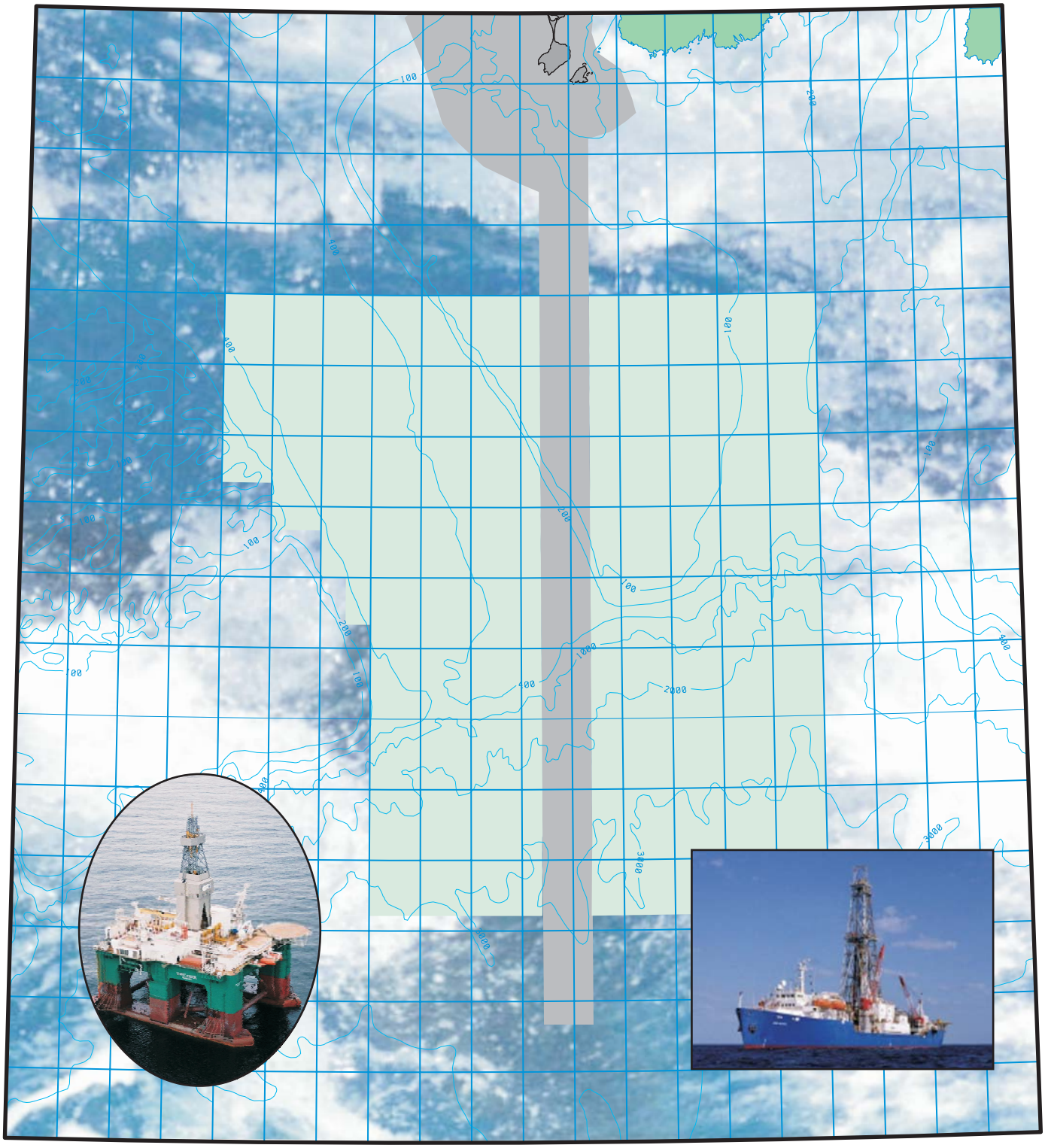
STRATEGIC ENVIRONMENTAL ASSESSMENT
LAURENTIAN SUBBASIN



CANADA-NEWFOUNDLAND OFFSHORE PETROLEUM BOARD

Addendum Summary Report

CANADA - NOVA SCOTIA OFFSHORE PETROLEUM BOARD

JW PROJECT NO. NFS08932

STRATEGIC ENVIRONMENTAL ASSESSMENT
LAURENTIAN SUBBASIN
ADDENDUM FOR PUBLIC REVIEW

SEPTEMBER 2003

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LAURENTIAN SUBBASIN

ADDENDUM FOR PUBLIC REVIEW

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1.0 INTRODUCTION

This report is an amendment to the Strategic Environmental Assessment (SEA) for the Laurentian Subbasin, previously released in April 2003 (C-NOPB 2003). The Canada-Newfoundland Offshore Petroleum Board (C-NOPB) and Canada-Nova Scotia Offshore Petroleum Board (C-BSOPB) have decided to increase the boundaries of the original study area (Figure 1) in anticipation of interest in the area.

The focus of this addendum is on the four Valued Environmental Components (VECs) assessed in the original SEA (fish and fish habitat, marine birds, marine mammals and sea turtles, and the fisheries). The purpose of this addendum is provide a summary of the existing information on the four VECs and indicate new (if any) information specific to the expanded area. This addendum also provides the reader with the summary of the assessment of potential effects to the VECs, again highlighting potential new effects (if any) that may arise as a result of the expanded study area.

1.1 Background

The Laurentian Subbasin is located to the south of the Island of Newfoundland, and surrounds the "French Corridor" south of the islands of St. Pierre and Miquelon. Although relatively unexplored at present, the subbasin is thought to have petroleum resource potential. Exploration rights in this region are held under exploratory permits issued by the Government of Canada in 1969 and 1971, which cover an area of approximately 3.3 million hectares. The expanded study area covers approximately 4.4 million hectares. The recent establishment of boundaries delineating the Newfoundland and Labrador and Nova Scotia Offshore Areas within this region has prompted increased interest in exploration drilling in the Laurentian Subbasin.

The C-NOPB and the C-NSOPB intend to negotiate the conversion of the existing federal exploratory permits for their respective offshore areas in the Laurentian Subbasin into exploration licences. As a consequence, exploration drilling (and, if successful, delineation drilling), may be proposed. It is also anticipated that seismic and other geoscientific surveys will be undertaken in the area. The Boards require a SEA of the Laurentian Subbasin region as part of the permit conversion process.

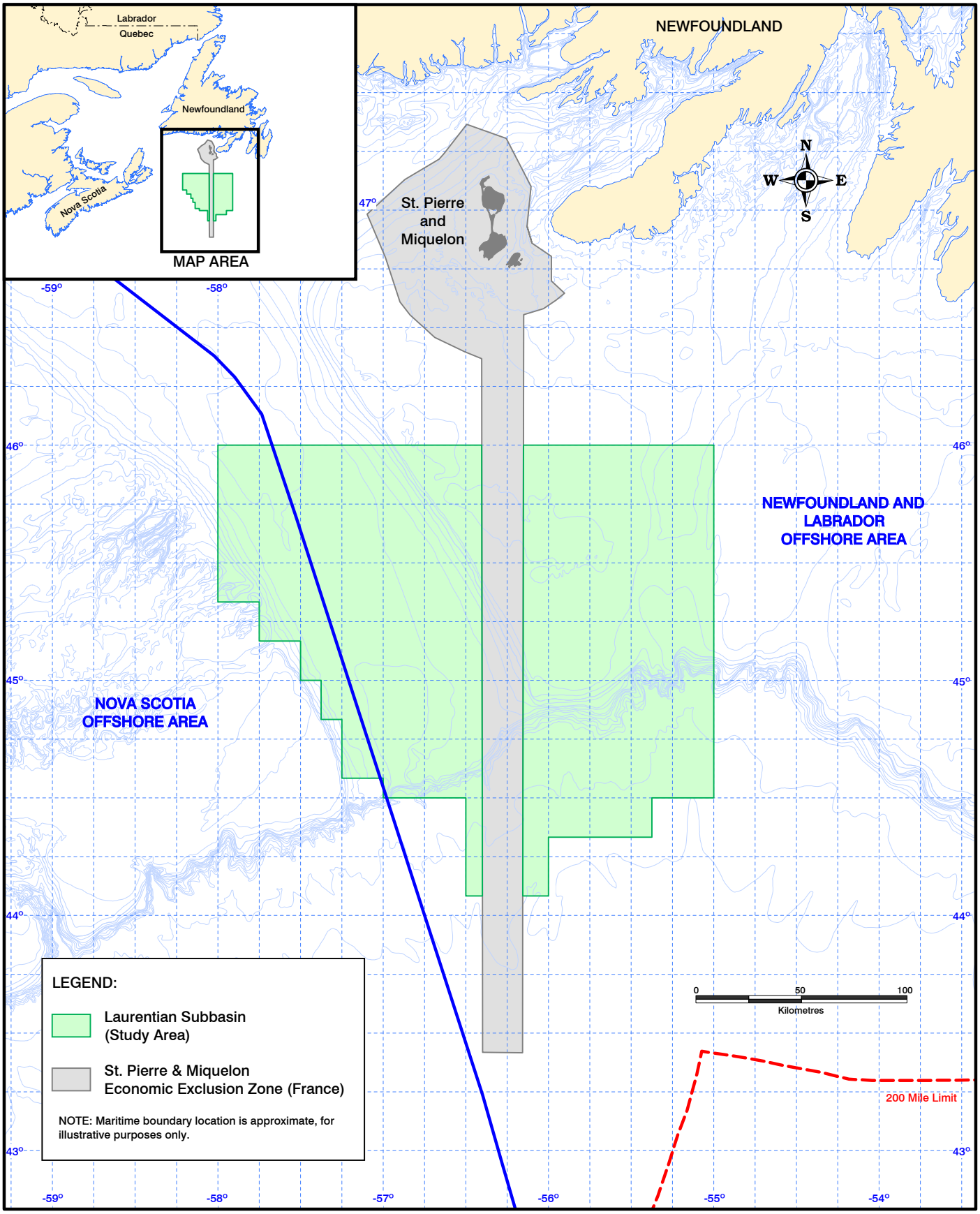

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Figure 1

LAURENTIAN SUBBASIN
STRATEGIC ENVIRONMENTAL ASSESSMENT
ORIGINAL STUDY AREA

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1.2 Strategic Environmental Assessment: An Overview

Environmental assessment is a systematic process for analyzing and evaluating the potential environmental effects of proposed activities, and is an important means of incorporating environmental considerations into decision-making. Although environmental assessment has traditionally been applied primarily to individual projects, recent years have seen increased interest in its application to earlier stages of the planning process, namely, policies, plans and programs. SEA has been defined as:

> [T]he formalized, systematic and comprehensive process of evaluating the environmental impacts of a policy, plan or programme and its alternatives...and using the findings in...decision-making (Therivel et al. 1992: 19-20).

1.3 Original Assessment Purpose and Context

The objective of the original study and this amendment is to complete a SEA of potential offshore oil and gas exploration within the expanded study area (Figure 2). The assessment focuses on the "exploration phase" of offshore petroleum activity in the Laurentian Subbasin, including potential seismic surveys and drilling programs.

The SEA provides an overview of the existing environment of the Laurentian Subbasin, discusses in broader terms the potential environmental effects which may be associated with offshore oil and gas exploration in the study area, identifies knowledge and data gaps, highlights any key issues of concern, and makes recommendations for mitigation and planning. Information from the SEA will assist the C-NOPB and C-NSOPB in determining whether exploration rights should be offered in whole or in part for an area, and may also identify general restrictive or mitigative measures that may be considered for application to seismic and/or drilling activities.

Following the issuance of exploration licences, and seismic or other geoscientific surveys in the area, the drilling of wells (exploration or delineation) would be able to proceed in the Laurentian Subbasin. These activities will require review and approval by the C-NOPB and C-NSOPB, and will be subject to individual environmental assessments. Again, the SEA is not intended as a substitute for project-specific environmental assessments. It will, however, provide individual operators with a general overview of the region's existing environmental setting, and help define key environmental issues and interactions which may require consideration in the early planning phases of individual seismic surveys and drilling programs, as well as in their subsequent environmental assessments.

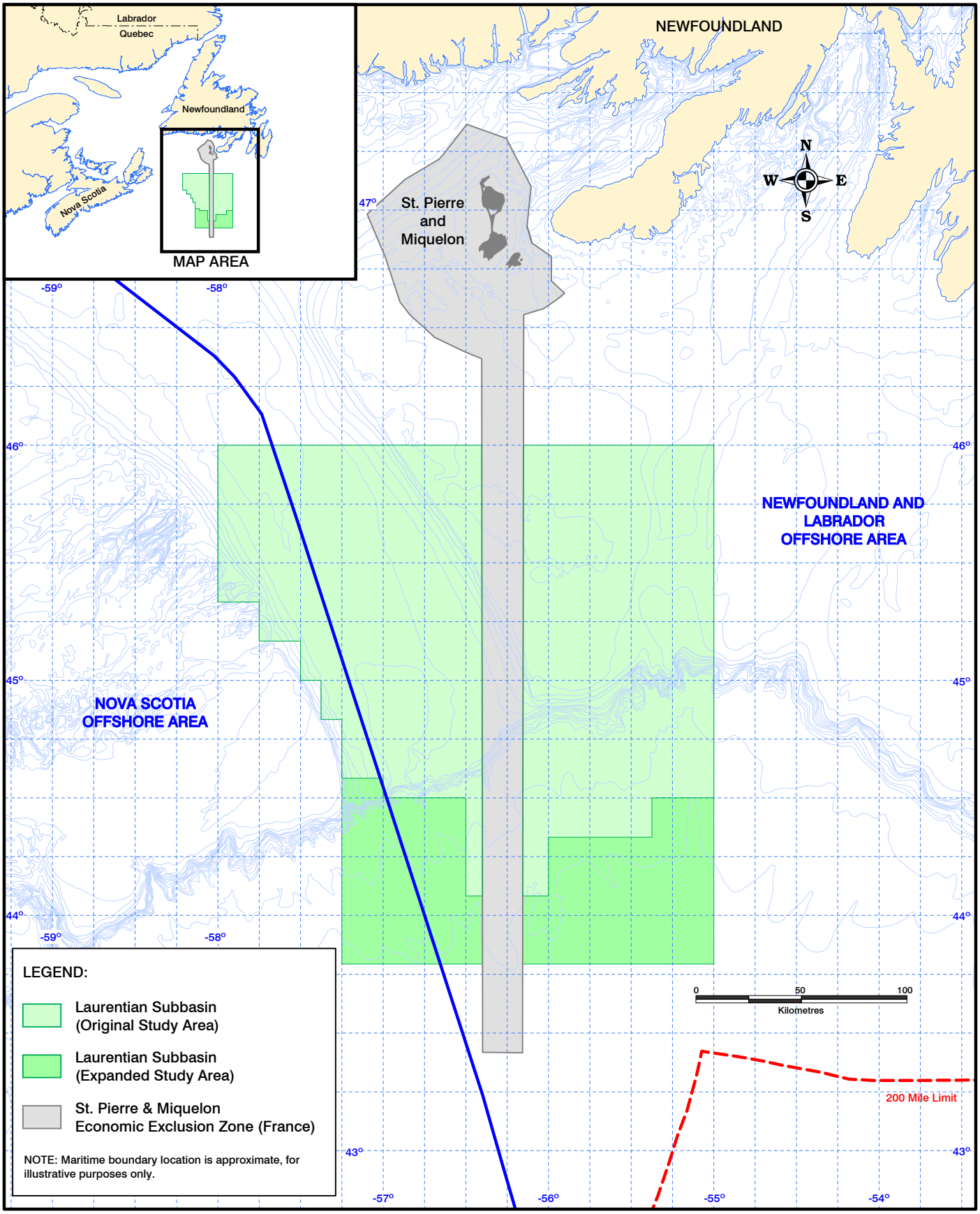

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Figure 2

LAURENTIAN SUBBASIN
STRATEGIC ENVIRONMENTAL ASSESSMENT
ORIGINAL AND EXPANDED STUDY AREA

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The SEA provides a description of the existing environmental setting in the study area based on existing, available information, and an overview of potential environmental issues at an early stage of the planning process. Changes in technology and/or advances in the understanding of the natural and socioeconomic environments of the region may eventually require that the SEA be updated to reflect current information. A review of the SEA will be undertaken in five years to determine if such updates are required.

1.4 Document Organization

This report is organized as follows:

Chapter 1 provides an introduction to SEA, and includes background information on the Laurentian Subbasin and SEA in general, as well as the purpose and context of the original assessment and this Addendum, and the organization of the document.

Chapter 2 provides a summary of the environmental setting of the Laurentian Subbasin, focussing on the biological, and socioeconomic environments, based on existing, available information.

Chapter 3 indicated that the methodology used in this Addendum is unchanged from the original SEA.

Chapter 4 provides the summary of the environmental effects analysis for each of the VECs under consideration.

Chapter 5 presents a summary of the key findings and conclusions of the assessment.

Any new references associated with this Addendum, including personal communications and the literature cited, are provided in Chapter 6.

2.0 EXISTING ENVIRONMENT

The following sections provide an overview of the existing environment of Laurentian Subbasin, focussing solely on the expanded study area and including its physical, biological and socioeconomic environments. This description is based upon existing, readily available information gathered through a review of the published literature, unpublished reports, and other relevant information sources. The reader is referred to the sections in the original SEA. Any new species, abundances, sensitivities, etc. will be described as they pertain to the new study area. If there is no difference from the original SEA, this will also be indicated.

2.1 Physical Environment

The reader is referred to Sections 3.1.2 to 3.1.9 in the original SEA. The only aspects of the physical environment which are unique to the new study area is the location of earthquake epicentres (Figure 3) and potentially the ice and iceberg regime.

2.2 Biological Environment

The following sections provide an overview of the existing biological environment of the new section of the study area, including information on plankton, benthos, fish, marine birds, marine mammals and sea turtles. Again, this overview description is based on existing, readily available information on the environmental setting of the study area.

2.2.1 Plankton

Plankton are the organisms that float freely in the water column. This includes micro-organisms, algae (phytoplankton), juvenile and adult invertebrates (zooplankton), and fish eggs and larvae (icthyoplankton). For more information, the reader is referred to Section 3.2.1 in the original SEA.

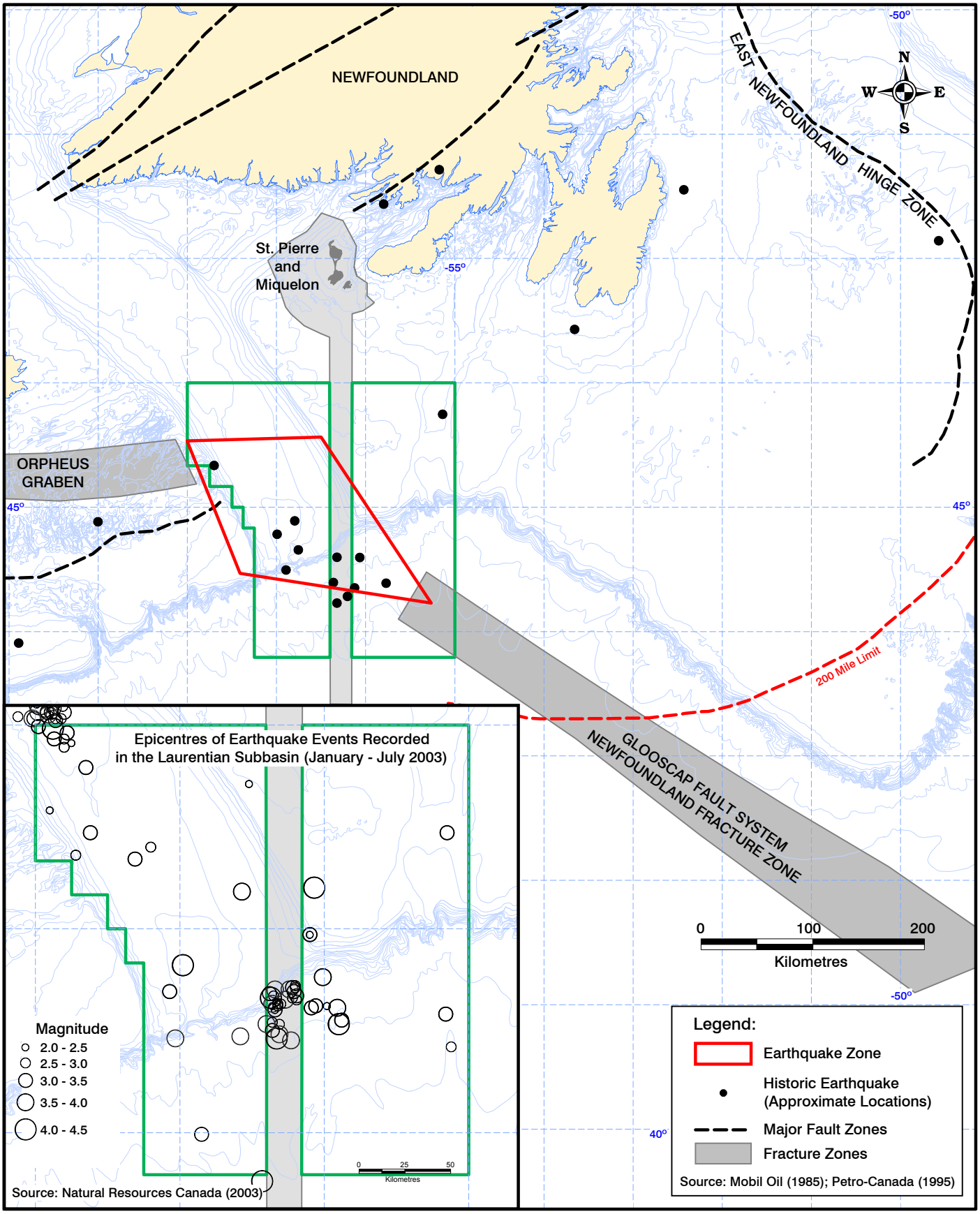

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FIGURE 3

SEISMOTECTONIC SETTING

2.2.1.1 Phytoplankton

Phytoplankton forms the base of the food chain in the ocean. As a source of primary production, it is an important part of the diet of zooplankton and larval stages of several fish and invertebrates species. Due to upwelling along the slopes of the offshore banks and channels, the area included in the original and expanded study area is very productive year-round (Breeze et al. 2002). Production peaks (blooms) twice a year, during the spring, and a second smaller bloom in the fall. A Continuous Plankton Recorder (CPR) has been used to collect plankton samples in the North Atlantic since 1959. The CPU is towed by commercial and weather ships along standard travel routes, collecting phytoplankton and zoopolankton samples. Data collected by the CPR between 1959 and 1992 were analyzed by Myers et al. (1994, as cited in Breeze et al. 2002). Analysis showed a high abundance of dinoglagellates and low abundance of diatoms over the Scotian Shelf (Meyers et al. 1994, as cited in Breeze et al. 2002), including the expanded study area.

2.2.1.2 Zooplankton/ Ichthyoplankton

Zooplankton are the link in the energy transfer from primary production (phytoplankton) and fish in the marine food web. They are fed on by all species of fish at some time during their lifecycle. Within the Laurentian Channel common species include the euphausiid krills *Meganyctiphanes norvegica* and *Thysanoessa* species (White and Johns 1997) and *Calanus* copepods. *Calanus* copepods are an important food source for whales in the Laurentian Channel. *M. norvegica* is also abundant within the expanded study area along the southeastern slope of Banquereau Bank (Sameoto and Cochrane 1996, as cited in Breeze et al. 2002).

Ichthyoplankton are the eggs and larvae of fish that float freely in the water column. Eggs and larvae of cod, haddock, pollock, and silver hake have been identified in the expanded study area, on the outer banks of the Scotian Shelf including the Banquereau Bank. However, there is very low larval fish diversity on Banquereau Bank and in the Laurentian Channel (Breeze et al. 2002). Species spawning on Banquereau Bank include cod, herring, winter and thorny skate, witch flounder, Atlantic halibut, Stimpson's surf clam, and snow crab (C-NSOPB 2003).

2.2.2 Benthos

The reader is referred to Section 3.2.2 in the original SEA for a detailed discussion on benthic communities that may occur in the original Laurentian Subbasin study area.

The benthos of the southeastern corner of Banquereau Bank, in the expanded study area, is similar to the benthos of the St. Pierre Bank. It is composed of two separate communities: *Echinarachnius parma* (sand dollar)-*Ammodytes americanus* (sand lance) community, and *Modiolus modiolus* (horse mussel)-*Ophiopolis aculeata* (brittlestar) community.

The sand dollar-sand lance community is found on sandy substrates at depths of 95 to 220 m, along the eastern and southern edges of Banquereau Bank (SOEP 1996, as cited in LGL 2000). Species typical of this community type include sand dollars, sand lance, *Arctica islandica* (ocean quahog), *Mactromeris polynyma* (Stimpson's surf clam), *Cyrtodaria siliqua* (northern propellor clam), *Ophiura* sp. (brittle stars), polychaete species (e.g., *Spiohanes bombyx*), and various amphipod crustaceans (e.g., *Ampelisac macrocephala* and *Pricillina armata*) (Breeze et al. 2002). The species in this community are important forage species for commercial fishes and invertebrates (snow crab) on Banquereau Bank.

The horse mussel-brittlestar community is typically found at greater depths than the sand dollar community, on coarse substrates (Breeze et al. 2002). This community is found in the southeastern corner of the Banquereau Bank (SOEP 1996, as cited in LGL 2000). Typical species of this community include horse mussels, brittlestars, several families of polychaetes (Sabellidae, Terebellidae, and Maldanidae), amphipod crustaceans (*Erichthonius fasciatus*, *Unicola* sp.), and encrusting coralline algae (Breeze et al. 2002). Bordering the southern and eastern slopes of Banquereau Bank, adjacent to the horse mussel–brittle star community, is a community consisting mainly of horse mussels and rhodophytes (red algae) (SOEP 1996, as cited in LGL 2000).

The eastern slope of Banquereau Bank, leading to the Laurentian Channel, contains a basket star (*Gorgonocephalus arcticus*) community. Most of this area is known as the Stone Fence, a very productive fishing area populated by large corals. This community is found on coarse substrate in water depths of 200 to 1,500 m. A complete description of this community and the Stone Fence can be found in Section 3.2.2.2 of the original SEA.

Recent benthic studies (JWEL 2002a; 2002b, as cited in Dillon 2003) of exploration licensees (EL 2404 (Stonehouse) held by EnCana Corp and EL 2414 (Craigmore) held by Kerr-McGee) adjacent to the study area described three habitat types. With the exception of corals located in the vicinity of the Stone Fence and in the Stonehouse license (which is outside the expanded study area), the species identified (Dillon 2003) were similar to those identified in the SEA (C-NOPB 2003).

The Laurentian Subbasin contains several species of commercially important invertebrates, and several invertebrate species that have been identified as having commercial potential. Commercial harvesting of snow crab, deep sea scallop, iceland scallop, and northern shrimp occur to varying degrees within the original study area. Currently there are commercial fisheries for snow crab and Stimpson's surf clam in the extended study area. There are also efforts underway to develop directed fisheries for northern propellor clam and ocean quahog in the Scotian Shelf/Banquereau Bank region. These species are currently caught and processed as by-catch of Stimpson's surf clam harvesting on Banquereau Bank (C-NSOPB 2003). A detailed discussion of the biology of these species can be found in Section 3.2.2.5 of the original SEA.

2.2.3 Fish

The original study area can be divided into three primary fish habitat types, based on the physiography of the area (Section 3.1.1 in the original SEA). The St. Pierre Bank is relatively shallow and cold, with a bottom temperature generally between 0 and 2°C (Colbourne et al. 2002). The predominant substrate type on the St. Pierre Bank is fine to coarse sand, except on the west-central part of the bank, which is rocky. The second fish habitat type occurs along the slopes of the bank. The Laurentian Channel slopes to the west, and Halibut Channel slopes to the east of St. Pierre Bank (see Figure 3.1 in the original SEA). The substrate on the slope is primarily coarse sand. The third fish habitat is the area of the slope and the Laurentian Channel, with water depths of greater than 200 m, and substrate predominately of silt and clay. On average, the water is also consistently warmer than on the shallower bank areas (Section 3.1.7 in the original SEA).

Fish assemblages on the continental shelf and slope are relatively distinct and linked to water depth (Gomes et al. 1992), with areas of the slope between 90 and 200 m having different species than areas below 200 m. However, as Gomes et al. (1992) point out, many fish species occur over a depth range of several hundred metres along the slope of the St. Pierre Bank. Some species move seasonally between shallow and deep water, while others move continuously between water depths.

American plaice, Atlantic cod, yellowtail flounder, and thorny skate dominate fish assemblages on the continental shelf, in water depths of less than 90 m on St. Pierre Bank. Plaice, cod, and thorny skate also dominate fish assemblages on the slopes of the bank, in water depths of 90 to 200 m. In the Laurentian Channel and on the slope of the continental shelf, at depths of greater than 200 m, redfishes, Atlantic cod, thorny skate, American plaice, witch flounder, striped wolffish, haddock, white hake, and halibut dominate fish assemblages (Gomes et al. 1992). An overview of fish species found within the original study area can be found in Section 3.2.3. in the original SEA.

The expanded study area includes the southwestern corner of Banquereau Bank, the western slope of the Laurentian Channel, and a large area of the abyssal south of the Laurentian Channel and St. Pierre Bank. Banquereau Bank is a large shallow bank on the eastern side of the Scotian Shelf. The predominant substrate type on Banquereau Bank is sand and gravel, with a clockwise water circulation around the outer edges of the bank (Amos and Nadeau 1988, as cited in C-NSOPB 2003). The southwest corner of the bank (included in the expanded SEA study area) has a high level of tidal mixing and is very productive (Rutherford and Breeze 2002, as cited in C-NSOPB 2003). Fish assemblages on Banquereau Bank are similar to those on St. Pierre Bank, including American plaice, thorny skate, Atlantic cod, yellowtail flounder, and winter skate.

Spawning of several commercial fish and invertebrate species occurs within the expanded study area. Atlantic cod spawn on the continental shelf off Banquereau Bank during November and December. Atlantic herring spawn on Banquereau Bank from August through November, however it is not known if spawning occurs within the specific study area. Snow crab spawn on Banquereau Bank from July to September, and Stimpon's surf clam spawn on the Bank from September to November (C-NSOPB 2003).

The fish assemblages on the shelf slope and Stone Fence are dominated by American plaice, thorny skate, Atlantic cod, and smooth skate. Longfin hake and marlin-spike dominate the fish assemblages along the slope on the western side of the Laurentian Channel.

Fish assemblages along the continental slope, from 400 to 1200 m, are defined by depth zones of 400 to 800 m, and 800 to 1,200 m (Markle et al. 1988, as cited in Breeze et al. 2002). Beyond a depth of 1,200 m in the abyssal, sampling has been very patchy and it is difficult to characterize species and assemblages in this region (Merrett and Haedrich 1997, as cited in Breeze et al. 2002). Redfishes, longfin hake, marlin-spike, and witch flounder dominate assemblages from 400 to 800 m depths. Black dogfish, longnose eel, marlin-spike, and rock grenadier dominate assemblages from 800 to 1,200 m depths. A study conducted by Pohle et al. (1992, as cited in Breeze et al. 2002) also identified Atlantic saury, blue hake, and black dogfish as deepwater species (>300 m) with potential as commercial fisheries.

Other fishes that occur in smaller numbers in the very deep waters of the continental shelf area include: longhorn sculpin, sea raven, American straptail grenadier, deep-sea cat shark, backfin tapirfish, shortspine tapirfish, eelpout, Gray's cutthroat eel, snubnose slime eel, spiny eel, knifenose chimera, lanternfish, trunkfish, and several species of skate (freckled, little, and Jensen's) (Pohle et al. 1992 as cited in Breeze et al. 2002).

Fish species that could potentially be found in the expanded SEA area, and not described in the original SEA, are listed in Table 1. An overview of the most abundant fish species identified in the expanded SEA area (Atlantic saury, blue hake, longnose eel, rocj grenadier and winter skate) is provided in Sections 2.2.3.1 to 2.2.3.5, respectively.

2.2.3.1 Atlantic Saury

Atlantic saury is a small pelagic fish, often mistaken for young swordfish. They are found schooling in the warm surface waters of the open ocean, preferring temperatures of 8 to 24°C. Within the study area they are found in small numbers on the St. Pierre Bank and in schools in the abyssal area. They undergo two migrations: seasonal and diurnal. They migrate to deeper water (50 m) during daylight hours, and migrate south during winter months. Spawning occurs during the winter and early spring outside of the study area (Scott and Scott 1988). This species is not fished commercially in Canadian waters.

The diet of Atlantic saury consists of zooplankton, mainly copeopds and euphausiids. Predators include Atlantic cod, pollock, mackeral, tunas, and dolphins (Scott and Scott 1988).

Table 1 Species Potentially Found in Expanded Area

Common Name	Scientific Name
American Straptail Grenadier	*Ventrifossa occidentalis*
Atlantic Saury	*Scomberesox saurus*
Backfin Tapirfish	*Lipogenys gilli*
Blue Hake*	*Antimora rostrata*
Deep-sea Cat Shark	*Apristurus profundorum*
Eelpout	*Lycodes sp.*
Jensen's Skate	*Raja jenseni*
Knifenose Chimera	*Rhinochimaera atlantica*
Lanternfish	*Diaphus sp.*
Little Skate	*Raja erinacea*
Longhorn Sculpin	*Myoxocephalus octodecemspinosus*
Longnose Eel*	*Synophobranchus kaupi*
Rock Grenadier*	*Coryphaenoides rupestris*
Sea Raven	*Hemitripterus americanus*
Shortspine Tapirfish	*Polyacanthonotus rissoanus*
Snubnose Slime Eel	*Simenchelys parasiticus*
Spiny Eel	*Notacanthus chemnitzi*
Trunkfish	*Lactophrys trigonus*
Winter Skate*	*Leucoraja ocellata*
* Most abundant species in expanded SEA area (and not described n original SEA). Sources: Scott and Scott 1988; DFO 2002.	

2.2.3.2 Blue Hake

The blue hake is a benthopelagic species living on mud bottoms at depths of 1,300 to 2,500 m, rarely moving up into the water column. It prefers a water temperature of approximately 2 to 3°C. Within the study area it is found year round offshore in the abyssal area. It is not known if they spawn within the study area. Their diet consists mainly of benthic invertebrates, including crustaceans and squid. There are no records of predation, but it is suggested that the blue hake is preyed on by large benthic fishes (Scott and Scott 1988). This species is not fished commercially in Canadian waters.

2.2.3.3 Longnose Eel

The longnose eel is a bottom dwelling fish, found at depths ranging from 238 to 3,656 m, preferring water no warmer than 1.4 °C. They are found within the study area, in the deep abyssal south of the

Grand Banks and Banquereau Bank. They spawn in the summer. No migration is described for the longnose eel, therefore it is assumed that spawning occurs within the study area. There is no information available regarding its diet or predators (Scott and Scott 1988). This species is not fished commercially in Canadian waters.

2.2.3.4 Rock Grenadier

The rock grenadier is found in the deep waters of the continental slope and abyss, at depths of 350 to 2,500 m, and temperatures of 3.5 to 4.5°C. It undergoes a significant vertical diurnal feeding migration, moving as much as 480 m off the bottom to feed. Its food is primarily pelagic invertebrates and small fishes including crustaceans, euphausiids, and squid. Spawning does not occur within the study area (Scott and Scott 1988).

Rock grenadier are slow swimming fish and are prey for many other fishes including Greenland halibut and redfishes. They are not harvested commercially by Canadian fishermen, but were harvested by USSR fleets in the 1960s through the 1980s (Scott and Scott 1988).

2.2.3.5 Winter Skate

Winter skate are bottom dwelling fish found on sand and gravel substrates with preferred depth range of 37 to 90 m (Scott and Scott 1988). Within the study area they are found and harvested commercially on the eastern shoal of Banquerueau Bank and the slope waters of NAFO zone 4Vs (DFO 2002). Reproduction occurs by internal fertilization in the summer and fall, and likely occurs within the study area, although the precise location is unknown (Scott and Scott 1988).

The diet of the winter skate consists primarily of amphipods and polychaetes. Fishes such as sand lance, decapods, isopods and bivalves are also important food sources. They are preyed upon by sharks, other rays, and grey seals (Scott and Scott 1988).

2.2.4 Marine Birds

Following is a summary of existing knowledge of the marine birds that may occur in the Laurentian Subbasin. The reader is referred to Section 3.2.4 in the original SEA for a detailed discussion on marine birds that may occur in the Laurentian Subbasin.

The northern fulmar is most abundant in the Laurentian Subbasin during the winter and early spring. Shearwater are predominantly found in the study area in summer, and are most abundant from June through August (Brown 1986). Most of the North Atlantic population of Leach's storm-petrel (>1 million birds) nest in Newfoundland, with approximately 300,000 pairs nesting on islands off the south coast of Newfoundland. Wilson's storm-petrel may occur in the Laurentian Subbasin, but the largest

numbers occur at the mouth of the Bay of Fundy and Georges Bank (Tufts 1986). Approximately 5,500 pairs of northern gannets nest on the south coast of Newfoundland at Cape St. Mary's, east of the Laurentian Subbasin (Cairns et al. 1989). Outside of the breeding season, northern gannets are largely pelagic and are not likely to be found in the Laurentian Subbasin except during spring and fall as they move between inshore and offshore areas.

Herring gulls and great black-backed gulls are common and can be found in the study area throughout the year. Other less common gull species that may be present in fall, winter, and spring include glaucous gull, Iceland gull, and ivory gull. Arctic and common terns are present in the Laurentian Subbasin area in the spring and summer months, and are known to nest at approximately 50 sites along the south coast of Newfoundland and along the Nova Scotia coast and Sable Island. Other species of terns that may occur infrequently in the Laurentian Subbasin area include caspian tern, that nest in Newfoundland (Canadian Wildlife Service – Atlantic, unpublished data), and the roseate tern.

Six species of alcids may be found in the Laurentian Subbasin, with most generally occurring outside of the nesting season. The alcid group is comprised of common and thick-billed murres, razorbills, dovekies, Atlantic puffin, and black guillemot. Common and thick-billed murres are most abundant during the winter, although they may be found year-round in the Laurentian Subbasin area. The Atlantic puffin is observed during fall and winter, although less frequently than common and thick-billed murres. Similarly, razorbills are less common residents outside of the breeding season. Dovekies spend the winter months in the offshore and coastal areas of Newfoundland and Nova Scotia, and may use coastal bays in large numbers (Threfall and Goudie 1986).

A variety of coastal and nearshore birds may also be found in the region, including bald eagle, osprey, loons, grebes, great cormorant, double-crested cormorant, common eiders, scoters, long-tailed duck, and mergansers. The greatest concentration of waterfowl occurs around Cape St. Mary's and in Placentia Bay, to the east of the Laurentian Subbasin. Other less common species include American black duck, greater scaup, and common goldeneye. Harlequin ducks are listed as a species of special concern by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC). The species occurs off Cape St. Mary's during the winter and may number over 100 birds in some years (LGL Limited et al. 2000).

A variety of shorebird species occur in or near the study area, primarily as migrants foraging along the coastline prior to moving to wintering or breeding habitat. Several pairs of piping plovers, listed as endangered by COSEWIC, are known to nest along the south coast of Newfoundland at Burgeo and Port aux Basques (approximately 200 km and 300 km northwest of the Laurentian Subbasin, respectively), along the coast of Nova Scotia, and on Miquelon (LGL Limited et al. 2000).

Important bird areas in the region include Cape St. Mary's where several species of nesting marine birds, including northern gannets, black-legged kittiwakes, and common murres occur, several islands near the Burin Peninsula that are sites of large Leach's storm-petrel colonies, and sites along the

southwestern and eastern shores of Nova Scotia and along the south coast of Newfoundland where common eiders nest.

2.2.5 Marine Mammals and Sea Turtles

A number of marine mammal and sea turtle species are known or likely to occur in the Laurentian Subbasin.

2.2.5.1 Whales and Dolphins

The reader is referred to Section 3.2.5.1 in the original SEA. A number of species of whales and dolphins (cetaceans) are known or expected to occur in the general region of the Laurentian Subbasin. These are listed in Table 2, along with the population status of those that have been categorized by COSEWIC (2003a) and the U.S. *Endangered Species Act* (NMFS 2002a). There is no new information pertinent to the small increase of area in largely offshore waters.

Table 2 Cetaceans Known or Expected to Occur in the Laurentian Subbasin and Their Status Under Canadian and US Endangered Species Legislation

Common Name	Scientific Name	COSEWIC Status	U.S. *Endangered Species Act*
Northern Right Whale	*Eubalaena glacialis*	Endangered (species)	Endangered (species)
Minke whale	*Balaenoptera acutorostrata*		
Fin whale	*Balaenoptera physalus*	Special Concern (Atl.)	Endangered (species)
Blue whale	*Balaenoptera musculus*	Endangered (Atl.)	Endangered (species)
Sei whale	*Balaenoptera borealis*		Endangered (species)
Humpback Whale	*Eubalaena glacialis*	Special Concern (NW Atl.)	Endangered (species)
Sperm Whale	*Physter macrocephalus*		Endangered (species)
Beluga Whale	*Delphinapterus leucas*	Endangered (St. Lawrence)	
Northern Bottlenose whale	*Hyperoodon ampulatus*	Endangered (Scot. Shelf)	
Sowerby's Beaked Whale	*Mesoplodon bidens*	Special Concern (Atl.)	
Killer Whale	*Orcinus orca*	Data deficient (NW Atl.)	
Long-finned Pilot Whale	*Globicephala melaena*		
White-beaked Dolphin	*Lagenorhynchus albirostris*		
Atlantic White-sided Dolphin	*Lagenorhynchus acutus*		
Short-beaked Comm. Dolphin	*Delphinus delphis*		
Bottlenose Dolphin	*Tursiops truncatus*		
Striped Dolphin	*Stenella coeruleoalba*		
Harbour Porpoise	*Phocoena phocoena*	Threatened (NW Atl.)	Candidate (Gulf of Maine)

Apart from the minke whale and harbour porpoise, both of which are known to frequent inshore waters, and only occasionally wander to deeper, offshore waters, cetaceans appeared much more thinly spread in the Gulf than on the eastern Scotian Shelf. It cannot, however, be inferred that cetaceans in the Laurentian Subbasin may be found in approximately intermediate densities. There are two main reasons for this: 1) because both the Gulf and the Eastern Scotian Shelf have areas where cetaceans are

concentrated, the overall estimates may be misleading if such concentration also occur in the Laurentian Subbasin, and 2) some species are known to migrate via the Cabot Strait to spend the ice-free season in biologically rich areas of the Gulf, and may or may not spend much time passing through the Laurentian Subbasin.

The endangered northern right whale has a total population of about 300 based on re-sightings analysis (NMFS 2002b), and its endangered status is well known. In Canadian waters it spends summers primarily in the Bay of Fundy and on the western Scotian Shelf (Breeze et al. 2002). As a north-south migrant species, any rare wanderings through the Laurentian Subbasin would be most likely from spring through late summer, and individuals could conceivably pause to feed on the large concentrations of descended *Calanus* copepods known to occur in the channel (Zakardjian et al. in press).

The minke whale, the smallest baleen whale in the region, tends to feed on schooling pelagic fishes and smaller groundfishes. Although there are be no published observations of it in the Laurentian Subbasin, it certainly occurs regularly there, especially as spring and fall migrants, and mostly on the flanking banks.

The fin whale is the most abundant large whale in the general region, its numbers augmented in summer by migration from more southern waters. They are known to migrate into and out of the Gulf, within which they are associated with the steep contours of the Laurentian Channel (Sergeant 1977; Kingsley and Reeves 1998). This species undoubtedly migrates regularly through the Laurentian Subbasin area, especially in the Laurentian Channel, spring and fall, with some lingering as summer residents.

The blue whale is the largest baleen whale, with a western North Atlantic stock largely in Canadian waters, but extending south of northeastern U.S. in winter (NMFS 2002). It is possible that a significant proportion of the western North Atlantic stock of blue whales passes through or pauses in the Laurentian Subbasin, mostly in the deeper parts and mostly during spring, summer, and fall.

The sei whale is a temperate species appearing in the region in summer, and consuming mostly copepods and euphausiids. During the summer feeding season it may be mostly concentrated off the banks of the Scotian Shelf, where individual sightings (Mitchell and Chapman 1977) are clustered off southwest Nova Scotia along the shelf break and around The Gully, and in and around the Laurentian Subbasin. It is possible that the sei whale is more frequent during summer in the deeper parts of the Laurentian Subbasin than might be suggested by its general status off Atlantic Canada.

The humpback whale is characterized by Breeze et al. (2002) as “known” to summer in a large area southwest of Sable Island Bank and around The Gully, and of “probable regular occurrence” in the outer half of the Scotian Shelf to about the middle of Banqueau Bank. Whitehead et al. (1998) document sightings from The Gully between May and November. Thus, the weight of evidence is that the species

is expected to occur, probably uncommonly, as a spring-fall transient and summer resident both in the channel and on flanking banks of the study area.

The sperm whale is the largest toothed whale. The Canadian population is comprised of almost all males (Mitchell 1974; Reeves and Whitehead 1997). The slopes and deep waters of the entrance to the Laurentian Channel appear to be a suitable environment for sperm whales, which are therefore expected to occur more commonly than other large whales in the Laurentian Subbasin area, mostly in summer, but probably at all times of year.

The endangered (COSEWIC 2003a) population of beluga whale in the lower St. Lawrence River is found mostly upstream from the Gulf proper, and it was not detected there in a 1995 aerial survey (Kingsley and Reeves 1998). Because extralimital strays to Atlantic Canada have included a known individual from this population (Brown Gladden et al. 1999), there is a possibility that an occasional beluga could stray to the Laurentian Subbasin, possibly at any time of year.

Although the northern bottlenose whale as a species is not listed under the U.S. *Endangered Species Act* (NMFS 2002a; 2002b), the status of its Scotian Shelf population (formerly listed as The Gully population) was recently elevated to "endangered" (COSEWIC 2003a). The northern bottlenose whale is potentially a species of primary concern in the Laurentian Subbasin. Although there appears to be no record of it from the area, there would appear to be suitable habitat along the slopes and depths of the channel and it could occur at any time of year.

Sowerby's beaked whale is listed by COSEWIC as of "special concern". Because of its proclivity for deeper waters, it is likely to occur in the study area, at least in small numbers, possibly at any time of year.

The killer whale in the western North Atlantic may form a single, wide-ranging stock, but its status is virtually unknown (NMFS 2002b). Because it is very wide-ranging, it is almost certain to occur in the Laurentian Subbasin area, if only as a rare transient.

The long-finned pilot whale is widespread in the western North Atlantic. Its relative abundance in aerial surveys of both the Scotian Shelf and Gulf of St. Lawrence suggests that it may be equally concentrated in the Laurentian Subbasin area, both as a transient and resident predominately in the deeper parts.

The white-beaked dolphin ranges widely in northern seas. Its regularity off eastern Newfoundland strongly suggests that it occurs in the Laurentian Subbasin (throughout) at any time of year. The white-sided dolphin is as wide-ranging as the white-beaked dolphin, but commonly extends further south along the US East Coast, where it is categorized as a "nearshore species" (Hamazaki 2002). As it was the most common species in aerial surveys of the Scotian Shelf, and outnumbered only by the more strictly coastal harbour porpoise in surveys of the Gulf of St. Lawrence, it could be the most common cetacean

species in the Laurentian Subbasin, possibly with spring and fall peaks involving migration of the putative Gulf of St. Lawrence stock.

The short-beaked common dolphin is certain to occur, at least in small numbers, in both shelf and channel areas of the Subbasin, during summer. A "western North Atlantic offshore stock" of the bottlenose dolphin frequents deep, offshore waters as far north as Atlantic Canada in summer. Although it could occur in the Laurentian Subbasin area in summer, especially in the channel, it is unlikely to do so frequently or in large numbers. Striped dolphins form a western North Atlantic stock. This species could occur, perhaps only occasionally and in small numbers, during the summer months, in the Laurentian Subbasin area. The harbour porpoise is thought to form four genetically distinct (mitochondrial DNA) resident stocks in the western North Atlantic: Gulf of Maine and Bay of Fundy; Gulf of St. Lawrence; Newfoundland; and Greenland (NMFS 2002b). Given the existence of stocks in the Gulf and around Newfoundland, it certainly occurs in the Laurentian Subbasin area, especially on the flanking shelves, but is not likely to be frequent or common there.

A number of other cetaceans are known to have occurred only very rarely in Atlantic Canada (see Breeze et al. 2002 for a brief summary). None has been given endangered status by COSEWIC (2003a) or NMFS (2002a). Because they are widespread but rare throughout their ranges, or regularly occur only in regions remote from the study area, they are not considered here.

2.2.5.2 Seals

The reader is referred to Section 3.2.5.2 in the original SEA. Four species of phocid seals are known or expected to occur in the Laurentian Subbasin: grey seal, harp seal, harbour seal and hooded seal. Only the harbour seal is rated by COSEWIC (2003a), and only as "data deficient". None is on the U.S endangered species list (NMFS 2002a). Occasional visits by the arctic-subarctic ringed seal, which has bred along the Quebec North Shore, bearded seal, and rarely, by the walrus, can be ignored in the present context. There is no new information pertinent to the small increase of area in largely offshore waters.

2.2.5.3 Sea Turtles

The reader is referred to Section 3.2.6 in the original SEA. Two species of sea turtles are known as regular summer migrants to Atlantic Canada, the leatherback turtle and Atlantic loggerhead turtle. A third, Kemp's Ridley turtle, is rare and has only occurred south of the study area, and is not considered further here. There is no new information pertinent to the small increase of area in largely offshore waters.

2.2.5.4 Summary of Status of Marine Mammals and Sea Turtles in the Study Area

Information detailed in the original SEA (Sections 3.2.5 and 3.2.6) is summarized in Table 3, with reference to the relative abundances, habitats, and seasons of occurrence. Only broad categorizations can be made, and Table 3 is best taken as a series of predictions about the Laurentian Subbasin area, and as a measure of knowledge deficiencies that should be addressed (see Section 4.3.2). A "?" indicates particularly uncertain status. Of special interest in any environmental assessment are those species designated by endangered species legislation in Canada, the U.S., or both (Table 2). It will be seen that the status of a number of these species is uncertain (with "?"), amplifying the need to address these knowledge deficiencies for the study area.

Table 3 Summary of Likely Marine Mammal and Sea Turtle Presence in the Study Area

Species	Occurrence	Seasonality	Habitat
Northern Right Whale	Infrequent, rare	Summer	Mostly channel
Minke Whale	Regular, common	Spring, Summer, fall	Mostly banks
Fin Whale	Regular, uncommon	Spring, summer, fall	Throughout
Blue Whale	Regular, uncommon	All year, mostly spring, fall	Mostly channel
Sei Whale	Regular, uncommon	Summer	Mostly channel
Humpback Whale	Regular, uncommon	Spring, summer, fall	Mostly banks
Sperm Whale	Regular, uncommon	All year, mostly summer	Throughout
Northern Bottlenose Whale	Infrequent, rare?	All year?	Channel
Sowerby's Beaked Whale	Infrequent, very rare	All year?	Channel
Killer Whale	Almost never, very rare	All year	Throughout?
Long-finned Pilot Whale	Regular, common	All year?	Throughout
White-beaked Dolphin	Regular, common?	All year?	Throughout
Atlantic White-sided Dolphin	Regular, common	All year, mostly spring, fall	Mostly channel
Short-beaked Common Dolphin	Irregular, uncommon	Summer	Throughout
Bottlenose Dolphin	Irregular, rare	Summer	Mostly channel
Striped Dolphin	Irregular, uncommon	Summer	Mostly banks
Harbour Porpoise	Regular, uncommon?	All year?	Mostly banks, inshore
Beluga Whale	Infrequent, very rare	All year?	Throughout
Grey Seal	Regular, common	Mostly summer	Throughout
Harp Seal	Regular, uncommon	Late winter, early spring	Throughout
Harbour Seal	Regular, uncommon	All year	Mostly banks, inshore
Hooded Seal	Regular, uncommon?	Especially late winter?	Mostly channel?
Leatherback Turtle	Regular, uncommon	Summer	Channel
Loggerhead Turtle	Regular, rare?	Summer	Channel
Kemp's Ridley Turtle	Almost never, very rare	Summer	Channel

2.2.6 Special Areas

At present there are no designated marine protected areas within the expanded study area. The Stone Fence is an area located along the southwestern side of the Laurentian Channel, along the shelf break of Banquereau Bank (Figure 4), extending a distance of approximately 100 km. This feature is recognized as providing habitat for a variety of fish species, and is a favoured fishing area with a wide variety of fish caught. The area sees considerable fishing activity for a wide variety of species, including cod, redfish, halibut, American plaice, flounder, skate, swordfish, shark, cusk and white hake in recent years. Deep-sea corals are also known to occur at the site. The Stone Fence is recognized as an area of special ecological and social importance in the general region.

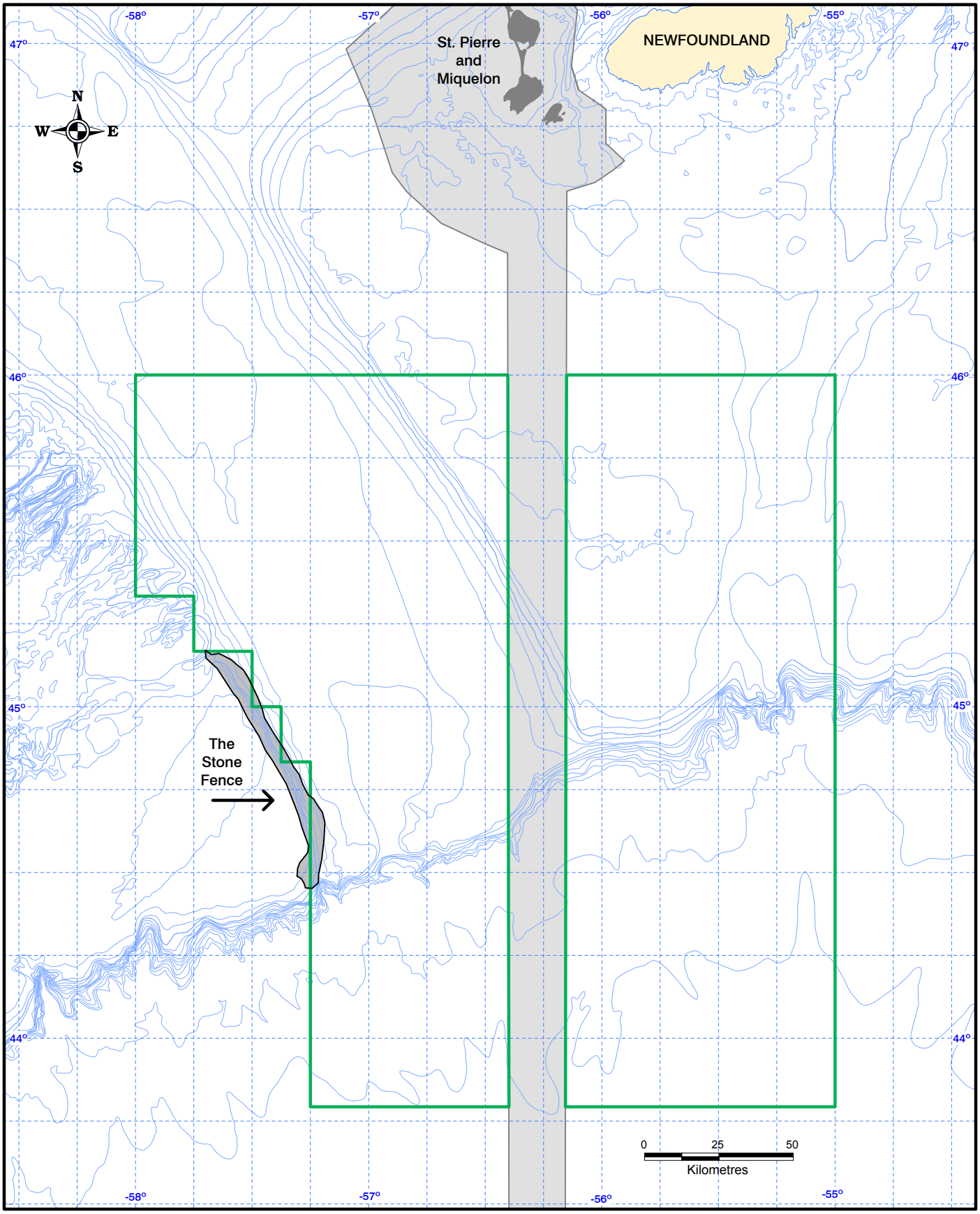
2.3 Socioeconomic Environment

2.3.1 The Fishery

The reader is referred to Section 3.3.1 in the original SEA. The fishery has played an important role in the history of Atlantic Canada, and remains an integral component of the economy of the region.

Fisheries in the Laurentian Subbasin with the highest landed values in recent years have been those for cod and snow crab. A number of other fisheries, including those for Iceland scallop, redfish and Atlantic halibut, have also had relatively high landed values in recent years. Most fishing in the study area (considering both fishing effort and landed value) takes place in the fall (October to December) period, but fishing does occur in all seasons. Based on fishing effort and the value of landings, some of the major fisheries in the Laurentian Subbasin by season include:

- redfish, cod and Atlantic halibut fisheries from January to March;
- snow crab, cod, Atlantic halibut, skate and Iceland scallop fisheries from April to June;
- cod, snow crab and swordfish fisheries from July to September; and
- cod, snow crab and redfish fisheries from October to December.



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Jacques Whitford Environment Limited
Environmental Scientists
Consulting Engineers

Figure 4

THE STONE FENCE
(Approximate Location)

Based on the spatial distribution of commercial fishing activity in the study area in recent years, the following general trends are evident:

- In winter (January to March), fishing activity has been concentrated primarily along the shelf in the southern portion of the study area, as well as to the northwest within the Laurentian Channel;
- In spring (April to June), fishing has occurred primarily along the shelf in the southeastern portion of the study area, as well as over the St. Pierre Bank and Halibut Channel and along the bank slope. Fishing activity in the northeastern corner of the study area is of particular significance in terms of landed value (primarily for snow crab);
- In summer (July to September), fishing activity is relatively more dispersed throughout the region, with fishing occurring on the St. Pierre Bank and Halibut Channel, along the shelf area, and along the slopes and within the Laurentian Channel. Again, fisheries in the northeastern portion of the study area are especially lucrative (mostly crab);
- In the fall period (October to December), considerable fishing activity occurs along the shelf in the southern part of the study area, as well as throughout the eastern portion of the area over the St. Pierre Bank and slope. Relatively lucrative fisheries (including those for cod, crab and other species) occur in the northeastern and east-central parts of the study area.

The highest vessel densities for fixed gear fisheries occur from April to June on the southern edge of the St. Pierre Bank, off the Burin Peninsula and in Fortune and Placentia Bay; and from July to September around Cape Breton Island and the middle Nova Scotia Shelf. The most intensive fishing activity with mobile gear occurs from April to June off the Nova Scotia Shelf and mostly in the Banquereau area.

DFO undertakes fisheries surveys in spring and fall (Newfoundland Region) and spring and summer (Maritimes Region) to assess fisheries stock status.

Expansion of the study area results in very little change in the description of the Existing Environment for Fisheries since most fisheries are prosecuted on, rather than off, the shelf. The statistics most affected by the expansion of the study area are for deeper water fisheries (Table 4 (Table 3.16 of the original SEA)). Total catch from 1995 to 2001 for redfish, Atlantic halibut, swordfish and pollock all increase by more than $0.5 million. Increases in catch statistics for other species are less pronounced. However, and with the exception of the summer fishery for swordfish, major fisheries trends observed from fisheries data and described in the Fisheries Section (Section 3.3.1 of the original SEA) remain unchanged. The distribution of all fisheries, including these deeper water species, is provided in Appendix C of the original SEA. Please note that the original Table 3.16 (Table 4) has been corrected, where bigeye tuna had been mistakenly identified as bluefin tuna.

Table 4 Value of Landings by Species by Season in the Study Area (1995-2001)

Species	Winter (Jan - Mar)	Spring (Apr - Jun)	Summer (Jul - Sept)	Fall (Oct - Dec)	Total
Cod	$4,023,223	$2,240,202	$5,068,889	$15,083,317	**$26,415,631**
Snow crab	$0	$10,348,300	$4,938,117	$5,575,302	**$20,861,719**
Redfish	$5,378,099	$818,797	$572,740	$2,343,064	**$9,112,699**
Atlantic halibut	$3,361,846	$1,660,398	$325,112	$981,562	**$6,328,919**
Iceland scallop	$0	$1,015,586	$918,390	$613,689	**$2,547,664**
Pollock	$256,801	$333,610	$816,171	$571,713	**$1,978,295**
Skate	$44,728	$1,144,563	$120,909	$318,824	**$1,629,024**
White hake	$398,992	$295,903	$503,806	$369,342	**$1,568,043**
Porbeagle shark	$4,802	$699,261	$323,814	$514,031	**$1,541,908**
Swordfish	$0	$0	$1,379,788	$2,933	**$1,382,721**
American plaice	$245,343	$62,850	$321,271	$362,297	**$991,760**
Greenland halibut (turbot)	$38,090	$331,057	$195,923	$108,554	**$673,623**
Sea scallop	$0	$73,656	$511,924	$53,032	**$638,612**
Witch flounder	$312,155	$13,200	$4,668	$257,239	**$587,262**
Haddock	$63,211	$55,081	$239,574	$193,024	**$550,889**
Monkfish	$12,926	$199,891	$127,152	$34,816	**$374,785**
Yellowtail flounder	$25,778	$1,911	$52,035	$216,917	**$296,641**
Shrimp	$0	$59,030	$158,389	$0	**$217,419**
Arctic surf clam	$0	$95,663	$0	$0	**$95,663**
Cusk	$14,673	$19,099	$9,902	$13,999	**$57,674**
Bigeye tuna	$0	$0	$12,414	$0	**$12,414**
Total	**$14,180,668**	**$19,436,360**	**$16,632,683**	**$27,613,655**	**$77,863,365**

Note: The information provided in this table is for directed fisheries that have occurred within the boundaries of the study area from 1995 to 2001. Values are derived from the available geospatial data on fisheries distributions (See original SEA Appendix C, Table 1 and 2).

3.0 ASSESSMENT SCOPE AND METHODOLOGY

The methodology used in the original SEA is used in this addendum. The reader is referred to Section 4 of the original SEA.

4.0 ENVIRONMENTAL EFFECTS ANALYSES

4.1 Fish and Fish Habitat

4.1.1 Potential Interactions and Existing Knowledge

The reader is referred to Section 5.1.1 in the original SEA for a discussion of the potential interactions and existing knowledge between offshore seismic surveys and drilling activities and fish and fish habitat.

4.1.2 Environmental Planning and Management Considerations

There are no additional environmental planning or management considerations as a result of the change in delineation of the study area. The reader is referred to Section 5.1.2 in the original SEA for a discussion of environmental planning and management considerations.

4.1.2.1 Species at Risk

Currently there are four species of marine fish within the original and expanded study area listed with COSEWIC as threatened species: cusk (recently added), Atlantic cod, the northern wolffish, and the spotted wolffish. The Atlantic wolffish is listed as a species of special concern. However, there are COSEWIC status reports being prepared for the following species occurring in the study area: barndoor skate, Acadian redfish, blue hake, porbeagle, roughhead grenadier, roundnose grenadier, spinytail skate, and winter skate. These new reports are either under review (blue hake, porbeagle, roughhead grenadier, roundnose grenadier, spinytail skate, and winter skate) or in draft preparation (barndoor skate and Acadian redfish); and are not considered final until a species is designated at a Species Assessment Meeting, indicated to be either May 2004 (Acadian redfish, blue hake, porbeagle, roughhead grenadier, roundnose grenadier and spinytail skate), May 2005 (winter skate) or a date not yet determined (barndoor skate) (COSEWIC 2003b).

4.1.2.2 Other Special Areas and Sensitive Times

The reader is referred to Section 5.1.2.2 of the original SEA. There are no other special areas or sensitive times in the expanded area.

4.1.3 Cumulative Environmental Effects

The expanded study area does not change the anticipated cumulative effects of offshore exploration and development on fish and fish habitat. The reader is referred to Section 5.1.3 in the original SEA for a discussion on the cumulative environmental effects to fish and fish habitat.

4.1.4 Summary

A summary of the activities likely to occur in association with seismic surveys and exploration drilling programs in the Laurentian Subbasin and potential interactions with fish and fish habitat is provided in Table 5. There is no change from the summary provided in Section 5.1.1.9 of the original SEA.

Table 5 Potential Environmental Interactions and Mitigation Summary – Fish and Fish Habitat

Components / Activities	Potential Environmental Interactions	General Mitigation Measures and Applicable Compliance Standards
SEISMIC SURVEYS		
Air Gun Operations	• possible injury, mortality or avoidance	• minimization of airgun source level • use of "soft-start" procedures • avoidance of sensitive areas and times
Vessel Traffic	• possible avoidance • discharges causing contamination	• minimize discharges; compliance with the *Canada Shipping Act* and other relevant regulations
DRILLING		
Planned Activities		
Vessel Traffic	• possible avoidance • discharges causing contamination	• minimization of traffic volume • use of existing and common travel routes where possible • minimize discharges; compliance with the *Canada Shipping Act* and other relevant regulations
Aircraft Traffic	• possible avoidance	• avoid low-level operations • minimization of activity
Presence of Structures / Lights	• possible attraction	
Over-the-side Discharges		
- Sewage, Deck Drainage, Bilge/Cooling Water, Wash Fluids	• contamination, taint, bioaccumulation • decreased water quality • habitat alteration	• compliance with 2002 OWTG • chemical screening and selection • use of an oily water separator to process contained deck drainage; collected oil shipped to shore • shipping of all solid and hazardous waste to onshore disposal facilities
- Drill Cuttings	• smothering of benthic communities • contamination, taint, bioaccumulation • decreased water quality • habitat alteration	• use of WBMs where possible • use of low-toxicity drilling fluids • treatment of SBM-associated drill cuttings to compliance with 2002 OWTG prior to discharge • chemical screening and selection
Discharges at Depth		
- Drilling Muds (WBMs) - Drill Cuttings	• smothering of benthic communities • contamination, taint, bioaccumulation • decreased water quality • habitat alteration	• compliance with 2002 OWTG • chemical screening and selection
Atmospheric Emissions (Exhaust, Gas Venting/Flaring)	• particulate deposition on water	• use of high efficiency burners

Components / Activities	Potential Environmental Interactions	General Mitigation Measures and Applicable Compliance Standards
Well Testing	• contamination	• atomize produced water with hydrocarbons in flare • compliance with 2002 OWTG
Well Abandonment		
- Mechanical Separation	• n/a	
- Chemical Explosives	• blasting effects (if required)	• use of mechanical separation where possible • design of well and casings to ensure effective mechanical cutting and recovery • scheduling of blasting • 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		
Fuel/Oil Spills (surface and subsurface)	• toxicity and bioaccumulation • plankton kill • decreased water quality	• prevention and design considerations • oil spill preparedness and response procedures

4.2 Marine Birds

4.2.1 Potential Interactions and Existing Knowledge

The reader is referred to Section 5.2.1 of the original SEA for a discussion of the potential interactions between offshore seismic surveys and drilling programs and marine birds.

4.2.2 Environmental Planning and Management Considerations

There are no additional environmental planning or management considerations as a result of the change in delineation of the study area. The reader is referred to Section 5.2.2 of the original SEA for a discussion of environmental planning and management considerations related to marine birds.

4.2.2.1 Occurrence and Spatial and Temporal Trends

There are no changes to occurrences and spatial and temporal trends of marine birds as a result of the change in delineation of the study area. The reader is referred to Section 5.2.2.1 of the original SEA for a discussion of occurrence and spatial and temporal trends of marine birds in the study area.

4.2.2.2 Species at Risk

No additional species at risk are identified as a result of the change in delineation of the study area. The reader is referred to Section 5.2.2.2 of the original SEA for a discussion of species at risk within the study area.

4.2.3 Cumulative Environmental Effects

The expanded study area does not change the anticipated cumulative effects of offshore exploration and development on marine birds. The reader is referred to Section 5.2.3 of the original SEA for a discussion on cumulative environmental effects to marine birds.

4.2.4 Summary

A summary of the activities likely to occur in association with seismic surveys and exploration drilling programs in the Laurentian Subbasin and potential interactions with marine birds is provided in Table 6. There is no change from the summary provided in Section 5.2.1.5 of the original SEA.

Table 6 Potential Environmental Interactions and Mitigation Summary – Marine Birds

Components / Activities	Potential Environmental Interactions	General Mitigation Measures and Applicable Compliance Standards
SEISMIC SURVEYS		
Air Gun Operations	• effects to some diving bird species	• minimization of airgun source level • use of "soft-start" procedures
Vessel Traffic	• attraction and disturbance	• minimize discharges; compliance with the *Canada Shipping Act* and other relevant regulations
DRILLING		
Planned Activities		
Vessel Traffic	• attraction and disturbance	• avoidance of bird colonies and large aggregations of avifauna • minimization of vessel traffic • minimize discharges; compliance with the *Canada Shipping Act* and other relevant regulations
Aircraft Traffic	• disturbance	• avoidance of bird colonies and large aggregations of avifauna • minimization of activity • avoidance of low-level operations
Presence of Structures / Lights	• attraction and disturbance • stranding	• collection and release of birds stranded on installations
Over-the-side Discharges		
- Sewage, Deck Drainage, Bilge/Cooling Water, Wash Fluids	• bird mortality • effects on prey species	• treatment of operational discharges prior to release in compliance with applicable guidelines (OWTG) • screening of chemicals through the OCSG
- Drill Cuttings	• effects on prey species	• use of WBMs where possible • treatment to compliance with 2002 OWTG • chemical screening and selection
Discharges at Depth		
- Drilling Mud (WBMs)	• effects on prey species	• compliance with 2002 OWTG • chemical screening and selection
- Drill Cuttings	• effects on prey species	
Atmospheric Emissions (Exhaust, Gas Venting/Flaring)	• bird mortality	• use of high efficiency burners
Well Testing	• bird mortality and effects on prey species	• atomize produced water with hydrocarbons in the flare • compliance with 2002 OWTG

Components / Activities	Potential Environmental Interactions	General Mitigation Measures and Applicable Compliance Standards
Well Abandonment		
- Mechanical Separation	• n/a	
- Chemical Explosives	• effects of blasting (if required) • effects on prey species	• use of mechanical separation where possible • design of well and casings to ensure effective mechanical cutting and recovery • scheduling of blasting • 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		
Fuel/Oil Spills (surface and subsurface)	• bird mortality • effects on prey species	• oil spill prevention • oil spill preparedness and response plans

4.3 Marine Mammals and Sea Turtles

4.3.1 Potential Interactions and Existing Knowledge

The reader is referred to Section 5.3.1 of the original SEA for a discussion of the potential effects on marine mammals and sea turtles that may result from seismic surveys and exploratory drilling.

4.3.2 Environmental Planning and Management Considerations

There are no additional environmental planning or management considerations as a result of the change in delineation of the study area. The reader is referred to Section 5.3.2 of the original SEA for a discussion of the environmental planning and management considerations related to marine mammals and sea turtles. Sections in the original SEA, and the summary in Table 7, make it clear that inferences about Marine Mammal and Sea-Turtle VECs within the Laurentian Subbasin are at best predictions based on limited knowledge from other regions.

4.3.3 Cumulative Environmental Effects

The expanded study area does not change the anticipated cumulative effects of offshore exploration and development on marine mammals and sea turtles. The reader is referred to Section 4.3.3 for a discussion on cumulative environmental effects to marine mammals and sea turtles.

4.3.4 Summary

A summary of the activities likely to occur in association with seismic surveys and exploration drilling programs in the Laurentian Subbasin and potential interactions with marine mammals and sea turtles is provided in Table 7. There is no change from the summary provided in Section 5.3.1.7 of the original SEA.

Table 7 Potential Environmental Interactions and Mitigation Summary – Marine Mammals and Sea Turtles

Components / Activities	Potential Environmental Interactions	General Mitigation Measures and Applicable Compliance Standards
SEISMIC SURVEYS		
Air Gun Operations	• avoidance, attraction, interference with vocal communication, injury	• minimization of airgun source level to minimum practical for survey • use of "soft-start" procedures
Vessel Traffic	• attraction, disturbance	• minimize discharges; compliance with the *Canada Shipping Act* and other relevant regulations
DRILLING		
Planned Activities		
Vessel Traffic	• attraction, disturbance	• minimization of traffic volume • use of existing and common travel routes where possible • minimize discharges; compliance with the *Canada Shipping Act* and other relevant regulations
Aircraft Traffic	• disturbance	• avoid overflights at low altitudes
Over-the-side Discharges		
- Sewage, Deck Drainage, Bilge/Cooling Water, Wash Fluids	• effects on marine mammal and sea turtle health • effects on food sources	• treatment of discharges (OWTG) • screening of chemicals through OCSG • oil water separator to treat contained deck drainage, collected oil shipped to shore • on-shore disposal of solid and hazardous wastes
- Drill Cuttings	• effects on marine mammal and sea turtle health • effects on food sources	• use of WBMs where possible • treatment to compliance with 2002 OWTG • chemical screening and selection
Discharges at Depth		
- Drilling Mud (WBMs)	• effects on food sources	• compliance with 2002 OWTG • chemical screening and selection
- Drill Cuttings	• effects on food sources	
Atmospheric Emissions (Exhaust, Gas Venting/Flaring)	• n/a	
Well Testing	• effects on marine mammal and sea turtle health • effects on food sources	• compliance with 2002 OWTG • atomize produced water with hydrocarbons in the flare
Well Abandonment		
- Mechanical Separation	• n/a	
- Chemical Explosives	• effects of blasting (if required)	• use of mechanical separation where possible • design of well and casings to ensure effective mechanical cutting and recovery • scheduling of blasting • marine mammal surveillance; delay of detonation until observed marine mammals are out of the area • 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

Components / Activities	Potential Environmental Interactions	General Mitigation Measures and Applicable Compliance Standards
Unplanned Events		
Fuel/Oil Spill (surface and subsurface)	• effects on marine mammal and sea turtle health	• oil spill prevention and preparedness • oil spill response plan

4.4 Fisheries

4.4.1 Potential Interactions and Existing Knowledge

The reader is referred to Section 5.4.1 of the original SEA for a discussion on the potential effects and existing knowledge as related to fisheries.

4.4.2 Environmental Planning and Management Considerations

There are no additional environmental planning or management considerations as a result of the change in delineation of the study area. The reader is referred to Section 5.4.2 of the original SEA for a discussion on environmental planning and management considerations.

4.4.3 Cumulative Environmental Effects

The expanded study area does not change the anticipated cumulative effects of offshore exploration and development on the fisheries. The reader is referred to Section 5.4.3 of the original SEA for a discussion of cumulative environmental effects to the fisheries.

4.4.4 Summary

A summary of the activities likely to occur in association with seismic surveys and exploration drilling programs in the Laurentian Subbasin and potential interactions with commercial fisheries is provided in Table 8. There is no change from the summary provided in Section 5.4.1.7 of the original SEA.

Table 8 Potential Environmental Interactions and Mitigation Summary – Fisheries

Components / Activities	Potential Environmental Interactions	General Mitigation Measures and Applicable Compliance Standards
SEISMIC SURVEYS		
Air Gun Operations	• behavioural / biophysical effects on fish • reduction in fish catches	• minimization of airgun source levels • use of "soft-start" procedures
Vessel Traffic	• temporary loss of access to fishing grounds • damage to fishing gear and vessels • increased communication • biophysical effects on fish	• where possible, coordinate activities with the fishing industry to reduce conflict/interaction with fishing activity during peak fishing times • discussion and communication with fishing industry • notification to mariners in a timely manner • compensation for gear damage • minimize discharges; compliance with the *Canada Shipping Act* and other relevant regulations
DRILLING		
Planned Activities		
Vessel Traffic	• temporary loss of access to fishing grounds • damage to fishing gear and vessels • increased communication • biophysical effects on fish	• discussion and communication with fishing industry • common traffic routes with other vessels, where practical • notification to mariners in a timely manner • compensation for gear damage • minimize discharges; compliance with the *Canada Shipping Act* and other relevant regulations
Aircraft Traffic	• n/a	
Safety Zone / Presence of Structures	• temporary loss of access to fishing grounds	• discussion and communication with fishing industry • small, temporary zone
Drilling / Discharges	• temporary loss of access to fishing grounds • damage to fishing gear and vessels • increased communication • biophysical effects on fish	• sequential approach to drilling (if multiple wells) • compliance with 2002 OWTG • chemical screening and selection
Atmospheric Emissions (Exhaust, Gas Venting/Flaring)	• n/a	
Well Testing	• damage to gear and vessels • effects on fish	• atomize produced water with hydrocarbons in the flare • compliance with 2002 OWTG
Well Abandonment	• loss of access to fishing grounds • damage to gear and vessels (if wellheads left in place) • effects on fish species (if blasting is required)	• discussion and communication with fishing industry • notifications to mariners in a timely manner • use of mechanical separation where possible • design of well and casings to ensure effective mechanical cutting and recovery • scheduling of blasting • 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		
Fuel/Oil Spills* (surface and sub-surface)	• temporary loss of access to fishing grounds • damage to gear and vessels • loss of market or market value • increased safety and communication	• design and prevention • oil spill preparedness and response • compensation for damage
* Note: Effects of oil spills on fishing gear and loss of access can often be remedied relatively quickly. However, loss of market and market value and the duration of any such effects depends on media coverage and public perception of fish taint.		

4.5 Effects of the Environment on Offshore Exploration

The reader is referred to Section 5.5 of the original SEA. The effects of the environment on offshore exploration in the original study area remain the same for the expanded area, including:

- extreme wind, wave and ice conditions;
- a region that is generally regarded as the most seismically active portion of the Newfoundland Continental Shelf (a number of significant earthquakes have occurred in the area over the past century);
- icebergs and sea ice (although less common than in other operating areas, icebergs do occasionally enter the study area and sea ice can occur in the Laurentian Subbasin);
- fog conditions;
- freezing precipitation is also an important consideration; and
- biofouling, or the colonization of structures by epibenthic communities; plankton blooms and possible interference with visual inspections of structures (time- and duration- dependent).

5.0 SUMMARY AND CONCLUSION

As there will be no new effects associated with the expanded study area, the conclusions/ recommendations in the original SEA (C-NOPB 2003) are valid and applicable to the expanded area. The reader is referred to Section 6.0 of the original SEA.

5.1 Summary of Environmental Planning and Management Considerations

The reader is referred to Section 6.1 in the original SEA. A number of the key environmental features of the study area are illustrated in Figure 5. A number of key environmental planning and management considerations related to future offshore exploration in the Laurentian Subbasin are summarized below:

- Several species at risk are known or likely to occur in or adjacent to the Laurentian Subbasin. Mitigating potential effects to species and habitats protected by the new *Species at Risk Act* will be an important consideration in decisions related to future offshore exploration.

- A number of areas and times are particularly important to fish and fish habitat in the region (e.g., spawning areas and periods; migration routes; areas of high productivity, etc.). Individual seismic programs should, where possible, be planned so as to reduce potential interactions during particularly sensitive times.

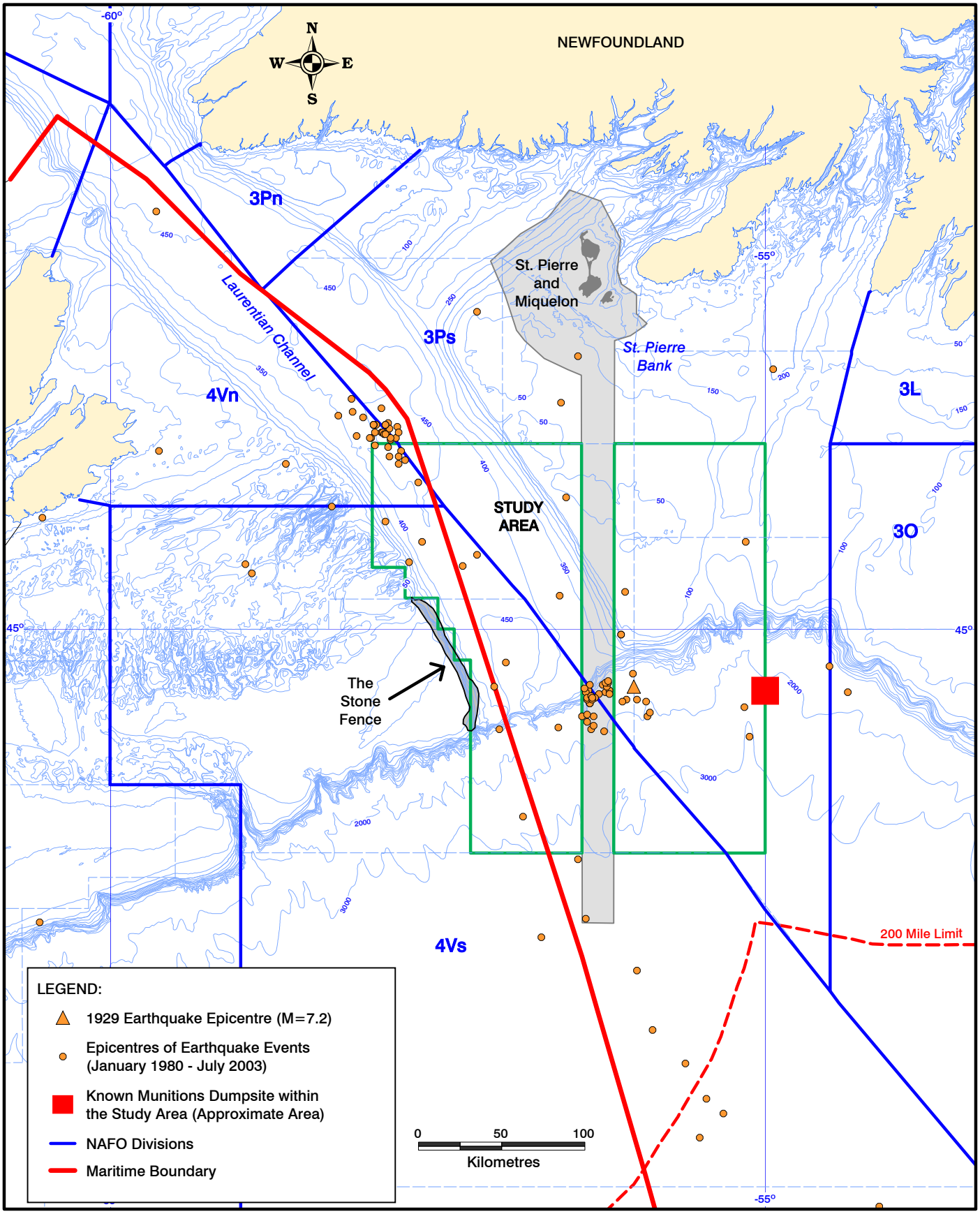

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Figure 5

LAURENTIAN SUBBASIN:
SELECT ENVIRONMENTAL FEATURES

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- Should exploration (particularly drilling) be proposed in the vicinity of the Stone Fence (or in other areas with known or likely coral aggregations or other sensitive features), additional information collection and mitigation measures may help to reduce any potential effects.

- A number of marine mammal and sea turtle species are known or likely to occur in the Laurentian Subbasin. In addition to standard mitigations, additional measures are available to help avoid or reduce potential effects on these species (e.g., surveillance), and may also be considered where necessary.

- Seismic surveys are, where possible, planned to coordinate program activities with the fishing industry to reduce potential conflict with commercial fishing activity during peak fishing times. On-going communication between the offshore petroleum and fishing industries is key.

- There is a known munitions dumpsite located on the southeastern edge of the study area (Figure 5), in the Newfoundland and Labrador Offshore Area of the Laurentian Subbasin. Operators should consider the possibility of underwater munitions being present in planning offshore work in the study area. The C-NOPB will require operators to consider potential interactions with such features in any future program-specific environmental assessments, which may result in the Board placing additional conditions on the program authorization or restricting certain activities in the area.

- The study area lies within a region that is generally regarded as the most seismically active portion of the Newfoundland Continental Shelf. The earthquake potential of the area will therefore require consideration in planning any future offshore petroleum activity in the Laurentian Subbasin.

5.2 Information Availability and Requirements

The reader is referred to Section 6.2 in the original SEA.

5.3 Cumulative Environmental Effects

The reader is referred to Section 6.3 in the original SEA. The potential environmental effects of offshore seismic surveys and drilling programs in the Laurentian Subbasin may interact with each other and/or with other projects and activities in the region to result in cumulative environmental effects. Consideration of cumulative environmental effects will be an on-going part of regulatory planning and decision-making regarding offshore exploration in the Laurentian Subbasin. This will minimize the potential for spatial and temporal interaction between individual seismic surveys and/or drilling programs in the area and their effects. Cumulative effects will therefore also be an important consideration in the environmental assessment and review of individual seismic surveys and exploration drilling programs, once specific locations and times are defined.

5.4 Conclusions

The results of the SEA indicate that exploration drilling programs and/or geoscientific programs could be undertaken in the expanded area, and the conversion of exploratory permits to exploration licences or the issuance of interests in the original and expanded study areas, respectively, may therefore proceed. The SEA provides an overview of the expanded study area's existing environmental setting and highlights what, if any, new information is available for the biological environment.

Following the issuance of interests (or exploration licences within in the original study area), all activities will require review and approval by the C-NOPB and C-NSOPB, and will be subject to project-specific environmental assessments. Subsequent assessments conducted in relation to individual seismic surveys and drilling programs will provide detailed information on proposed activities and their potential environmental effects, and will allow for informed decisions regarding the environmental acceptability of specific proposals. These project-specific environmental assessments will also determine whether these activities require specific mitigation measures and/or monitoring programs to further reduce or prevent potential environmental effects.

6.0 REFERENCES

This section contains new references used to prepare this addendum. The reader is referred to Section 7 in the original SEA for a complete list of references.

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