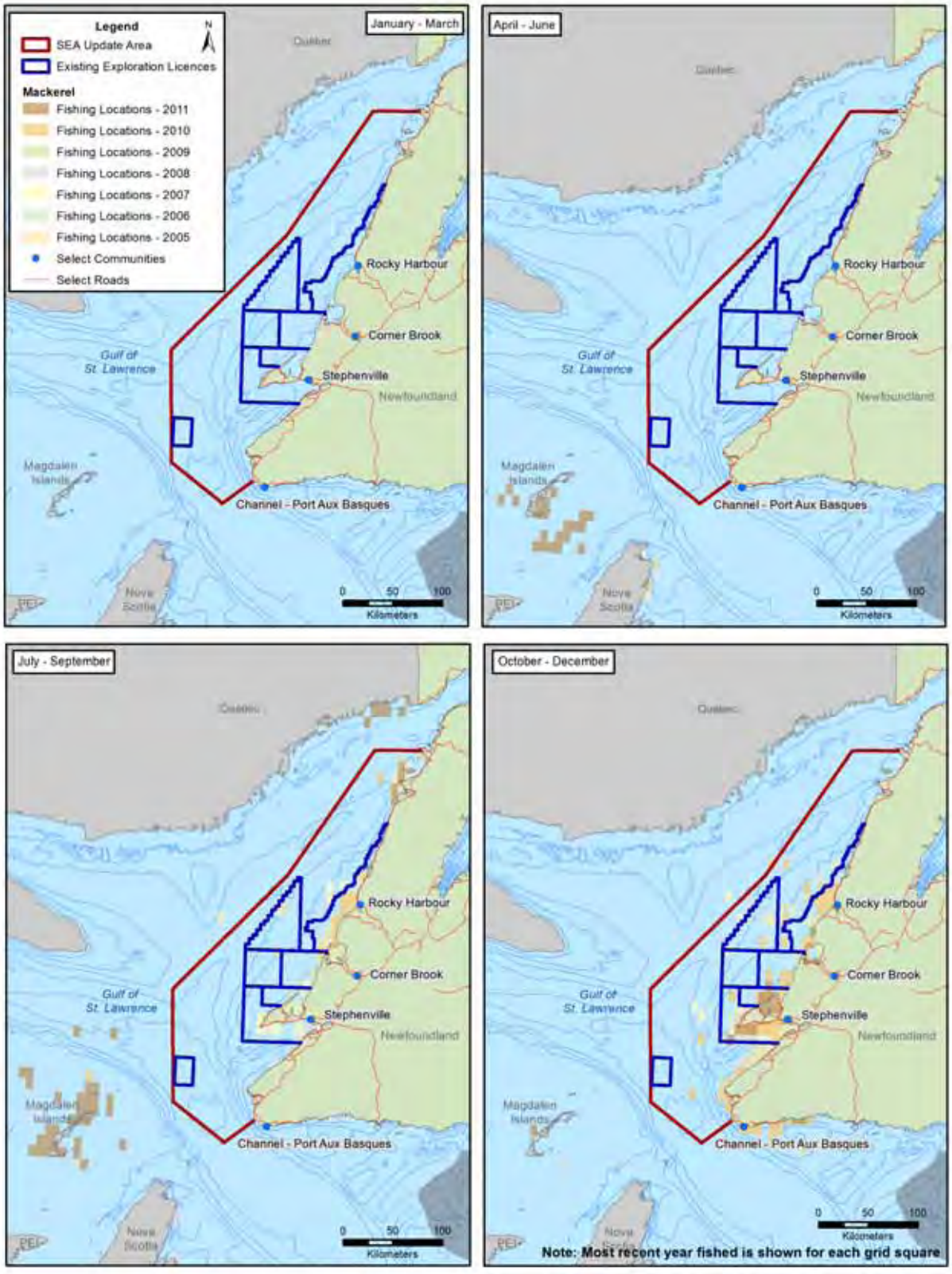

Legend
SEA Update Area
Existing Exploration Licences
Turbot/Greenland Halibut
Fishing Locations - 2011
Fishing Locations - 2010
Fishing Locations - 2009
Fishing Locations - 2008
Fishing Locations - 2007
Fishing Locations - 2006
Fishing Locations - 2005
Select Communities
Select Roads
N
January - March
April - June
July - September
October - December
Quebec
Gulf of St. Lawrence
Newfoundland
Magdalen Islands
Nova Scotia
PEI
Rocky Harbour
Corner Brook
Stephenville
Channel - Port Aux Basques
0 50 100
Kilometers
Note: Most recent year fished is shown for each grid square

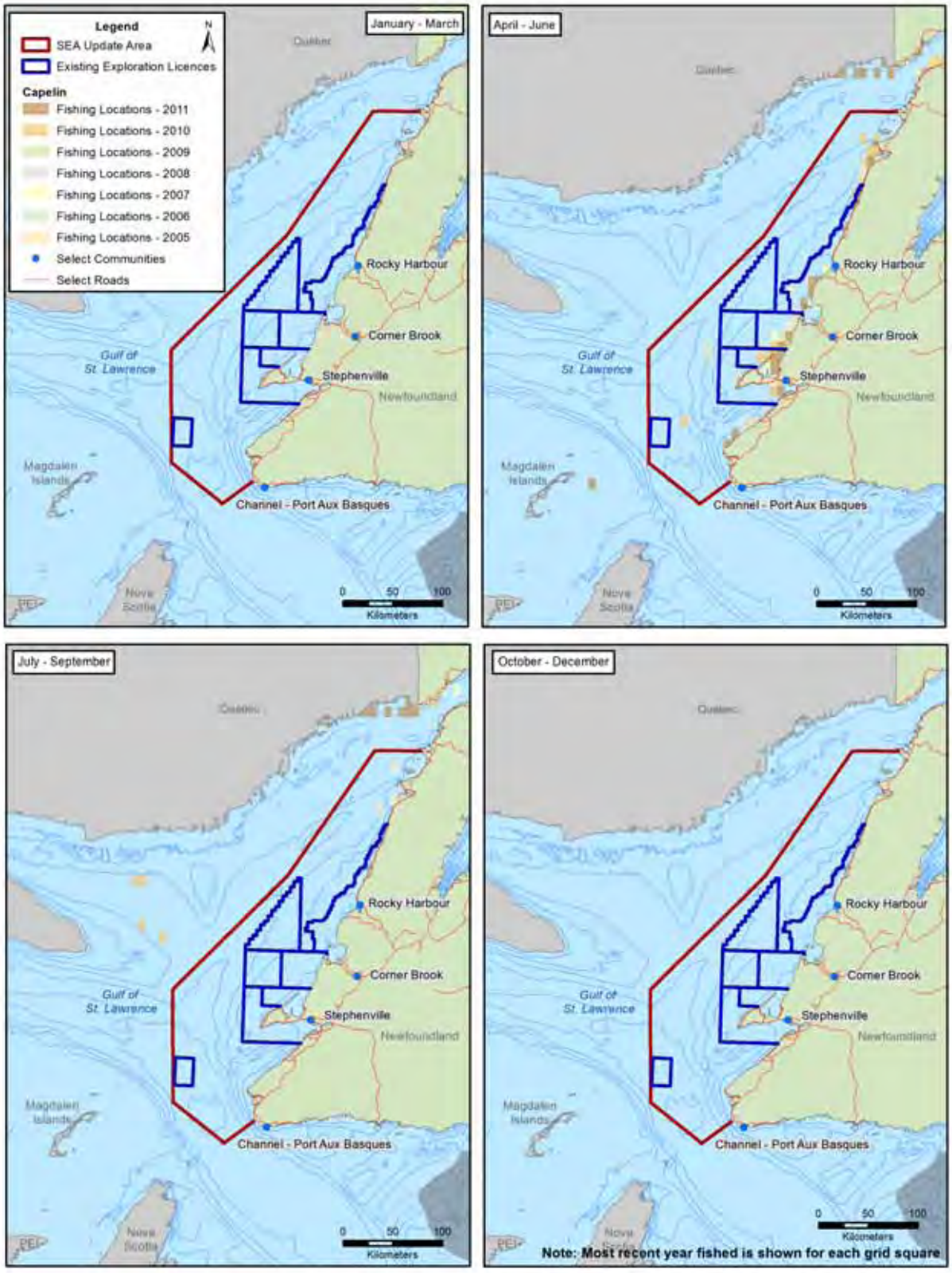

Legend
SEA Update Area
Existing Exploration Licences
Greysole/Witch Flounder
Fishing Locations - 2011
Fishing Locations - 2010
Fishing Locations - 2009
Fishing Locations - 2008
Fishing Locations - 2007
Fishing Locations - 2006
Fishing Locations - 2005
Select Communities
Select Roads
N
January - March
April - June
July - September
October - December
Rocky Harbour
Corner Brook
Stephenville
Channel - Port Aux Basques
Gulf of St. Lawrence
Newfoundland
Magdalen Islands
Nova Scotia
PEI
Quebec
0 50 100
Kilometers
Note: Most recent year fished is shown for each grid square

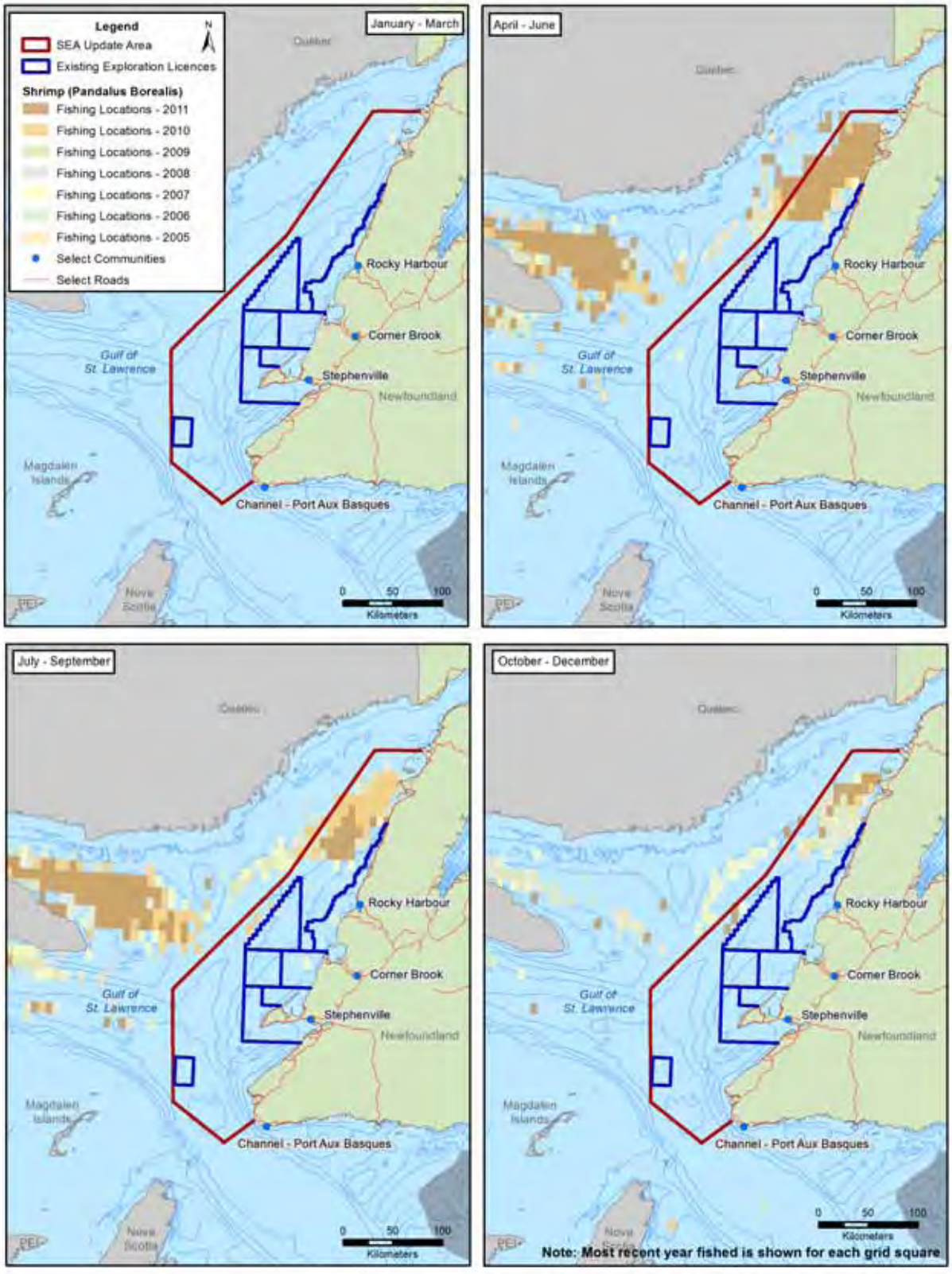

Legend
SEA Update Area
Existing Exploration Licences
Redfish
Fishing Locations - 2011
Fishing Locations - 2010
Fishing Locations - 2009
Fishing Locations - 2008
Fishing Locations - 2007
Fishing Locations - 2006
Fishing Locations - 2005
Select Communities
Select Roads
N
January - March
April - June
July - September
October - December
Quebec
Gulf of St. Lawrence
Newfoundland
Magdalen Islands
Nova Scotia
PEI
Rocky Harbour
Corner Brook
Stephenville
Channel - Port Aux Basques
0 50 100
Kilometers
Note: Most recent year fished is shown for each grid square

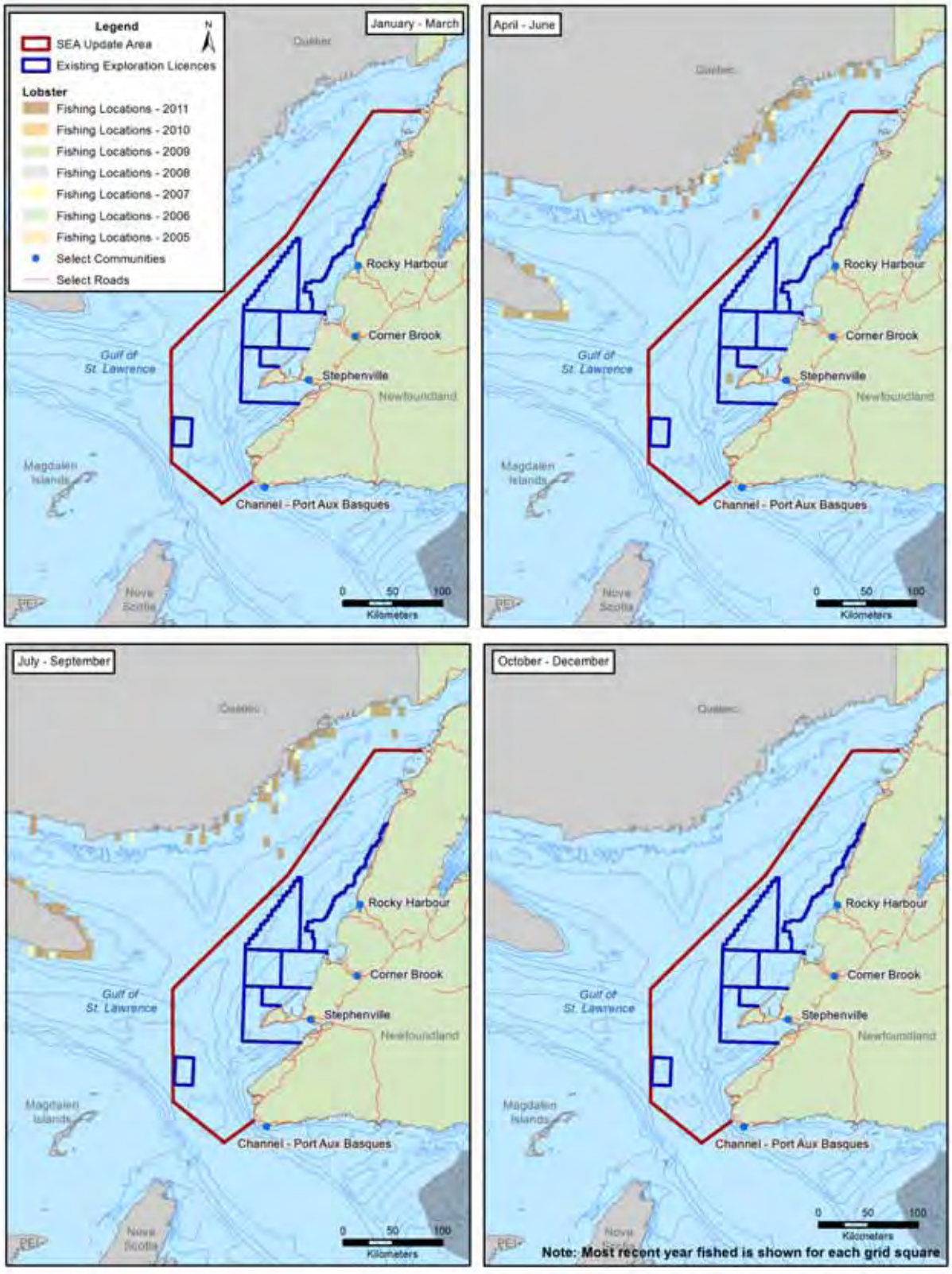

Legend
SEA Update Area
Existing Exploration Licences
Halibut (Atlantic)
Fishing Locations - 2011
Fishing Locations - 2010
Fishing Locations - 2009
Fishing Locations - 2008
Fishing Locations - 2007
Fishing Locations - 2006
Fishing Locations - 2005
Select Communities
Select Roads
N
January - March
April - June
July - September
October - December
Rocky Harbour
Corner Brook
Stephenville
Channel - Port Aux Basques
Gulf of St. Lawrence
Newfoundland
Magdalen Islands
Nova Scotia
PEI
Quebec
0 50 100
Kilometers
Note: Most recent year fished is shown for each grid square

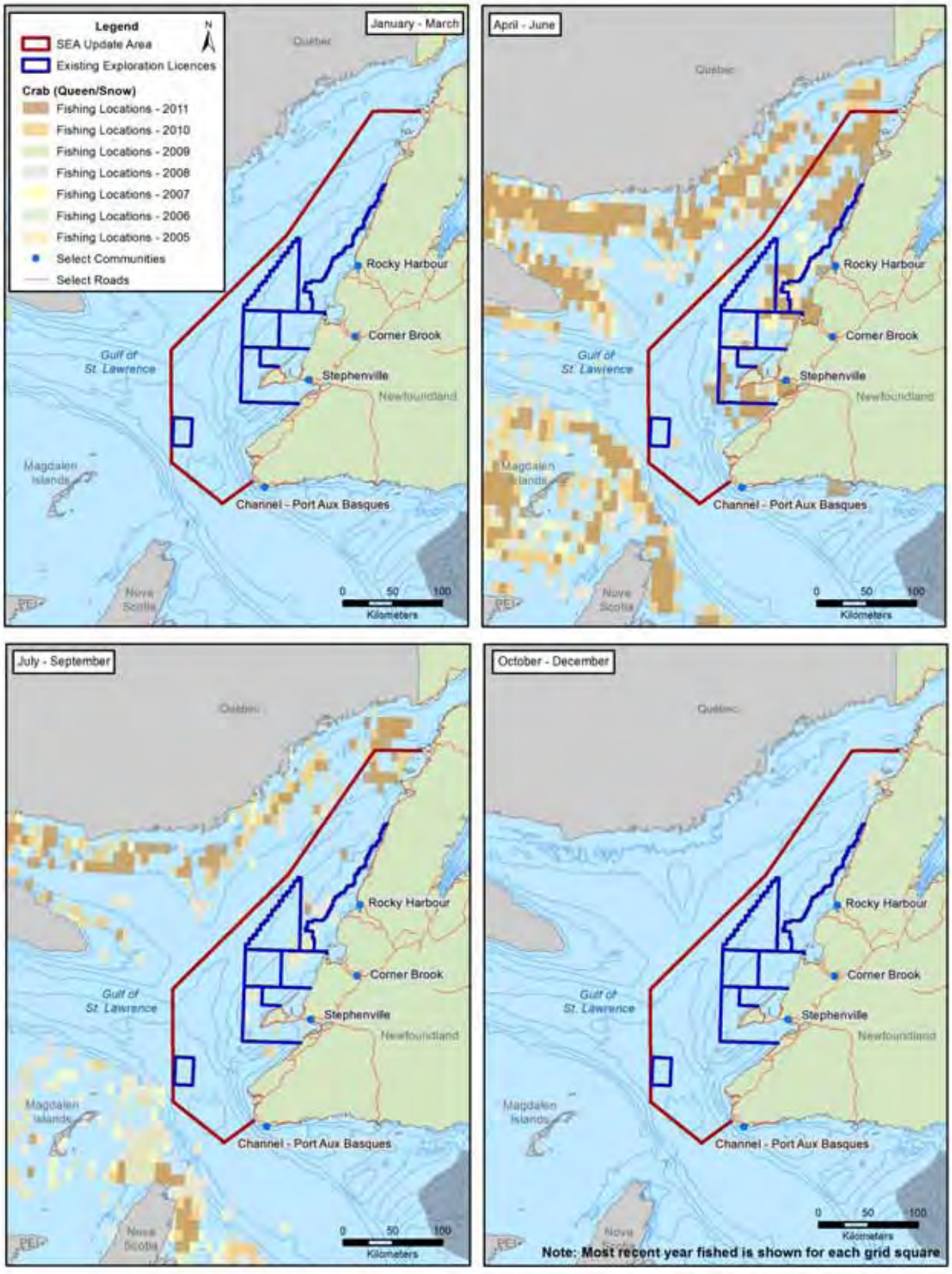

Legend
SEA Update Area
Existing Exploration Licences
Herring (Atlantic)
Fishing Locations - 2011
Fishing Locations - 2010
Fishing Locations - 2009
Fishing Locations - 2008
Fishing Locations - 2007
Fishing Locations - 2006
Fishing Locations - 2005
Select Communities
Select Roads
N
January - March
April - June
July - September
October - December
Quebec
Rocky Harbour
Corner Brook
Stephenville
Newfoundland
Gulf of St. Lawrence
Magdalen Islands
Channel - Port Aux Basques
Nova Scotia
PEI
0 50 100
Kilometers
Note: Most recent year fished is shown for each grid square


Legend
SEA Update Area
Existing Exploration Licences
Mackerel
Fishing Locations - 2011
Fishing Locations - 2010
Fishing Locations - 2009
Fishing Locations - 2008
Fishing Locations - 2007
Fishing Locations - 2006
Fishing Locations - 2005
Select Communities
Select Roads
January - March
April - June
July - September
October - December
Rocky Harbour
Corner Brook
Stephenville
Channel - Port Aux Basques
Gulf of St. Lawrence
Newfoundland
Magdalen Islands
Nova Scotia
PEI
Quebec
0 50 100
Kilometers
Note: Most recent year fished is shown for each grid square


Legend
SEA Update Area
Existing Exploration Licences
Capelin
Fishing Locations - 2011
Fishing Locations - 2010
Fishing Locations - 2009
Fishing Locations - 2008
Fishing Locations - 2007
Fishing Locations - 2006
Fishing Locations - 2005
Select Communities
Select Roads
N
January - March
April - June
July - September
October - December
Quebec
Rocky Harbour
Corner Brook
Stephenville
Newfoundland
Gulf of St. Lawrence
Magdalen Islands
Channel - Port Aux Basques
Nova Scotia
PEI
0 50 100
Kilometers
Note: Most recent year fished is shown for each grid square


Legend
SEA Update Area
Existing Exploration Licences
Shrimp (Pandalus Borealis)
Fishing Locations - 2011
Fishing Locations - 2010
Fishing Locations - 2009
Fishing Locations - 2008
Fishing Locations - 2007
Fishing Locations - 2006
Fishing Locations - 2005
Select Communities
Select Roads
N
January - March
April - June
July - September
October - December
Quebec
Rocky Harbour
Corner Brook
Stephenville
Channel - Port Aux Basques
Gulf of St. Lawrence
Newfoundland
Magdalen Islands
Nova Scotia
PEI
0 50 100
Kilometers
Note: Most recent year fished is shown for each grid square


Legend
SEA Update Area
Existing Exploration Licences
Lobster
Fishing Locations - 2011
Fishing Locations - 2010
Fishing Locations - 2009
Fishing Locations - 2008
Fishing Locations - 2007
Fishing Locations - 2006
Fishing Locations - 2005
Select Communities
Select Roads
January - March
April - June
July - September
October - December
Rocky Harbour
Corner Brook
Stephenville
Channel - Port Aux Basques
Gulf of St. Lawrence
Newfoundland
Magdalen Islands
Nova Scotia
PEI
Quebec
0 50 100
Kilometers
Note: Most recent year fished is shown for each grid square


Legend
SEA Update Area
Existing Exploration Licences
Crab (Queen/Snow)
Fishing Locations - 2011
Fishing Locations - 2010
Fishing Locations - 2009
Fishing Locations - 2008
Fishing Locations - 2007
Fishing Locations - 2006
Fishing Locations - 2005
Select Communities
Select Roads
N
January - March
April - June
July - September
October - December
Quebec
Gulf of St. Lawrence
Newfoundland
Magdalen Islands
Nova Scotia
PEI
Rocky Harbour
Corner Brook
Stephenville
Channel - Port Aux Basques
0 50 100
Kilometers
Note: Most recent year fished is shown for each grid square