5.0 BIOLOGICAL ENVIRONMENT

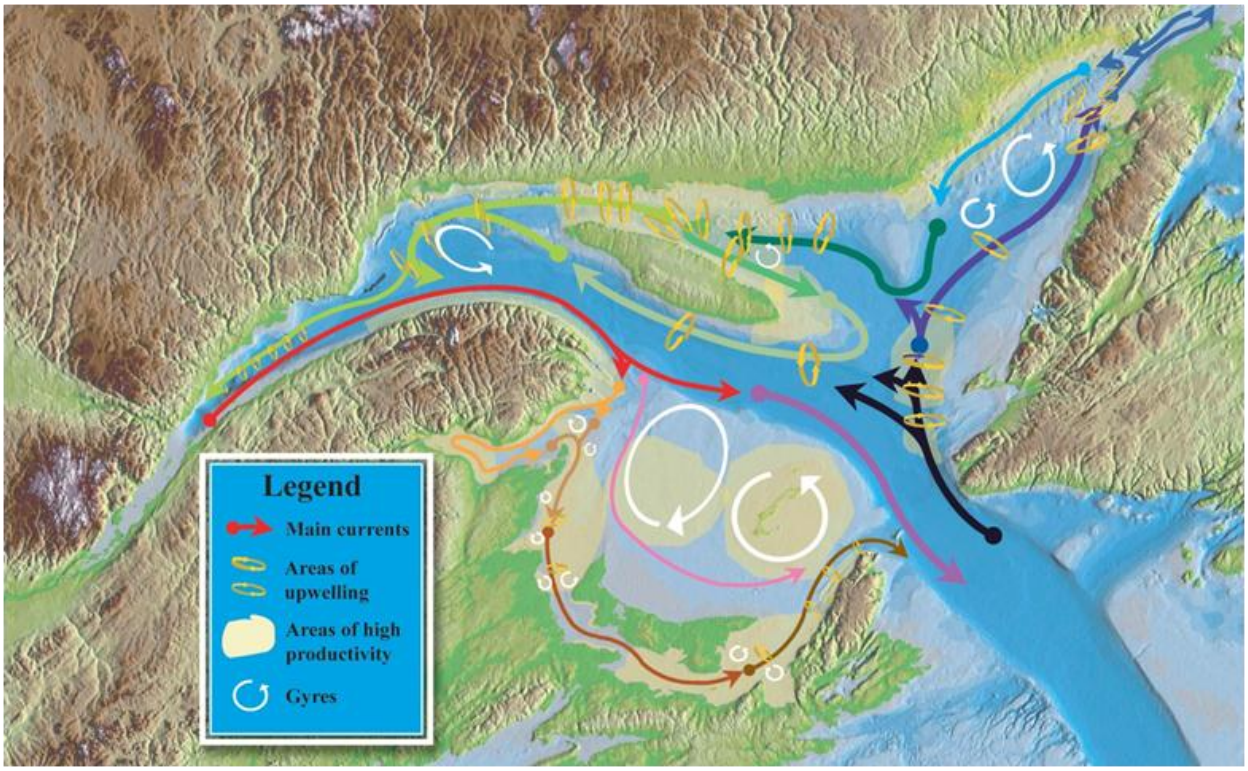
The biological environment in which the Project is located is described below at several different scales. Most information is presented for the Gulf in general or in relation to the offshore waters of Western Newfoundland. Where area-specific information is available, further details have been provided for EL 1105, recognizing that this is where the majority of Project activities will be focused. It is anticipated that a regional perspective on the biological environment of the Western Newfoundland offshore environment will be provided in the Western Newfoundland and Labrador SEA update (in preparation at time of writing).

5.1 Regional Overview

The Estuary and Gulf of St. Lawrence are described as a semi-enclosed sea with a unique marine ecosystem. This is a result of the Gulf being partially separated from the North Atlantic, receiving freshwater discharge from major rivers, a deep trough running along its length, seasonal ice, several water masses including a cold intermediate layer, regions of shallow water depths and plateaus and high biological productivity and diversity (DFO 2005a). There are only two openings in the Gulf that permit water exchange with the North Atlantic: the Strait of Belle Isle to the northeast of the Gulf through which cold, dense water flows in from the Arctic via the Labrador Current; and the Cabot Strait in the Laurentian Channel to the southeast of the Gulf, where Atlantic waters of the Gulf Stream flow into the Gulf. EL 1105 is located approximately 70 km northwest of the Cabot Strait in the Laurentian Channel.

The unique features of the Gulf give rise to enhanced areas of plankton production and biomass that establishes diverse benthic communities and also attracts feeding populations of fish, marine birds and marine mammals to the Gulf. These enhanced biological areas are a result of physical factors (*e.g.*, unique topography of the seafloor, oceanographic currents and winds), combined with chemical factors (*e.g.*, nutrient-rich waters), resulting in increased growth and production in the biological environment, and/or acting as a mechanism to steer, concentrate and retain marine populations into a smaller area, thereby yielding higher abundance and reproductive, rearing and feeding successes. An overview of these physical processes is illustrated in Figure 5.1.

The enhanced productivity of marine populations in the Gulf and protection from high energy waves and storms in the Atlantic Ocean have given rise to important commercial fisheries, vessel navigation routes, ports, marine mammal tourism, aquaculture, human settlements in coastal communities, with some populations of marine life declining substantially. This has resulted in certain marine species being listed as at risk by SARA for the Estuary and Gulf populations, or for marine populations that migrate to the Gulf during a stage of their life cycle. The species at risk include commercial fisheries species, marine birds and marine mammals, which are described in more detail in Section 5.2.



Source: http://www.glf.dfo-mpo.gc.ca/e0006095

Figure 5.1 Physical Processes and Major Areas of High Productivity for the Biological Environment in the Estuary and Gulf of St. Lawrence

5.2 Species at Risk

For the purpose of this environmental assessment, species at risk are defined as those species listed by SARA and/or assessed as Threatened, Endangered, or Special Concern by COSEWIC. Only those species listed on Schedule 1 of SARA are legally protected under the Act.

The purposes of SARA are to prevent Canadian indigenous species, subspecies, and distinct populations of wildlife from becoming extirpated or extinct, to provide for the recovery of endangered or threatened species, and to encourage the management of other species, to prevent them from becoming at risk. Under Section 32(1), “no person shall kill, harm, harass, capture or take an individual of a wildlife species that is listed as an extirpated species, an endangered species or a threatened species” as listed in Schedule 1 of SARA. Critical habitat, as defined under SARA, is “the habitat that is necessary for the survival or recovery of a listed wildlife species,” and is identified as such in a recovery strategy or action plan for that species.

Table 5.1 presents an overview of SARA-listed species at risk which may occur in the Gulf of St. Lawrence. Table 5.2 presents those species assessed by COSEWIC to be at risk, but are not yet listed on Schedule 1 of SARA. Additional details on these species are provided in subsequent sections.

Table 5.1 Species at Risk Occurring in the Gulf (SARA Schedule 1)

Common Name	Species Name	SARA Schedule 1 Status	Occurrence in Relation to EL 1105
Marine Fish			
Northern Wolffish	*Anarhichas denticulatus*	Threatened	Low potential for occurrence – May occur along the slope of the Laurentian Channel. Most commonly found inhabiting the seafloor in water depths of 500 to 1,000 m, although they can be found at shallower depths up to the surface. Spawning information is lacking for the Northern Wolffish. It is currently unknown if spawning migrations occur. Larvae may be present on the seafloor in fall to early winter.
Spotted Wolffish	*Anarhichas minor*	Threatened	Low potential for occurrence – May occur along the slope of the Laurentian Channel though populations are declining. Most commonly found inhabiting the seafloor in water depths of 200 to 750 m. Spawning information is lacking for the Spotted Wolffish. It is currently unknown if spawning migrations occur. Eggs / larvae may be present on the seafloor in summer to fall.
Atlantic (striped) Wolfish	*Anarhichas lupus*	Special Concern	Low potential for occurrence – May occur along the slope of the Laurentian Channel and the coast of western Newfoundland. Most commonly found inhabiting the seafloor in water depths of 150 to 350 m, although it has been found at depths from nearshore to 918 m. Short migrations to spawning in shallow waters during the Fall. Eggs / larvae may be present on seafloor in fall to early winter.
White Shark (Atlantic population)	*Carcharodon carcharias*	Endangered	Low potential for occurrence – Rare in Canadian waters (32 records in 132 years). Most records are located within the Bay of Fundy (the northern-most edge of their range). Extremely rare as far north as EL 1105.
Marine Birds			
Ivory Gull	*Pagophila eburnea*	Endangered	May occur in the Gulf during winter months, on pack ice, both offshore and in coastal areas.
Eskimo Curlew	*Numenius borealis*	Endangered	Likely extinct and extremely unlikely to be encountered in the Gulf.
Piping Plover *melodus* subspecies	*Charadrius melodus melodus*	Endangered	Breeds and forages on Atlantic Canada beaches during summer, including on the Magdalen Islands and in western Newfoundland.
Red Knot *rufus* subspecies	*Calidris canutus rufa*	Endangered	Uncommon passage migrant. One of most important areas for migration in eastern Canada is along the north shore of the St. Lawrence.
Roseate Tern	*Sterna dougallii*	Endangered	Occurs in low numbers at several remote islands in Nova Scotia, New Brunswick, and on the Magdalen Islands from April to early August, where they nest. This species exhibit high site fidelity and are unlikely to occur in western Newfoundland or elsewhere in the Gulf.
Barrow's Goldeneye (Eastern population)	*Bucephala islandica*	Special Concern	Breeds on high altitude lakes and nest in trees. In the non-breeding (summer) season, these ducks occur in coastal areas of the St. Lawrence Estuary and Gulf, where they feed.
Harlequin Duck (Eastern population)	*Histrionicus histrionicus*	Special Concern	Forages in nearshore marine waters during summer, fall, and winter. Prefers offshore islands, coastal headlands and exposed rocky coastlines during winter and move inland to rivers during spring for breeding. Could occur off western Newfoundland and coastal areas of the Gulf year round.
Horned Grebe (Magdalen Islands population)	*Podiceps auritus*	Endangered	Small (average approximately 15 adults), isolated population exists on the Magdalen Islands during summer months where they breed and feed. Wintering grounds are unknown but likely along the mainland Atlantic coastline.

Table 5.1 Species at Risk Occurring in the Gulf (SARA Schedule 1)

Common Name	Species Name	SARA Schedule 1 Status	Occurrence in Relation to EL 1105
Yellow Rail	*Cortunicops noveboracensis*	Special Concern	Unlikely to be encountered. Prefers marshy wet areas and coastal salt marshes. Few breeding records in southern New Brunswick and northern Nova Scotia.
Marine Mammals			
Blue Whale	*Balaenoptera musculus*	Endangered	Forages for krill in both coastal and offshore areas of the northern Gulf of St. Lawrence and eastern Nova Scotia during spring, summer and fall. May migrate through the Gulf and western Newfoundland waters during these months.
North Atlantic Right Whale	*Eubalaena glacialis*	Endangered	Occurs very occasionally in the Gulf during late summer (north shore and east of Gaspé) where it forages for copepods.
Northern Bottlenose Whale (Scotian Shelf population)	*Hyperoodon ampullatus*	Endangered	Rarely sighted as it is a pelagic, deep water species (>800 m), except that it is common to 'The Gully' off southeastern Nova Scotia, and in the Labrador Sea. Could occur rarely, and in low numbers, in the Gulf where it may feed in deep waters.
Beluga Whale (St. Lawrence Estuary population)	*Delphinapterus leucas*	Threatened	St. Lawrence Estuary represents its southern limit, however individuals and small groups are occasionally sighted in coastal Atlantic Canada waters, including the Gulf and western Newfoundland.
Fin Whale (Atlantic population)	*Balaenoptera physalus*	Special Concern	Concentrated in the Northwest Atlantic region during the summer months, including coastal and offshore waters of the Gulf and western Newfoundland to feed along oceanic fronts.
Sea Turtles			
Leatherback Sea Turtle	*Dermochelys coriacea*	Endangered	Forages along the Scotian Shelf and in the southern Gulf of St. Lawrence, from June to October, mainly feeding on jellyfish.

Table 5.2 Species Assessed as 'At Risk' by the Committee of the Status of Endangered Wildlife in Canada that may occur in the Gulf

Common Name	Species Name	COSEWIC Designation	Occurrence in Relation to EL 1105
Marine Fish			
Atlantic Cod (Laurentian North population)	*Gadus morhua*	Endangered	High potential for occurrence – Benthopelagic species that inhabits coastal waters as juveniles. Adults prefer deeper waters up to 500 m. Resident populations are also located within the coastal waters of Newfoundland. Eggs and Larvae may be present in upper water column from May to April.
Atlantic Cod (Laurentian South population)		Endangered	High potential for occurrence – Benthopelagic species that migrates from the southern Gulf to the waters of Cape Breton between May to October. The population is distributed throughout the southern Gulf during the summer and overwinters along the side of the Laurentian Channel, with dense aggregations typically occurring in the Laurentian Channel north of St. Paul Island. The entire population is known to use two migration routes, the Cape Breton Trough and the southern slope of the Laurentian Channel and thus can be found in proximity to EL 1105 during the spring and fall.
Atlantic Cod (Newfoundland and Labrador population)		Endangered	Low potential for occurrence - Atlantic Cod from this population inhabit waters from the Northern tip of Labrador to the Southern Grand Banks.

Table 5.2 Species Assessed as 'At Risk' by the Committee of the Status of Endangered Wildlife in Canada that may occur in the Gulf

Common Name	Species Name	COSEWIC Designation	Occurrence in Relation to EL 1105
Atlantic Cod (Southern population)		Endangered	Low potential for occurrence – Atlantic Cod from this population inhabit waters from the Bay of Fundy and Southern Nova Scotia to the southern extent of the Grand Banks.
Winter Skate (Southern Gulf of St. Lawrence population)	*Leucoraja ocellata*	Endangered	Low potential for occurrence – Located within the Southern Gulf. Closely associated with the seafloor and commonly inhabits waters approximately 100 m in depth. Could occur at any time of the year. Winter skate lay egg cases and emerge as juveniles. The seasonality of spawning is not well known.
Roundnose Grenadier	*Coryphaenoides rupestris*	Endangered	Low potential for occurrence - Closely associated with the seafloor commonly found inhabiting waters 800 to 1,000 m in depth. Could occur at any time of the year. Non-migratory spawning occurs in fall.
Porbeagle Shark	*Lamna nasus*	Endangered	Low potential for occurrence – Migrant in Atlantic Canadian waters. May be found in EL 1105 from May to late fall and are most often caught in water depths of 35 to 100 m.
Atlantic Salmon (Anticosti island population)	*Salmo salar*	Endangered	Low potential for occurrence – Juvenile Atlantic salmon migrating from freshwaters streams to the North Atlantic may pass through EL 1105, with any presence being transient in nature.
Atlantic Bluefin Tuna	*Thunnus thynnus*	Endangered	Low potential for occurrence – Atlantic bluefin tuna migrate into the Gulf following food stocks in July through December. Forms schools of <50 individuals.
Deepwater Redfish (Gulf of St. Lawrence - Laurentian Channel population)	*Sebastes mentella*	Endangered	High potential for occurrence - Closely associated with the seafloor and commonly found inhabiting waters 350 to 500 m in depth in the Gulf / Laurentian Channel. Mature individuals expected to occur in EL 1105 from May to October. Mating occurs in fall with spawning occurring from April to July.
Deepwater Redfish (Northern population)		Threatened	Low potential for occurrence - Closely associated with the seafloor and commonly found inhabiting waters 350 to 500 m in depth from the Grand Banks to Northern Labrador.
Atlantic Salmon (South Newfoundland population)	*Salmo salar*	Threatened	Low potential for occurrence – Juvenile Atlantic salmon migrating from freshwaters streams to the North Atlantic may pass through EL 1105, with any presence being transient in nature.
Acadian Redfish (Atlantic population)	*Sebastes fasciatus*	Threatened	Low potential for occurrence - Closely associated with the seafloor and commonly found inhabiting waters 150 to 300 m in depth. Mature individuals expected to occur in EL 1105 from May to October. Mating occurs in fall with spawning occurring from May to August.
Shortfin Mako	*Isurus oxyrinchus*	Threatened	Low potential for occurrence – A pelagic species which migrates north following food stocks (*i.e.*, mackerel, herring, tuna) and may pass through EL 1105. Any occurrence would be transient in nature.
American Plaice(Maritime population)	*Hippoglossus platessoides*	Threatened	High potential for occurrence – Closely associated with the seafloor and commonly found in water depths of 100 to 300 m where sandy/shell fragmented sediments are present. American plaice overwinter in the deep waters of the Laurentian Channel and migrate to the shallow waters off the Magdaline Islands to spawn in April and May. Larvae may be present in the water column between May and June.
American plaice (Newfoundland and Labrador population)		Threatened	Low potential for occurrence – Closely associated with the seafloor commonly found in water depths of 100 to 300 m where sandy/shell fragmented sediments are present. The Newfoundland and Labrador population is located from the Grand Banks north and to the northern tip of Newfoundland.

Table 5.2 Species Assessed as 'At Risk' by the Committee of the Status of Endangered Wildlife in Canada that may occur in the Gulf

Common Name	Species Name	COSEWIC Designation	Occurrence in Relation to EL 1105
Striped Bass (Southern Gulf of St. Lawrence population)	*Marone saxatilis*	Threatened	Low potential for occurrence – Scientific evidence suggests that populations currently exist in only two Canadian rivers: the Shubenacadie which flows into the Bay of Fundy, and the Miramichi River in the southern Gulf of St. Lawrence. The St. Lawrence estuary population is considered extirpated.
Cusk	*Brosme brosme*	Threatened	Low potential for occurrence – Commonly found between the Gulf of Maine and southern Scotian Shelf. Rare along the continental shelf off Newfoundland and Labrador. Very rare within the Gulf, with three observations.
Atlantic Salmon (Gaspé-Southern Gulf of St. Lawrence population)	*Salmo salar*	Special Concern	Moderate potential for occurrence – Juvenile Atlantic salmon migrating from freshwater streams to the North Atlantic and adult salmon migrating back to their native rivers may pass through EL 1105.
Atlantic Salmon (Quebec Eastern North Shore population)	*Salmo salar*	Special Concern	Moderate potential for occurrence – Juvenile Atlantic salmon migrating from freshwater streams to the North Atlantic and adult salmon migrating back to their native rivers may pass through EL 1105.
Atlantic Salmon (Quebec Western North Shore population)		Special Concern	Moderate potential for occurrence – Juvenile Atlantic salmon migrating from freshwater streams to the North Atlantic and adult salmon migrating back to their native rivers may pass through EL 1105.
Atlantic Salmon (Inner St. Lawrence population)		Special Concern	Moderate potential for occurrence – Juvenile Atlantic salmon migrating from freshwater streams to the North Atlantic and adult salmon migrating back to their native rivers may pass through EL 1105.
Roughead Grenadier	*Macrourus berglax*	Special Concern	Low potential for occurrence – Closely associated with the seafloor and commonly found in water depths of 400 to 1,300 m on or near the continental slope of the Newfoundland and Labrador Shelves from the Davis Strait to the southern Grand Banks. Spawning may occur within the southern Grand Banks.
Spiny Dogfish (Atlantic population)	*Squalus acanthias*	Special Concern	Low potential for occurrence – Commonly found from the intertidal zone to the continental slope in water depths up to 730 m. Most abundant between Nova Scotia and Cape Hattaras.
Blue Shark (Atlantic population)	*Priomace glauca*	Special Concern	Low potential for occurrence – Commonly found in offshore waters in water depths up to 350 m. Most abundant along the coast of Nova Scotia to the Scotian Shelves.
Basking Shark (Atlantic population)	*Cetorhinus maximus*	Special Concern	Low potential for occurrence –Found in offshore waters and coastal waters of Newfoundland concentrated between Port aux Basques and Hermitage. May be present within EL 1105 feeding on plankton.
American Eel	*Anguilla rostrata*	Special Concern	Low potential for occurrence – Adult American eels migrating from freshwater streams to the Sargasso Sea may pass through EL 1105. Any presence would be transient in nature.
Atlantic Sturgeon (Great Lakes/ Gulf of St. Lawrence Populations)	*Ancipenser oxyrinchus*	Threatened	Low potential for occurrence - Highly migratory species capable of traveling great distances and are spread out along the east coast of North America and over the continental shelf regions to at least 50 m depths. Therefore may pass through EL 1105, with any presence being transient in nature.
Atlantic Sturgeon (Maritimes Populations)		Threatened	Low potential for occurrence - Highly migratory species capable of traveling great distances and are spread out along the east coast of North America and over the continental shelf regions to at least 50 m depths. Therefore may pass through EL 1105, with any presence being transient in nature.

Table 5.2 Species Assessed as 'At Risk' by the Committee of the Status of Endangered Wildlife in Canada that may occur in the Gulf

Common Name	Species Name	COSEWIC Designation	Occurrence in Relation to EL 1105
Marine Mammals			
Harbour Porpoise (Northwest Atlantic population)	*Phocoena phocoena*	Special Concern	Occurs in both offshore and coastal waters of the Gulf. Occurs regularly in coastal bays and inlets during summer and can move rapidly following prey or stay in areas where for food is abundant for periods of time.
Killer Whale (Northwest Atlantic/ Eastern Arctic population)	*Orcinus orca*	Special Concern	Distribution is not well documented, but they are widespread, and sightings are reported most commonly in the offshore and coastal waters of Newfoundland, including western Newfoundland.
Northern Bottlenose Whale (Davis Strait-Baffin Bay-Labrador Sea Population	*Hyperoodon Ampullatus*	Special Concern	Low potential for occurrence - the northern bottlenose whale is confined to the waters of the northern Atlantic Ocean, with population centres off the Davis Strait / northern Labrador. More survey effort is needed to fully describe the distribution and abundance of northern bottlenose whales in Canada, particularly in the northern part of its distribution and around Newfoundland.
Sea Turtles			
Loggerhead Sea Turtle	*Caretta caretta*	Endangered	Widely distributed in pelagic (>200 m) waters feeding, particularly on jellyfish. Juveniles concentrate along the edge of the Gulf Stream. Occurs in the offshore parts of the Gulf and western Newfoundland, particularly in summer months.

5.2.1 Marine Fish Species at Risk

There are 19 species (and 23 populations) of marine fish that could potentially be found within or near the Gulf that are considered at risk (refer to Tables 5.1 and 5.2 for conservation status).

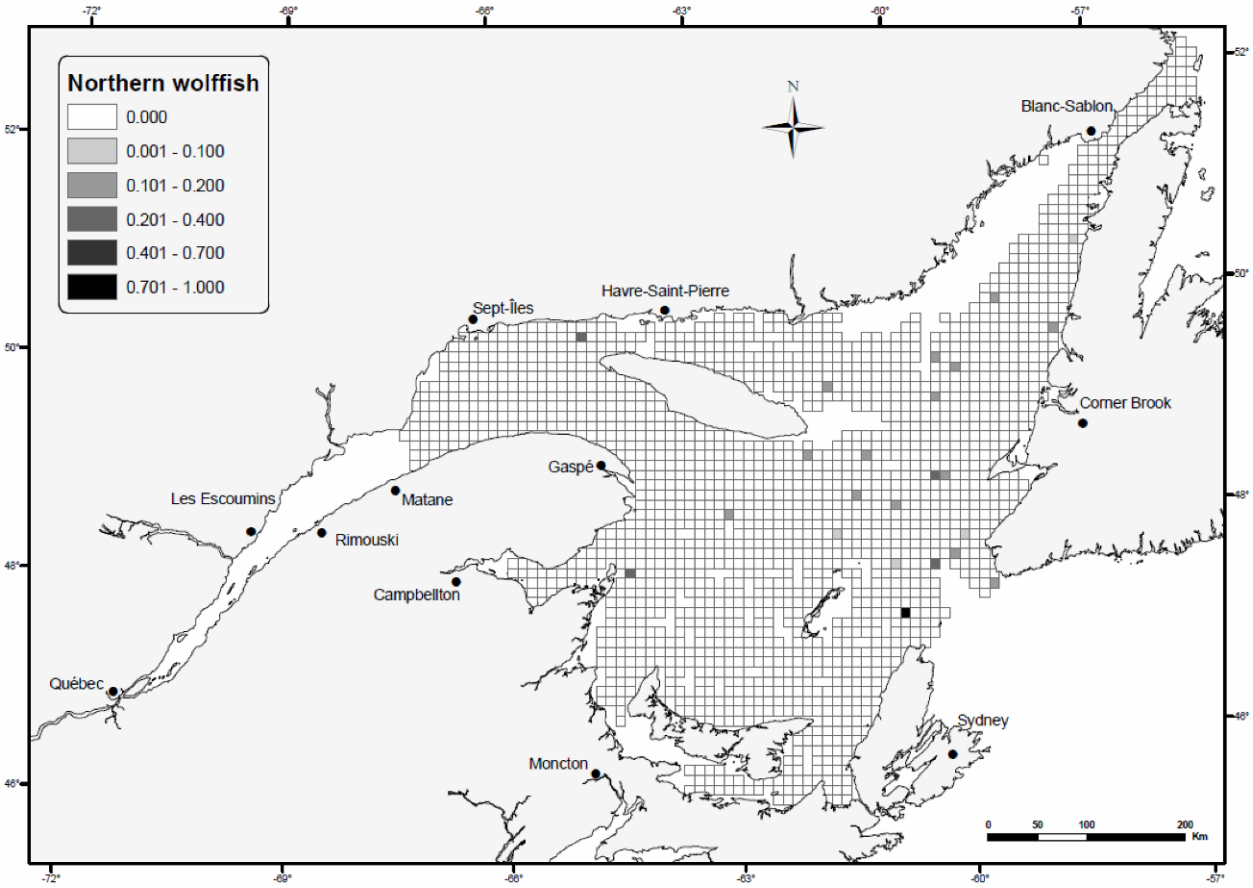
5.2.1.1 Wolffish

Three species of wolffish, each of which has been designated a status under SARA Schedule 1, can be found in the Gulf and in or near EL 1105. The northern and spotted wolffish have been listed as Threatened under SARA Schedule 1; the Atlantic wolffish is considered of Special Concern.

The northern wolffish can be found in cold continental shelf waters at depths up to 1000 m but prefer depths of approximately 70 to 300 m (Kulka *et al.* 2007). Spawning occurs in fall and females can lay up to 23,000 extremely large eggs (Kulka *et al.* 2007). This species is non-migratory and usually make nests to guard their eggs. They feed upon benthic invertebrates (Kulka *et al.* 2007). Spatial distribution of the relative occurrence of northern wolffish in the Sentinel Fisheries Program from 1995 to 2002 from stratified random stations and fixed stations are provided in Figures 5.2 and 5.3, respectively.

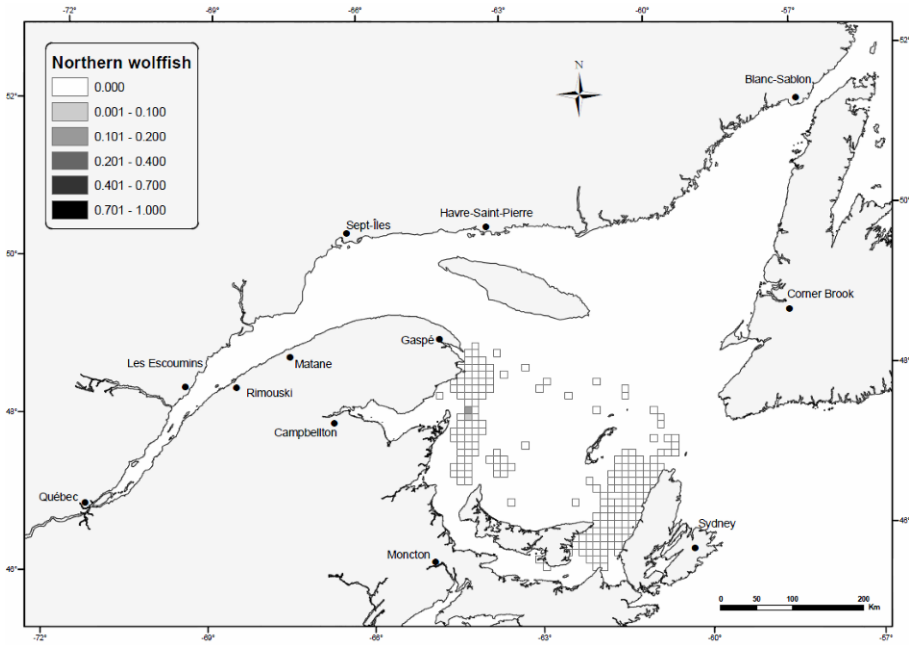
Northern wolffish in the Northwest Atlantic is treated as a single population and is listed as Threatened on Schedule 1 of SARA due to the rapid decline along the Northeast Newfoundland / Labrador Shelf and the Grand Banks. Northern wolffish occur along the slope of the Laurentian Channel, along the edges and slopes of the Labrador shelf, northeast Newfoundland shelf and in low numbers on the Grand Banks (Kulka *et al.* 2004). Abundance off northeast Newfoundland

is thought to have declined by 98 percent from 1978 to 1994. The number of locations where the species occurs has also declined (SARA 2010).



Source: Dutil *et al.* 2010.
Note: The data are aggregated by 100 km^2 cells. No trawling took place in areas where the grid is not shown.

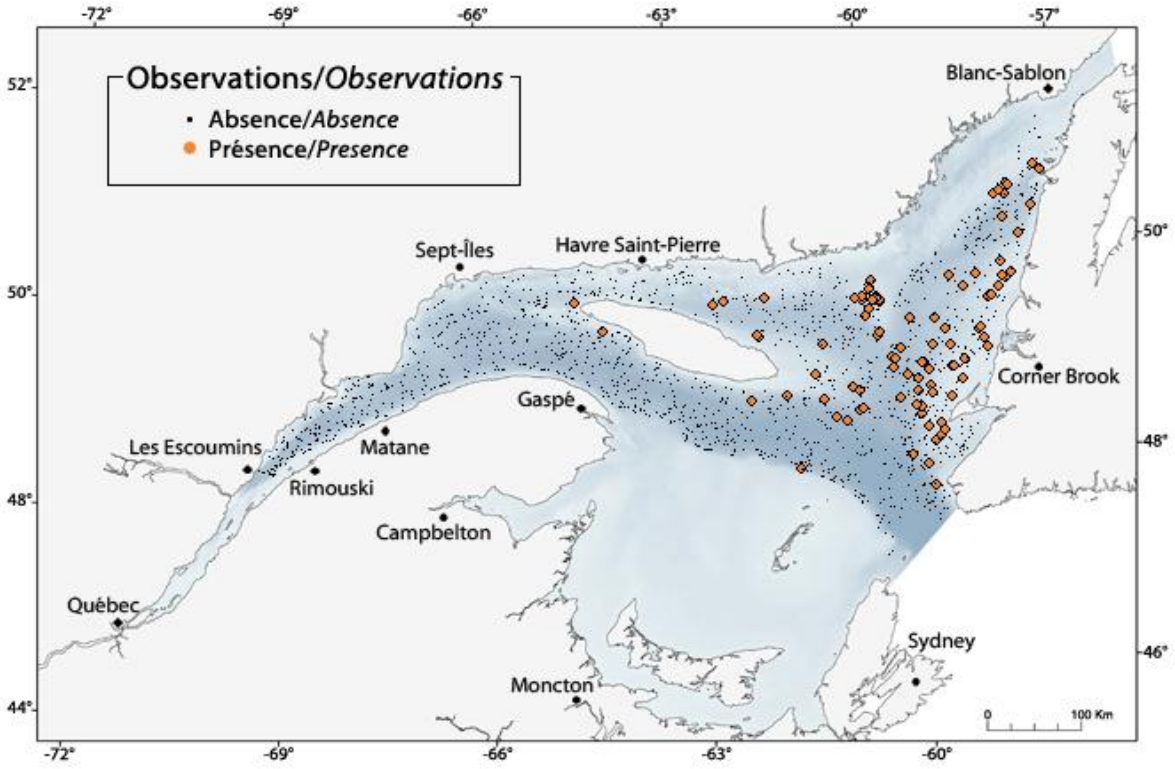
Figure 5.2 Spatial Distribution of the Relative Occurrence of Northern Wolffish in the Sentinel Fisheries Program from 1995 to 2008 from Stratified Random Stations



Source: Dutil *et al.* 2010.
Note: The data are aggregated by 100 km^2 cells. No trawling took place in areas where the grid is not shown.

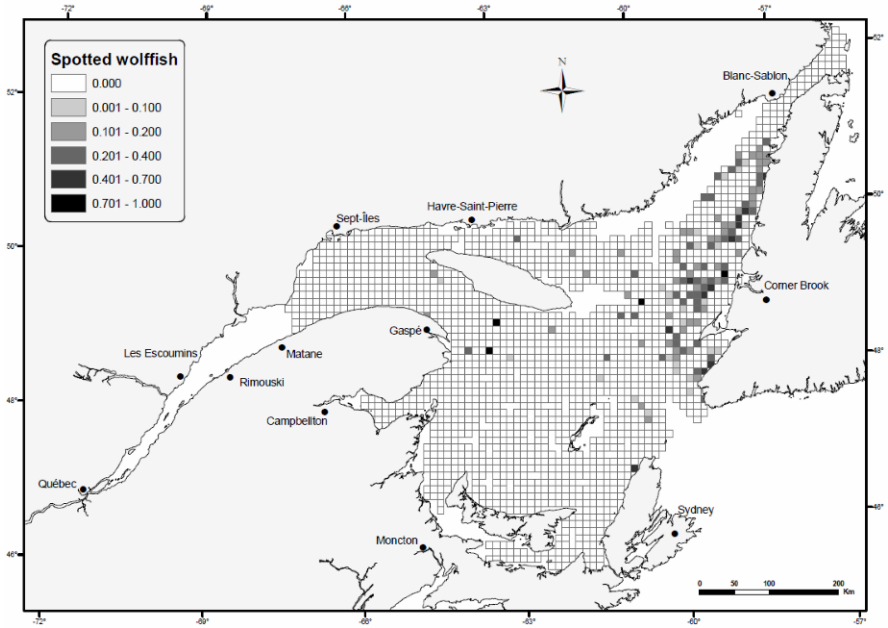
Figure 5.3 Spatial Distribution of the Relative Occurrence of Northern Wolffish in the Sentinel Fisheries Program from 1995 to 2002 from Fixed Stations

The spotted wolffish is a bottom-dwelling predatory fish that can be found in cold continental shelf waters, at depths ranging from 50 to 750 m. Spawning occurs in summer (Kulka *et al.* 2007). Spotted wolffish are treated as a single population in the Northwest Atlantic and are listed as Threatened on Schedule 1 of SARA, due to the rapid decline along the northeast Newfoundland / Labrador Shelf and the Grand Banks. In the western North Atlantic, they occur primarily off northeast Newfoundland. Scientific surveys indicate a 96 percent decline in the Canadian population over 21 years. Distribution of spotted wolffish in the Estuary and Northern Gulf (based on survey data from missions on the *CCGS Alfred Needler* from 2004 to 2012) is depicted in Figure 5.4. The spatial distribution of the relative occurrence of spotted wolffish in the Sentinel Fisheries Program from 1995 to 2002 from stratified random stations is provided in Figures 5.5.



Source: http://slgo.ca/en/species/data.html

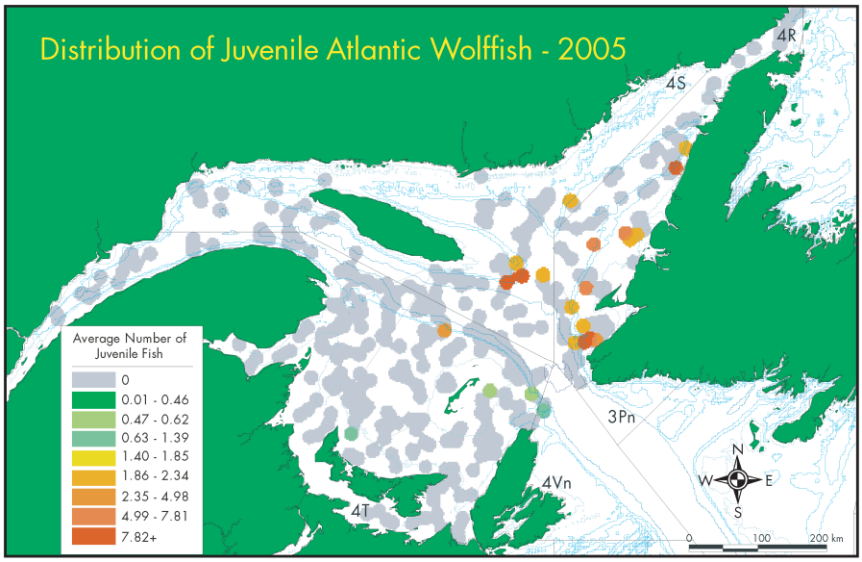
Figure 5.4 Spotted Wolffish Distribution in the Gulf of St. Lawrence, 2004 to 2012



Source: Dutil *et al.* 2010.
Note: The data are aggregated by 100 km^2 cells. No trawling took place in areas where the grid is not shown.

Figure 5.5 Spatial Distribution of the Relative Occurrence of Spotted Wolffish in the Sentinel Fisheries Program from 1995 to 2002 from Stratified Random Stations

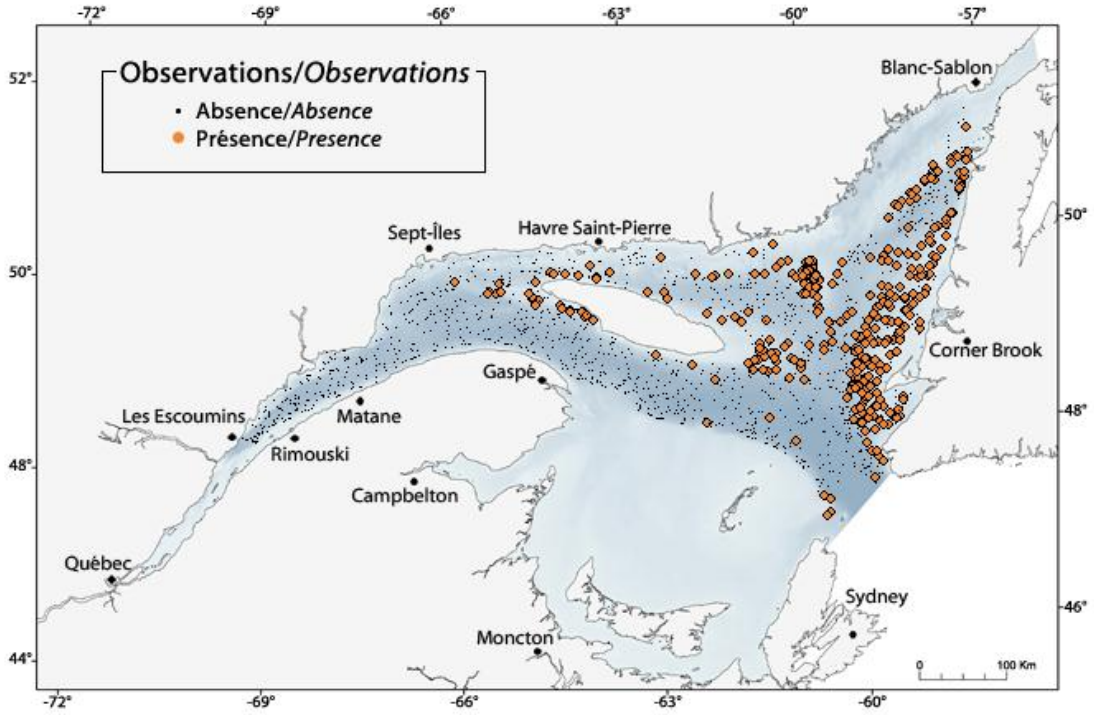
The Atlantic (or striped) wolffish inhabits cold deep waters with rocky or hard clay bottoms along the continental shelf. Within the western Atlantic Ocean, this species can be found in the Strait of Belle Isle and in the Gulf. Spawning typically occurs in September in shallow waters; juvenile fish however remain in deeper waters. Their diet is composed of hard shelled benthic invertebrates and smaller fish (Kulka *et al.* 2007). Modelled juvenile Atlantic wolffish densities (from DFO RV data) for 2005 are illustrated in Figure 5.6.



Source: Ollerhead and Lawrence 2007.

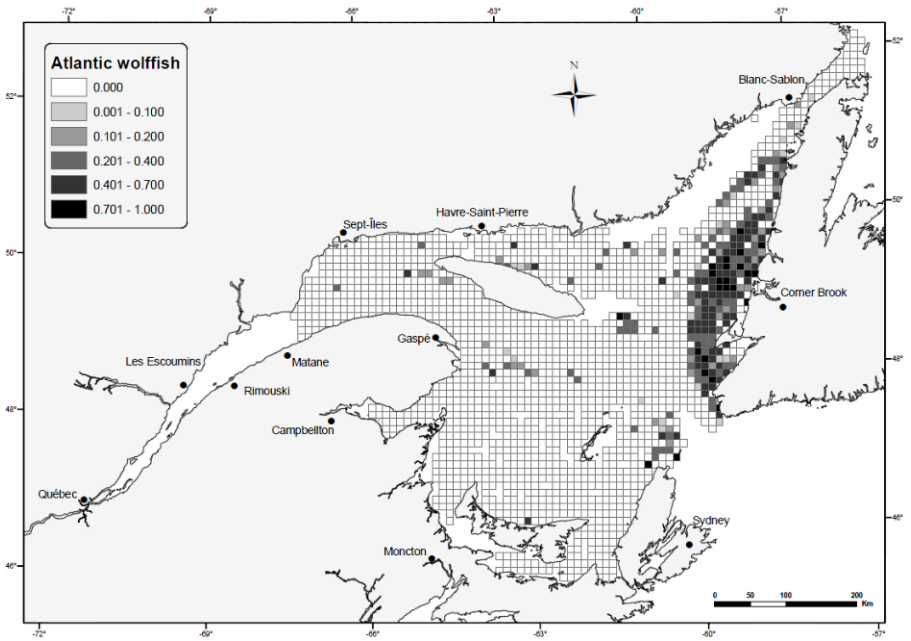
Figure 5.6 Distribution of Juvenile Atlantic Wolffish, 2005

Distribution of Atlantic wolffish in the Estuary and Northern Gulf (based on survey data from missions on the *CCGS Alfred Needler* from 2004 to 2012) are depicted in Figure 5.7. The spatial distribution of the relative occurrence of Atlantic wolffish in the Sentinel Fisheries Program from 1995 to 2002 from stratified random stations is provided in Figure 5.8.



Source: http://slgo.ca/en/species/data.html

Figure 5.7 Atlantic Wolffish Distribution in the Gulf of St. Lawrence, 2004 to 2012



Source: Dutil *et al.* 2010.
Note: The data are aggregated by 100 km^2 cells. No trawling took place in areas where the grid is not shown.

Figure 5.8 Spatial Distribution of the Relative Occurrence of Atlantic Wolffish in the Sentinel Fisheries Program from 1995 to 2002 from Stratified Random Stations

Atlantic wolffish is listed as a species of Special Concern on Schedule 1 of SARA. They occur further south and in greater abundance than the northern and spotted wolffish. They occur along the south coast and St. Pierre Bank, along the Labrador and northeast Newfoundland shelves and on the Grand Banks (Kulka *et al.* 2004). Available data indicate populations in Canadian waters have declined by 87 percent from the late 1970s to the mid-1990s. As well, locations where the species occur have declined and the range where the species is abundant may be shrinking. Even though it has measurably declined, it is thought to be very widespread and to still exist in relatively large numbers (SARA website 2010).

A Recovery Strategy for northern and spotted wolffish, and Management Plan for Atlantic wolffish, have been developed to increase the population levels and distribution of the northern, spotted and Atlantic wolffish in eastern Canadian waters such that the long-term viability of these species is achieved (Kulka *et al.* 2007). Five primary objectives have been identified to achieve the long term viability of the three wolffish species and relate to activities that may be mitigated through human intervention. These primary objectives are to: enhance knowledge of the biology and life history of wolffish species; identify, conserve and/or protect wolffish habitat required for viable population sizes and densities; reduce the potential of wolffish population declines by mitigating human impacts; promote wolffish population growth and recovery; and develop communication and education programs to promote the conservation and recovery of wolffish populations.

The impact of incidental capture of wolffish in many fisheries is thought to be the leading cause of human induced mortality. However, the live release of spotted and northern wolffish mitigates the affect of incidental capture to some degree. Other potential sources of harm (*e.g.*, habitat alteration, oil exploration and production, pollution, shipping, cables and lines, military activities, ecotourism and scientific research) are considered to have negligible impacts on the ability of both spotted and northern wolffish to survive and recover (Kulka *et al.* 2004).

Details of this recovery plan can be found in the Northern and Spotted Wolffish Recovery Strategy and Atlantic Wolffish Management Plan Report (Kulka *et al.* 2007).

5.2.1.2 Atlantic Cod

Generally the Atlantic cod can be found in waters of continental shelves and slopes, inshore or offshore, with spawning typically occurring in shallow waters (Scott and Scott 1988). There are four different populations of Atlantic cod that could be present in the Gulf and in the vicinity of EL 1105. These include the Laurentian North population, the Laurentian South population, the Newfoundland and Labrador population and the Southern population (COSEWIC 2010a). Each of these populations of Atlantic cod has been designated as Endangered under COSEWIC. Although representatives of each population may be found in the Gulf at any one time, there are only two resident populations: the Laurentian North population and the Laurentian South population (DFO 2012a). Due to their designated status and the fact that there is uncertainty regarding the specific timing and route of the Laurentian North cod migration (which is an extensive annual migration between southwestern and southern Newfoundland (winter) and Port au Port Peninsula (April and May, the onset of spawning) and along the west coast of Newfoundland and middle and lower North Shore of Quebec (summer) (DFO 2009b)), all four populations are assessed for this Project.

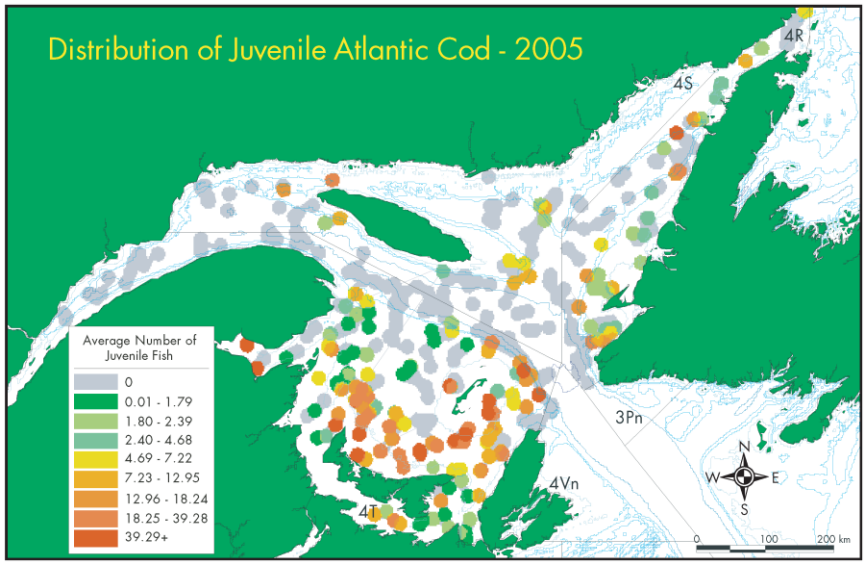
The Newfoundland and Labrador population of the Atlantic cod includes those fish that inhabit waters ranging from the northern tip of Labrador, southeast to the Grand Banks of Newfoundland. Three stocks of cod are typical for this region and include, the Northern Labrador cod (Northwest Atlantic Fisheries Organization (NAFO) Divisions 2GH), Northern cod (NAFO Divisions 2J3KL) and Southern Grand Bank cod (NAFO Divisions 3NO) (COSEWIC 2003a). Historically the Newfoundland and Labrador population has been highly migratory (DFO 2011o). The population overwinters in dense aggregations near the edge of the continental shelf and migrate in the spring and summer to shallow waters along the coast and the plateau of the Grand Banks. The cod in this area have declined by more than 99 percent since the 1960s (COSEWIC 2010a), with the major cause of the decline being overfishing. Even though fishing efforts have been reduced since the early 1990s, this population has shown very little sign of recovery (COSEWIC 2010a).

The Laurentian South population and the Southern population were designated in April 2010, by splitting the previously named Maritimes population, which included five different DFO stocks (the Southern Gulf (NAFO Division 4T), the Cabot Strait (NAFO Division 4Vn), the Eastern Scotian Shelf (NAFO Divisions 4VsW), the Bay of Fundy / Western Scotian Shelf (NAFO Division 4X) and cod found in the Canadian waters of Georges Bank (NAFO Division 5Zjm) (COSEWIC 2010a). Both populations are designated as Endangered. The Laurentian South population includes the management units 4T, 4Vn and 4VsW and the Southern population includes the management units 4X and 5Zjm. The Laurentian South cod population is distributed throughout the southern Gulf during the summer and overwinters along the side of the Laurentian Channel, with dense aggregations typically occurring in the Laurentian Channel north of St. Paul Island. The entire population is known to use two migration routes to migrate in and out of the Gulf in the spring and fall (the Cape Breton Trough and the southern slope of the Laurentian Channel) and thus can be found in proximity to EL 1105 during the spring and fall (DFO 2012a). These migrations typically occur in April and May, and November and December. Spawning typically occurs in the shallow waters east of Chaleur Bay from May to September (Swain *et al.* 2012).The Southern population is a more widespread population where spawning can occur year round (DFO 2011p). The population spawns in both offshore and inshore waters in large aggregations at differing times of year depending on location. Spring spawing occurs throughout the designatable unit with some concentrations on Browns Band and Eastern Georges Bank. Fall spawning tends to occur along the coast of Nova Scotia. The main cause of decline of these populations of cod was also a result of overfishing. Commercial fishing efforts were reduced in the early 1990s; however, increased natural mortality of older cod and continual small catch efforts have caused the population to continue to decline (COSEWIC 2010a).

The Laurentian North population of the Atlantic cod includes two DFO identified stocks, St. Pierre Bank (NAFO Division 3Ps) and the Northern Gulf (NAFO Divisions 3Pn4RS) (COSEWIC 2003a); EL 1105 (including the proposed wellsite) is in NAFO Unit Area 4Ss, with the likely supply vessel routes extending into Unit Area 4Tf. These areas are closed to cod fishing from April to mid-June. The Laurentian North Population exhibits seasonal migratory patterns. During the winter, the stock can be found off Southwestern (3Pn) and Southern (3Ps) Newfoundland at a depth greater than 350 m (DFO 2012a). In April and May, they migrate to the Port au Port Peninsula on the West Coast of Newfounland (4R) where they spawn (DFO

2012a). During the summer months they continue to migrate and disperse into the coast zones along western Newfoundland (4R) towards Quebec's Middle and Lower North Shore (4S) (DFO 2012a). The status of this population was re-examined in April 2010 and assessed as Endangered by COSEWIC. The population has declined by 89 percent over three generations as a result of overfishing and there is no indication of recovery (COSEWIC 2010a). Between 2000 to 2009, exploitation rates were too high compared to current productivity to permit any substantive rebuilding of the Northern Gulf stock (DFO 2010a).

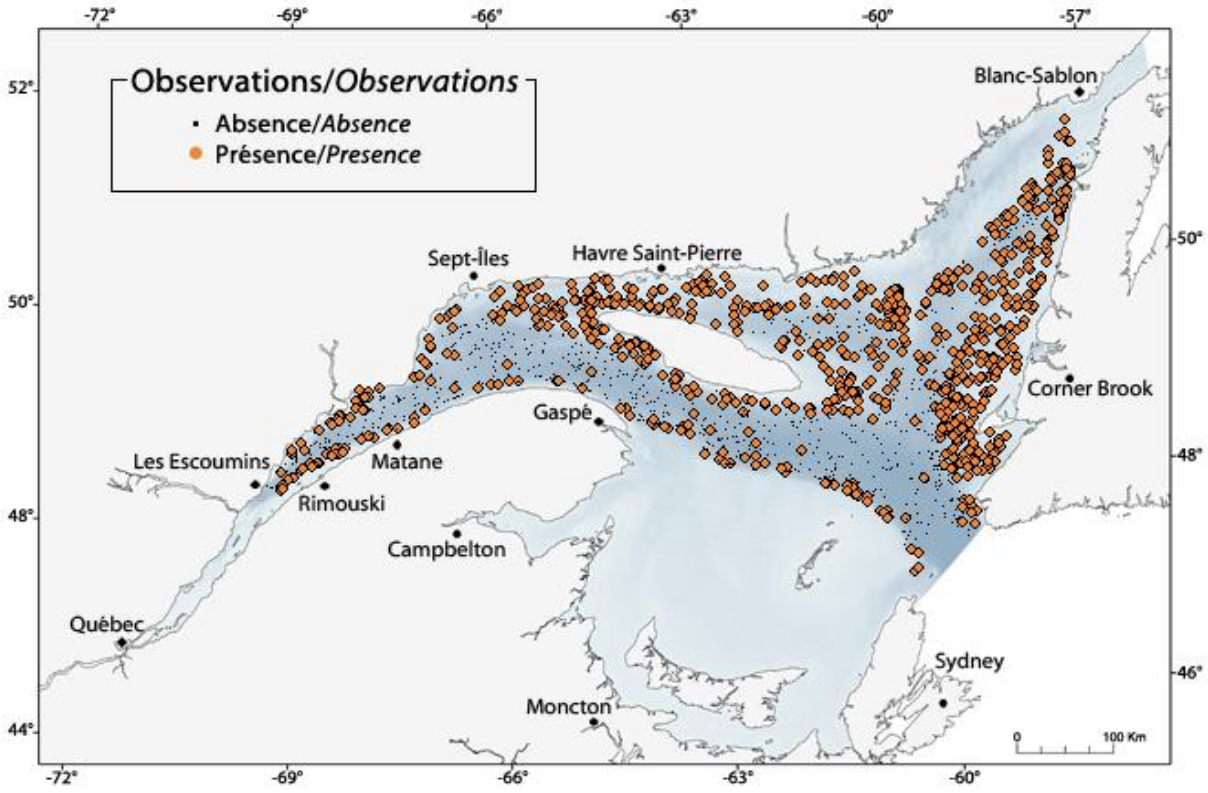
Atlantic cod eggs and larvae are planktonic until they reach a size of approximately 25 to 50 mm and are primarily zooplankton feeders; once they settle, their primary food source are benthic and epibenthic invertebrates (Scott and Scott 1988). Pelagic juveniles can occupy eelgrass beds, macroalgal habitat, sandy bottoms, cobble and rock reefs (Keats *et al.* 1985; Tupper and Boutilier 1995a, 1995b). The primary diet of juvenile cod includes pelagic crustaceans, especially zooplankton (but benthic species are also included in their diet (*e.g.*, gammarids and harpacticoids) (Grant and Brown 1998), while inshore adult cod feed primarily on capelin (Lilly 1987), depending on the season (O'Driscoll *et al.* 2000). Modelled juvenile Atlantic cod densities (from DFO RV data) for 2005 are illustrated in Figure 5.9.



Source: Ollerhead and Lawrence 2007.

Figure 5.9 Distribution of Juvenile Atlantic Cod, 2005

Distribution of Atlantic cod in the Estuary and Northern Gulf (based on survey data from missions on the *CCGS Alfred Needler* from 2004 to 2012) is depicted in Figure 5.10.



Source: http://slgo.ca/en/species/data.html

Figure 5.10 Atlantic Cod Distribution in the Gulf of St. Lawrence, 2004 to 2012

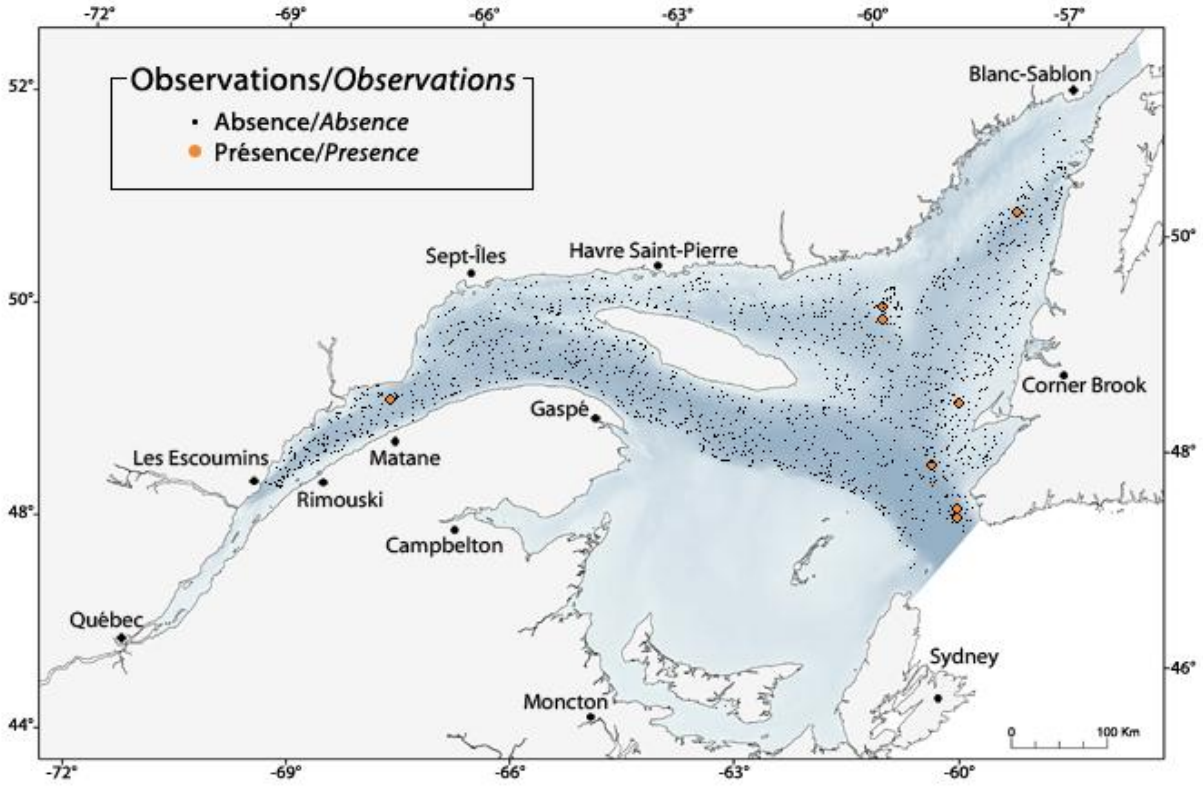
5.2.1.3 Winter Skate

The southern Gulf population of the winter skate has been designated as Endangered under COSEWIC. As indicated in Table 5.2, this species has a low potential to occur within EL 1105. The winter skate is endemic to the Northwest Atlantic and in Canadian waters this species tends to be concentrated in three areas, the southern Gulf, the eastern Scotian Shelf, and the Canadian portion of Georges Bank. It is a bottom-dwelling species that prefers sand and gravel bottoms and occurs at depths up to 371 m. However, they are more commonly found at a depth of approximately 100 m. Spawning occurs during late summer to early fall and their diets consist mainly of various shellfish, amphipods and small fish (COSEWIC 2005a).

The winter skate in the southern Gulf appear to be distinct from other populations (Swain *et al.* 2006; DFO 2005f). The southern Gulf population matures at a smaller size (42 cm), has a smaller maximum size, and is morphologically different than other populations (Swain *et al.* 2006; DFO 2005f). The winter skate is oviparous, depositing a single egg in a capsule/purse. The purse has an adhesive mucus which helps maintain bottoms contact by attaching to substrate material. The southern Gulf population has a shorter gestation time (6 to 9 months) than other populations (18 to 22 months). Seasonally, the majority of the population can be found in shallow waters during the summer and deeper waters along the edge of the Laurentian

Channel during the winter months, which is the opposite of the other populations (Swain *et al.* 2006).

Distribution of winter skate in the Estuary and Northern Gulf (based on survey data from missions on the *CCGS Alfred Needler* from 2004 to 2012) is depicted in Figure 5.11.

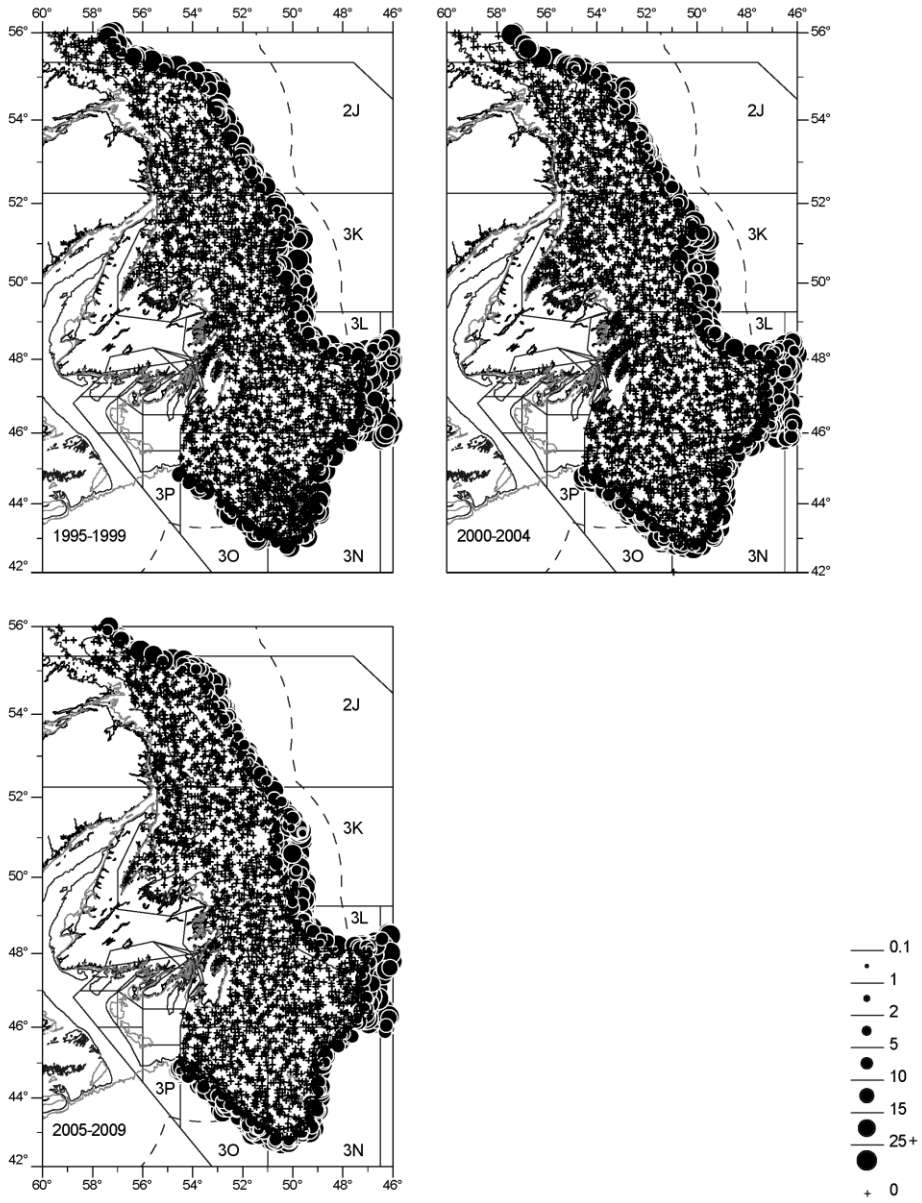


Source: http://slgo.ca/en/species/data.html

Figure 5.11 Winter Skate Distribution in the Gulf of St. Lawrence, 2004 to 2012

5.2.1.4 Roundnose Grenadier

In November 2008, the roundnose grenadier was designated as Endangered under COSEWIC. The population of the roundnose grenadier showed declines of 98 percent from 1978 to 1994 and additional declines from 1995 to 2003. Roundnose grenadier inhabit the Northwest Atlantic's continental slopes (see Figure 5.12), from Baffin Island and Greenland south to Cape Hatteras (DFO 2010b). Roundnose grenadier is under moratorium in NAFO Subareas 0, 2 and 3 within the Canadian Economic Exclusion Zone (EEZ); however, it is part of the bycatch of other fisheries within and outside the EEZ (DFO 2010b). This species is typically found at depths between 180 and 2,600 m, primarily between 400 to 1,200 m (COSEWIC 2008a) and migrates vertically to feed on squid and small fish and crustaceans (DFO 2010b). They live for a long time and are slow to grow; they are late to mature and females have relatively low fecundity (DFO 2010b). As indicated in Table 5.2, roundnose grenadier is considered to have low potential to occur in EL 1105.



Source DFO 2010b.

Figure 5.12 Distribution of Roundnose Grenadier from DFO-Newfoundland Fall Research Vessel Surveys, 1995 to 2009

5.2.1.5 Porbeagle Shark

The porbeagle shark is a large, cold-temperate pelagic shark, with a maximum life span of up to 49 years (Campana *et al.* 2003). The porbeagle shark has been assessed as Endangered by COSEWIC. In Canadian waters, the porbeagle shark can be found from northern Newfoundland into the Gulf and around Newfoundland to the Scotian Shelf and Bay of Fundy. This shark is a pelagic species more commonly found on continental shelves in waters between 5°C and 10°C. The porbeagle is ovovivporous (internal fertilization, giving birth to live offspring) and oophageous (embryos feed on live eggs in the uterus) with an average litter size of four pups.

Mating occurs during late summer to early fall on the Grand Banks, Southern Newfoundland, and at the enterance of the Gulf of St. Lawrence. Birthing occurs during late winter or spring after an eight to nine month gestation period (Campana *et al.* 2003). The diet of the porbeagle changes seasonally following a migration from deep to shallower waters. In the fall, groundfish make up the majority of prey species, while in the spring a shift in diet comprised mostly of pelagic and cephalopod species occurs. Seasonal migration occurs up and down the east coast of Canada beginning in the Gulf of Maine. During January and February, porbeagles can be found in the Gulf of Maine, Georges Bank, and the southern Scotian Shelf. In the spring, they move northeast along the Scotian Shelf and inhabit the South Coast of Newfoundland and the Gulf of St. Lawrence by late summer and early fall, making a return trip beginning in late fall. As indicated in Table 5.2, they are considered to have a low potential for occurrence within EL 1105.

5.2.1.6 White Shark

White sharks are designated on SARA, Schedule 1 as Endangered. They are rare (only 32 records in over 132 years for Atlantic Canada) in Canadian waters (which represent the northern-most edge of their range) and are recorded mostly in the Bay of Fundy area (COSEWIC 2006a). They are extremely rare as far north as the Gulf and would be an unlikely occurrence in EL 1105.

5.2.1.7 Redfish

Two species of redfish occur in the Gulf, Acadian and deepwater redfish, and both are expected to be found in EL 1105. These species are very similar in appearance and are managed together and not separated in the fishery (DFO 2004a). EL 1105 falls within the redfish management Unit 1 (which includes NAFO Divisions 4RST).

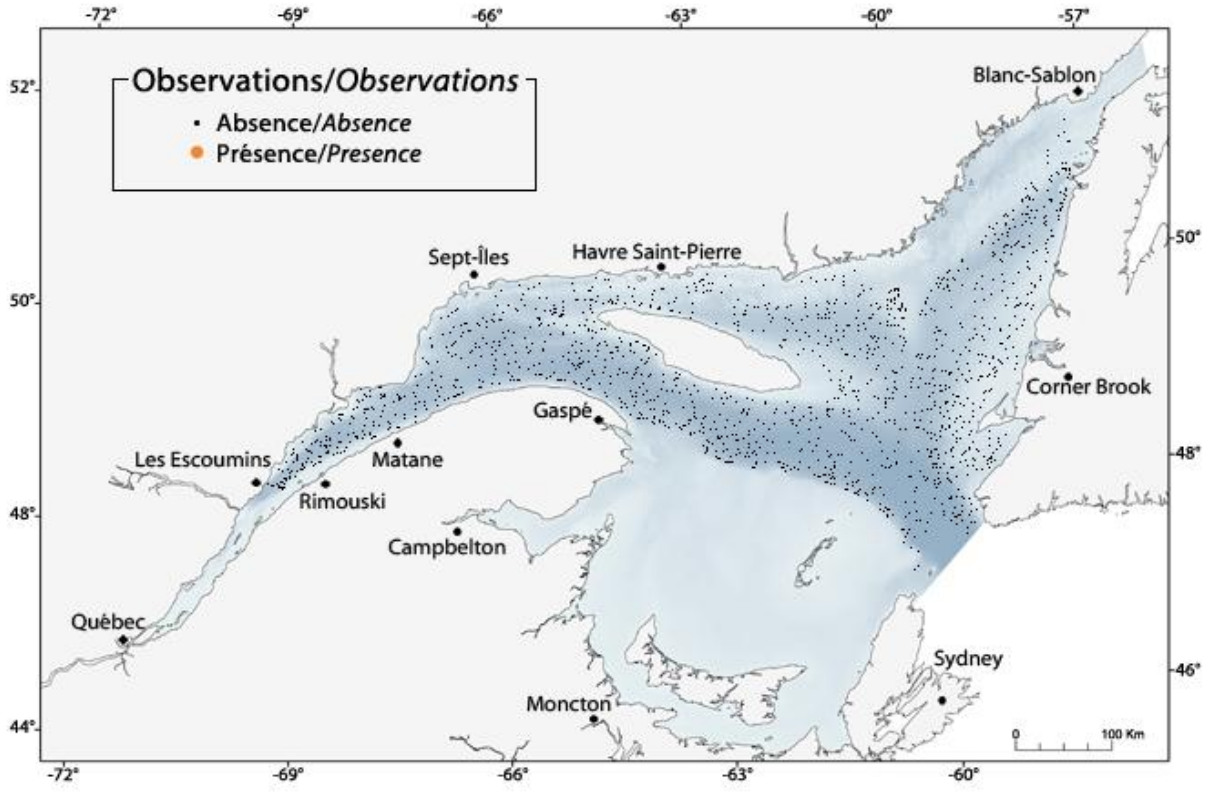
Redfish are a slow growing ovoviviparous species with a maximum age of 75 years in some individuals (DFO 2011q). Mating takes place in the fall (September to December) and spawning occurs from April to July (LGL 2005c). The fecundity of the redfish ranges from 1,500 to 10,700 offspring. Larvae feed mainly on fish eggs and invertebrate eggs (DFO 2011q). Juvenile and adult fish feed mainly on copepods, euphausids and fish species. The knowledge of habitat requirements is limited. The Gulf of St. Lawrence redfish larvae are mainly concentrated in the deep waters of the Laurentian Channel (DFO 2011q). There are high abundances found south and east of Anticosti Island, with deepwater redfish larvae being found in deeper water mid-channel and Acadian redfish being found on the shallower channel banks. Juvenile redfish are pelagic for 4 to 5 months and can be found at depths from 75 m to 175 m. Adults can be commonly found at depths ranging from 100 m to 700 m. Adults generally inhabit areas near the bottom, but are considered semi-pelagic as they venture vertically at night to follow prey. In the Gulf, they have a seasonal migration, moving southeast outside of the Gulf in the fall and winter, with a return to the Gulf in the summer months. The species overwinters and mates in the Cabot Strait and off of southern Newfoundland.

In the early 1990s, the landings of redfish in Unit 1 dropped from about 60,000 t in 1993 to approximately 19,500 t in 1994 (DFO 2001a). The directed redfish fishery was closed in 1995 as a result of low stock levels (DFO 2001a; LGL 2007). In April 2010, the status of both species of

redfish potentially found near the Project was re-examined and the deepwater redfish was assessed as Endangered and the Acadian redfish was assessed as Threatened by COSEWIC. The deepwater redfish has declined by 98 percent since 1984 and the Acadian redfish has declined by 99 percent, in areas of historical abundance over two generations.

From 2000 to 2009, the biomass of the deepwater redfish has declined steadily. The combined index of mature biomass has decreased from 273,000 t (469 million mature individuals) (2000) to 115,400 t (181 million mature individuals) (2009) with an average biomass of 170,300 t from 2000 to 2009 (DFO 2011q). The Acadian redfish has had a relatively stable mature biomass from 2000 to 2009, with 505 million mature individuals in 2009 and an average of 538 million mature individuals from 2000-2009. It should be noted that declines are in mature abundance as per the COSEWIC criteria.The major threats to both species are directed fishing and incidental harvest (COSEWIC 2010b).

Distribution of deepwater redfish in the Estuary and Northern Gulf (based on survey data from missions on the *CCGS Alfred Needler* from 2004 to 2012) are depicted in Figure 5.13.



Source: http://slgo.ca/en/species/data.html

Figure 5.13 Deepwater Redfish Distribution in the Gulf of St. Lawrence, 2004 to 2012

For the remainder of this report, any discussions regarding redfish will collectively include both the deepwater redfish and the Acadian redfish, as their species profiles are similar, with the major difference being that the deepwater redfish are generally distributed at greater depths than that of the Acadian redfish (LGL 2005b).

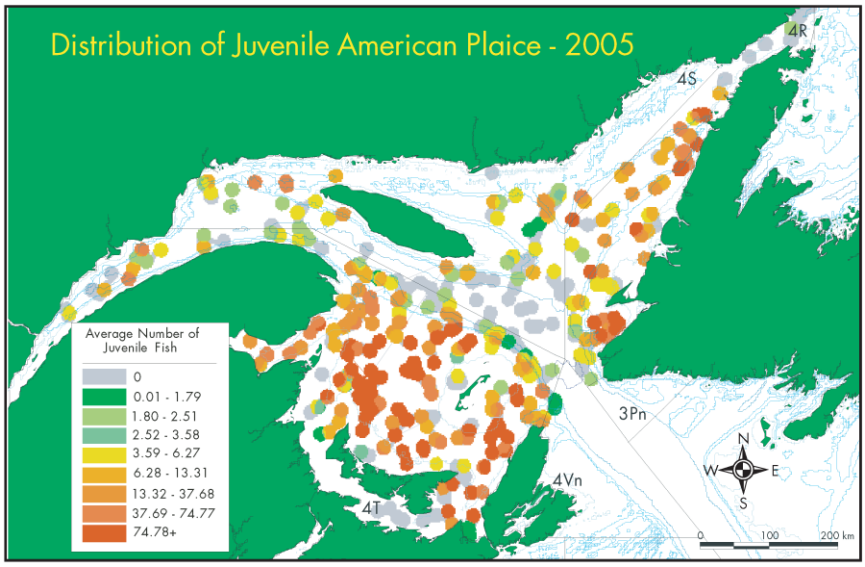
5.2.1.8 Shortfin Mako

The shortfin mako is a large temperate/tropical pelagic shark species. The Atlantic population of the shortfin mako has been assessed as Threatened under COSEWIC. This species is highly migratory and its distribution pattern is dependent on water temperature, but it can withstand significant changes in temperature as well as food availability. In Canadian waters, the short-fin mako is closely associated with the warm waters around the Gulf Stream and can typically be found from the surface to depths of 500 m (Campana *et al.* 2006). Migration to the Atlantic coast of Canada and to the warm waters of the Gulf, typically occurs in later summer and fall and can typically be found from Georges/ Browns Bank to the Gulf of St. Lawrence. It is believed that Canadian waters are the northern most limit of the species range (Campana *et al.* 2006). They feed primarily on tuna, mackerel, bluefish, swordfish and marine mammals and are considered one of the fastest swimming sharks in the world (SARA 2010). Shortfin makos are ovovivipourous, with a 15 to 18 month gestation period and an estimated 3 year parturition cycle. On average females will give birth to 11 pups every three years and have a theoretical maximum age of 45 (Camapana *et al.* 2006). As indicated in Table 5.2, this species is considered to have a low potential of occurring in EL 1105.

5.2.1.9 American Plaice

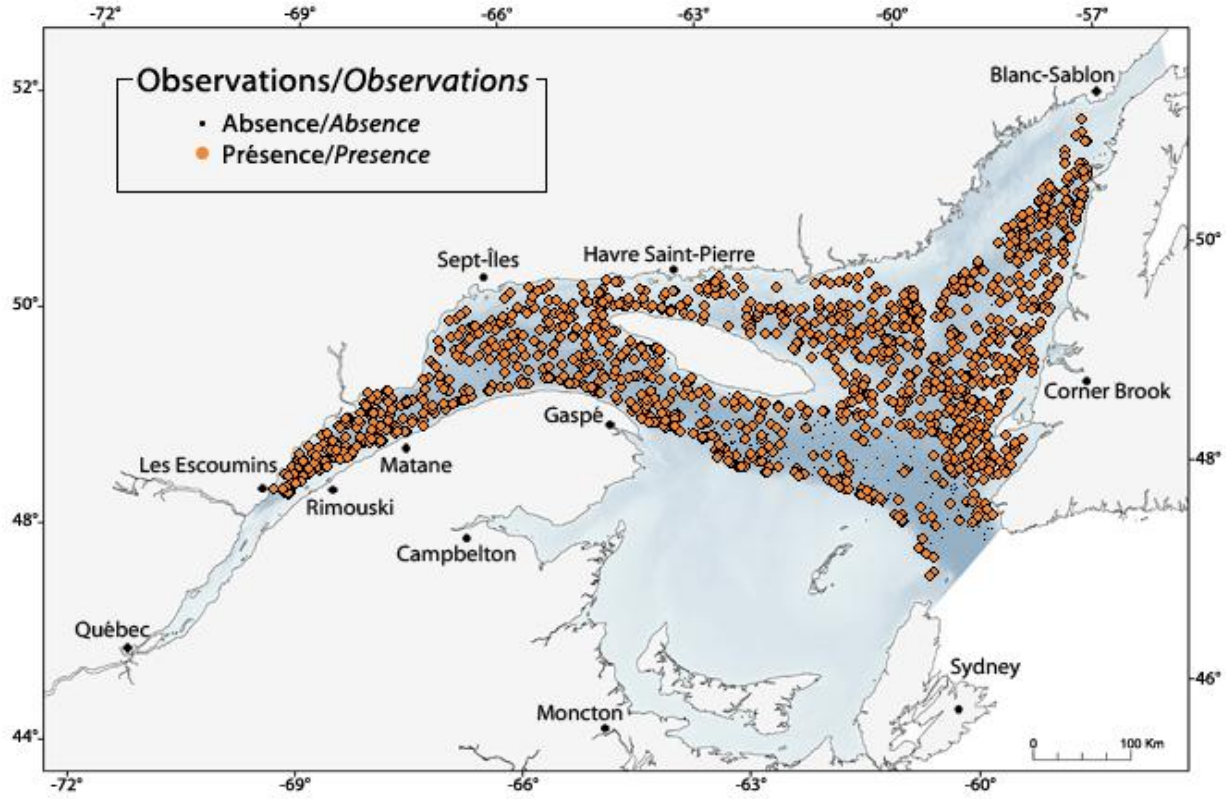
Both the Maritime and Newfoundland and Labrador populations of the American plaice occur in the Gulf and could be found in EL 1105. In 2009, both populations were assessed as Threatened by COSEWIC. This species prefers depths of 100 to 200 m and sediment suitable for burrowing. The Maritime population is more common to the Gulf. The abundance of mature individuals has declined by 86 percent in the Gulf due mainly to overfishing, but also natural mortality (COSEWIC 2009a). Modelled juvenile American plaice densities (from DFO RV data) for 2005 are illustrated in Figure 5.14. American plaice exhibit a seasonal pattern, inhabiting intermediate depths from 80 m to 250 m and cold water temperatures (0°C to 1.5°C) during the summer months (Morin *et al.* 2008). During the winter months, the species moves into the deeper channel waters, where they occupy warmer water and cease feeding.

Distribution of American plaice in the Estuary and Northern Gulf (based on survey data from missions on the *CCGS Alfred Needler* from 2004 to 2012) are depicted in Figure 5.15.



Source: Ollerhead and Lawrence 2007.

Figure 5.14 Distribution of Juvenile American Plaice, 2005



Source: http://slgo.ca/en/species/data.html

Figure 5.15 American Plaice Distribution in the Gulf of St. Lawrence, 2004 to 2012

5.2.1.10 Striped Bass

Striped bass occur from the St. Lawrence Estuary along the Atlantic coast to Florida, with historical breeding in five eastern Canadian rivers, including the St. Lawrence Estuary, the Southern Gulf of St. Lawrence (Miramachi River Population), and the Bay of Fundy (St. John's River, Annapolis River, and Schubenacadie River populations). Two genetically distinct (and isolated) extant populations occur within the vicinity of the Gulf of St. Lawrence: the southern Gulf population and the St. Lawrence Estuary population (COSEWIC 2004).

Females usually spawn at age five (although they can mature at age four) and males mature at year three or four. Spawning occurs in late May or early June, in freshwater and brackish water of the rivers inhabited by each population triggered by increasing temperatures (+10°C). Spawning can last 3 to 4 weeks and takes place during twilight near the surface. Groups of males will surround a single female and fertilize eggs once they are released into the water column. The eggs are semi-pelagic and require a moderate current to develop, remaining suspended in the water column for the entire development stage (COSEWIC 2004). Development from egg to young-of-the-year corresponds to a gradual movement to salt water. Once yolk sacs are depleted, the larvae feed on zooplankton for approximately one month. Immature and adult bass feed on invertebrates or fish in estuaries and coastal waters in summer and can overwinter in rivers. Striped bass hunt prey as a school and can cover tens of kilometres in one day (COSEWIC 2004).

Immature and adult striped bass frequent coastal and estuarine habitats. For the first two years, they feed primarily on invertebrates, gradually becoming pisscivorous (COSEWIC 2004). During the summer months, migrations are associated with the availability of prey. During the fall, they will migrate upstream to prepare for overwintering in brackish and freshwater.

As of 2008, there has been no evidence of spawning in the St. Lawrence Estuary since 1960, nor has there been any authenticated catches of local bass in the same time period (Robitaille *et al.* 2011). Limiting factors included commercial and recreational overfishing and alteration of habitat (*e.g.*, flow modifications and changes in water quality due to pollution from anthropogenic activities) (COSEWIC 2004). Stocking of stripped bass in the St. Lawrence Estuary began in 2002. Six years later mature individuals with the capability were present in the system. Juveniles aged 0+ have been confirmed in the system, confirming the presence of a spawning population once again (Robitaille *et al.* 2011). The St. Lawrence Estuary population is listed as extirpated on Schedule 1 of SARA and the southern Gulf population has been assessed as Threatened by COSEWIC (no SARA status). As indicated in Table 5.2, this species is considered to have a low potential for occurrence in the vicinity of EL 1105 due to the coastal and estuarine nature of the species.

5.2.1.11 Roughead Grenadier

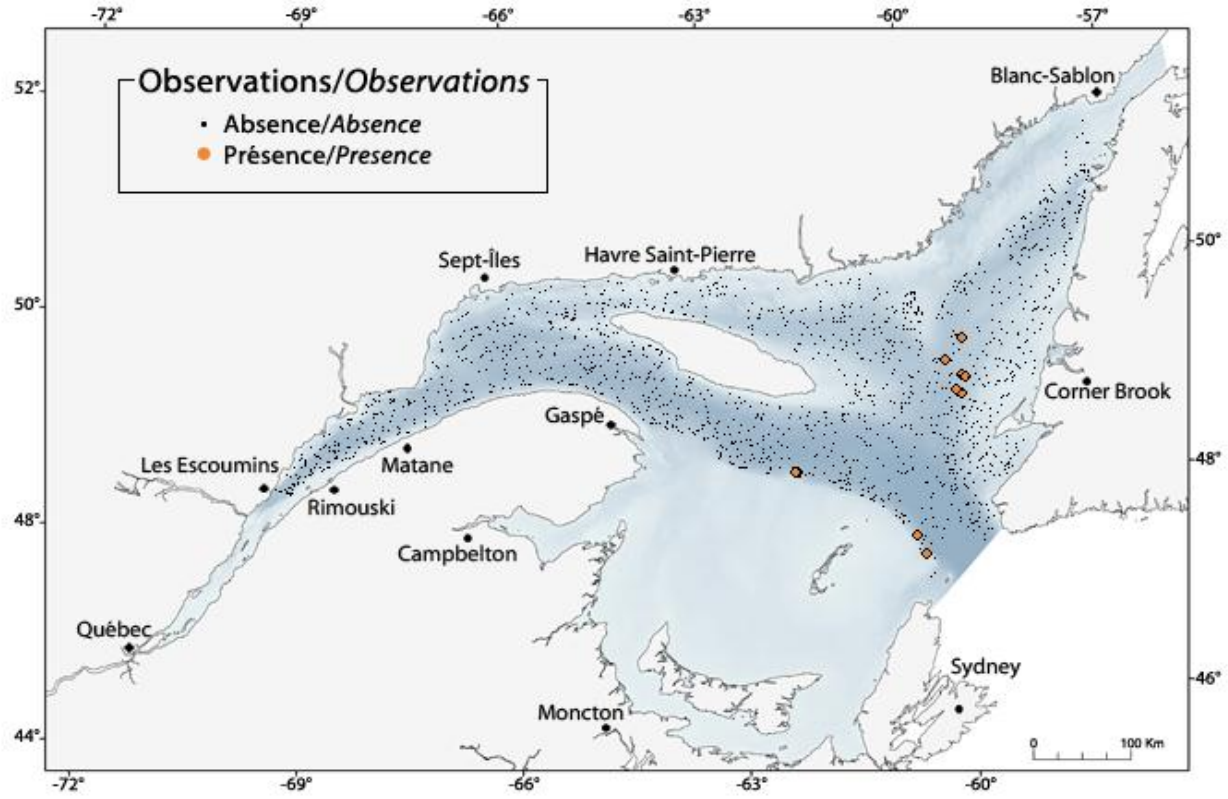
Roughead grenadier is abundant throughout the North Atlantic and can be located on both the shelf and continental slope (González-Costas and Murua 2007). In the Northwest Atlantic, it shows a continuous distribution along the slope of the continental shelf from the Davis Strait to the southern Grand Bank (COSEWIC 2007a). Roughead Grenadier has been assessed as

Special Concern by COSEWIC. As indicated in Table 5.2, this species is considered to have a low potential for occurrence in the vicinity of EL 1105.

5.2.1.12 Spiny Dogfish

The spiny dogfish, Atlantic population, was assessed to be of Special Concern by COSEWIC in April 2010. This small shark is abundant in Canadian waters and widely distributed in temperate regions, being most abundant in southwest Nova Scotia. The species can be found inhabiting depths ranging from 0 to 350 m and temperatures from 0 to 12 °C. The spiny dogfish is ovoviviparous with a reproduction cycle lasting two years. Pupping grounds for the species have not been observed. Large aggregations of mature females occur in the deep warm waters off the edge of the continental shelf or in the deep basins of the Scotian Shelf in the winter months. It is believed that pupping occurs in late winter in these locations (Campana *et al.* 2008). Reasons for concern in Canadian waters include low fecundity, long generation time, and uncertainty regarding abundance of mature females and demonstrated vulnerability to overfishing in US waters (COSEWIC 2010c). As indicated in Table 5.2, this species is considered to have the potential to occur in low numbers in the vicinity of EL 1105.

Distribution of spiny dogfish in the Estuary and Northern Gulf (based on survey data from missions on the *CCGS Alfred Needler* from 2004 to 2012) are depicted in Figure 5.16.



Source: http://slgo.ca/app-guidesp/en/poiss/sp/s-acanthias.html

Figure 5.16 Spiny Dogfish Distribution in the Gulf of St. Lawrence, 2004 to 2012

5.2.1.13 Blue Shark

The blue shark is widespread and highly migratory. It has been assessed as a species of Special Concern by COSWEIC. In Atlantic Canada, they can be found in almost all offshore surface waters to a depth of 350 m. The species moves into Canadian waters over the Scotian Shelf in late spring, moving into the Gulf of St. Lawrence and over the Grand Banks by summer and early fall. By late fall they begin to migrate back to warmer waters and can be found off the continental shelf by winter (DFO 1996). The blue shark has a 9 to 12 month gestation period and females produce litters of approximately 26 to 50 pups every two years (DFO 1996). They are opportunistic feeders and tend to eat a variety of prey including pelagic fish, squids, birds and marine mammal carrion (COSEWIC 2006b). This species is considered to have a low potential for occurrence in the vicinity of the Project (see Table 5.2).

5.2.1.14 Basking Shark

The Atlantic population of basking shark has recently been assessed as a species of Special Concern by COSEWIC; it has no status under SARA (SARA 2010). The basking shark is found in the western North Atlantic from northern Newfoundland south to Florida and occurs in Canadian waters from May to September (Scott and Scott 1988). The Canadian population ranges from approximately 5,000 to 10,000 individuals (COSEWIC 2009b). The basking shark is believed to be ovoviviparous giving birth during the summer after a gestation period of 2.5-3.5 years (Campana *et al.* 2008). This species is considered to have a low potential for occurrence in the vicinity of the Project (see Table 5.2).

5.2.1.15 American Eel

American eel are found from northern South America to Greenland and Iceland. They breed at sea and return to fresh water to feed and grow; all spawners are part of a single breeding unit. Spawning and hatching takes place in the Sargasso Sea and spawning occurs only once per adult. The larval stages are completely physiologically dissimilar to the adult eel. The life stages are: egg; leptocephalus (larval form); glass eel (upon reaching the continental shelf; unpigmented); elver (progressively pigmented as they approach shore), yellow eel (the growth stage of the life cycle); and silver eel (the spawning stage of the life cycle) (COSEWIC 2006c). Female silver eels exit Newfoundland freshwater systems between August to October (Gray and Andrews, in COSEWIC 2006c). The population abundance in the southern Gulf has had a generally increasing trend between 1997 to 2008, while population abundance in Newfoundland is deemed to be variable, but stable in recent years (DFO 2010c). American eel was assessed as Threatened by COSEWIC in May 2012 (previously assessed as Special Concern). As indicated in Table 5.2, any occurrence of this species in the vicinity of EL 1105 would be transient in nature.

5.2.1.16 Atlantic Salmon

Atlantic salmon (*Salmo salar*) is an anadromous species, living in freshwater rivers for the first one to five years of life before migrating to sea. Atlantic salmon return annually to their natal river or tributary for spawning. Both post-smolt (juvenile) and adult salmon migrate from northeastern North America in the spring and summer to over-winter in waters off Labrador.

While at sea, adult salmon were found spending a considerable amount of time in the upper portion of the water column (Reddin 2006). Tagging studies of post-smolts also indicated they spend most of their time near the surface, but undergo deep dives, likely in search of prey (Reddin *et al.* 2006). While at sea, they consume euphausiids, amphipods and fishes such as herring, capelin, small mackerel, sand lance and small cod. Salmon are prey for seals, sharks, pollock (Pollachius spp.) and tuna (Scott and Scott 1988).

As Atlantic salmon transition from freshwater to the marine environment, the length of time that is spent in the nearshore environment is brief, lasting as short as one to two tidal cycles (Reddin 2006). The general movement of post-smolts in the open ocean is in the north east direction towards the Labrador Sea. Post-smolts can be found annually in the Labrador Sea, with some overwintering in the Labrador Sea and Grand Banks areas. Salmon from the Gulf of St. Lawrence stock exit the Gulf through the Strait of Belle Isle, while a few remain in the Gulf until late autumn. It is thought that this exodus from the Gulf may be related to environmental factors such as temperature, as well as the presence or absence of prey species. The Northern Gulf of St. Lawrence stock tends to exit through the Strait of Belle Isle, while the Southern Gulf of St. Lawrence stock exits through the Cabot Strait and South of Newfoundland. Both stocks arrive in the Labrador Sea and Northern Grand Banks from late summer to early fall (Reddin 2006). Many post-smolts can be found in the Labrador sea within four months of leaving their native rivers. It is thought that this area is an important nursery ground for early life stages.

Adult salmon can be found in the surface waters of the northwest Atlantic from the southern edge of the Grand Banks, to the southern edge of Cape Farewell in Greenland (Reddin 2006). In the late summer and fall, first sea winter salmon can be found inshore along the northeast coast of western Greenland and in the Irminger Sea, including the eastern coast of Greenland. Salmon are concentrated along the west Greenland coast from the inner fjords to 45/60 km offshore. Multi-sea winter salmon who have not matured in their second summer at sea and spend another winter at sea can be found in these areas as well (Reddin 2006).

The commercial fishing of Atlantic salmon in Newfoundland waters was placed under moratoria since 1992. There are four at-risk populations that may occur in the Gulf and have the potential to interact with the Project: the Anticosti Island population, assessed by COSEWIC as Endangered; the South Newfoundland population, assessed by COSEWIC as Threatened; the Gaspé-Southern Gulf of St. Lawrence population assessed by COSEWIC as Special Concern; and the Quebec Eastern North Shore population, also assessed by COSEWIC as Special Concern. All of these populations are considered to have a moderate potential for occurrence within EL 1105 during their post-smolt and returning adult migrations (Table 5.2).

The primary cause of population decline for Atlantic salmon is not well understood, although it is thought that poor marine survival rates is a major factor as a result of fishing and overall changes in the marine ecosystem brought about by climate change (COSEWIC 2010d).

5.2.1.17 Atlantic Bluefin Tuna

Bluefin tuna is a warm-blooded pelagic species that is distributed from the Gulf of Mexico (GOM) to the Gulf. The large, endothermic bluefin tuna are adapted for migration to colder waters while maintaining a high metabolic rate, which is evident in their migration into the Gulf in

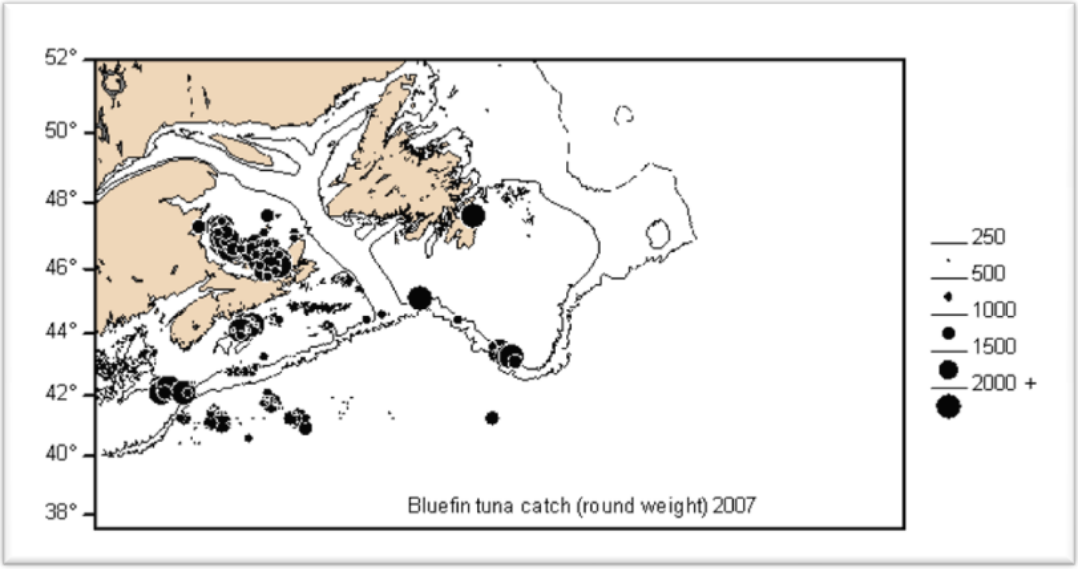
search of food stocks (National Oceanic and Atmospheric Administration (NOAA) 2005). The bluefin tuna generally follow food stocks that aggregate in the Gulf from July through November.

There are two populations of bluefin tuna based on their distinct spawning areas, the Eastern Mediterranean population and the Western Gulf of Mexico (GOM) population; 99 percent of bluefin tuna found within the Gulf are from the Western GOM population (Walli *et al.* 2009; COSEWIC 2011a). Bluefin tuna are oviparous and iteroparous (reproduce more than once in a lifetime), having asynchronous oocyte development and are multiple batch spawners (multiple spawning of an individual in a spawning season; a fish which sheds eggs more than once through a spawning season rather than within a short period) (COSEWIC 2011a). The western Atlantic bluefin tuna spawn between mid-January and late March, with the eastern population spawning in late May. Eggs incubate for a few days with larvae hatching at 2-3 mm as early as two days after spawning (DFO 2009c, COSEWIC 2011a). Early growth is very rapid and the species can be divided into three size classes: “school size” (<61 kg or <120 cm curved fork length (CFL)), “medium” (61 to 140 kg, 120 to 205 cm CFL), and “giant” (>140 kg, <205 cm CFL). Maturity is expected to occur around age eight (DFO 2009c) with habitat range expanding with age.

Adults follow Atlantic herring and Atlantic mackerel fishing grounds and are known to forage on Atlantic herring in late summer and switch to Atlantic mackerel in the fall (Walli *et al.* 2009). In addition to herring and mackerel, bluefin tuna feed on a variety of both pelagic and groundfish including: capelin, saury, lantern fish, barracundinas, silver hake, white hake, squid and euphasiids. Giants gain 8.5 to 10 percent body weight per month in Canadian waters and can reach a maximum age of 38 years (COSEWIC 2011a). Atlantic bluefin tuna have a countercurrent heat exchange system which allows them to maintain muscle temperatures which are greater than the surrounding water. This allows the species to travel to cool waters to feed where the abundance of prey is very plentiful.

It is believed that Spawning Stock Biomass (SSB) peaked in 1973 at 51 460 mt, and the most recent stock estimate is at 14 072 mt in 2009 (Maguire and Lester 2012). Total abundance (age 1+) in 1970 was estimated at 1,266,000 individuals and has dropped to an estimate of 316,000 in 2009. The species is currently assessed as Endangered by COSEWIC and is being considered for a potential Species at Risk status under SARA.

The distribution of the catch of bluefin tuna in the western Atlantic including the Gulf is presented in Figure 5.17. As indicated in Table 5.2, this species has a low potential for occurrence within EL 1105.



Source: DFO 2009c.

Figure 5.17 Bluefin Tuna Catch Distribution in the in the Gulf of St. Lawrence and Western Atlantic

5.2.1.18 Atlantic Sturgeon

Atlantic sturgeon are assessed as Threatened by COSEWIC, and are a large-bodied, slow-growing, late-maturing anadromous fish that occurs in rivers (preferably with deep channels), estuaries (with relatively warm and partially saline water), nearshore marine environments and shelf regions to at least 50 m. The Maritimes Designated Unit has an estimated 1,000 to 2,000 adults (minimum), with spawning occurring within the lower Saint John River area only. The St. Lawrence Designated Unit has an estimated 500 to 1,000 adults. Breeding populations are known from the St. Lawrence River and possibly other rivers tributary to the St. Lawrence river. Potential spawning locations occur in the St. Lawrence River and Estuary (COSEWIC 2011b).

Limiting factors and threats include changes to riverine habitat and potentially, pollution in rivers, and from offshore oil and gas developments. Atlantic sturgeon are fished commercially and that, along with pollution, may have been the most important factor in the suspected past population declines (COSEWIC 2011b).

5.2.1.19 Cusk

Cusk are assessed as Threatened by COSEWIC, but not listed under SARA. Cusk are a cod-like fish that can live up to 20 years and grow to a length greater than 100 cm, with at least half of the adults reaching sexual maturity when they are approximately 50 cm in length (five or six years old). They are usually located at depths of 150 to 400 m in relatively warm water (6ºC to 10ºC) (COSEWIC 2003b).

Cusk are a northern species inhabiting subarctic and boreal shelf waters of the North Atlantic, with the centre of abundance in the Gulf of Maine and southern Scotian Shelf (overlapping the international border of Canada and the United States). While rare, it also occurs in the deep waters along the edge of the continental shelf off Newfoundland and Labrador. Cusk are virtually absent from the Gulf of St. Lawrence and are rare north of the Laurentian Channel in the Newfoundland and Grand Bank region (COSEWIC 2003b).

5.2.2 Bird Species at Risk

There are nine species of birds that could potentially be found in the Gulf and within or near EL 1105 that are considered at risk by SARA (Table 5.1). In addition to SARA, migratory birds in general are protected federally under the *Migratory Birds Convention Act, 1994* (MBCA). The MBCA and regulations provide protection to all birds listed in the Canadian Wildlife Service Occasional Paper No. 1, “Birds Protected in Canada under the Migratory Birds Convention Act”. The act and regulations state that no person may disturb, destroy, or take/have in their possession a migratory bird (alive or dead), or its nest or eggs, except under authority of a permit. Other bird species not protected under the federal act, such as raptors, are protected under provincial wildlife acts.

5.2.2.1 Ivory Gull

The Ivory Gull is a medium sized, long-lived gull species that is associated with polar pack ice at all times of the year (Gilchrist and Mallory 2004), which is unusual for a gull species (Stenhouse *et al.* 2004).

The wintering grounds of the Ivory Gull are thought to be along the edge of pack ice in the North Atlantic Ocean, particularly in the north Gulf, Davis Strait, the Labrador Sea and the Strait of Belle Isle. Various studies conducted from 2002 to 2005 suggest that the Canadian breeding population of the Ivory Gull has decreased. They nest on flat terrain or on sheer cliffs during May and early June. Outside their breeding season, they live near the edges of pack ice, as mentioned above. The Ivory Gull is a surface feeder and primarily feeds on small fish and small mammals (SARA 2010).

Approximately 35,000 individuals were observed among the pack ice of the Labrador Sea in 1978 (Orr and Parsons 1982), representing the bulk of the world population of Ivory Gulls. A 2004 survey conducted off the coast of Newfoundland and Labrador showed a decrease in Ivory Gull numbers, with sightings of, from 0.69 individuals sighted per 10 minutes observed in 1978 to 0.02 individuals sighted per 10 minutes in 2004 (COSEWIC 2006d).

The Ivory Gull is listed as Endangered on Schedule 1 of SARA and is protected under the *Migratory Birds Convention Act* 1994 and *Migratory Bird Regulations* (COSEWIC 2006d). This species is rare in the Gulf of St. Lawrence during October to May and absent during June to October. As indicated in Table 5.1, it is likely to occur in the vicinity of EL 1105 only in association with pack ice.

The management plan for the Ivory Gull (Stenhouse 2004) outlines specific measures that can be taken to increase knowledge and promote the recovery of Ivory Gulls in Canada. The long-term recovery goal is to restore "the Canadian breeding population to historic levels and to expand the breeding range to historically occupied areas". The objectives aim to: maintain Ivory Gull colonies currently in existence and prevent further loss; identify and understand the threats to Ivory Gulls in Canada, with a focus on anthropogenic activities; acquire further knowledge to understand the life history characteristics of the species; identify and protect critical habitat; educate stakeholders and the general public on ways to support recovery; and work collaboratively at an international level to further recovery.

Currently, the hunting of birds on migration is negatively affecting survival and possibly population viability (Stenhouse 2004). Human disturbance at breeding colonies may have a considerable effect by reducing reproductive success and possible habitat degradation. Resource extraction near Ivory Gull breeding areas requires use of planes, helicopters, snowmobiles and ATVs, which may introduce noise and pollution. The presence of semi-permanent drilling camps may also attract predators to otherwise remote areas.

There are several other factors influencing the potential for recovery in Ivory Gulls, for which there is no current data, including ecological perturbation, such as changes in the extent of ice cover causing degradation of winter habitat; exposure to toxic pollutants in the marine environment; and vulnerability to oiling (Stenhouse 2004).

Details of this management plan can be found in the Canadian Management Plan for the Ivory Gull (*Pagophila eburnea*) (Stenhouse 2004).

5.2.2.2 Piping Plover

The Piping Plover *melodus* subspecies is a migratory shorebird that nests in coastal areas on the southwest coast of Newfoundland (Amirault 2005) in sand, gravel, or cobble, in open, elevated areas of the beach (Haig and Elliot-Smith 2004), on barrier island sandspits, or peninsulas in marine coastal areas. It breeds in eastern and central Canada and adjoining regions in the United States. Piping Plover nest on the Island of Newfoundland, the Magdalen Islands and St. Pierre and Miquelon, as well Nova Scotia (including Cape Breton Island), Prince Edward Island, and New Brunswick (Goosen *et al.* 2002; Newfoundland and Labrador Department of Environment and Conservation 2010).

The North American breeding population consists of approximately 5,900 birds, 2,100 breeding in Canada (Goosen *et al.* 2002). The eastern Canadian population was estimated at 481 adults in 2001. A census in Newfoundland in 2006 identified 48 nesting adult Piping Plovers, an increase from 39 birds in 2001. In 2009, a pair of nesting Piping Plovers was identified in Gros Morne National Park for the first time since 1975 (Newfoundland and Labrador Department of Environment and Conservation 2010). In 2010 and 2011, a pair of Piping Plovers was been observed nesting in the Park. The 2011 International Piping Plover Census reported 51 Piping Plovers (21 pairs, 9 singles) on 16 beaches in Newfoundland. A single Piping Plover was recorded on the northeast coast, representing the first record of species presence on the northeast coast since 1987 (Environment Canada 2012c).

Nesting sites for this species on the Island of Newfoundland include Big Barasway, Sandbanks Provincial Park, Little Barasway, Seal Cove and areas around J.T. Cheeseman Provincial Park, Grand Bay West and Little Codroy. Piping Plovers that nest in Newfoundland generally overwinter along the southern Atlantic Coast of the United States. One of its largest breeding areas in Newfoundland and Labrador is the beach at Big Barasway Piping Plover Wildlife Reserve near Burgeo (Protected Areas Association of Newfoundland and Labrador 2000), in addition to the adjoining Sandbanks Provincial Park in Burgeo.

The Piping Plover *melodus* species is listed as Endangered on Schedule 1 of SARA, Endangered under the Newfoundland and Labrador *Endangered Species Act* and is protected under the MBCA. In addition to protection of nests afforded by the Migratory Birds Regulations, Piping Plover habitat is protected under SARA, which provides a residence description of the *melodus* (and *circumcinctus*) subspecies (SARA 2010). The 2012 recovery strategy for Piping Plover (Environment Canada 2012c) identifies critical habitat for this species as "any site with suitable habitat occupied by at least one nesting pair of Piping Plovers (*melodus* subspecies) in at least one year since 1991 (the first year of complete survey coverage)". "Suitable habitat" is outlined as those areas with the following key habitat features, as identified by Boyne and Amirault (1999): a gently sloping foredune; wide stretches of beach that afford protection from flooding at normal high tide; a substrate combined of sand, gravel, or cobble, or some combination of these; and a foredune that is sparsely vegetated or relatively free of vegetation. Sites identified as critical habitat for Piping Plover correspond with its currently known nesting distribution in eastern Canada, and in the Gulf are primarily found along the north shore of Prince Edward Island, the eastern shore of New Brunswick, and along the Magdalen Islands, with additional sites being present along the south and western shores of Newfoundland, and the Northumberland shore of Nova Scotia (Environment Canada 2012c).

Noted threats to this species are human disturbance, predation (egg, chick and adult), habitat loss and degradation, and livestock disturbances. Additional specific threats may directly affect the plovers including driving vehicles on beaches, pets, boats, oil spills, mosquito control, and hurricanes (Stucker and Cuthbert 2006). This species is not expected to occur in offshore areas of the Gulf, such as within the Study Area, but does occur in coastal areas of western Newfoundland with the potential to occur in the vicinity of supply vessel or helicopter transit routes, depending on the final route selected.

5.2.2.3 Roseate Tern

The Roseate Tern breeds almost exclusively on coastal islands in Nova Scotia, although small numbers of birds also breed on islands in Quebec and New Brunswick. Roseate Tern nesting sites are populated with beach grass and herbaceous plants and always in association with Common or Arctic Terns (in northeastern North America) to provide protection from diurnal predators (Nisbet and Spendelow 1999, in COSEWIC 2009c). There are approximately 120 to 150 pairs in Atlantic Canada, mostly in one or two colonies (Country Island (>40 pairs) and the Brothers (>80 pairs), Nova Scotia), with small colonies of Roseate Terns nesting on Sable Island and the Magdalen Islands (COSEWIC 2009c).

The Roseate Tern is listed as Endangered on Schedule 1 of SARA and is a migratory bird covered under the MBCA. There is a recovery plan in place for the Roseate Tern (Environment

Canada 2010b); however, recovery of the entire population relies heavily on the recovery of the portion of the population nesting in the US (which also has a recovery plan (United States Fish and Wildlife Service 1998), as less than five percent of the northeastern North American population of Roseate Terns nests in Canada. Critical habitat has been identified for this species and includes Sable Island, specific coastal islands of Nova Scotia, and, within the Gulf of St. Lawrence, the Magdalen Islands (Environment Canada 2010b).

The objectives of the recovery plan are to maintain high numbers of breeding pairs at Country Island, Nova Scotia (>40 pairs) and The Brothers, Nova Scotia (>80 pairs), enhance productivity at managed colonies to high levels, restore a broader distribution by establishing at least one more managed colony, remove or reduce threats to Roseate Terns and their habitat, and maintain small peripheral colonies of Roseate Terns nesting on Sable Island, Nova Scotia and the Magdalen Islands, Quebec. These objectives will be achieved primarily by: monitoring population size, distribution, movement, and productivity; enhancing nesting habitat; managing additional colonies; identifying critical habitat; protecting habitat; identifying limiting factors at managed colonies; monitoring threats; and improving decision making and planning (Environment Canada 2010b). Threats to this species that were identified include predation from gulls and animals such as foxes, high post-fledging mortality and a shortage of males.

Details of this recovery plan can be found in the Recovery Strategy for the Roseate Tern (*Sterna dougallii*) in Canada. (Environment Canada 2010b). Because this species exhibits high site fidelity, it is unlikely to occur in Western Newfoundland or in the vicinity of EL 1105 (Table 5.1).

5.2.2.4 Red Knot

The Red Knot *rufus* subspecies is a medium-sized shorebird, the largest of the calidridine sandpipers in North America. Its breeding range falls entirely within the central parts of the Canadian Arctic and the species overwinters in South America (COSEWIC 2007b). The Red Knot nests on barren habitats and during migration in North America, uses coastal areas with extensive sandflats.

The estimated population in 2006 was 18,000 to 20,000 birds based on surverys conducted in the wintering range in South America. This represents a decrease of 73.4 percent since 1982. The principal threats to the Red Knot include deterioration of food resources during spring migration, and habitat loss and degradation. The dwindling supply of horseshoe crab eggs in Delaware Bay, the most important food used during the final spring stopover, is the single most important threat to the Red Knot. Various factors leading to decreased habitat availability during migration in eastern North America are also contributing threats to the population (COSEWIC 2007b).

In Canada, the Red Knot *rufus* subspecies is listed as Endangered on Schedule 1 of SARA, and is protected under the MBCA. In 2005, the *rufa* subspecies was added to Appendix 1 of the Convention on Migratory Species which lists migratory species threatened with extinction. The subspecies is listed as Endangered under the Newfoundland and Labrador *Endangered Species Act* and the Nova Scotia *Endangered Species Act.*

This species could occur in the Gulf as an uncommon passage migrant, primarily during fall migration. The Magdalen Island is among one of the major fall staging sites in the Gulf (Aubrey and Cotter 2007).

5.2.2.5 Horned Grebe

The Horned Grebe is a small duck-like waterbird, found across Eurasia and in northwestern North America, primarily in Canada. A small, isolated breeding population has persisted for at least a century in the Magdalen Islands and includes birds breeding in this archipelago and other sporadic breeders that occur in Quebec. While it is unknown where the Magdalen Islands population overwinters, it is assumed that birds winter along the Atlantic coast of North America (SARA 2010).

Between 1993 and 2007, the population on the Magdalen Islands declined by 2 percent per year, with only five adults observed in 2005 (the average has been 15 adults, with no more than 25 adults seen during the same breeding season); this suggests a 22 percent population decline over the last three generations. From 2000 to 2007, most of the birds and nests found during the breeding season were concentrated on East Pond and on Brion Island; other nesting areas of the archipelago seem to be deserted (SARA 2010).

Almost half of the ponds preferred by the Horned Grebe on the Magdalen Islands are located on protected lands including: the Pointe de l'Est National Wildlife Area, managed by Canadian Wildlife Service (CWS); an additional 1,049 ha protected by conservation organizations; an additional 1,290 ha adjacent to this reserve, forming part of the Pointe-de-l'Est Wildlife Preserve; and all the ponds on Brion Island located within the limits of the Brion Island Ecological Reserve, under the jurisdiction of the Quebec government (COSEWIC 2009d). On the Magdalen Islands, adults gather on East Pond before migrating to the wintering areas in late September or early October. At sea, these birds are particularly vulnerable, since they spend most of their time on the water.

The Horned Grebe, Magdalen Islands population, is listed as Endangered on Schedule 1 of SARA (added February 3, 2011). It is also protected under the *Quebec Act Respecting Threatened or Vulnerable Species* (*Loi sur les espèces menacées et vulnérables du gouvernement du Quebec*) (which protects the species but does not offer any protection to the their breeding habitat) and the *Migratory Birds Convention Act*, 1994, which prohibits harming migratory birds, their nests or their eggs (SARA 2010). Pursuant to the listing of the Horned Grebe, Magdalen Islands population as Endangered on Schedule 1 of SARA, a recovery strategy will be required to be developed. Factors limiting Horned Grebe populations in Canada are not known although several possible causes for the decline have been identified including loss of wetlands and oil spills on their wintering grounds (COSEWIC 2009d).

This species is not expected to occur in the vicinity of EL 1105 or elsewhere off the west coast of Newfoundland.

5.2.2.6 Yellow Rail

Yellow Rail is a small, quail-like bird that nests in wet marshy areas of short, grass-like vegetation throughout much of Canada, although its range is poorly known since they inhabit relatively inaccessible habitat and call mainly at night (COSEWIC 2009e). Approximately 90 percent of the global population breeds in Canada. The global population of Yellow Rails overwinters along the coast of the Gulf of Mexico southeeastern coast of the United States (COSEWIC 2009e).

It is estimated that approximately 10,000 individuals nest in Canada although it is suspected that this number is in decline. Habitat loss and degradation, both on its breeding grounds and wintering grounds, is the main threat to this species (COSEWIC 2009e). Yellow Rail is listed on SARA Schedule 1 as a Species of Special Concern and is protected under the MBCA. The species is also provincially listed as Threatened in Quebec.

It is unlikely that the Yellow Rail would occur in the vicinity of EL 1105 except as an uncommon migrant.

5.2.2.7 Harlequin Duck

The eastern population of Harlequin Duck breeds on the Island of Newfoundland, Labrador, northern Quebec, the Gaspé Peninsula and northern New Brunswick (CWS website). Harlequin Duck migrate north in the Gulf until May and then again in later summer, when the birds return to the ocean from inland rivers where they breed. They can be found offshore of the Magdalen Islands (near Île Brion and Rocher–aux-Oiseaux) during migration periods (Environment Canada 2012b). During most of the year, Harlequin Duck are found in such coastal marine environments, but in spring they ascend to high-elevation rivers and streams to breed. Harlequin Duck breed in central Newfoundland and it is expected that they breed in low densities on south coast rivers as well. Harlequin Duck are known to overwinter on the coast of the Island of Newfoundland, near Ramea, Burgeo, Connoire Bay and near the Penguin Islands. Harlequins are known to winter along the St. Pierre and Miquelon coast and have site fidelity to wintering sites (Jacques Whitford 2007; Thomas 2008).

The eastern population of Harlequin Duck is listed on SARA Schedule 1 as a Species of Special Concern and listed as Vulnerable under the Newfoundland and Labrador *Endangered Species Act* (2002). There is a Management Plan for Harlequin Duck conservation for Atlantic Canada and Quebec (Environment Canada 2007).

The goal for the Management Plan is to maintain a wintering population of 3000 Harlequin Ducks in eastern North America for three of five consecutive years. To meet this goal, the Management Plan has established a series of objectives and actions meant to address maintaining population levels and protecting important habitat (Environment Canada 2007). The objectives identified to meet the management goal is to clarify possible threats to the species and outline a regime(s) to address these issues; assess population status; identify, protect and manage important areas for breeding, moulting, wintering, and staging habitat; work with governments, industry, aboriginal groups, and private citizens to identify the threats to the Harlequin Duck, and work toward eliminating or reducing these threats; identify targeted groups

for education and stewardship initiatives on Harlequin Duck issues, and develop appropriate campaigns and programs; conduct gap analysis to determine shortcomings in knowledge of the Harlequin Duck; and engage Greenland in further collaboration with Canada regarding Harlequin Duck conservation.

Threats identified for the Harlequin Duck include pollution (oil/bilge contamination, shipping, oil spills), Insect control programs, habitat loss or degradation (hydro developments, forestry, and mining), accidental mortality as a result of fishery bycatch and aquaculture, disturbances due to aircraft and human activities and illegal hunting (Environment Canada 2007).

Details of this management plan can be found in the Management Plan for the Harlequin Duck (*Histrionicus histrionicus*) Eastern Population, in Atlantic Canada and Quebec (Environment Canada 2007). This species could occur off western Newfoundland and coastal areas of the Gulf year round, but are unlikely to be encountered as far offshore as EL 1105.

5.2.2.8 Barrow's Goldeneye

Barrow's Goldeneye is a medium-sized diving duck that primarily breeds and winters in Canada (SARA 2012), with the majority of wintering occurring in the inner Gulf and the North Shore of Québec. Wintering mostly in coastal marine habitats (bays, inlets, harbours and rocky shores), their winter diet consists of marine molluscs and crustaceans (SARA 2012). The world distribution of Barrow's Goldeneye consists of three separate populations, with approximately 4,500 (or 1,400 pairs (based on an estimate of 30 percent of birds are adult females)) previously identified for the eastern North America population (Savard and Dupuis 1999; Robert *et al.* 2003; Robert and Savard 2006). The eastern population of Barrow's Goldeneye is listed as a Species of Special Concern under Schedule 1 of SARA. It is also protected by the MBCA and is listed as Vulnerable on the Newfoundland and Labrador *Endangered Species Act*. The Newfoundland and Labrador Department of Environment and Conservation has a management plan for Barrow's Goldeneye in Newfoundland and Labrador (Schmelzer 2006).

The range of the eastern population is unknown, but data indicate that breeding is exclusive to Canada, with the only confirmed breeding records being from Québec. Barrow's Goldeneye prefer to breed at high elevations on alkaline wetlands around freshwater lakes. Wintering populations in Quebec are found on small fishless lakes above 500 m elevation, nesting in tree holes or cavities within 2 to 3 km of a water body (Todd 1963; Robert *et al.* 1999a, 1999b). Small numbers (approximately 400 birds) of the eastern population have previously been found to winter in the Atlantic Provinces and along the northern Atlantic coastline in the United States (approximately 100 birds in Maine) (Robert and Savard 2006, in CWS Waterfowl Committee 2008; Schmelzer 2006). Only a small number of birds were previously documented at six sites in Newfoundland, including Traytown Bay, Port Blandford, Spaniard's Bay, St. Mary's Bay, Stephenville Crossing and at the mouth of the Humber River near Corner Brook (Schmelzer 2006).

More recent surveys for Barrow's Goldeneye have revealed that they may be more abundant in the region than previous data indicated. Mid-winter surveys conducted in waters of Quebec, Prince Edward Island, New Brunswick and parts of Nova Scotia (surveys not conducted along the Atlantic coast) in February / March 2009 tallied 6,800 wintering Barrow's Goldeneye, most of

which (approximately 6,250) were in Quebec, with the remainder in the Gulf of St. Lawrence zone of the Maritime Provinces (EC-CWS, unpublished data, pers. comm. 2012). Aerial surveys conducted along the western coast of Newfoundland during the spring of 2006 identified 925 adult males in the Bay of Islands area; 209 adult males at Gros Morne; and 1,615 adult males between St. John Bay and Genevieve Bay on the Northern Peninsula (Gilliland unpublished data, 2006). Although present along the coast, this species is unlikely to occur in offshore areas of the Gulf, including EL 1105.

5.2.3 Marine Mammal Species at Risk

There are seven species of marine mammals that could potentially be found in the Gulf and within or near EL 1105 that are considered at risk. The status of these species is presented in Tables 5.1 and 5.2.

5.2.3.1 Blue Whale

The Northwest Atlantic population of the blue whale has been listed as Endangered under SARA. Blue whale winter distribution and migration routes are not well understood (Reeves *et al.* 2004); some researchers suggest a southern migration (Beauchamp *et al.* 2009), while other researchers note that some whales remain near Newfoundland and Nova Scotia (Sears 2002; Sears and Calambokidis 2002). During spring, summer and fall, the blue whale inhabits both coastal and open ocean waters of the north shore of the Gulf and off eastern Nova Scotia where they are are frequently observed in highly productive coastal waters feeding on krill, their primary food source. A 2007 survey resulted in an estimated abundance of 16 blue whales in the entire Canadian survey (Lawson and Gosselin 2009), with one whale being sighted in the survey portion of the Gulf that covers the location of EL 1105. Surveys conducted in 1995 and 1996 (Kingsley and Reeves 1998) identified 5 blue whales in the north side of the St. Lawrence Estuary. It should be noted that efforts to understand the distribution of blue whales has been largely concentrated in the Northwest of the Gulf (DFO 2012c). Whales can dive on average for 5 to 15 minutes after breathing at the water's surface. They mate and give birth during fall and winter in warmer southern waters. The blue whale is one of the largest and loudest (calls of 186 dB) animals in the world (SARA 2010).

The major factor responsible for the reduction in abundance of the blue whale was historical whaling activities. It has been estimated that whaling reduced the blue whale population by approximately 70 percent (Beauchamp *et al.* 2009) and it is estimated that there is currently likely less than 250 mature blue whales present in the Northwest Atlantic population (Sears and Calambokidis 2002). Twelve threats to the north Atlantic blue whale were identified in the 2009 Blue Whale Recovery Strategy including anthropogenic noise (acoustic degradation and changes in behaviour), food availability, contaminants, collisions with vessels, whale watching, anthropogenic noise (physical damage), accidental entanglement in fishing gear, toxic algal blooms, toxic spills, whaling, ice and predation. Those of highest concern include anthropogenic noise (acoustic degradation and changes in behaviour) and food availability. A number of recovery actions have already been undertaken, including blue whale protection programs and habitat protection measures and awareness, one of which includes the development of the *Statement of Canadian Practice with respect to the Mitigation of Seismic Sound in the Marine Environment* (which is an appendix of the *Geophysical, Geological, Environmental and*

Geotechnical Program Guidelines (C-NLOPB 2012). The goal of this recovery plan is to reach a population of 1,000 mature blue whales and the objectives that were established for the next five years to help meet this goal include undertaking a long term assessment of the number of northwest Atlantic blue whales and population trends, implementing control and follow-up measures for those activities that could disrupt the recovery of the blue whale, and increasing awareness of the potential treats. Details of this recovery plan can be found in the Blue Whale Recovery Strategy Report (Beauchamp *et al.* 2009).

5.2.3.2 North Atlantic Right Whale

The North Atlantic right whale is a migratory species that typically inhabitants coastal waters. They spend their summers feeding in cooler waters and their winters feeding in warmer waters. This species has been listed as Endangered under Schedule 1 of SARA. In 2003, the abundance of the species was critically low with an estimated 325 to 350 individuals (DFO 2007c). Two stocks of the North Atlantic right whale can be found in Canadian waters, the eastern North Atlantic stock and the western North Atlantic stock. The western North Atlantic stock can be found from the coast of Florida to Newfoundland and Labrador (SARA 2010). In the summer and fall, they can be seen in large concentrations in the Bay of Fundy and Southwestern Scotian Shelf foraging on calanoid copepod, *Calanus finmarchicus*. In the Gulf of St. Lawrence, the whales are observed in smaller numbers and could occasionally occur in the vicinity of EL 1105 (DFO 2007c). Critical Habitat for the North Atlantic Right Whale was identified in the Bay of Fundy and Roseway Basin. The Gulf of St. Lawerence was not identified as critical habitat (DFO 2007c).

Since commercial whaling has ended, threats to the abundance of the North Atlantic right whale are a result of strikes by vessels and entanglements with fishing gear most commonly, as well as disturbance and habitat reduction (Brown *et al.* 2009). The 2009 North Atlantic Right Whale Recovery Strategy states that where there is limited knowledge on the actual abundance of this species, long term abundance targets cannot be determined and instead a goal to achieve an increasing tread in population abundance over three generations iss identified. The objectives identified to meet this goal included: reducing mortality and injury as a result of vessel strikes and fishing gear interactions; reducing injury and disturbance as a result of vessel presence or exposure to contaminants and other forms of habitat degradation; monitoring population and threats; increasing the understanding of life history characteristics, low reproductive rate, habitat and threats to recovery through research; supporting and promoting collaboration for recovery between government and agencies; and developing and implementing educational programs. Details regarding the strategies that are in place to meet such objectives can be found in the North Atlantic Right Whale Recovery Strategy Report (Brown *et al.* 2009).

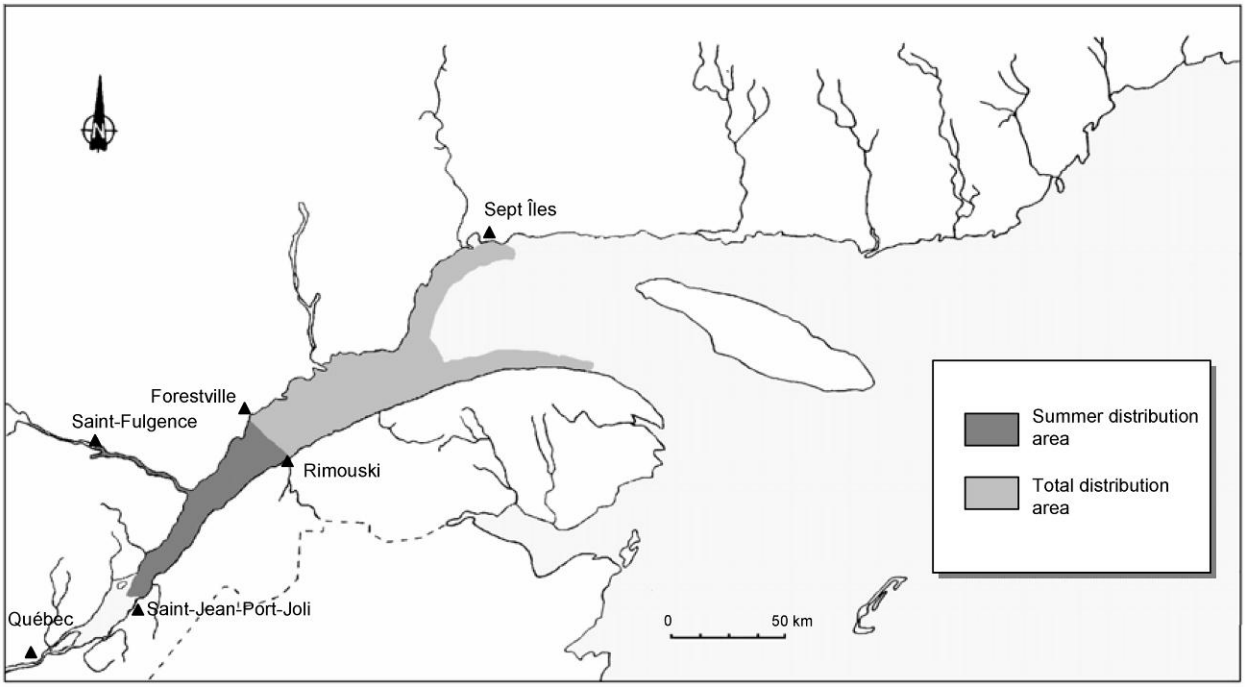
5.2.3.3 Beluga Whale

The St. Lawrence Estuary population of the beluga whale has been listed as Threatened under Schedule 1 of SARA. This population of the beluga represents the southern limit of the species. Their habitat is generally ice-covered in winter and their summers are spent in warmer, shallow, turbid waters. This species feeds on various types of invertebrates and fish including squid, tube worms, capelin and Greenland and Atlantic cod (SARA 2010). A 2007 survey resulted in an estimated abundance of 893 beluga whales in the Gulf (Lawson and Gosselin 2009) down from

historical levels of between 7,800 and 10,100 whales (DFO 2005b; Hammill *et al.* 2007). Aerial survey data between 1988 and 2005 indicate that the population increased slightly, but not statistically significantly, from 900 whales in 1988 to just over 1,200 in 2005, or approximately 12 percent of historical levels (Hammill *et al.* 2007). A 1996 survey identified 6 beluga whales on the north side of the Gulf of St. Lawrence estuary (Kingsley and Reeves 1998). While the range of this species is generally considered limited geographically to the St. Lawrence River and Estuary, the 2007 survey did include two individual sightings within the main part of the Gulf and off the northwest coast of Newfoundland (Lawson and Gosselin 2009). No sightings were reported in the area of Gulf where EL 1105 is located, however, these results do indicate that there is a low possibility that individuals of this species could occur occasionally in the vicinity of the Project (Lawson and Gosselin 2009). In recent years, occasional observations of several hundred belugas have been reported, although it was not clear to which population the herds belonged (*i.e.*, the St. Lawerence population or one of the Arctic stocks) (DFO 2012c). The St. Lawrence Estuary population of belugas is listed as Threatened under Schedule 1 of SARA

The beluga is a typical cold-water marine mammal with winter distribution associated with areas of fast ice where open water provides air access (Barber *et al.* 2001). In the summer, beluga whales concentrate in specific estuaries, with high site fidelity (Fraker *et al.* 1979; Finley 1982). In the St. Lawrence Estuary, belugas tend to gather in certain areas more regularly than others (DFO 2011e).

The total distribution area of the St. Lawrence Estuary beluga population is smaller than it used to be, covering a territory of over 8,000 km² in the St. Lawrence Estuary, the Gulf of St. Lawrence, and the Saguenay River (DFO 2011e). The current summer distribution zone, which has changed very little in the last 20 years, is only a portion of what it was historically (Lesage and Kingsley 1998; Gosselin *et al.* 2007). The population is concentrated at the mouth of the Saguenay River, where it occupies an area of 2,000 km² extending from the Battures aux Loups Marins across from Saint-Jean-Port-Joli to Rimouski on the south shore of the St. Lawrence River and Forestville on the North Shore (Figure 5.18). Approximately 30 belugas over the last several years have been sighted in the Estuary east of Rimouski and Forestville and in the area of Sept-Îles, suggesting a wider distribution than was previously thought (Gosselin *et al.* 2007). The summer distribution into the Saguenay River extends from the mouth of the river to Saint-Fulgence.



Source: DFO 2011e

Figure 5.18 Present Distribution Area of the St. Lawrence Beluga (adapted from Michaud 1993)

Sightings are rare in spring and fall, and while uncertain, the distribution in these seasons is thought to be similar to that for summer (DFO 2011e). This population is partially migratory, moving to the northwest sector of the Gulf of St. Lawrence in the winter (Lesage and Kingsley 1998; DFO 2011e). Occasional sightings, along with aerial surveys conducted in 1989 and 1990, suggest that the winter distribution area extends downstream into the Gulf, all the way to Sept-Îles on the North Shore and small groups have also been sighted in the Estuary up to Rivière-du-Loup. It is likely that the winter distribution varies from year to year, depending on ice conditions. In early spring, belugas can be found off the Gaspé Peninsula upstream as far as the Battures aux Loups Marins (DFO 2011e).

In September 2011 (DFO 2011e), a proposed recovery strategy for the St. Lawrence Estuary population was released. The following six recovery objectives have been identified: reduce contaminants in belugas, their prey, and their habitat that could prevent population recovery; reduce anthropogenic disturbances; ensure adequate and accessible food supply; mitigate the effects of other threats to population recovery; protect beluga habitat throughout the entire distribution range; and ensure regular monitoring of the St. Lawrence Estuary beluga population. Numerous critical, necessary and beneficial recovery strategies have been identified and include the following which may be particularly pertinent to petroleum industry activity in the Gulf (DFO 2011e): develop new regulations or full apply existing regulations to control the discharge of toxic pollutants into the environment, especially new contaminants; determine the short- and long-term effects of chronic and acute forms of disturbance; study the impacts of noise pollution on belugas; reduce anthropogenic disturbances in high-use areas; and develop

and implement adequate protective measures for all inshore and offshore projects that could have an impact within the beluga distribution area.

The recovery strategy (DFO 2011e) identified threats as historic, current (population and individuals) and occasional or sporadic. Hunting and harassment were identified as historic threats. Current threats to the beluga population included: long term contaminant exposure; marine traffic, marine life observations (including ecotourism activities), noise (included noise associated with offshore oil and gas activities, marine traffic, fisheries and ecotourism and recreation); reduced prey abundance (due to overfishing, habitat degradation, pollution, barriers to migration and climate change); predator competition; commercial fisheries competition; habitat degradation (construction and dredging, hydroelectric projects, offshore oil and gas); and the introduction of exotic species. Current threats to individual belugas were identified as ship strikes, entanglement in fishing gear, and scientific research. Occasional or sporadic threats were identified as toxic spills, harmful algal blooms, and epizootic disease. Under toxic spills, it was noted that oil exploration and development can considerably increase the risk of accidents and spills in the Gulf (Kingston 2005) and that given the relatively limited habitat available in the St. Lawrence Estuary and Gulf, a large oil spill poses a serious risk for the beluga population.

Details regarding the strategies that are in place to meets such objectives can be found in the Recovery Strategy for the Beluga Whale (*Delphinapterus leucas*) St. Lawrence Estuary population in Canada (Proposed) (DFO 2011e).

5.2.3.4 Northern Bottlenose Whale

The northern bottlenose whale is confined to the waters of the northern Atlantic Ocean. There are two populations, the Davis Strait-Baffin Bay-Labrador Sea population and the Scotian Shelf population.

The Scotian Shelf population of the northern bottlenose whale has been listed as Endangered under Schedule 1 of SARA. The Scotian Shelf population is largely found in and around the Gully. These whales are non-migratory, are never seen in water less than 800 m deep and differ greatly from other northern bottlenose whales found in other populations (SARA 2010). Currently, there is no population estimate for the entire North Atlantic population of the northern bottlenose whale, and it is believed that the Scotian Shelf population represents an extremely small portion of the entire North Atlantic population. The Scotian Shelf population is also considered to be an isolated population with localized movements. Sightings data indicate that this population may have 163 individuals (DFO 2010d). The major threats to the abundance of the northern bottlenose whale include impacts from historical whaling, entanglement with fishing gear, oil and gas activities, acoustic disturbance, contaminants, changes to food supply and vessel strikes. The goal of the northern bottlenose recovery strategy is to achieve a stable or increasing population and to maintain, at a minimum, current distribution (DFO 2010d). The following objectives have been identified to help reach this goal: improving the understanding of the northern bottlenose whale ecology; improving the understanding of this species population abundance and trends; improving the understanding of and monitoring of anthropogenic threats; and engaging the public and stakeholders through education.

Details regarding the strategies that are in place to meets such objectives can be found in the Recovery Strategy for the Northern Bottlenose Whale, Scotian Shelf population, in Atlantic Canadian Waters (DFO 2010d).

COSEWIC recently assessed the Davis Strait-Baffin Bay-Labrador Sea population of Northern Bottlenose Whale as Special Concern (DFO 2011f). Trends in population size since then are uncertain but survey sighting rates have been low (COSEWIC 2002). The major threats to the abundance of this population of northern bottlenose whale include impacts from historical whaling, entanglement with fishing gear, oil and gas activities, acoustic disturbance, contaminants, changes to food supply and vessel strikes. More survey effort is needed to fully describe the distribution and abundance of northern bottlenose whales in Canada, particularly in the northern part of its distribution and around Newfoundland (DFO 2011f).

Because of the low sighting of this species and deep water distribution (normally greater than 500 m with most caught at depths greater than 1000 m (DFO 2011f), it is unlikely to occur in western Newfoundland or in the vicinity of EL 1105 (Table 5.2).

5.2.3.5 Fin Whale

The Atlantic population of the fin whale has been listed as Special Concern under SARA. This species tends to make seasonal migrations traveling alone or in small groups from low latitude areas during the winter to high latitude summer feeding areas. They can be observed near the coast as well as far offshore. Their diet consists of krill and small fish such as herring and capelin (DFO 2012c). Summer concentrations of the fin whale can be found in the Gulf, on the Scotian Shelf, in the Bay of Fundy, and in the nearshore and offshore waters of Newfoundland and Labrador (COSEWIC 2005b). It is possible that fin whales could be present in or pass through EL 1105. Little is known about their overwintering or breeding areas. A 2007 survey resulted in an estimated abundance of 28 fin whales in the Gulf (Lawson and Gosselin 2009), with no individuals observed in the portion of the Gulf in which EL 1105 occurs. Surveys conducted in 1995 and 1996 identified 380 fin whales along the margins of the Laurentian Channel or on the North Shelf (Kingsley and Reeves 1998).

Several factors threaten the recovery of the Atlantic fin whale population. The primary threat is noise pollution (*e.g.*, shipping, seismic exploration, military sonar and industrial development) and secondary threats include changes in food availability, toxic spills, whaling (e.g, in Greenland and Iceland) and diseases. Ship strikes, entanglements in fishing gear, marine life observation activities and harmful algal blooms may also present a threat to the population (DFO 2012b). A draft management plan for the fin whale is under review and was expected to be available for public comment in 2012 as part of SARA recovery process.

5.2.3.6 Harbour Porpoise

The Northwest Atlantic population of the harbour porpoise is widely distributed over continental shelves and is made up of three sub-populations found in Canadian waters, Newfoundland-Labrador, Gulf and the Bay of Fundy / Gulf of Maine. A 2007 survey resulted in an estimated abundance of 3,629 harbour porpoise in the Gulf and Scotian Shelf combined (Lawson and Gosselin 2009); 15 individuals were sighted in the survey portion of the Gulf that includes

EL 1105. Surveys conducted in 1995 and 1996 resulted a total of 302 harbour porpoises counted which equates to an uncorrected abundance of 21,000 harbour porpoises present in the northern part of the Gulf alone (Kingsley and Reeves 1998). This population of the harbour porpoise has been designated as Special Concern under COSEWIC. This species is well adapted to cold water and often inhabits bays and harbours during summer. They feed upon a variety of small fishes including cod, herring, hake, capelin and sand lance (SARA 2010).

The most signficant threats to the harbour porpoise are bottom-set gill nets, habitat degradation, and loss of habitat due to acoustic harassment devices used by commercial fish-farmers (*i.e.*, salmon producers) to deter natural predators away from their stocks (DFO 2008b). Northwest Atlantic harbour porpoises are also at risk from environmental contamination by pesticides and other chemicals (DFO 2008b).

5.2.3.7 Killer Whale

The Northwest Atlantic/Eastern Arctic population of the killer whale is assessed as Special Concern under COSEWIC. While these whales were historically considered common in the Gulf and St. Lawrence Estuary, they are now sighted only occasionally (Lesage *et al.* 2007, in COSEWIC 2008b). They are seen in nearshore waters of Newfoundland, particularly in the Strait of Belle Isle (Lawson *et al.* 2007, in COSEWIC 2008b). While no killer whales were sighted in the Gulf during a 2007 survey (Lawson and Gosselin 2009), EL 1105 does occur on the periphery of their documented range and therefore killer whales may be expected to occur occasionally in this area. The distribution of this species seems to be dependent on the availability and accessibility of their prey. The killer whale can withstand significant changes in salinity, temperature and turbidity.

Little is known about threats to killer whales in the northwestern Atlantic and eastern Arctic. Physical and acoustical disturbances as well as increasing levels of contamination are likely threats to killer whale populations (COSEWIC 2008b).

5.2.4 Sea Turtles

There are two at-risk species of sea turtles that occur in the Gulf and could potentially be found within or near EL 1105: leatherback turtle (Endangered, SARA Schedule 1), and loggerhead turtle (Endangered, COSEWIC assessment; no SARA status).

5.2.4.1 Leatherback Turtle

The leatherback turtle is a migratory sea turtle that breeds in tropical and subtropical waters and feeds in temperate waters. The leatherback turtle has been listed as Endangered under Schedule 1 of SARA. These turtles spend the majority of their life at sea but do come ashore to nest and lay eggs. Leatherback turtles nest from November to April and are typically present in Canadian waters from June to November to forage (Atlantic Leatherback Turtle Recovery Team 2006). Leatherbacks have been observed foraging in two broad areas of the temperate northwest Atlantic: waters >44°N near Cape Breton, southern Newfoundland and the southern portion of the Gulf of St. Lawrence; and relatively southern waters (<44°N) along the Scotian Shelf, Georges Bank and Mid-Atlantic Bight (Sherrill-Mix *et al.* 2008). From 1998 to 2005,

fishers and other mariners reported 851 geo-referenced sightings of free-swimming or entangled leatherback turtles in Atlantic Canada with most sightings located on the Scotian Shelf (perhaps reflecting reporting bias where fishing activity is more concentrated). Smaller numbers of sightings were recorded in coastal Newfoundland waters and slope waters south of Nova Scotia; relatively few turtles were reported in the Bay of Fundy and northern Gulf of St Lawrence (James *et al.* 2006). Satellite telemetry data from turtles tagged in Canadian waters have shown that leatherbacks do forage for prey in and around EL 1105 (James *et al.* 2005).

While there are a number of factors contributing to their vulnerability (*i.e.*, a long lifespan, very high rates of egg and hatchling mortality, and a late age of maturity) (COSEWIC 2001), major sources of mortality in Canadian waters are incidental capture in fishing gear (COSEWIC 2001; James *et al.* 2005) and ingestion of plastic which may be mistaken for jellyfish (Mrosovsky *et al.* 2008). Interaction of leatherbacks with pelagic fishing gear (*e.g.*, longlines) has been the focus of species conservation measures in pelagic waters, although James *et al.* (2005) suggest interactions with bottom fixed gear in shelf waters may lead to higher mortality risk).

In Atlantic Canada, the recovery goal is to "achieve the long-term viability of the leatherback turtle populations frequenting Atlantic Canadian waters" (Atlantic Leatherback Turtle Recovery Team 2006). The objectives to reach this goal are to: understand the threats to leatherbacks in Atlantic Canadian waters; acquire further information to improve the general knowledge of the species and its habitat; take further steps to identify critical habitat so that it may be protected; reduce the risk of harm to leatherback turtles from anthropogenic activities; educate stakeholders and the general public on ways to support recovery; and work collaboratively at an international level to further recovery. Identified threats to this species include fishing gear entanglement, marine vessel collisions, marine pollution, acoustical disturbances (oil and gas exploration and development, shipping, fishing, military activity, underwater detonations, and shore based activities), poaching, coastal construction, artificial light, climate change, beach erosion, nest predation, beach driving, beach cleaning, beach mining, and exotic vegetation (Atlantic Leatherback Turtle Recovery Team 2006.

Details regarding the strategies that are in place to meet such objectives can be found in the Recovery Strategy for Leatherback Turtle (*Dermochelys coriacea*) in Atlantic Canada (Atlantic Leatherback Turtle Recovery Team 2006).

5.2.4.2 Loggerhead Sea Turtle

The loggerhead sea turtle is the largest hard-shelled turtle in the world and the most abundant in North American waters. Globally, there are nine loggerhead sea turtle distinct population segments (DPS), including the Northwest Atlantic DPS in which EL 1105 is located (Conant *et al.* 2009). There are no estimates of loggerhead sea turtle abundance in Canadian waters, with data limited to opportunistic sightings, fisheries bycatch, strandings, and limited survey information (DFO 2010e). An assessment of the loggerhead sea turtle population in the Western North Atlantic is derived from nest counts reported in the five subpopulations identified by the US Turtle Expert Working Group; nest counts are used as an index of mature female abundance. Using this data collected betwewen 2004 and 2008, estimates of the adult female population in the western North Atlantic range from 16,000 to 90,000 (National Marine Fisheries Service 2009, cited in DFO 2011e). Annual numbers of nests (and by extension, adult females)

of all Western North Atlantic loggerhead subpopulations have been decreasing during the past decade (TEWG 2009). There are limited estimates of the density of loggerhead turtles offshore western Newfoundland (LGL 2005b). The largest nesting beaches are along the southeastern United States coastline with the largest subpopulation from Peninsular Florida (TEWG 2009).

Its distribution is largely constrained by water temperature and it does not generally occur where the water temperature is below 15°C (Brazner and McMillan 2008). Loggerheads can migrate considerable distances between nesting areas that are occupied from late April to early September (Spotila 2004) and temperate foraging areas, some moving with the Gulf Stream into eastern Canada waters during the summer and fall (Hawkes *et al.* 2007). Information to date indicates a seasonal population of juvenile loggerheads in Atlantic Canada (Witzell 1999; COSEWIC 2010e) but the number occurring in Canadian waters is unknown.

Little is known about the diet of juveniles at sea (Conant *et al.* 2009) although it is expected they consume prey such as gelatinous zooplankton, squid and shellfish (Spotila 2004; Conant *et al.* 2009).) Most loggerhead records offshore Newfoundland have occurred in deeper waters south of the Grand Banks and sightings have extended as far east as the Flemish Cap (COSEWIC 2010e). The loggerhead sea turtle was designated as Endangered under COSEWIC in April 2010. This species is threatened by commercial fishing activities, loss and degradation of nesting beaches, marine debris, chemical pollution and illegal harvesting of eggs and nesting females (COSEWIC 2010e).

5.3 Marine Ecosystem

The Gulf is divided into two zones, the northern and southern Gulf (which includes the Magdalen Islands, as well as New Brunswick, Nova Scotia and Prince Edward Island). Within each of these zones, fish habitat is divided into two areas, the shelf areas and the deep channels. The shallow waters along the shelf areas are characterized by warm, high productivity waters in the summer, and serve as feeding, nursing and spawning grounds for both demersal and pelagic fish. The bottom area over much of the Magdalen Island Shallows is within the Cold Intermediate Layer (CIL), making these temperatures colder than those found in the deep channels (DFO 2012a). The shallow waters surrounding the Magdalen Islands support high densities of American plaice and Atlantic cod. These species are the most dominant demersal fish found in the southern Gulf (Dufour and Ouellet 2007). The highly productive, warm water areas also serve as important feeding areas for marine fish that migrate to the area looking for food, such as spiny dogfish and bluefin tuna.

A comprehensive review of the western Newfoundland offshore area in the Gulf was completed for a SEA in 2005 (LGL 2005b) and amended in 2007 (LGL 2007). The SEA (and subsequent amendment) study area was located immediately adjacent to the Old Harry Prospect and as such, these SEA documents provide a thorough assessment of the coastal and marine Gulf regions under consideration for the current Project. Where appropriate, specific report sections of the Western Newfoundland SEA documents are cross-referenced. Another update of the Western Newfoundland SEA is expected in 2013, although this document was not available for review at the time of writing this EA report.

The fish and shellfish habitat supported in EL 1105 is characteristic of the Laurentian Channel. Oceanographic characteristics have been discussed in Section 4.2, and physical habitat features are described below.

5.3.1 Coastal Habitats

The rocky shores in western Newfoundland can be classified as primary coasts, such that primary structural characteristics have been determined by natural processes, mainly erosion and tectonic forces caused by glacier activity and historic plate movements, respectively. The shorelines of New Brunswick and Prince Edward Island are characterized by highly erodible shorelines including barrier beaches, salt marshes and other geographical features (DFO 2012a). Many organisms live within the coastal habitats, specifically within the tidal and subtidal zones. An abundance of plant life is present, various species of cyanophyta, seaweeds, lichens and to a lesser extent saline-tolerant species such as seaside plantain.

The focus of this section on coastal habitats will encompass the aquatic portion of the tidal and subtidal zones and as such, the primary producers will be phytoplankton (discussed in Section 5.3.4.1) and macrofloral algal seaweeds and aquatic vascular plants.

5.3.1.1 Algal Communities

Algal seaweed species are generally differentiated by color and fall within either the red, brown or green algal community. Species vary in the tidal and subtidal zones depending on wave action and substrate characteristics. A comprehensive inventory of benthic marine algae for Western Newfoundland can be found in “NEAS Keys to Benthic Marine Algae of the Northeastern Coast of North America from Long Island Sound to the Strait of Belle Isle” (Sears 2002).

Apart from being the primary producers in the coastal environment, algal seaweed species provide shelter and food for marine fauna. Species anticipated to inhabit coastal areas include mollusks, worms, crustaceans, echinoderms and fish. Commercially-sensitive species that may at some life stage inhabit or pass through coastal areas are described in Sections 5.4 and include whelks, sea urchins, northern shrimp, rock crab, lobster, Atlantic herring, Atlantic mackerel, pollock, white hake and Atlantic salmon.

5.3.1.2 Eelgrass Community

A vascular species of the aquatic macrophyte, eelgrass *(Zostera marina*) is of ecological importance as beds of eelgrass support a high biodiversity of species, provide refuge for small species of fish, a food source for migrating and overwintering waterfowl and play a role in the global climate and ocean cycles. Eelgrass has characteristics which meet the criteria of an Ecologically Significant Species. This means that if the species were to be perturbed severely, the ecological consequences would be substantially greater than an equal perturbation of most other species associated with this community. As such, eelgrass is also protected by law, under the *Fisheries Act*, based on its high value for fisheries species. Eelgrass and other seagrass populations worldwide are indicator species (*i.e.*, loss of seagrass is indicative of anthropogenic stress) (DFO 2009d).The following data are taken from DFO’s distribution and description of

eelgrass beds in Quebec (DFO 2009e) and indicate eelgrass beds are prevalent in coastal Quebec and the Magdalen Islands, representing upwards of 9,380 ha of coastal habitat. The Magdalen Islands harbour some of the eelgrass beds closest in proximity to EL 1105. In the Magdalen Islands, eelgrass beds tend to flourish within the subtidal zones of all inshore waters, with the largest beds in Lagune de la Grande Entrée, Lagune du Havre aux Maisons, Lagunes du Havre aux basques, Bassin aux Huitres and Baie du Bassin.

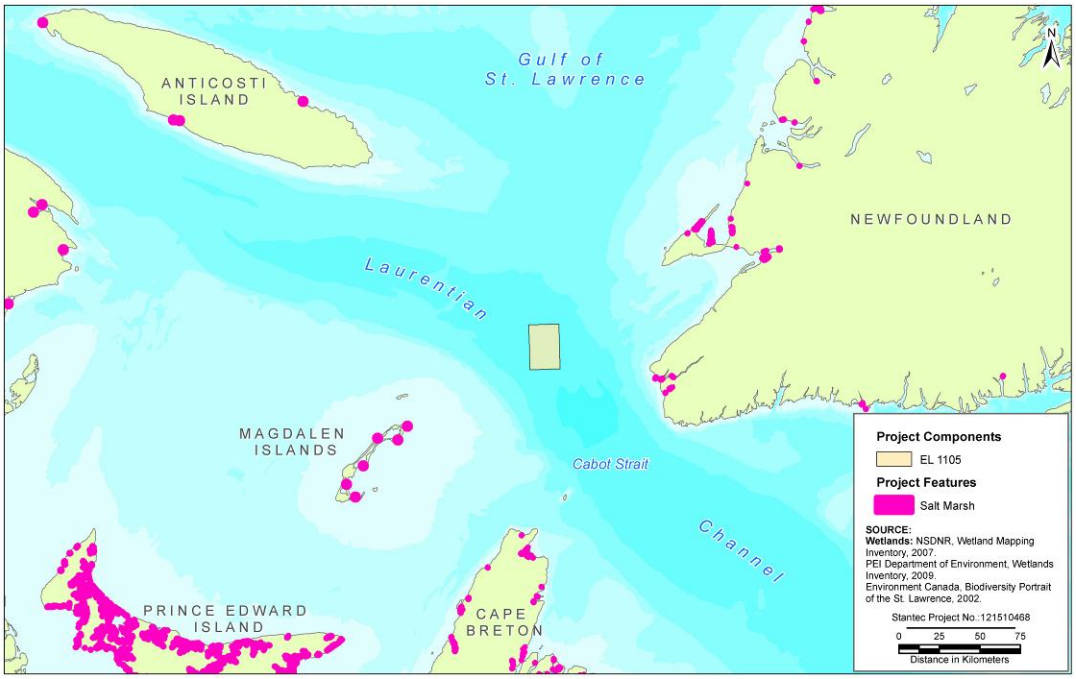
Other scattered eelgrass beds proximal to EL 1105 occur in Newfoundland and are greatest along the southwest coast, including large beds distributed along the western coast (DFO 2009d). Eelgrass in Prince Edward Island is also distributed commonly in the bays and estuaries. The Maritime Wetland Inventory (CWS, Environment Canada) estimates over 30,000 ha of eelgrass beds in Prince Edward Island, with 20,000 ha in each of New Brunswick and Nova Scotia (Environment Canada no date). In Prince Edward Island, large eelgrass beds are located within St. Mary's Bay, Hillsborough River, Bedeque River, Cascumpec Bay and Rustico. Eelgrass beds in New Brunswick are generally located within estuaries and lagoons along the Gulf and most notably in Kouchibouguac, Richibucto, Cocagne and Baie Verte. In Nova Scotia, the eelgrass beds are fairly evenly distributed along the Northumberland Strait and the Atlantic coast (DFO 2005e).

5.3.1.3 Salt Marsh Community

Salt marshes are salinoclines between freshwater and marine waters that support a variety of halophytic plants and organisms. They form within stable and emerging coastlines where sediment accumulates within sheltered intertidal areas. Cord grass (*Spartina* spp.) colonization plays an important role in the accumulation of sediments through the reduction in currents and stabilization of the substrate with their large root structures. Within Atlantic Canada, salt marshes are generally distributed among estuaries, protected bays and sheltered areas inland of spits, bars or islands. Salt marshes are generally divided into two types: low marshes and high marshes, each with a distinct plant community. The low marsh (as its name implies) is topographically lower than the high marsh and the plant community is mostly comprised of cord grass, rockweed, glasswort (*Salicornia* spp.), sea-blite (*Suaeda linearis*), seaside sand spurrey (*Spergularia villosa*) and orach (*Atriplex* spp.). These species tend to be more tolerant of tidal fluctuations. Within the high marsh, conditions are drier and marsh hay dominates the landscape with other halophytes, such as sea-lavender (*Limonium* spp.), arrow grass (*Triglochin* spp.), seaside plantain (*Plantago maritima*) and milkwort (*Polygala* spp.) with various grasses and sedges.

Salt marshes in closest proximity to the Study Area include those found in the Magdalen Islands, western Newfoundland and Cape Breton. In Cape Breton, marshes along the Northumberland Strait are often well developed, with 625 ha of salt marsh present in Victoria and Inverness counties, and large marshes located within Margaree Harbour and St. Ann's Bay (Nova Scotia Museum of Natural History, undated). In the Magdalen Islands, the salt marshes are intertidal wet meadows dominated by sedges and bulrushes and flooded only at high tide. Nearly half of the 1,400 ha of salt marshes on the Magdalen Islands are located on the shores of East Pond. Other large marshes are located in the southern part of Havre-aux-Basques Bay and along the sand bars bordering the lagoons. These marshes developed before the closure of

the bay in 1956 (Gagnon 1998). In Newfoundland, the topography limits the creation of salt marshes along the southwestern coastline and only 2,200 ha were identified. These marshes were concentrated in St. Georges Bay, Port-au-Port Bay and Cox's Cove. The distribution of identified salt marshes in the region of the Gulf (and closest to EL 1105) is illustrated in Figure 5.19.



Source: DFO 2011g

Figure 5.19 Salt Marsh Distribution in the Gulf of St. Lawrence in Relation to EL 1105

5.3.2 Marine Habitats

Fish and shellfish distribution varies seasonally in response to physical or chemical changes in the surrounding environment (*e.g.*, depth, salinity, temperature), and as a result of seasonal habitat requirements (*e.g.*, feeding, spawning, rearing). Long annual migrations are undertaken by most pelagic species such as herring and mackerel, and groundfish species such as Atlantic cod. The eggs of benthic spawners are found where oceanographic factors and bottom substrates are suitable, ranging from the marine sponges used by sea ravens to the hard, rocky substrate (and solid objects resting on the substrate) preferred by lumpfish. Other fish spawn in open water (*e.g.*, pollock and wolffish), making the offshore, open ocean important habitat. Juvenile fish often require habitat that allows them to hide from predators. In this case, even scallop shells can function as protective habitat (*e.g.*, hake).

During the winter, the waters in the shelf areas become cold and tend to freeze, resulting in the majority of the marine fish that feed in these areas during the summer migrating out of the area for the winter and into deeper waters. The Esquiman Channel is the main migration corridor for the entire population of groundfish, including cod and redfish (DFO 2007b). Spiny dogfish and mackerel migrate completely out of the Gulf to more southern areas, whereas other species including Atlantic herring, Atlantic cod, white hake, American plaice, witch flounder and thorny

skate stay within the Gulf, moving into the deeper, warmer waters of the Laurentian Channel and slope. Some of these species remain in this area for the entire winter, while others (Atlantic cod and Atlantic herring) migrate to the entrance of the Laurentian Channel in the Cabot Strait (Dufour and Ouellet 2007). The warmer, deep waters of the Laurentian Channel and slope also serve as feeding, nursing and spawning grounds for certain deep-water and slope species, including redfish, Greenland halibut and witch flounder. Hence, they do not need to migrate during the winter to avoid harsh conditions (Dufour and Ouellet 2007). In addition, the Cabot Strait is an important migration corridor for marine mammals moving in and out of the Gulf of St. Lawrence (Hammill *et al.* 2001).

5.3.3 Deep-Water Corals and Sponges

Deep-water corals are sessile, colonial animals that can occur individually at low density or in concentrations, depending on the taxa and ecological conditions. They are generally slow growing, and may represent decades or centuries of growth (DFO 2012c). They are considered suspension feeders, but not a lot of attention has been given to food and feeding in the literature. Numerous species of deep-water coral are present in the Gulf of St. Lawrence, with significant concentrations in the Gulf and the Laurentian Channel (Kenchington *et al.* 2010).

Sea pens (*Anthoptilum grandiflorum*) were present but not common in EL 1105 (as described in Section 5.4.1). Sea pens (Order Pennatulacea) are colonial animals containing many polyps, each with eight tentacles. They are not true stony or soft corals but are grouped with octocorals (polyps having eight tentacles) that include sea whips and sea fans (Order Gorgonacea), organ-pipe ‘corals’ (Order Stolonifera), blue ‘corals’ (Order Heliporacea) and the true soft corals (Order Alcyonacea). Soft corals contain soft fleshy or leathery tissue and do not possess a hard skeleton like stony corals that build reefs. *Anthoptilum grandiflorum* (observed infrequently in the vicinity of the Project) is relatively common elsewhere in the Laurentian Channel. The distribution of corals in the Gulf can be seen in Figure 5.21.

Wareham and Edinger (2007) noted that sea pens were generally distributed along the edge of the continental shelf east of Baffin Basin, off southeast Baffin Island, Tobin’s Point, the Flemish Cap and the southwest Grand Bank. Eleven species of sea pens were identified, with the greatest diversity of sea pens found near the southwest Grand Bank. The sea pens were found at depths between 96 to 1,433 m and ranged in size between 10 to 80 cm, with *Anthoptilum grandiflorum* and *Pennatula phosphora* (not observed near the Project) being the most abundant.

Kenchington *et al.* (2010) describe the presence of corals and sponges in the north Atlantic. The majority of coral species found within the Gulf are the soft corals (*Alcyonacea*), which are not vulnerable species. Sea pens, mostly the genus *Pennatula*, make up the majority (47 percent) of the remainder of coral species found within the Gulf (Kenchington *et al.* 2010). A total of 14 taxa of corals have been documented. Other species found within the Gulf include two species of large gorgonian corals (*Primnoa resedaeformis* and *Paramuricea* sp.), and the solitary stony cup coral (*Flabellum alabastrum*). There are important sea pen catches on the western slope of the Laurentian Channel northeast of the Magdalen Islands located approximately 12.5 km from EL 1105 (Figure 5.20). A limited number of coral catches have been observed within EL 1105

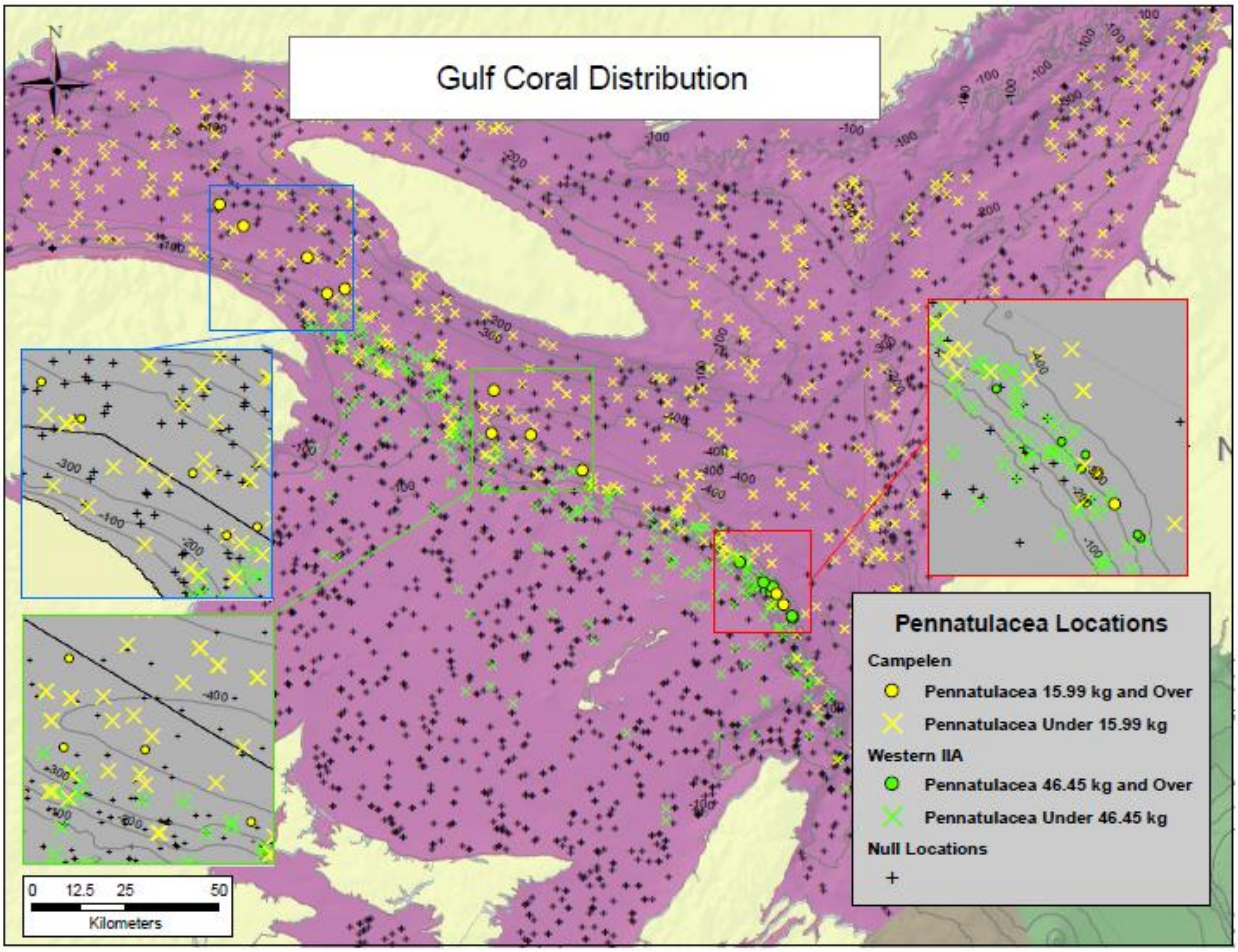
and within close proximity to EL 1105 , with the most concentrated numbers of corals being located on the slope of the Laurentian Channel (Figure 5.21).

Using historical RV trawl data, Kenchington *et al.* (2010) identified that significant areas (clusters of trawls) and individual locations (single trawl points) of sea pens (pennatulacea) were located within the Gulf. These significant areas indicated that one of the densest distributions of *Pennatulaea* occurs on the Laurentian Channel slope within the study area just southwest of the Project Area (Fig 5.20). The study was conducted to provide insight into the distribution of deep-water corals to determine if these areas constituted Valuable Marine Environments (VMEs) by NAFO. If these areas were identified as VMEs, the area could then be subject to ground fishery closures (Kenchington *et al.* 2010).

The underwater videography of benthic habitat collected during the October 2010 geohazard survey did not identify the presence of any deep-water corals or sponges, only sea pens as noted above. Most of the corals and sponges that were noted from fishery observer programs and DFO research (Campbell and Simms 2009; Gilkinson and Edinger 2009, Kenchington *et al.* 2010) appear not to be concentrated near EL 1105 or the Laurentian Channel within the Gulf (Figures 5.21 and 5.23).

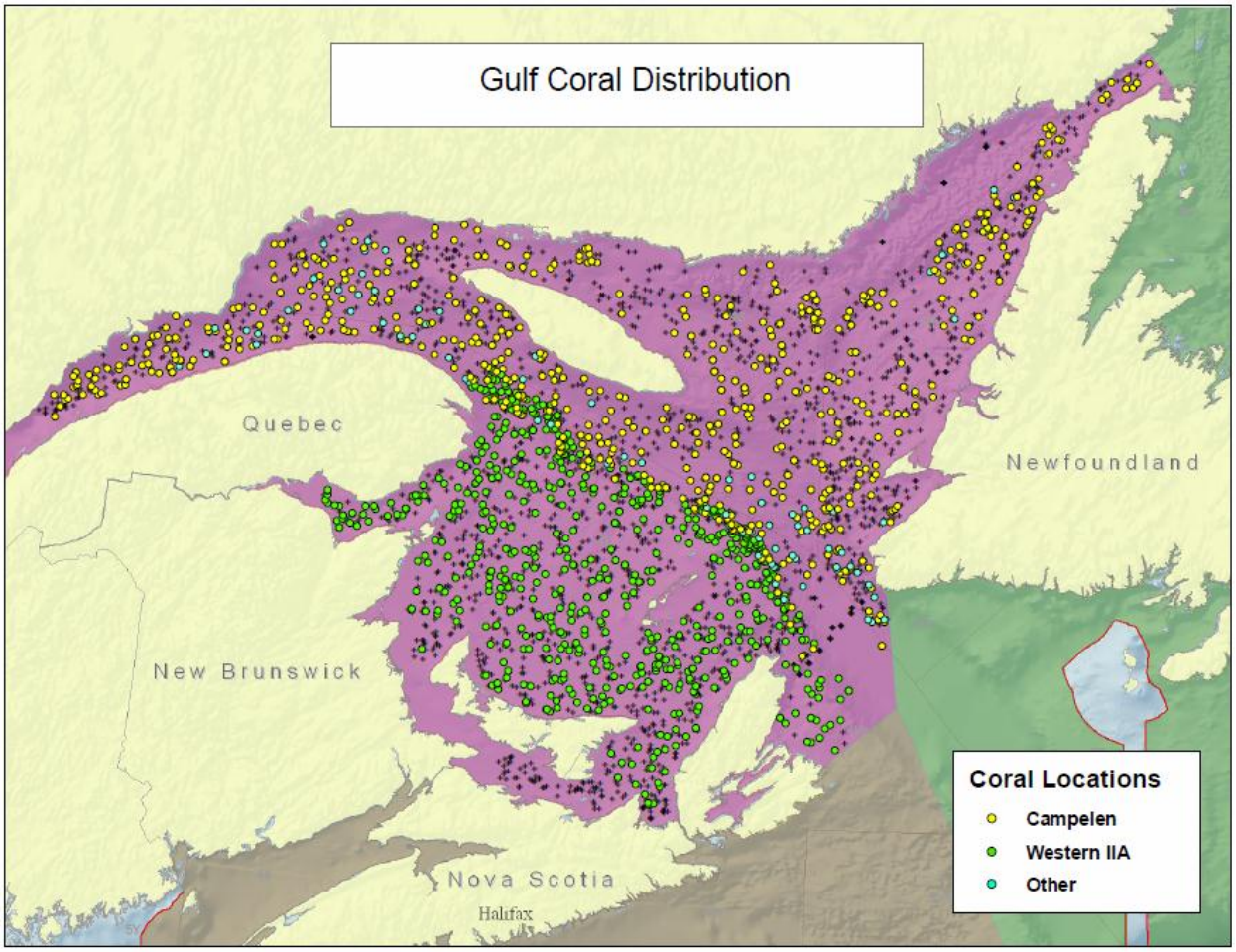
Deep-water corals (also referred to as cold-water corals since water depth is not a limiting factor in their distribution) are generally found attached to hard substrate such as bedrock, boulders and rubble, and some species on gravel beds, but not on unconsolidated sediment such as sand, silts, clays and mud as present in EL 1105. The report by LGL (2007) indicates that "*In general, the low abundance of corals in the Laurentian Channel (other than the Stone Fence at the southern end of the Laurentian Channel) probably reflects the low cover of cobble and boulder in the area (Mortensen 2006).*" The Stone Fence Coral Conservation Area in the Laurentian Channel is located outside the Cabot Strait and closer to the Scotian Shelf and the Atlantic Ocean and is in NAFO Division 4Vs at a depth of approximately 2,500 m (refer to Figures 5.21 and 5.22). Deep-water corals also require relatively higher water current speeds to survive and food sources such as zooplankton, seabed detritus or organic matter sinking from surface layers (DFO 2012c). The environment where these conditions are generally found is located in the deep water along continental slopes and shelves (particularly on the flanks of banks) (Figures 5.21, and 5.22). The water current data in Section 4.2 indicate that the bottom currents approximately 60 km from EL 1105 are relatively weak, and the seabed relatively flat and at a distance from the slope of the Laurentian Channel. These factors suggest that the area for which the Project is planned is not a favourable habitat for deep-water corals and likely for sponges as well, since they too depend on food sources such as zooplankton, detritus or organic matter (DFO 2012c).

Twenty-five large structure forming sponge species have been documented between 200 m to 2000 m in the north Atlantic (Kenchington *et al.* 2010). The most common species found are the large *Geodia* species and *Thenea* species. There are no important sponge locations within EL 1105 or within approximately 20 km of the Project area. Refer to Figure 5.22 for sponge locations within the Gulf and Figure 5.23 for significant sponge locations within the Gulf.



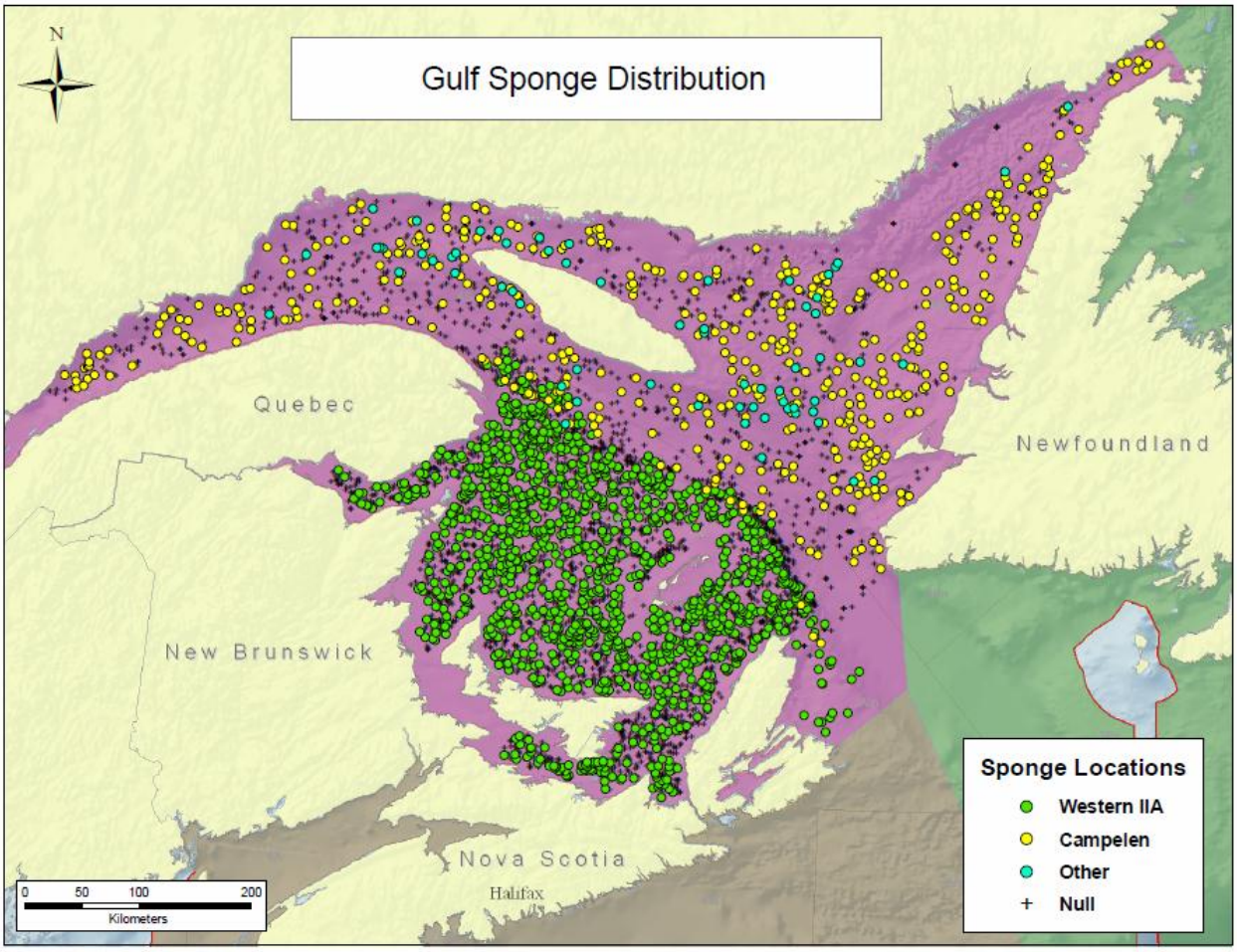
Source: from Kenchington et al 2010.

Figure 5.20 Location of Significant Catches of Sea Pens in the Gulf of St. Lawrence by Trawl Type



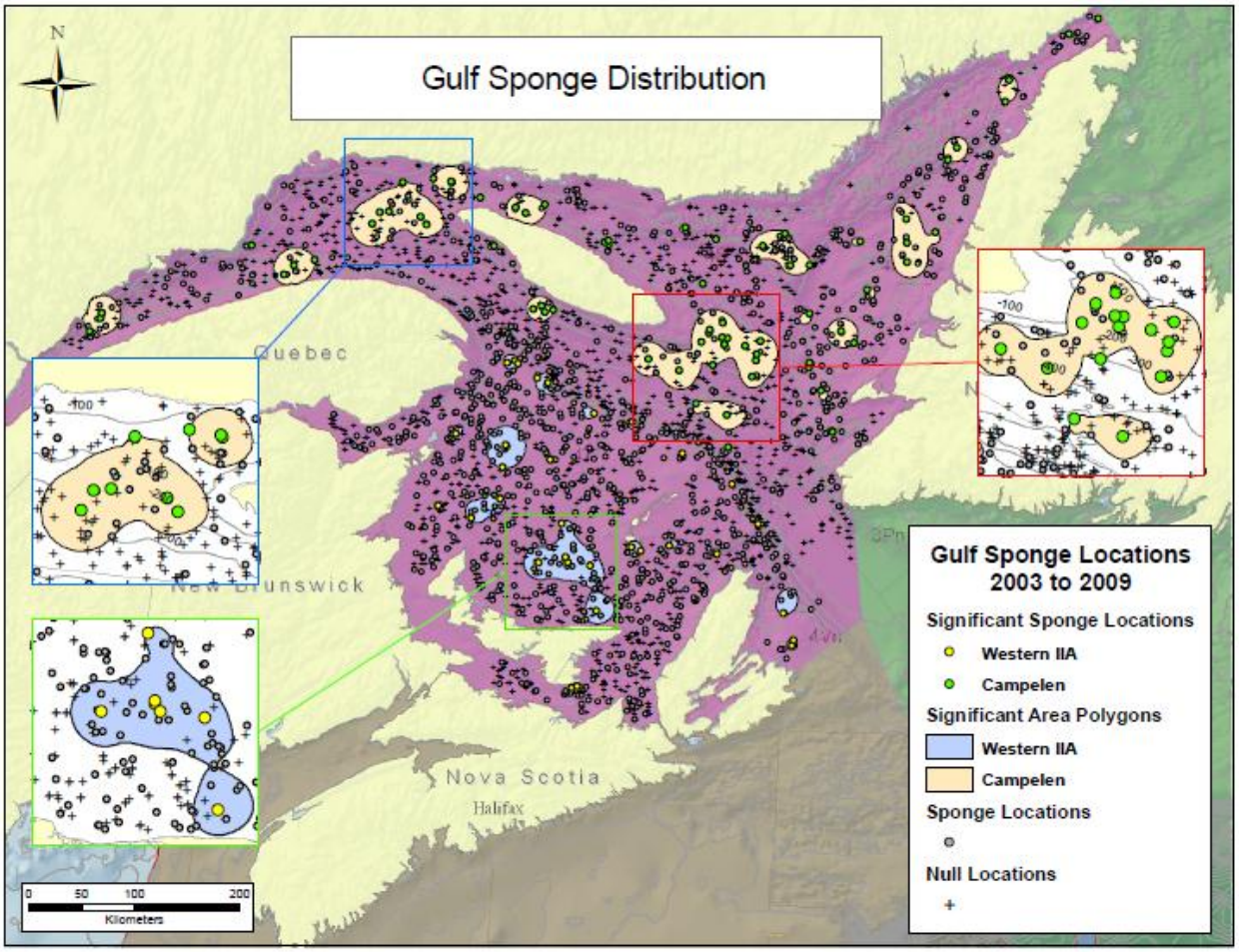
Source: from Kenchington *et al.* 2010.

Figure 5.21 Location of Research Vessel Survey Tows Showing the Distribution of Corals by Trawl Type in the Gulf of St. Lawrence 1990-2009. Null sets are indicated by a cross



Source: from Kenchington *et al.* 2010.

Figure 5.22 Distribution of Sponge (presence and absence) from Research Vessel surveys from 1990-2009 by Trawl Type



Source: Kenchington *et al.* 2010.

Figure 5.23 Locations of Significant Sponge By-catch using thresholds calculated separately for each gear type. Data collected with the Western IIA Trawl are from 2003-2009. Data collected with the Campelen Trawl are from 2006-2009.

5.3.4 Plankton

Plankton are the very small (often microscopic), free-floating organisms that live suspended in the water column. Physical processes, such as water currents and turbulent mixing, often control the distribution of plankton. Plankton are the productive base of marine ecosystems. Phytoplankton (often unicellular algae) are the autotrophic component of plankton, whereas zooplankton are the heterotrophic component of plankton. Plankton are an integral part of the ocean food chain; phytoplankton are eaten by zooplankton, which are, in turn, eaten by larger organisms. Plankton are therefore a major factor in influencing the biodiversity and productivity of marine habitats. Recognizable areas of enhanced plankton production may therefore suggest potentially important areas for fish, marine birds, marine mammals and sea turtles.

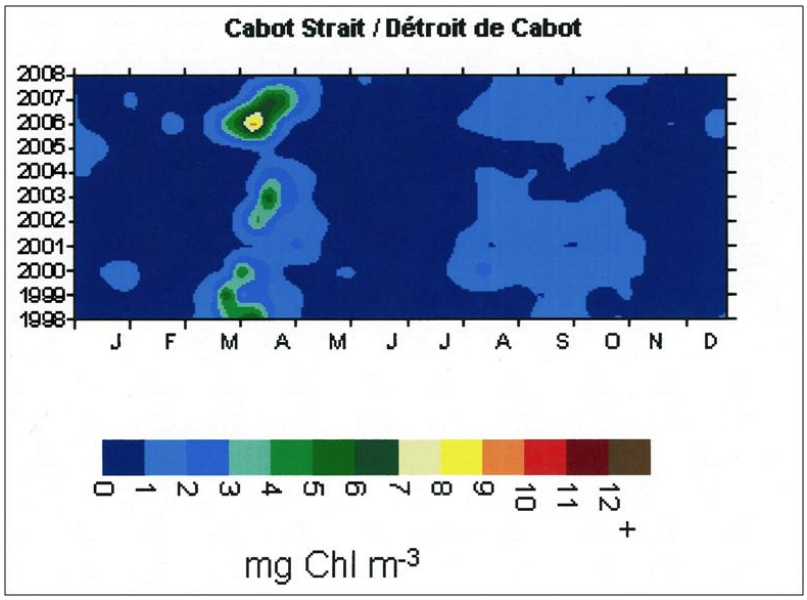
Information on plankton in the Gulf and in the vicinity of EL 1105 was compiled based on available data and scientific publications. Reports and data sources include DFO's Atlantic Zone Monitoring Program (AZMP), where field studies and data collection began in 1998 and are ongoing, Sciences Advisory Reports and data from various publications in the scientific literature. The AZMP conducts sampling at seven fixed stations and 13 transect locations (sections) in the Estuary and Gulf and generally during the spring and fall seasons (DFO 2011h). The transect line across Cabot Strait (identified as TDC in the AZMP program) is of most relevance because it spans across the Laurentian Channel between Newfoundland and Cape Breton Island and is situated approximately 70 km southeast of EL 1105. General water flow through EL 1105 and water properties would likely resemble those at Cabot Strait. Therefore, although there are no available data specifically for EL 1105 and its immediate vicinity, a comparable plankton community structure can be expected and is described in the following sections.

The AZMP also uses data from satellites (primarily those with the SeaWiFS and MODIS sensors) to obtain synoptic spatial coverage for oceanographic variables such as temperature, chlorophyll as an indicator of phytoplankton biomass and ice conditions.

5.3.4.1 Phytoplankton and Primary Production

Phytoplankton consist of free-floating algae, protists and cyanobacteria. Phytoplankton form the beginning of the food chain for aquatic animals and fix large amounts of carbon through photosynthesis. Chlorophyll is the green molecule in plant cells that carries out the bulk of energy fixation in the process of photosynthesis. Besides its importance in photosynthesis, chlorophyll is probably the most commonly used estimator of algal biomass in marine systems.

In general, the annual growth cycle for primary production in the Gulf has been characterized by a most intense abundance peak in the spring and attributed to when nutrient concentrations are high and light conditions are favourable for photosynthesis (Dufour *et al.* 2010). In addition, inter-annual variability of phytoplankton biomass is related to freshwater runoff and wind conditions. Chlorophyll data from satellite images covering Cabot Strait are presented in Figure 5.24 (Dufour *et al.* 2010) and indicate the more intense spring phytoplankton growth occurs in late March to April, followed by a much smaller phytoplankton peak from August to October.



Source: Dufour *et al.* 2010.

Figure 5.24 Seasonal and Inter-annual Chlorophyll *a* in Surface Water for the Cabot Strait Region of the Gulf of St. Lawrence (based on satellite SeaWIFS images, 1998 to 2008)

Dufour and Ouellet (2007) summarized the seasonal pattern of phytoplankton growth in the entire Gulf. The spring bloom occurs in late April or early May and is characterized by rapid growth of large diatoms (*Thalassiora* sp. and *Chaetoceros* sp.). As nutrients are depleted, the abundance of larger diatoms decline, and several important dinoflagellates (*e.g.*, *Peridinium* sp., *Alexandrium* sp. and *Ceratium* sp.) become numerically dominant. However, the diversity remains high during the summer but the chlorophyll concentrations and productivity remain low. A fall bloom may occur from September to November in the Gulf, where the chlorophyll concentrations are not much higher than those in the summer. The areas with relatively high phytoplankton growth were described as occurring in the Lower Estuary, the northwestern Gulf and primarily along the Gaspé Peninsula, at the southern and western end of Anticosti Island and along Quebec's North Shore, with lower values on the western shore of Newfoundland and the Magdalen Shallows.

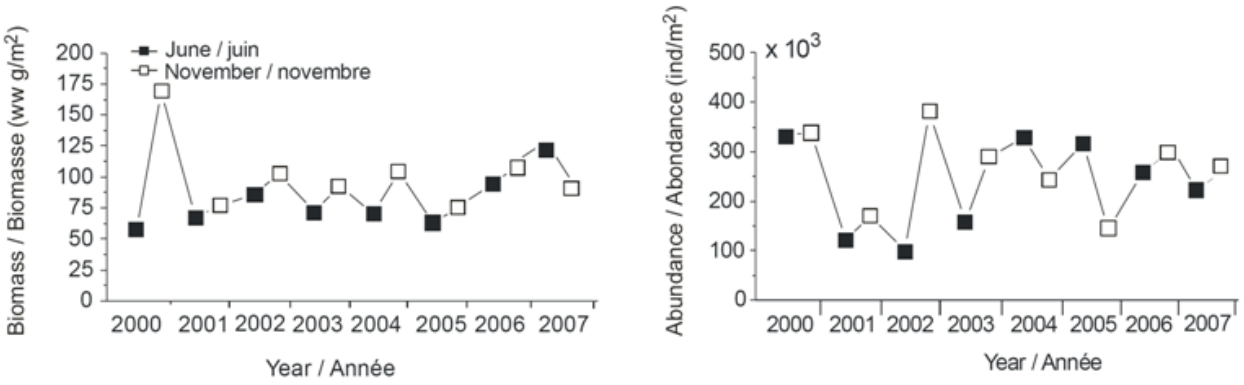
The non-native phytoplankton species *Neodenticula seminae* is a diatom from the Pacific that has been introduced and observed in the Estuary and Gulf since 2001 (Dufour *et al.* 2010). In 2001, this species comprised 80 percent of the phytoplankton community during the spring bloom, where the concentrations were up to $2x10^6$/L. This cold-water marine planktonic species was limited to the North Pacific and Bering Seas. It is believed to have been naturally introduced into the Gulf, where it migrated across the Arctic and down the Labrador Current, rather than from ship's ballast waters. It is hypothesized that other introductions are likely to occur from the Pacific into the Atlantic, including the Gulf, as the Arctic ice continues to melt, resulting in potentially large effects on biodiversity and fisheries in the Northwest Atlantic, including the Gulf (Dufour *et al.* 2010).

Other species newly introduced in the St. Lawrence region include dinoflagellates (the toxic dinoflagellate *Alexandrium pseudogonyaulax* (observed since 2001) and the non-toxic dinoflagellate *Prorocentrum rhathymum* (observed since 1999) (Dufour *et al.* 2010)). However, their method of introduction in the St. Lawrence is unknown. Harmful algal blooms and those responsible for paralytic shellfish poisoning by the dinoflagellate *Alexandrium tamarense* occur most notably in the Lower St. Lawrence Estuary along the north and south shores (Dufour *et al.* 2010). Harmful algal blooms are not known to occur in open areas of the Gulf or EL 1105.

5.3.4.2 Zooplankton

Zooplankton are animals ranging in size from <1 mm, such as copepods, to approximately 4 cm (*e.g.*, krill). Zooplankton are consumers and depend on phytoplankton for the bulk of their food. Eggs and larvae of larger animals, such as fish and crustaceans, are also included in the diet of larger zooplankton. In turn, many organisms in higher trophic levels, such as fish and marine mammals, include zooplankton in their diet. Thus, zooplankton play a very important role in marine food webs. Physical parameters, which exert control on primary production in the Gulf, also exert an influence on the zooplankton in the system.

AZMP data collected annually in late spring and fall along different sections in the whole Gulf showed that during seven years (2000 to 2007), the average copepod abundance along the Cabot Strait section in the Gulf generally increases from late spring to late fall (Harvey and Devine 2008; Figure 5.25). This is also the general observation for other AZMP sections in the Gulf. The copepod assemblage at Cabot Strait is dominated by the mesozooplankton, comprising of small copepod species (*Oithona* sp., *Pseudocalanus* sp. and *Temora* spp.), which represented on average 64 percent of the total annual copepod abundance (Table 5.3).



Source: Harvey and Devine 2008.

Figure 5.25 Mean Zooplankton Biomass (Wet Weight) and Abundance at the AZMP Cabot Strait Section in June and November 2000 to 2007

Table 5.3 Mean Zooplankton Abundance at the AZMP Cabot Strait Section, 2000 to 2007

2002 to 2006				2007			
Ranking	**Species**	**% Total Zooplankton**	**Yearly Average (ind/m2*102)**	**Ranking**	**Species**	**% Total Zooplankton**	**Yearly Average (ind/m2*102)**
1	*Oithona* spp.	38.44	899.90	1	*Oithona* spp.	43.32	1,095.10
2	*Pseudocalanus* spp.	15.63	366.02	2	*Calanus finmarchicus*	8.70	219.94
3	*Calanus finmarchicus*	10.21	238.96	3	*Pseudocalanus* spp.	8.55	216.08
4	*Temora* spp.	9.99	233.86	4	*Calanus hyperboreus*	8.03	202.96
5	*Calanus hyperboreus*	5.70	119.92	5	Appendicularia	4.08	103.21
6	*Microcalanus* spp.	3.01	70.49	6	*Temora* spp.	4.07	102.95
7	Appendicularia	2.22	52.07	7	*Microcalanus* spp.	3.00	75.75
8	Copepod nauplii	2.01	47.11	8	Pteropods	2.77	69.91
9	Copepod eggs	1.85	43.21	9	*Metridia* spp.	2.74	69.25
10	Bivalve larvae	1.58	37.03	10	Bivalve larvae	2.33	45.15
Total			2,108.57	Total			2,200.30
Total Abundance of Zooplankton (N/m^2*10^2)			2,341.18	Total Abundance of Zooplankton (N/m^2*10^2)			2,523.51
Source: adapted from Harvey and Devine 2008.							

Mesozooplankton consist of predominantly copepods, but also includes other mesozooplankton organisms (*e.g.*, invertebrate larvae, decapods, ostracods). Copepod nauplii were typically much more abundant in June than in November. The higher June abundance is attributed to nauplii of *Calanus finmarchicus*, which is the dominant large copepod in the Gulf marine system. The seasonal and interannual patterns in total copepod abundance are largely due to small copepods (including *Pseudocalanus* spp.), confirming that this group largely dominated the whole copepod assemblage in abundance.

For mesozooplankton other than copepods (meroplankton (marine animals with planktonic early life stages (*e.g.*, fish larvae)), carnivorous zooplankton and krill larvae), their total abundances were usually higher in June than in November; this is the opposite of what was observed for the mesozooplankton biomass (excluding *Calanus hyperboreus*) and the total abundance of copepods, which were usually higher in November than in June.

The larger copepod species *Calanus finmarchicus* and *Calanus hyperboreus*, usually found in deeper water such as the Laurentian Channel, are generally less abundant than the small copepod species but contribute in terms of biomass and generally contribute to the high total zooplankton biomass in the region (Dufour and Ouellet 2007). Dufour and Ouellet (2007) suggest that the influence of water masses from various sources such as the Arctic and Atlantic promote the presence of these larger copepods, as well as euphausiids (krill), chaetognaths (*Sagitta elegans*), hyperiid amphipods and gelatinous organisms such as jellyfish-like hydrozoans (siphonophores). In addition, late developmental stages of *Calanus* spp., present in the deep waters of the Laurentian Channel in the autumn, are subsequently transported by the deep current towards the head of the Laurentian Channel in the Lower Estuary of the

St. Lawrence. Similarly, krill are also believed to be transported by deep-water currents to the head of the Laurentian Channel where the mature individuals are concentrated. This transport mechanism is suggested to create the greatest concentration of krill (mostly *Meganyctyphanes norvegica* and *Thysanoessa rashi*) observed in the Northwest Atlantic (Simard *et al.* 2002, in Dufour and Ouellet 2007).

As indicated earlier, macrozooplankton are a large contributor to the plankton biomass in the St. Lawrence marine system, making up 10 to 20 percent of the total zooplankton biomass (approximately 123 g wet weight per m^2) (Harvey and Devine 2008). They play a significant role in the pelagic ecosystem as food for marine mammals, marine birds and fish, and as predators on copepods and/or fish larvae. The macrozooplankton are mainly adult and juvenile euphausids, or krill (*Meganyctiphanes norvegica*, *Thysanoessa inermis*, *Thysanoessa raschii*). This category of zooplankton also includes mysids (*Boreomysis arctica*, *Mysis mixta*, *Erythrops erythrophthalma*), which are commonly found in deep samples, hyperiid amphipods (*Themisto libellula*, *Themisto abyssorum*, *Themisto compressa*), and chaetognathes (*Sagitta elegans*, *Pseudosagitta maxima*, *Eukrohnia hamata*). Concerning the macrozooplankton species, the two more abundant overall species in the Gulf are the hyperiid amphipod *Themisto abyssorum* and the chaetognath *Sagitta elegans* at all sampling seasons and years.

Thermisto libellula is an Arctic hyperiid amphipod that has been introduced and observed in the Gulf waters since the early 1990s (Dufour *et al.* 2010). Analogous to introduced phytoplankton species, *Thermisto libellula* is believed to have been carried by Labrador Shelf water advected into the Gulf through the Strait of Belle Isle during winter.

5.3.4.3 Ichthyoplankton

Ichthyoplankton are part of the zooplankton population that are specific to fish larvae and eggs and at times, have been known to include the larvae and eggs of important shellfish species as well. Ichtyoplankton, along with other planktonic early life stages of marine animals, are collectively referred to as the meroplankton, which was described in Section 5.3.4.3.

The ichthyoplankton of the Gulf include up to 50 species of fish eggs and larvae (Table 5.4). Dominant in the ichthyoplankton are the larva of herring, capelin, snailfish, shanny and sculpin (White and Johns 1997), all of which are benthic spawners, whose pelagic larvae hatch from eggs deposited on the seafloor. In more inshore areas, species such as lobster, herring, scallop, cunner, radiated shanny, winter flounder and capelin dominate the ichthyoplankton. In early May, the most common fish larva in the northeast Gulf is the sandlance and by late June, redfish and capelin are prominent (de Lafontaine *et al.* 1991). Redfish and Greenland halibut are most prominent in waters over the Laurentian Channel and also potentially in EL 1105.

Table 5.4 Common Ichthyoplankton in the Estuary and Gulf of St. Lawrence

Pelagic Spawning Species		Benthic Spawning Species	
Atlantic Mackerel	*Scomber scombrus*	Atlantic Herring	*Clupea harengus*
Atlantic Cod	*Gadus morhua*	Rainbow Smelt	*Osmerus mordax*
American Plaice	*Hippoglossoides platessoides*	Tomcod	*Microgadus tomcod*
Fourbeard Rockling	*Enchelyopus cimbrius*	Winter Flounder	*Pseudopleuronectes americanus*
Hake	*Urophycis* sp.	Capelin	*Mallotis villosus*
Cunner	*Tautogolabrus adspersus*	Snailfish	*Liparis* sp.
Yellowtail Flounder	*Limanda ferruginea*	Shanny	*Lumpenus* sp.
Redfish[A]	*Sebastes* sp.		*Stichaeus* sp.
Crustaceans[B]			*Ulvaria* sp.
Snow Crab	*Chionoecetes opilio*	Sculpins	*Myoxocephalus* sp.
Rock Crab	*Cancer irroratus*		*Icelus* sp.
American Lobster	*Homarus americanus*		*Hemitripterus* sp.
Boreal Shrimp	*Pandalus borealis*		*Artediellus* sp.
		Sandlance	*Ammodytes* sp.

[A] Give birth to live young.
[B] Eggs attach to the underside of female abdomen until the following year; larvae drift in surface waters.
From: White and Johns 1997.
Sources: de Lafontaine 1990; de Lafontaine *et al.* 1991.

The most notable densities of ichthyoplankton in the Gulf have been observed on the west coast of Newfoundland, Anticosti Island and the southwestern coast of the Gulf including Chaleur Bay (DFO 2009a). Along the west coast of Newfoundland, fish larvae, particularly capelin and herring, are found in substantial quantities in the coastal region north of the Port-au-Port Peninsula and northeast to EL 1105. One of the high densities of fish eggs and larvae (particularly cod and winter flounder eggs, sand lance and Arctic shanny larvae) and decapod crustaceans occur in the northern and western regions of Anticosti Island. The southwestern coast and larger southern Gulf region has the greatest abundance in terms of species, as well as having the most abundant eggs and larvae from different marine organisms throughout the entire Gulf. This area also represents an important area for Atlantic mackerel spawning and for the southern Gulf population of Atlantic cod.

5.4 Marine Fish and Fish Habitat

The marine waters of the Gulf are home to many species of marine fish and shellfish. One of the main reasons for this diversity is the presence of warm, productive waters in the summer followed by cold waters, covered in ice, during the winters. Approximately 20 species of marine fish are currently, or have been historically, fished commercially or experimentally in the Gulf (DFO 2005a). Commercial fisheries are further discussed in Section 5.8.

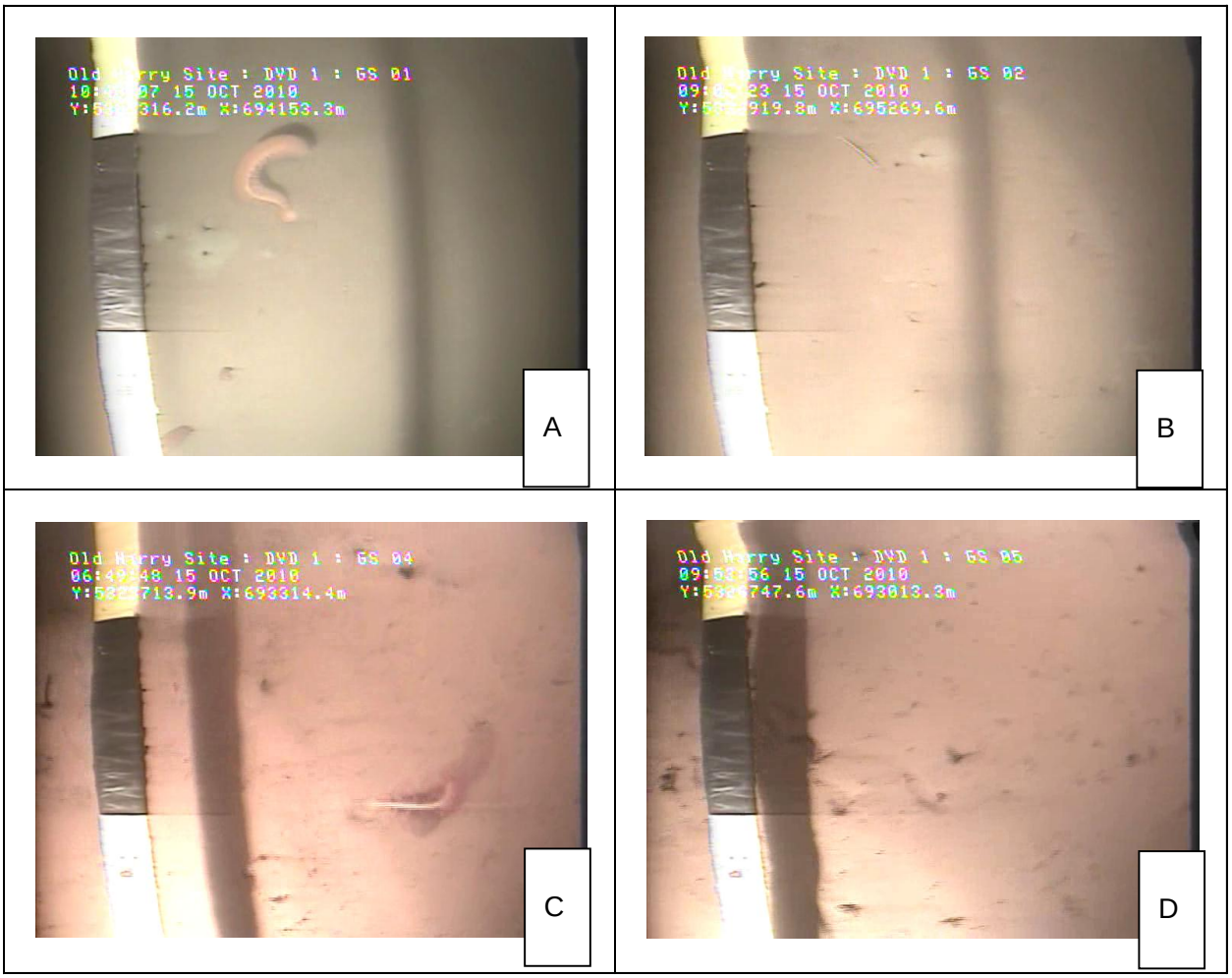
5.4.1 Fish Habitat

As part of the geohazard survey conducted by Fugro GeoSurveys Inc. in October 2010, underwater videography and grab samples of the surficial sediment were taken at station locations indicated in Figure 5.26. The description of the benthic habitat provided below for this area is based on the information and data obtained from this fieldwork.

Figure 5.26 Location of Seafloor Videography and Benthic Sampling Stations during the Geohazard Survey Program (October 12 to 15, 2010)

The seafloor consists of soft, muddy sediment that appears uniformly distributed throughout the surveyed area. Images of the sea bottom are provided in Figure 5.27, where a benthic habitat with low species diversity can be observed, primarily the presence of holes and cast material deposited by burrowing infaunal invertebrates, such as polycheate worms. The occasional sea pen, *Anthoptilum grandiflorum*, (also known as a feather boa sea pen and looks like a “question mark”), rising from the seabed can also be observed (Figure 5.27, A and C). The infrequently observed sea pen species is relatively common elsewhere in the Laurentian Channel and off the Scotian Shelf and is discussed further in Section 5.3.2.

The above description of a very fine sediment substrate supporting a benthic habitat with low species diversity (as compared to benthic species diversity on a substrate with coarse sediment) is typical for all the five videography stations that were surveyed. No fish, crustaceans, or true stony and soft corals (alcyonarians) were observed in any of the video images that were analyzed. Analysis of the video images also suggest that the bottom water currents appear to be relatively weak (likely <0.5 m/s) because it took a few seconds for the sediment cloud to disperse after the seafloor was accidentally disturbed with the video camera.



Note: The sea pen *Anthoptilum grandifllorum* and burrowing holes by infaunal marine organisms in the soft bottom are visible. (A, Station GS-01; B, Station GS-02; C, Station GS-04; D, Station GS-05 – refer to Figure 5.26 for the location of stations).

Figure 5.27 Underwater Photographic Images of the Seafloor in Water Depths of Approximately 460 to 490 m in the Area of the Old Harry Prospect

Fugro GeoSurveys Inc. collected sediment samples with a Van Veen grab from three locations on October 15, 2010 (stations GS-01, GS-02 and GS-05; Figure 5.26). Mechanical failure prevented collection of the fourth and fifth sediment samples (*i.e.*, stations GS-03 and GS-04 to the south; Figure 5.26).

Physical and chemical sediment quality analyses were conducted on the three grab samples and included the following parameters:

- total metals;
- total organic carbon;
- total petroleum hydrocarbon / benzene, toluene, ethylbenzene and xylene (BTEX) / total extractable hydrocarbon;
- polycyclic aromatic hydrocarbons (PAHs);

- mercury; and
- grain size analysis.

The results are summarized in Tables 5.5 and 5.6.

Table 5.5 Grain Size Analysis of Sediment Samples from Sampling Stations

Parameter	Units	RDL	GS-01	GS-02	GS-05
Moisture	%	1	66	64	66
Gravel	%	0.1	ND	ND	0.5
Sand	%	0.1	3.8	4.6	4.0
Silt	%	0.1	32	33	34
Clay	%	0.1	64.2	62.4	61.5
RDL = Reportable Detection Limit ND = Not detected					

Table 5.6 Summary of Chemical Analyses of Sediment Samples from Sampling Stations

Parameter	Units	RDL	GS-01	GS-02	GS-05	CCME Marine PEL[A]	CEPA Disposal at Sea Guidelines[B]
Total Organic Carbon	g/kg	0.5	17	17	16	-	-
Aluminum	mg/kg	10	15,000	15,000	15,000	-	-
Antimony	mg/kg	2	ND	ND	ND	-	-
Arsenic	mg/kg	2	5	6	4	41.6	-
Barium	mg/kg	5	230	230	210	-	-
Beryllium	mg/kg	2	ND	ND	ND	-	-
Bismuth	mg/kg	2	ND	ND	ND	-	-
Boron	mg/kg	3	62	67	60	-	-
Cadmium	mg/kg	0.3	ND	ND	ND	4.2	0.6
Chromium	mg/kg	2	37	37	37	160	-
Cobalt	mg/kg	1	12	12	12	-	-
Copper	mg/kg	2	24	25	25	108	-
Iron	mg/kg	50	26,000	26,000	25,000	-	-
Lead	mg/kg	0.5	15	15	15	112	-
Lithium	mg/kg	2	28	29	28	-	-
Manganese	mg/kg	2	580	630	630	-	-
Mercury	mg/kg	0.1	0.2	0.1	0.1	0.7	0.75
Molybdenum	mg/kg	2	ND	ND	ND	-	-
Nickel	mg/kg	2	35	35	34	-	-
Rubidium	mg/kg	2	25	25	23	-	-

Table 5.6 Summary of Chemical Analyses of Sediment Samples from Sampling Stations

Parameter	Units	RDL	GS-01	GS-02	GS-05	CCME Marine PEL[A]	CEPA Disposal at Sea Guidelines[B]
Selenium	mg/kg	2	ND	ND	ND	-	-
Silver	mg/kg	0.5	ND	ND	ND	-	-
Strontium	mg/kg	5	140	130	120	-	-
Thallium	mg/kg	0.1	0.2	0.2	0.2	-	-
Tin	mg/kg	2	ND	ND	ND	-	-
Uranium	mg/kg	0.1	1.8	1.9	1.5	-	-
Vanadium	mg/kg	2	60	59	59	-	-
Zinc	mg/kg	5	81	85	82	271	-
Total PAHs	mg/kg	0.01	ND	ND	ND	-	2.5
Benzene	mg/kg	0.03	ND	ND	ND	-	-
Toluene	mg/kg	0.03	ND	ND	ND	-	-
Ethylbenzene	mg/kg	0.03	ND	ND	ND	-	-
Xylene	mg/kg	0.05	ND	ND	ND	-	-
C_6-C_{10} Hydrocarbons (less BTEX)	mg/kg	3	ND	ND	ND	-	-
>C_{10}-C_{16} Hydrocarbons	mg/kg	10	ND	ND	ND	-	-
>C_{16}-C_{21} Hydrocarbons	mg/kg	10	ND	ND	ND	-	-
>C_{21}-<C_{32} Hydrocarbons	mg/kg	15	ND	ND	ND	-	-
Total Petroleum Hydrocarbons	mg/kg	20	ND	ND	ND	-	-

RDL = Reportable Detection Limit
ND = Not detected
' - ' = Not available
[A] Marine Probable Effect Level (PEL) Sediment Quality Guidelines, Canadian Environmental Quality Guidelines, updated 2002.
[B] *Canadian Environmental Protection Act* Disposal at Sea sediment screening guidelines.

The grain size analysis results on the sediment samples are provided in Table 5.5. Results indicate that the sediment is predominantly fines (95 to 97 percent) and mainly comprised of silty clays (mud). This information supports the videography observations of the seafloor. It is also consistent with the description of the surficial geology at this location and over a broader area of the Laurentian Channel that has been classified as pelite (clastic rock with a grain size <0.0625 mm and typically mud) by Loring and Nota (1973) and postglacial basinal ponded muds by Josenhans and Zevenhuizen (1993).

The results of the chemical analyses for the sediment samples collected are provided in Table 5.6. No hydrocarbons or PAHs were detected in the samples and all metals including mercury concentrations in the sediment are below marine sediment quality guidelines.

During the Fugro GeoSurveys Inc. geohazard survey in October 2010, additional sediment grab samples were collected and preserved with 10 percent formalin. Samples were sieved and the organisms were collected for sorting and identification by Arenicola Marine. The results support

the videography information in that there were few benthic macrofauna in the samples, which consisted of mainly polychaetes and molluscs (Table 5.7). This further corroborates and supports the low species diversity and abundance of the soft-bottom benthic habitat. The record of *Littorina littorea* from the grab sample GS-02 is remarkable given that this is a primarily intertidal species extending into the shallow subtidal. The presence of this organism is not representative of the benthic fauna within EL 1105 and was likely transported into the area.

Table 5.7 Summary of Benthic Invertebrates Collected from Station Locations

Family	Species	Number of Individuals[A]		
		GS-01	GS-02	GS-05
Copepoda	*Calanus finmarchicus*[B]	3		
Polychaeta	*Spio limicola*	1	1	
	Brada inhabilis	1		
Mollusca	*Limacina helicina*	1		
	Littorina littorea		1	
Oligochaeta	unidentified		1	
Foraminifera[B]	*Triloculina* sp.	1		
	Lenticulina sp.	3		
Nematoda[B]	indeterminate		3	2

[A] Grab sampling area of 0.1 m^2.
[B] Not considered benthic macrofauna.

5.4.2 Shellfish

EL 1105 is located within NAFO Unit Areas 4Ss and 4Tf, the orientation of these Unit Areas results in them containing both pelagic and coastal habitats. Based on the 2006 to 2008 fish catch weight data for these Unit Areas and the Western Newfoundland SEA, Atlantic lobster, snow crab, rock crab, Atlantic sea scallop, whelk and northern shrimp are designated as important commercial invertebrate species. While some of these species, such as lobster and rock crab may not inhabit the marine habitat within EL 1105, they do inhabit the environment within the Study Area. Therefore, the life histories and distributions of these species are further described. Commercial fisheries species and activities relevant to the Project are discussed in Section 5.8.

It is worth noting as well that large snow crab have been reported to occur at similar depths as EL 1105 (*i.e.*, 200 to 500 m) (LGL 2005b). A review of commercial fisheries data provided by DFO revealed several additional shellfish species that have been recorded in the vicinity of EL 1105, including whelk, sea scallop, toad crab (likely *Hyas araneus* and/or *Hyas coarctatus*), rock crab, and multiple types of clams (Atlantic razor (likely *Ensis directus*), softshell (*Mya arenaria*) and surf clams) (DFO Fish Catch Data, pers. comm. 2011). Additional species-specific information is provided in the 2005 Western Newfoundland SEA document, Section 3.4.1 (LGL 2005b). Squid were also confirmed to be present in the vicinity of EL 1105 (DFO Fish Catch Data, pers. comm. 2011).

One invasive shellfish species has also been confirmed to occur in the coastal waters along western Newfoundland. The green crab (*Carcinus maenas*) was first reported in Newfoundland

waters in 2007 and is known as an aggressive invasive species. As with most invasive species, the presence of the green crab in the waters surrounding St. George's Bay and Little Port Harmon has the potential to exert pressure on the ecosystem and on the existing fish and shellfish assemblage. A disruption to the natural balance of the ecosystem can, in turn, increase the vulnerability of indigenous species to further pressures, including interactions with potential anthropogenic activities.

5.4.2.1 American Lobster

American lobsters are distributed in localized populations in nearshore reefs around the island of Newfoundland, including the west coast of Newfoundland, Magdalen Islands, Prince Edward Island, New Brunswick and Nova Scotia. The spring fishing season removes adult individuals from the population prior to moulting and spawning. Adult female moulting and spawning occurs during one summer, whereas the second summer is dedicated to laying the eggs. With proper conditions, some young females will moult, spawn and lay eggs in the same summer (DFO 2003).

Mating generally occurs before moulting for adult females. Immediately after moulting (when the female's carapace is still soft), the female will mate with a male and store the male's spermatophore within a receptacle under the female's abdomen until she spawns the following year. The eggs are extruded during the summer and autumn months and may number in the thousand to tens of thousands. Even with the large number of eggs released the survival rate is low, and about 0.1 to 0.01 percent will grow to become adults (DFO 2009f).

Once spawning has occurred, eggs are brooded for a year under the female's abdomen. Hatching and larval release occurs and the post-larval lobsters live for 6 to 10 weeks in the water column in a planktonic phase, where they moult and pass through three larval stages before settling on the seafloor. The planktonic larvae spend most of the time in the upper 1 m of the water column. The feathery hairs on the legs provide mobility and along with currents, this aids in the larvae locating appropriate habitat for growth and development (DFO 2003).

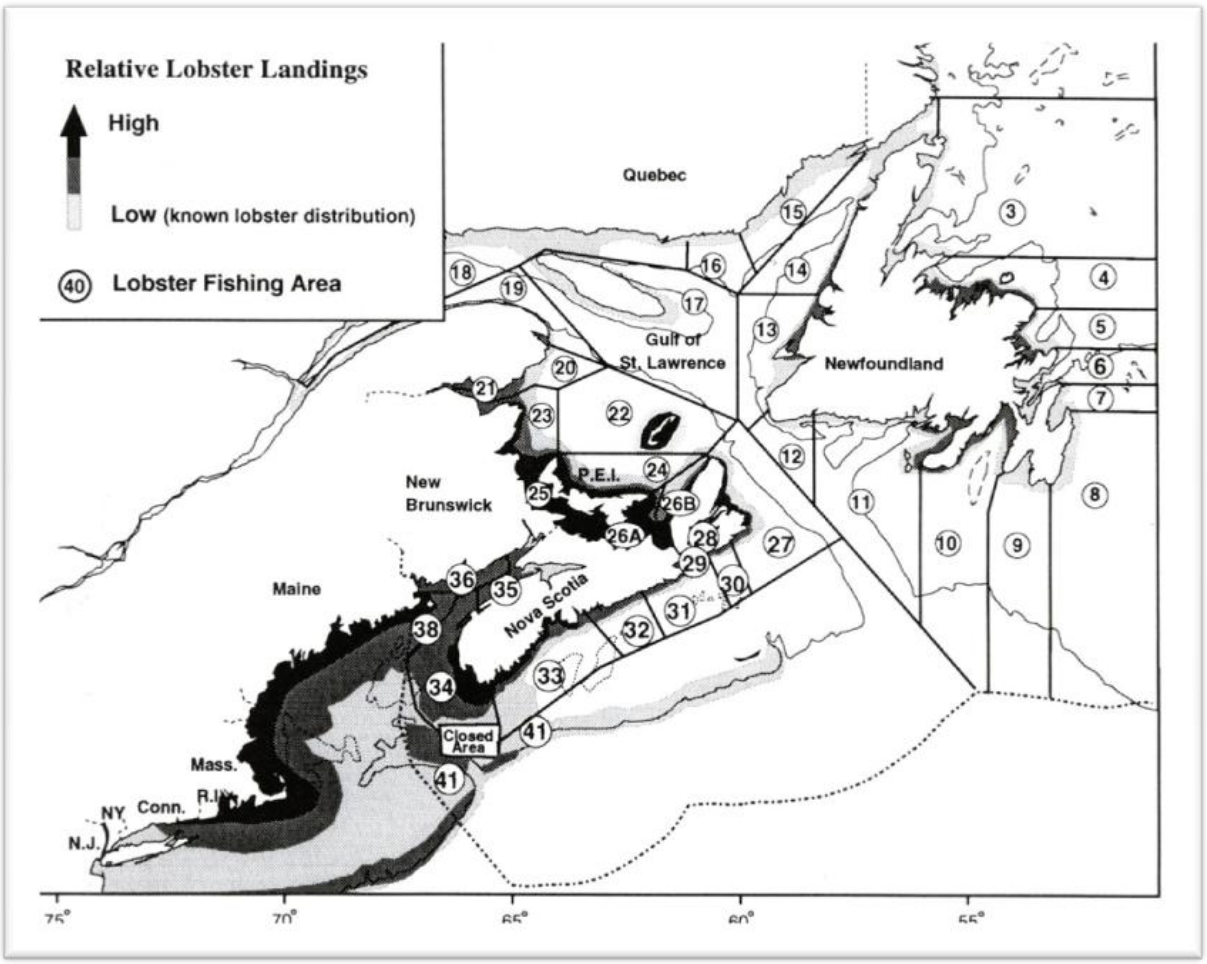
The fourth larval stage is where the lobster begins the search for specific habitats. The post-larval lobster will move up and down in the water column, bobbing along in search of habitats. The preference for habitats seems to be for hard bottom with many interstitial spaces (*e.g.*, cobble or larger rock). As the lobster settles into its new habitat, it moults into the fifth stage. The first year of benthic life is spent mostly hiding from enemies in tunnels or crevices in between rocks (Gulf of Maine Research Institute 2008).

In Newfoundland, the most frequent prey found in a study of lobster stomach contents included green sea urchins, mussels, rock crab, polychaetes and brittle stars (DFO 2009g). A study by Sainte-Marie and Chabot (2002) determined that bivalves, flesh and rock crab were the three main prey found in the stomachs of Atlantic lobster surrounding the Magdalen Islands. Four groupings of lobster were created based on carapace length (CL). The range varied from <4 mm CL to >62.5 mm CL. It was determined that the volume of bivalves and flesh found in the stomachs of lobster were negatively correlated with carapace length and that the volume of rock crab was positively correlated. This indicates that the diet of juvenile lobsters varies as compared to their mature counterparts and the diets of mature lobster include a larger volume of

rock crab and less flesh and bivalves than their smaller counterparts. In this study flesh consisted of tissue bolus composed of animal soft parts the could not be attributed to a taxon.

In Newfoundland waters, lobsters take between 8 to 10 years from time of hatching to grow, to where 50 percent of females become functionally mature and extrude eggs. This represents a mean carapace length of 81 mm (the minimum size to be retained when fishing). There is a lack of fishery independent data (and limited fishery-dependent data) on lobster caught in Newfoundland waters; however, relatively small animals seem to comprise the bulk of the population structure (DFO 2009h). Lobster caught in the Magdalen Islands have shown positive productivity indicators from 2006 to 2008, with a good abundance of berried females and juveniles remain high (DFO 2009h).

Relative lobster landings and approximate lobster distributions are provided in Figure 5.28 (from DFO's Review of Lobster Landing Trends in the Northwest Atlantic (DFO 1992)).



Source: DFO 1992

Figure 5.28 Lobster Distribution in the Gulf of St. Lawrence and Northwest Atlantic

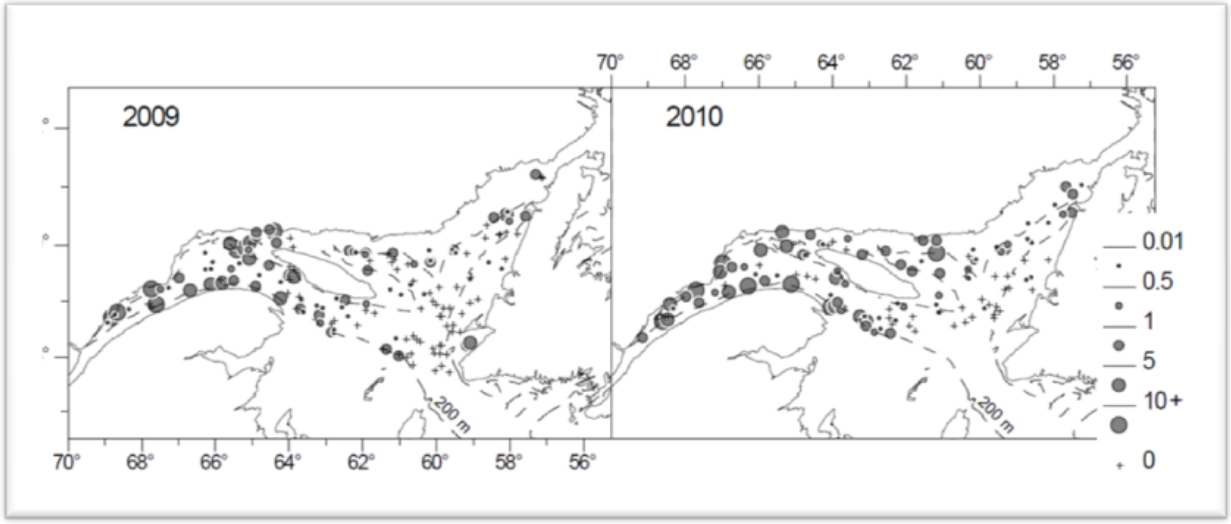
During SEA consultations with fishermen in July 2005 (LGL 2005b Appendix 1), the inshore area between the outer portion of Port-au-Port Bay and Shag Island to the north (4Rc) was identified as prime lobster spawning area. Fishermen indicated that lobster fishing grounds in the area between Long Point (outer Port-au-Port Bay) and Shag Island generally yield very large females. Fishers also noted lobster nursery areas near Shoal Point, Outer Bay of Islands located just above North Head (LFA 13B; Parcel 6), and at an area further north known as Trout River Bay (LFA 14A; Parcel 7). These two areas are presently closed to the lobster fishery as a means of conservation.

5.4.2.2 Snow Crab

Snow crab is a decapod crustacean that occurs over a broad depth range (50 to 1,300 m) in the Northwest Atlantic. The distribution of this decapod in waters off Newfoundland and southern Labrador is widespread and has recently been identified as a single stock with a genetic break between Atlantic Canada and Greenland (Puebla *et al.* 2008). Snow crab have a tendency to prefer water temperatures ranging between -1.0°C and 4.0°C. Fertilization occurs internally for snow crabs and mating occurs once the pubescent female has moulted; multiparous females are those individuals who have terminally molted and therefore these individuals do not molt before mating. The fertilized eggs are extruded within 24 hours and are attached to the female's pleopods. The number of eggs released by the female in one clutch can number up to 128,000 (DFO 2010f). Subsequent clutches of eggs can be fertilized by spermatophores stored in the ventral spermathecae (DFO 2012a). The eggs are incubated up to 27 months, with embryonic development occurring more quickly in warmer waters (DFO 2010g). Hatching occurs during early spring (April to June), where the larvae, known as zoea, spend 12 to 20 weeks as zooplankton feeding on microzooplankton in the water column (DFO 2010f). There are a total of three larval stages before the snow crabs settle to the bottom.

Adult males are defined by their terminal molt and only a portion will recruit into the fishery, which defines a minimum carapace width of 95 mm (DFO 2009g). It takes on average eight years for snow crab to be large enough to be retained by the fishery (DFO 2010h). Commercial-size snow crab can be found on a variety of substrates but are most common on mud or mud / sand bottoms, while smaller crabs are found within the interstitial spaces between harder substrates or biogenic structures in soft sediments. Adult snow crab typically feed on fish, clams, polychaete worms, brittle stars, shrimp and crustaceans, including smaller snow crab (DFO 2009j).

The 2009 and 2010 distribution of snow crab in the Estuary and northern Gulf is presented in Figure 5.29, as obtained by DFO during the annual summer trawl surveys conducted onboard the *CCGS Teleost* (Bourdages *et al.* 2010a, 2010b). The surveyed area includes EL 1105 and therefore provides an indication for the presence of this and other species (described below).



Source: Bourdages *et al.* 2010a, 2010b; distribution data presented as catch rate (kg/15 minute tow)

Figure 5.29 Snow Crab Distribution in the Estuary and Northern Gulf of St. Lawrence

5.4.2.3 Rock Crab

Rock crabs are decapod crustaceans that congregate in waters typically less than 20 m deep and prefer rocky substrate to sandy bottom habitat. Preference is given to those habitat areas with macroalgal growth on the rocky substrate (DFO 2010i).

There is sexual dimorphism in rock crab carapace width, with males growing to bigger sizes (140 mm) than females (100 mm). Sexual maturity is generally attained with three to six years of age, with carapace widths of 57 and 75 mm for females and males, respectively (DFO 2012c). Moulting typically occurs primarily in April and May, with mating occurring while the female is in a soft-shelled state during late summer/early fall. The fertilized eggs are extrudedsoon after mating and the eggs are stored under their abdomen for up to 10 months (DFO 2012c). Larval hatching occurs in the late spring / summer months, with the free-swimming larvae aggregating near the surface. The larvae moult through six stages (five zoeas and one megalopa) before settling to the seafloor (DFO 2010i). These six stages of planktonic larvae can take up to three months before settling to the seafloor as a benthic crab (DFO 2000a). Rock crab larvae are omnivorous planktivores.

Adult rock crabs are one of the major predators in northern subtidal communities. Their diet includes bivalves, juvenile scallops, mussels, snails, green sea urchins, seastars, amphipods, sand shrimp and polychaetes. Large rock crabs are known to take young lobsters. Adult rock crabs will reach commercial size at 102 mm or approximately six years of age (DFO 2010i).

5.4.2.4 Atlantic Sea Scallop

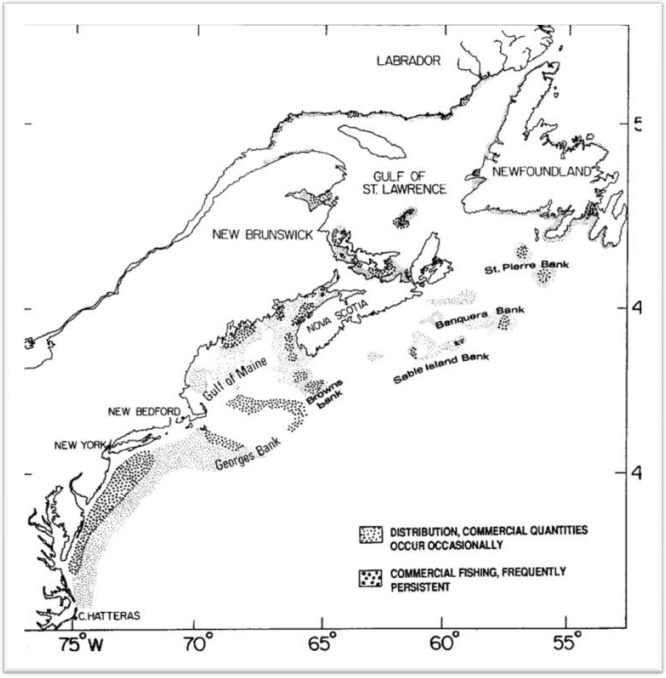
The Atlantic sea scallop is a bivalve mollusk that lives in communal beds on the seafloor and is found from North Carolina to Newfoundland. It occurs on the Atlantic continental shelf and typically occurs in relatively shallow water, <100 m depth. In the Gulf, sea scallop are found at water depths of 10 to 25 m. Scallop occur in groups or beds that may be sporadic or last for

numerous years. These beds correspond to areas of suitable temperature, food availability and substrate. Adult scallop are typically located on clean bottom such as gravel and where gyres occur, keeping larval stages in the vicinity of the spawning population (Stewart and Arnold 1994).

Sexual differentiation occurs at age 1, with sexual maturity reached at age 2, although mature scallop do not contribute substantially to reproduction until age 3. Spawning occurs in early fall (August to October), prompted by water temperature decreases. Within the western coast of Newfoundland, a second spawning season occurs between the months of June and July (Stewart and Arnold 1994).

Males and females release gametes synchronously and fertilization is external in the water column. Eggs develop in one to two days into the first of three larval stages, which all together will last five weeks. In the first larval stage, the sea scallops are planktonic but can swim freely and have been shown to undergo daily vertical migration (DFO 1996). During the planktonic stage, a shell, eye spot and foot develop. Scallop larvae are omnivorous planktonic feeders. The sea scallop larvae then settle to the bottom and develop the remainder of features. Planktonic larvae usually settle on suitable substrates such as sand to begin their benthic life (DFO 1996). Newly settled larvae attach to suitable substrate by secreting threads, which aid against movement from bottom currents. As young scallop age, they become less mobile and show less of a tendency to attach to the bottom.

Adult sea scallop are filter feeders that use gills to capture phytoplankton and other suspended particulate material from the water. The distribution of sea scallop is presented in Figure 5.30.



Source: Hart and Chute 2004.

Figure 5.30 Sea Scallop Distribution in the Gulf of St. Lawrence and Northwest Atlantic

5.4.2.5 Whelk

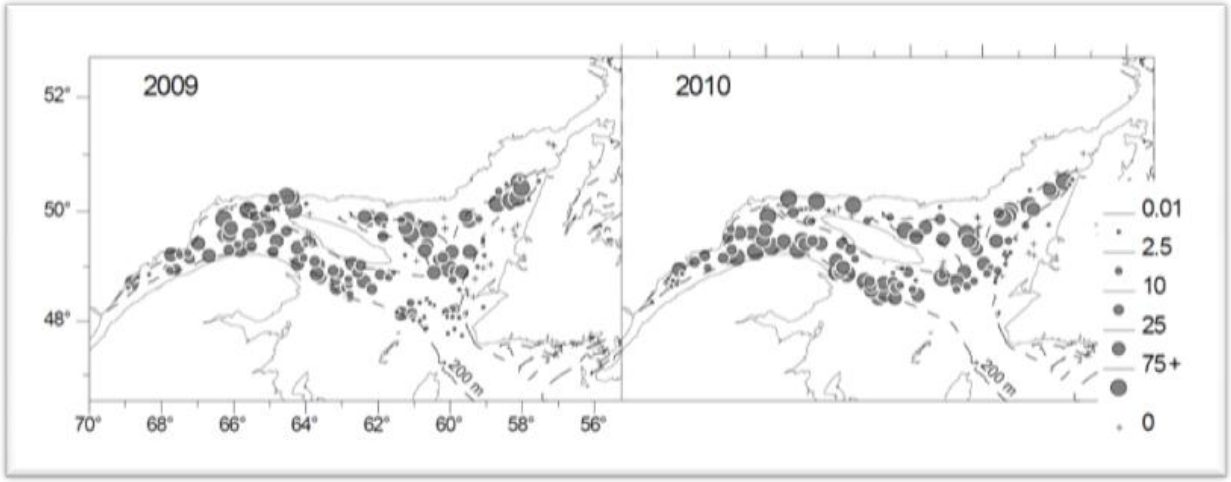
A whelk is a gastropod mollusk found from tidal levels to water depths of 180 m in a range of temperatures from 0°C to 16°C and a range of salinity from open ocean to estuarine conditions. The majority of whelk are observed in less than 30 m of water (DFO 2006a). Whelk feed on invertebrates such as polychaetes, mollusks and echinoderms and are primarily scavengers. Often whelk head on a shoreward migration prior to mating. Whelk fertilization occurs internally, with mating occurring from May to July. Females lay capsules which contain numerous eggs two weeks after mating and are released in masses and attached to the substrate (DFO 2006a). Preferred capsule laying areas appear to be irregular surfaces, face of boulders and kelp stalks, with the capsules vulnerable to predation by urchins and loss through detachment (DFO 2006a). It is estimated that 1 percent of the eggs fertilized result in hatching (DFO 2006a). The juveniles emerge after five to eight months and lack a planktonic larval stage, which limits the whelk's capacity for dispersal. As whelks grow, they move from deeper sand-mud substrates to shallower, coarser substrates. Even within the coarser substrates adults are sedentary, spending most of the time half-buried in sediments in between coarse substrate.

5.4.2.6 Northern Shrimp

Northern shrimp mating takes place in the fall and the females carry the fertilized eggs for approximately eight months (September to April). Larvae are pelagic upon hatching in the spring but eventually settle to the bottom by late summer. Shrimp migrations tend to be associated with breeding (berried females move into shallower waters in winter) and feeding (upward movement in water column at night to get to plankton) (DFO 2004b). Northern shrimp are generally found throughout the Estuary and northern Gulf in areas with water depths ranging between 150 and 350 m and prefer areas of soft mud and silt substrates (DFO 2004b, 2009j). The northern shrimp is a protandric hermaphrodite and first functions sexually as a male (at approximately 2.5 years) and then undergoes sexual inversion (between four and five years old) and spends the remainder of its life as a sexually mature female (DFO 2009k). Variations in its life history can occur depending on environmental temperatures. Northern shrimp spawns once a year, generally around late June or early July. The eggs are extruded and fertilized during late summer and fall, remaining attached to the female's abdomen until hatching the following spring / summer. Berried females may migrate to shallower / warmer waters in order to maximize the rate of embryonic development.

Upon egg hatching, the larvae swim to the surface to feed on plankton. This planktonic stage lasts for a few months before the larvae move down in the water column and metamorphose to adult form. Maturity usually occurs during year 2 as males, with female inversion occurring in the fourth year.

The 2009 and 2010 distribution of northern shrimp is presented in Figure 5.31, as obtained by DFO during the annual summer trawl surveys conducted onboard the *CCGS Teleost* (Bourdages *et al.* 2010a, 2010b).



Source: Bourdages *et al.* 2010a, 2010b; distribution data presented as catch rate (kg/15 minute tow)

Figure 5.31 Northern Shrimp Distribution in the Estuary and Northern Gulf of St. Lawrence

5.4.3 Fish

A comprehensive review of the western Newfoundland offshore area was undertaken for a SEA completed in 2005 (LGL 2005b) and amended in 2007 (LGL 2007). The SEA amendment study area included the Old Harry Prospect and as such, these SEA documents provide a thorough assessment of the fish assemblage anticipated to inhabit the area of the Gulf under consideration for the current Project. There is currently another western Newfoundland offshore area SEA update underway, although this document was not available for reference at time of writing this EA Report.

There are three main types of marine fish present in the Gulf: pelagic fish, those that live and feed close to the surface; demersal or groundfish, those that live and feed close to the bottom; and shellfish, which include crustaceans and bivalves discussed in Section 5.4.2. Approximately two-thirds of all marine fish species known to occur in the Gulf are demersal. A list of the most commonly occurring pelagic and demersal marine fish known to inhabit the Gulf in the vicinity of EL 1105 are presented in Table 5.8. Note that this table is limited to species that are not considered at risk. At-risk fish species that may occur in the vicinity of the Project are listed in Tables 5.1 and 5.2 and include northern wolffish, Atlantic wolffish, spotted wolffish, blue shark, porbeagle shark, winter skate, Atlantic cod, American plaice, deepwater redfish, Acadian redfish, roughead grenadier, roundnose grenadier, spiny dogfish, Atlantic bluefin tuna,shortfin mako, basking shark, white shark, Atlantic sturgeon, Atlantic salmon, American eel, cusk, and striped bass. These species at risk are further discussed in Section 5.2.

Table 5.8 Summary of Not-at-risk Fish Species with the Potential to Occur in or Near EL 1105

Common Name	Latin Name	Relative Level of Occurrence in EL 1105	Timing of Presence and Spawning within EL 1105
Pelagic Fish Species			
Atlantic herring	*Clupea harengus*	Moderate	Year round presence with spring and fall spawning.
Capelin	*Mallotus villosus*	Moderate	Mature fish migrate inshore inspring to spawn.
Pollock	*Pollachius virens*	Moderate	Migrate inshore during summer, winter offshore, fall spawning.
Atlantic argentine	*Argentina silus*	Low	Year round presence.
Atlantic mackerel	*Scomber scombrus*	Low	May to November (adults).
Haddock	*Melanogrammus aeglefinus*	Low	Move to deeper water in winter; inhabit shallow banks in summer.
Swordfish	*Xiphius gladius*	Low (anticipated)[A]	Migrate in summer and fall.
Groundfish / Demersal Fish Species			
Greenland halibut	*Reinhardtius hippoglossiodes*	High	Year round presence.
Longfin hake	*Urophycis chesteri*	High	Year round presence and fall spawning.
Marlin-spike grenadier	*Nezumia bairdi*	High	Year round presence and fall spawning.
Thorny skate	*Raja radiata*	High	Year round presence.
White hake	*Urohycis tenuis*	High	Year round presence.
Witch flounder (greysole)	*Glyptocephalus cynoglossus*	High	Year round presence.
Atlantic hagfish	*Myzine glutinosa*	Moderate	Year round presence.
Atlantic halibut	*Hippoglossus hippoglossus*	Moderate	Migrate to shallow waters in summer, return for winter.
Atlantic soft pout	*Melanostigma atlanticum*	Moderate	Year round presence.
Black dogfish	*Centroscyllium fabricii*	Moderate	Year round presence.
Lumpfish	*Cyclopterus lumpus*	Moderate	Migrate to shallow waters to spawn, return during fall.
Smooth skate	*Raja senta*	Moderate	Year round presence.
Spotted barracudina	*Notolepis rissoi*	Moderate	Year round presence.
White barracudina	*Arctozenus risso*	Moderate	Year round presence.
Atlantic hookear sculpin	*Artediellus atlanticus*	Low	Migrate inshore in the spring; occupy moderately deep waters in winter.
Checker eelpout	*Lycodes vahilii*	Low	Year round presence.
Fourbeard rockling	*Enchelyopus cimbrius*	Low	Year round presence.
Greater eelpout	*Lycodes esmarki*	Low	Year round presence.
Monkfish (goosefish)	*Lophius americanus*	Low	Year round presence.
Polar sculpin	*Coltunculus microps*	Low	Year round presence
Sea raven	*Hemitripterus americanus*	Low	Year round presence and fall spawning.
Silver hake	*Merluccius bilinearis*	Low	Year round presence.
Threebeard rockling	*Gaidropsarus ensis*	Low	Year round presence.

Table 5.8 Summary of Not-at-risk Fish Species with the Potential to Occur in or Near EL 1105

Common Name	Latin Name	Relative Level of Occurrence in EL 1105	Timing of Presence and Spawning within EL 1105
Windowpane flounder	*Scophthalmus aquosus*	Low	Year round presence.
Wrymouth	*Cryptacanthodes maculatus*	Low	Year round presence.
Yellowtail flounder	*Limanda ferruginea*	Low (anticipated)[A]	Move from shallow to deep waters in the fall.

References: Scott and Scott 1988; Environment Canada 2002b; Government of Canada 2008; DFO (pers. comm.)
[A] Not included in the *Biodiversity Portrait of the St. Lawrence* (Environment Canada 2002b) distribution mapping.

According to the *Biodiversity Portrait of the St. Lawrence* (Environment Canada 2002b), the most abundant pelagic species found within EL 1105 include Atlantic herring, Atlantic softpout, capelin and pollock. The most abundant demersal species include Greenland halibut, longfin hake, marlin-spike grenadier, thorny skate, white hake, witch flounder, Atlantic hagfish, Atlantic halibut, black dogfish, lumpfish, smooth skate, spotted barracudina and white barracudina.

The list of species for which life histories are presented below is based on fish catch weight data collected from 2006 to 2010, in zones 4Ss and 4Tf (*i.e.*, the zones of most relevance to the Project). Life histories are described below to further aid in the assessment of Project- related effects (Section 7.4). The species described are of commercial importance and also have the potential to inhabitat EL 1105. These species include: herring, mackerel, capelin, swordfish, Atlantic halibut, Greenland halibut, haddock, longfin hake, monkfish, pollock, white hake, , witch flounder and yellowtail flounder. Species-specific distribution and life history information for these commercially-fished species are described below. While also commercially important and present within EL 1105, Atlantic cod, American plaice, bluefin tuna and redfish are discussed at length in Section 5.2 as they are designated as at-risk species by COSEWIC. In 2010, COSEWIC assessed cod in the Laurentian North and Laurentian South Channel populations as Endangered, though they are not listed by SARA. Similarly for redfish, in April 2010, COSEWIC designated this species as Endangered, but it has status under SARA. Redfish can also be fished but with a quota imposed by DFO. Commercial fisheries data are further discussed in Section 5.8.

5.4.3.1 Pelagic Fish

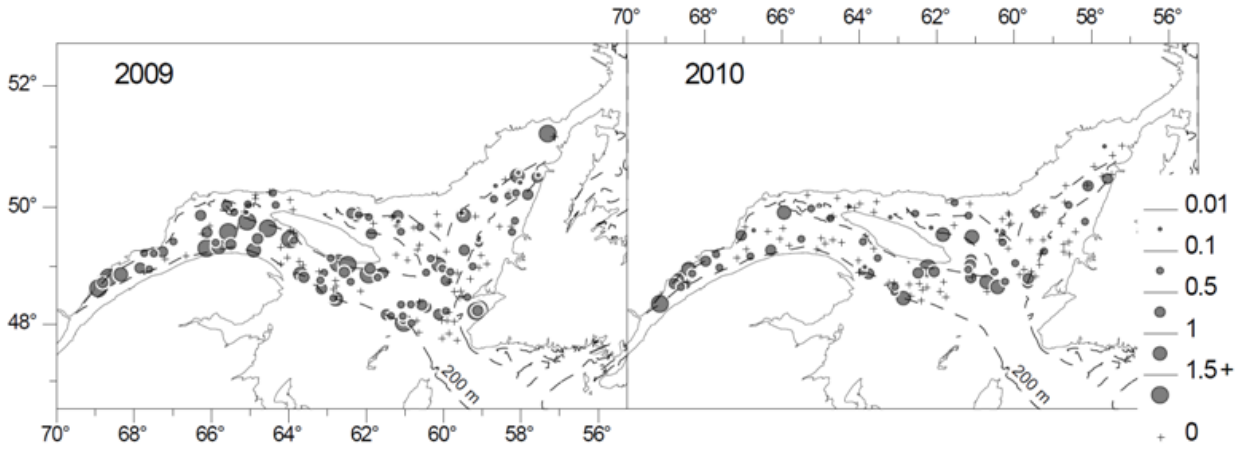
Atlantic Herring

Atlantic herring is a cold-water, coastal, pelagic species that can be found within waters on both sides of the North Atlantic Ocean. Juveniles undergo complex north-south and inshore-offshore migrations during their lives for spawning, feeding and overwintering (DFO 2010j).

Herring eggs are heavier than water and the demersal eggs are laid on substrates as large as boulders to as fine as sand, shell fragments and even macrophytes. Spawning in the southern Gulf occurs in the spring (April to May / June) in waters less than 10 m deep and fall (mid-August to October) in water depths of 5 to 20 m (DFO 2010k). Eggs hatch in 10 to 15 days

(DFO 2010j). The larval stage lasts from four to eight months depending on the time of spawning and the associated water temperatures. During this time, the larvae survive on the attached yolk sac and feed opportunistically on zooplankton. The planktonic herring larvae make vertical migrations daily or semi-daily. The purpose for these migrations is not completely understood (DFO 2010j). The larval stage ends in early spring (April to May), when Atlantic herring larvae metamorphose into juveniles. Juveniles form large schools in coastal waters and in the fall and in early winter, move to deep bays or near the seafloor in offshore areas to overwinter (DFO 2010j). Males and females mature at approximately three to four years of age and adults have a diet consisting of euphausiids (krill), chaetognaths and copepods, with the juvenile diet similar to that of the adults (DFO 2010j).

The 2009 and 2010 distribution of Atlantic herring in the Estuary and northern Gulf is presented in Figure 5.32, as obtained by DFO during the annual summer trawl surveys conducted onboard the *CCGS Teleost* (Bourdages *et al.* 2010a, 2010b).



Source: Bourdages *et al.* 2010a, 2010b; distribution data presented as catch rate (kg/15 minute tow)

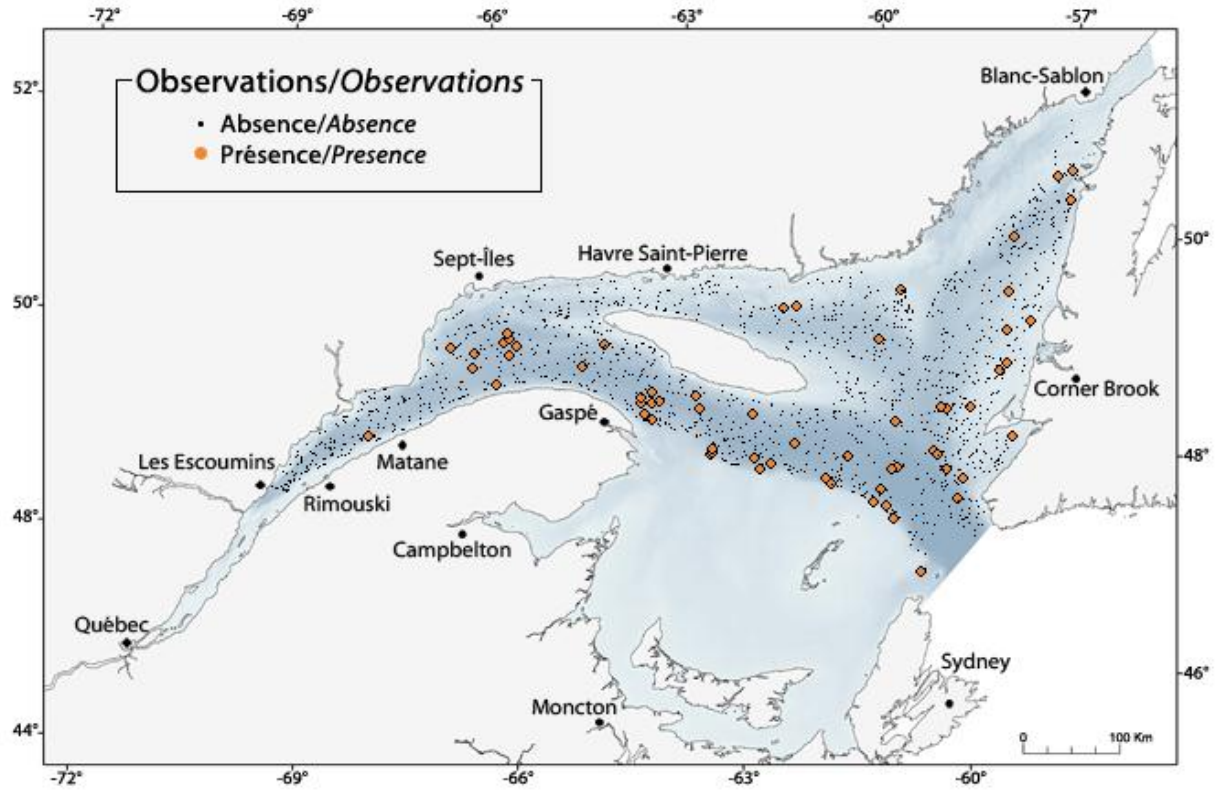
Figure 5.32 Atlantic Herring Distribution in the Estuary and Northern Gulf of St. Lawrence

Atlantic Mackerel

Atlantic mackerel belong to the order Perciformes, family Scombridae. The family Scombridae is widely distributed through temperate and tropical waters and of the three species that occupy the genus *Scomber*, the Atlantic mackerel has the most northerly distribution. Atlantic mackerel are found on the eastern and western coasts of the Atlantic from the Mediterranean to Norway and North Carolina to Newfoundland. In the spring and summer, mackerel are found in coastal waters, where they move to deeper waters in the fall to overwinter (DFO 2007a). Within Canadian waters, the Gulf is recognized as prime mackerel spawning grounds. Spawning generally occurs in June and July in coastal regions (Studholme *et al.* 1999). Spawning occurs near the surface and the eggs incubate for approximately one week. During incubation, the eggs float above the thermocline (Studholme *et al.* 1999). Mackerel go through a larval stage where the yolk sac is absorbed into the body over the course of a couple months while fins are

being developed. Once the fins are developed and the yolk sacs absorbed, the juvenile mackerel form schools and remain in coastal waters (DFO 2007a).

Maturity is reached generally at a younger age than other species and by the age of four, all mackerel are sexually mature. Adult mackerel feed on zooplankton including copepods, planktonic crustaceans, euphausiids, amphipods and chaetognaths. The distribution of Atlantic mackerel in the Estuary and northern Gulf is presented in Figure 5.33.



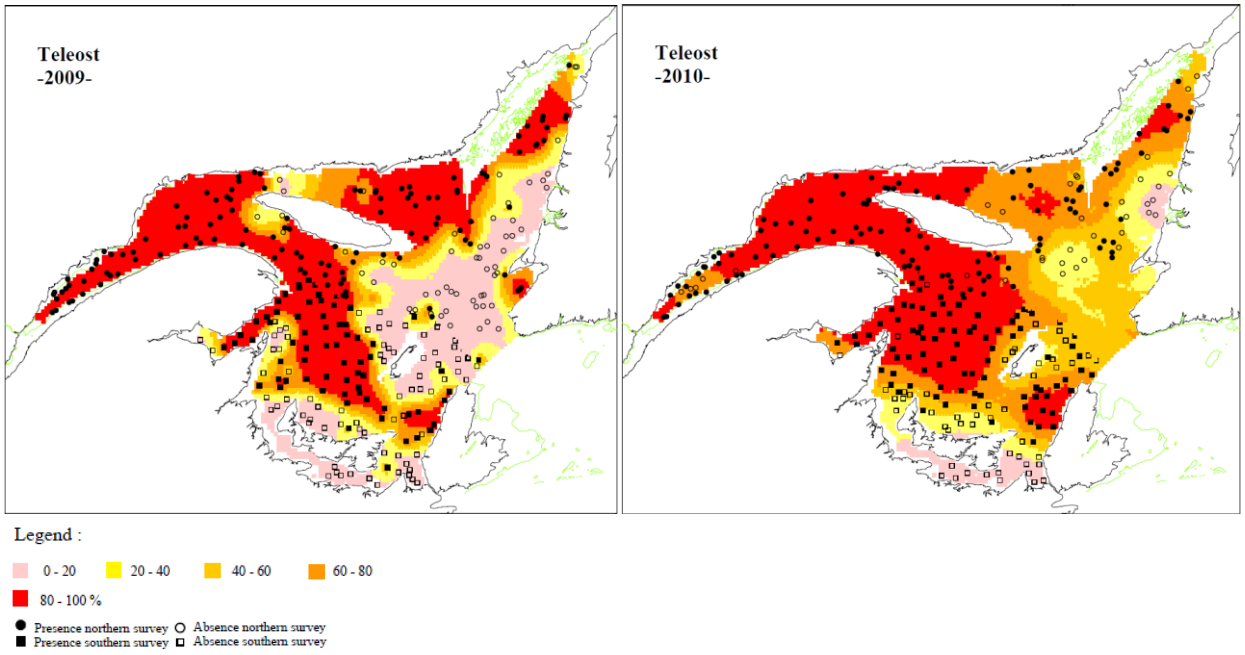
Source: http://slgo.ca/en/species/data.html

Figure 5.33 Atlantic Mackerel Distribution in the Estuary and Northern Gulf of St. Lawrence

Capelin

Capelin is a small pelagic species that is widely distributed within the coastal waters off Labrador, Newfoundland, on the Grand Banks and in the Estuary and Gulf of St. Lawrence. Capelin may also occur within the northeast Atlantic in waters near Russia, Iceland, Norway and Greenland. Capelin spawn within the sand or fine gravel in the inter-tidal portion of beaches or in deeper coastal waters up to 125 m of water depth (DFO 2001b). This spawning activity occurs in early summer after a migration of mature capelin from the open ocean to coastal habitats (DFO 2001b; DFO 2011s). The spawning activity is most pronounced at night, where external fertilization occurs (DFO 2001b; DFO 2011s). The eggs attach to the substrate and incubate for approximately 2 weeks; once hatched the planktonic larvae remain near the surface for the remainder of summer and fall (DFO 2011s). Growth is prolific within the intial two years

and from this age on males are generally larger than females (DFO 2001b; DFO 2011s). Maturity is reached around three years of age with a life span of five to six years. Capelin feed mainly on plankton including zooplankton such as copepods, euphausiids, and amphipods. The distribution of capelin in the Estuary and northern Gulf is presented in Figure 5.34 through a surface probability map of capelin occurance based on data collected in 2008, 2009 and 2010 groundfish and shrimp multidisciplinary surveys (DFO 2011s).



Source: DFO 2011

Figure 5.34 Capelin Distribution along the Western Atlantic

Swordfish

A highly migratory species, swordfish spawn in the southern Atlantic Ocean in the Sargasso Sea in the spring (Bigelow and Schroeder 1953). Migration beginning in the spring brings numerous individual swordfish to the waters of the North Atlantic. They are commonly found off the east coast of Nova Scotia throughout June to October and are also found within the western Gulf. The fish migrate north in search of food stocks, mostly other pelagic species such as Atlantic mackerel, silver hake, redfish and herring. The typically oceanic species can occur at water depths of up to 375 m and may on occasion be found in coastal waters (Bigelow and Schroeder 1953).

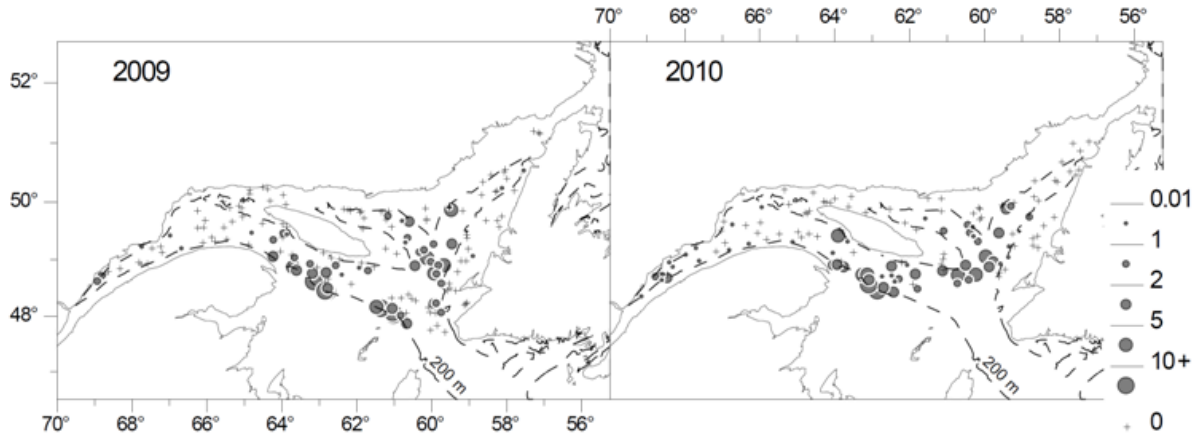
5.4.3.2 Demersal Fish

Atlantic Halibut

A cold-water demersal flatfish, the Atlantic halibut, can be found in waters on both sides of the North Atlantic and into parts of the Arctic. They are found throughout the Estuary and Gulf, occurring at depths of 200 m and more in the northern Gulf and less than 100 m in the southern

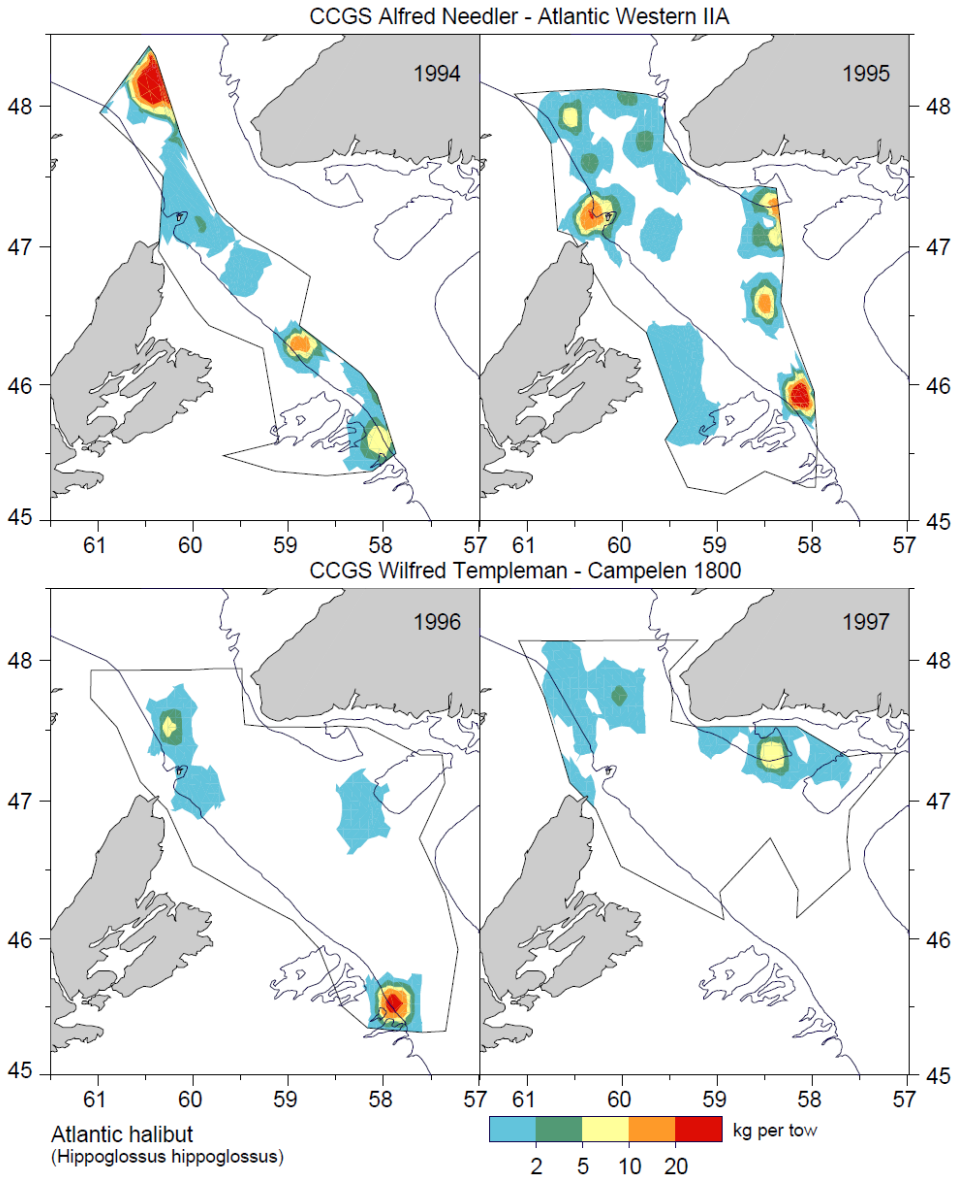
Gulf (DFO 2009l). Atlantic halibut spawn annually between winter and spring (January to May in the Gulf (DFO 2009l), synchronous within a group. Females are batch spawners able to ovulate several batches of eggs during one winter. Atlantic halibut eggs are some of the largest in the fish community, measuring up to 4 mm. Once fertilized, the eggs are deposited into the water column and free-float at depths ranging from 54 to 200 m (Scott and Scott 1988). The eggs are neutrally buoyant in salinities ranging from 35 to 37 ppt, meaning the Atlantic halibut eggs would sink towards the seafloor. Incubation of the eggs lasts for up to 20 days. Upon hatching into a larval state, the larvae are 6 to 7 mm long and have no pigment, functional eyes, or mouth (DFO 2011i). Little is known on the larval stage of the Atlantic halibut, but it is thought that the larvae remain close to the water surface. The larvae survive on a relatively large yolk sac, which is completely absorbed after 50 days. Eye migration begins approximately at day 80 (Scott and Scott 1988). Juveniles are known to inhabit distinct nursery grounds for three to four years before migration to spawning habitat (DFO 2006b). Sexual dimorphism is present within adult of the species, with females substantially larger than males. Adult populations feed on fish, mollusks and crustaceans, with a similar diet in the juvenile stages.

The 2009 and 2010 distribution of Atlantic halibut in the Estuary and northern Gulf is presented in Figure 5.35, as obtained by DFO during the annual summer trawl surveys conducted onboard the *CCGS Teleost* (Bourdages *et al.* 2010a, 2010b). Figure 5.36 presents data from the winter surveys where aggregations appear to be present in proximity to EL 1105.



Source: Bourdages *et al.* 2010a, 2010b; distribution data presented as catch rate (kg/15 minute tow)

Figure 5.35 Atlantic Halibut August Distribution in the Estuary and Northern Gulf of St. Lawrence



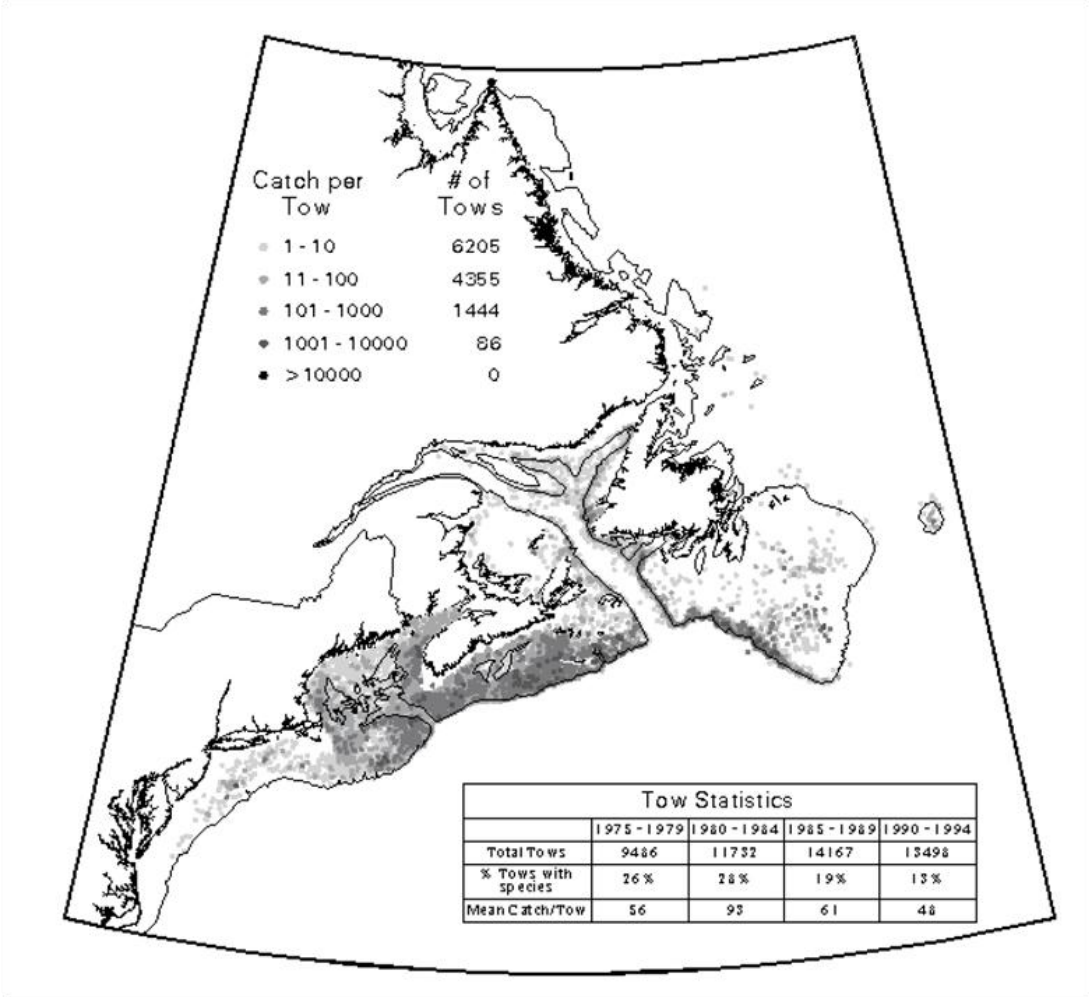
Source: Chouinard and Hurlbut 2011; distribution data presented as catch rate (kg/15 minute tow)

Figure 5.36 Atlantic Halibut January Distribution in the Estuary and Northern Gulf of St. Lawrence

Haddock

Haddock is a demersal species that is distributed from Greenland to the eastern mid-Atlantic. Haddock spawn over pebble and gravel substrate (avoiding rocks, kelp and soft mud) between March and April. The eggs are spawned on the seafloor but become buoyant after fertilization and rise in the water column (Cargnelli *et al.* 1999a). Hatching occurs 9 to 32 days after spawning. Larvae metamorphose into juveniles in 30 to 42 days, with an average length of 2 to 3 cm. The juveniles inhabit the upper water column, where they are opportunistic feeders on zooplankton. After 3 to 5 months, the juveniles migrate to the seafloor, where they begin their demersal life (Cargnelli *et al.* 1999a). Early juveniles feed on less motile prey such as

invertebrate eggs, copepods and phytoplankton. Adults tend to feed more on polychaetes and ophiuroids, but haddock are mostly opportunistic and will feed on crustaceans, polychaetes, mollusks and echinoderms. Adults are strongly associated with hard substrate seafloors of pebble and gravel and found in water depths from 40 to 150 m (Cargnelli *et al.* 1999a). The distribution of haddock in the Gulf (according to Environmental Canada. (2000)) is provided in Figure 5.37.



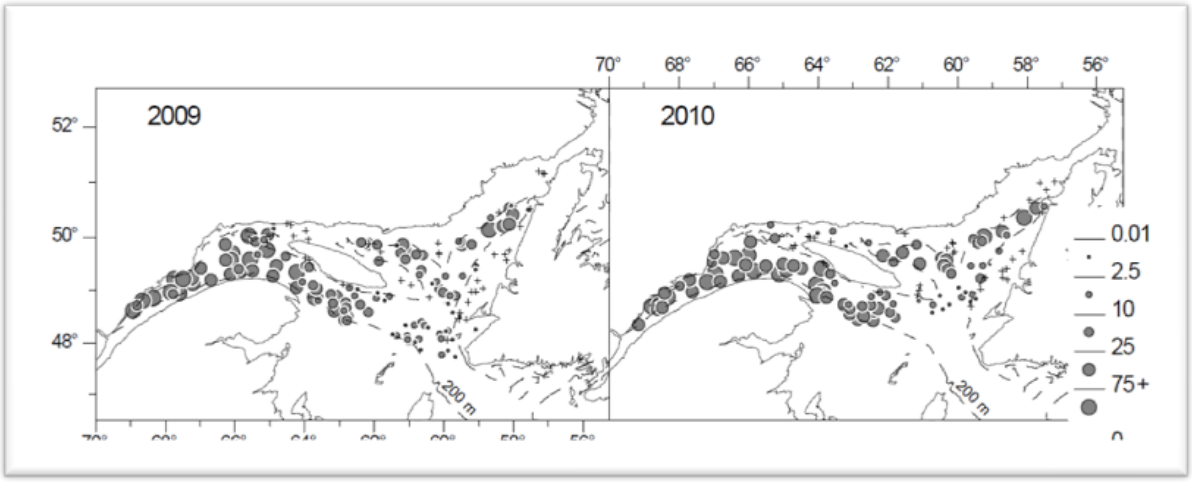
Source: Cognelli *et al.* 1999a.

Figure 5.37 Haddock Distribution along the Western Atlantic

Greenland Halibut (Greenland turbot)

Greenland halibut, also fished under the name Greenland turbot, is a cold-water, demersal flatfish species. Greenland halibut is described as having an amphiboreal distribution, meaning it is found in both the Atlantic and Pacific oceans. In the Atlantic Ocean, Greenland halibut can be located from Davis Strait through Newfoundland to as far south as the Gulf of Maine. Greenland halibut are widely distributed through the Gulf. In summer, the main populations are found in the St. Lawrence Estuary, the areas west and northeast of Anticosti Island, and near the west coast of Newfoundland in the Esquiman Channel (DFO 2010l).

Spawning generally occurs in the winter (November to February) within the Cabot Strait and can occur in depths of up to 1,000 m (DFO 2000b). Eggs are fertilized externally and float low within the water column. Eggs incubate for up to 12 weeks until metamorphosis into the larval stage. Early larval stages are also buoyant and found within the water column. Once the yolk sac has been absorbed, the larvae have been observed to rise in the water column; this is thought to correspond with the onset of feeding. Larval development lasts for up to 15 weeks and results in larval drift and dispersal from spawning areas (Chiperzak *et al.* 1995). A recent publication from Ouelett *et al.* (2012) presents data from 1971 to 1986 that indicates a high larval abundance of Greenland halibut in the vicinity of EL 1105, particularly southeast of EL 1105 in the Laurentian Channel between Cape Ray and the Magdalen Islands. In August or September and nearly one year after spawning, the post-larvae settle to the seafloor, at which time the left eye has migrated to the right side of the fish. Unlike most flatfish, the migrating eye stops at the dorsal margin of the head (Alton et al. 1988). Adults reach maturity sooner in the Gulf (on average in 7.8 years). Adults generally feed on small crustaceans, demersal fishes (particularly redfish) and squid. The distribution of Greenland halibut in the Estuary and northern Gulf is presented in Figure 5.38.



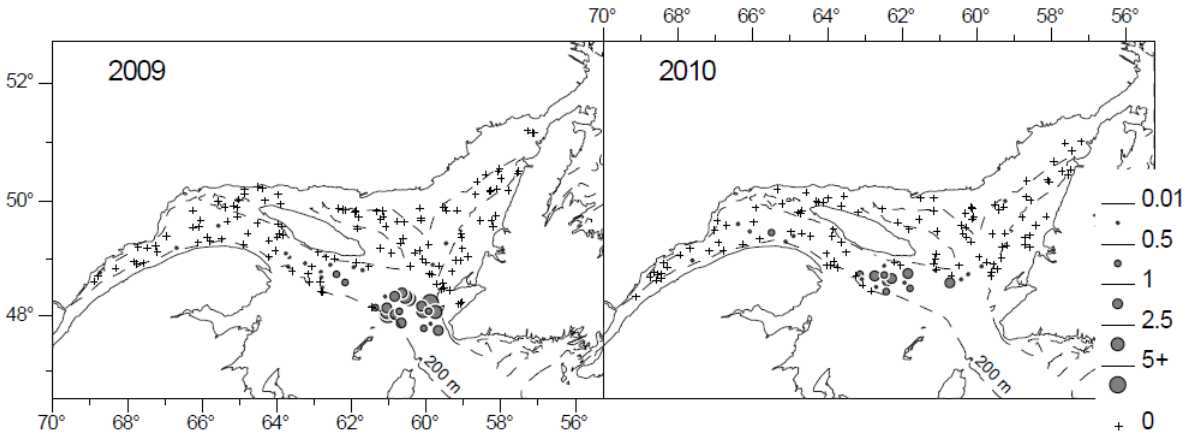
Source: Bourdages *et al.* 2010a, 2010b; distribution data presented as catch rate (kg/15 minute tow)

Figure 5.38 Greenland Halibut Distribution in the Estuary and Northern Gulf of St. Lawrence

Longfin Hake

Longfin hake is a benthic species distributed along the outer continental shelves of the western North Atlantic. This sedentary species is often found on the seafloor and often associated with silty-sand substrates at water depths from 360 to 800 m. The most recent distribution of longfin hake in the Estuary and northern Gulf for 2009 and 2010 is presented in Figure 5.39. It should be noted that 2010 is the lowest recorded indices of longfin hake and that the highest catch rates are generally made in the eastern portion of the Laurentian Channel and near Cabot Strait, as seen in 2009 in Figure 5.39 (Bourdages *et al.* 2010a, 2010b). However, because of technical issues, this particular area was not sampled in 2010 and smaller catches were recorded further upstream in the Laurentian Channel, as illustrated in Figure 5.39 (Bourdages *et*

al. 2010a, 2010b). Spawning of longfin hake occurs from late September to April, peaking in December and January (Cohen *et al.* 1990). Fecundity is generally high and development resembles that of other gadiforms with buoyant eggs that contain a large oil globule and where the eggs most likely develop in the pelagic zone. Young longfin hake remain pelagic for up to 18 months before descending to the seafloor (Coad *et al.* 1997). Longfin hake's diet is poorly documented and includes crustaceans (shrimp) and euphausiids (Collette and Klein-Macphee 2002).

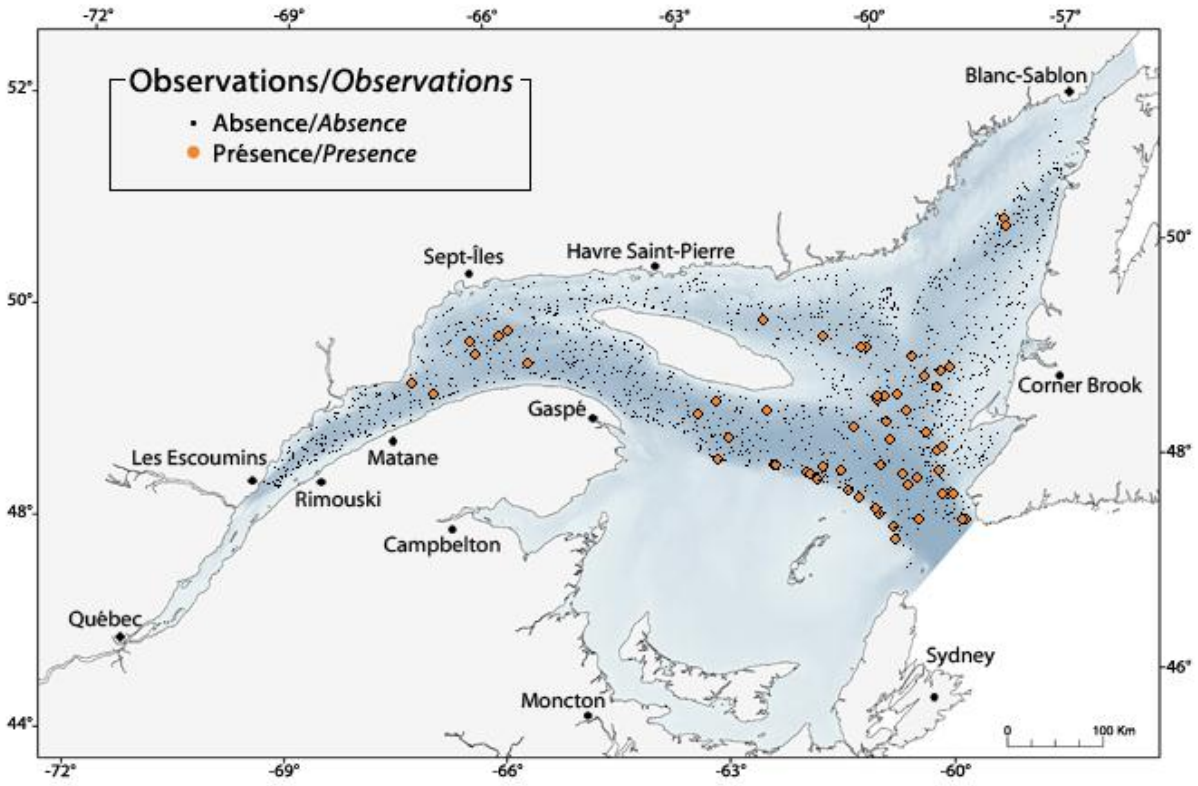


Source: Bourdages *et al.* 2010a, 2010b; distribution data presented as catch rate (kg/15 minute tow)

Figure 5.39 Longfin Hake Distribution in the Estuary and Northern Gulf of St. Lawrence

Monkfish

Monkfish, sometimes known as goosefish, is a large demersal fish from the family Lophiidae. The large, bulky head and enormous mouth characterize this species. Monkfish are distributed throughout the Western Atlantic Ocean from Florida to Labrador. The Gulf provides habitat for an abundant population within the warmer bank waters during summer with individuals moving to deeper waters during the winter (Newfoundland and Labrador Department of Fisheries and Aquaculture undated B). The monkfish prefer waters of between 6°C and 10°C (DFO 2000c) and research has shown that the monkfish will migrate to shallower water in summer and into deeper water throughout the winter (DFO 2000c). Monkfish can inhabit depths ranging from subtidal to 650 m. Spawning generally occurs in the fall (June to September), with the eggs deposited on the seafloor within large mucus sheets. Once fertilized, the eggs hatch in approximately seven days into larvae complete with pelvic fins and dorsal head spines (DFO 2000c). The larvae are pelagic for the first several months as opportunistic planktonic feeders prior to starting their demersal lives. Sexual maturity is reached between four and seven years. Adults consume a variety of marine organisms but are mainly piscivorous, with prey that includes herring, sand lance, alewife (*Alosa pseudoharengus*), smelt, cod, mackerel, striped bass, sculpin, sea raven, flounder, skate, crab, shrimp, starfish and marine worms (DFO 2000c). The distribution of monkfish in the Estuary and northern Gulf is presented in Figure 5.40.

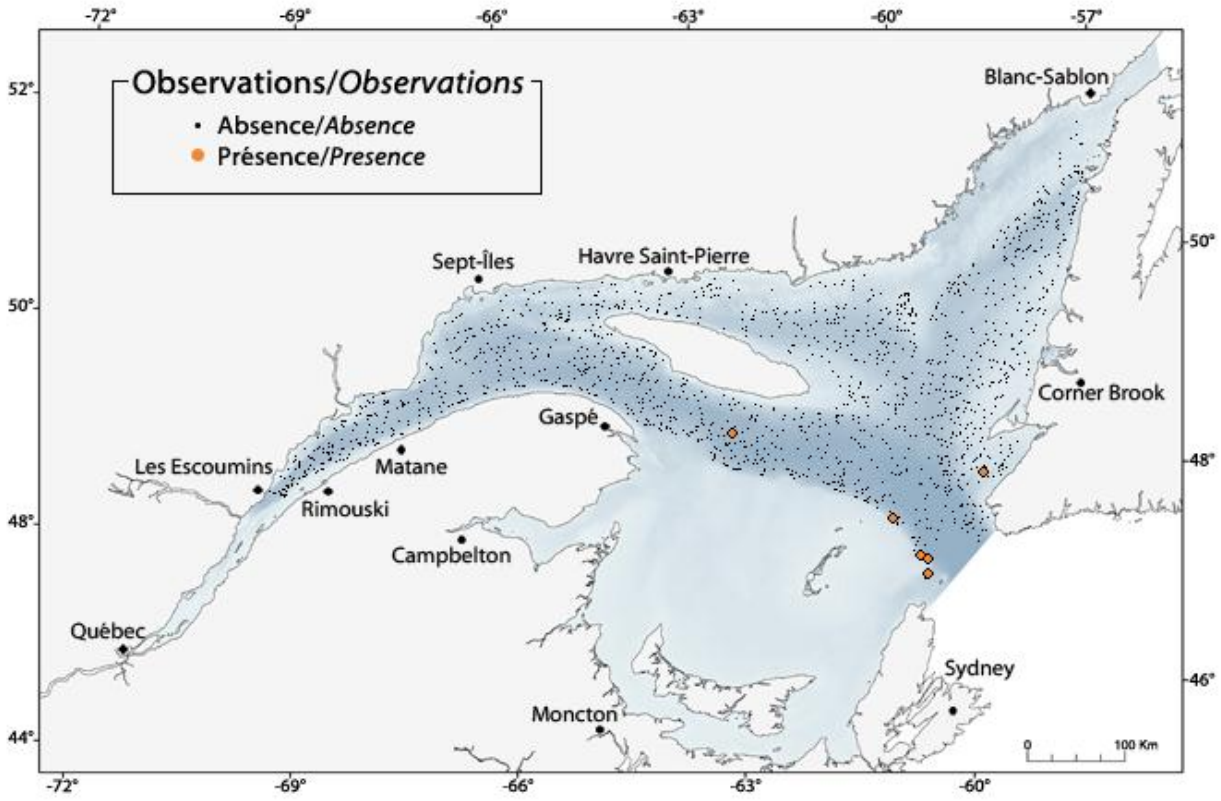


Source:http://slgo.ca/en/species/data.html

Figure 5.40 Monkfish Distribution in the Estuary and Northern Gulf of St. Lawrence

Pollock

Pollock are a cold water fish of the same family as cod, although pollock generally spend less of their life on the seafloor as a true demersal species. Stocks are generally distributed from Cape Hateras to the Labrador Shelf. The timeframe for spawning is variable in the northern habitats and generally occurs from fall to spring (September to April), peaking in December to February. The principle pollock spawning areas include the Scotian Shelf, Georges Bank, the Great South Channel and the Gulf of Maine. Pollock prefer hard stony or rocky bottoms. Pollock eggs are buoyant and after fertilization rise in the water column. Upon metamorphosis to a larval state, the pelagic larvae feed on zooplankton, including copepods, for several months. The juvenile pollock migrate inshore to inhabit rocky subtidal zones and undergo onshore-offshore migration based on temperature fluctuations (Cargnelli *et al.* 1999b). Pollock remain generally stationary with the exception of short migrations for spawning. Sexual maturity is reached between the ages of four to seven years (DFO 1999b). Adults consume euphausiids, fish and mollusks; juvenile diets are similar but composed of more coastal species (DFO 1999c). The distribution of pollock in the Estuary and northern Gulf is presented in Figure 5.41.

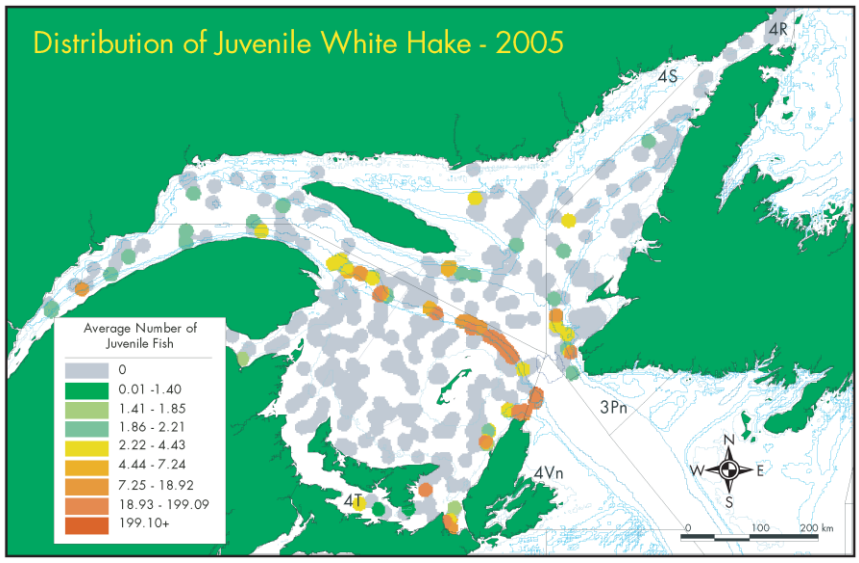


Source:http://slgo.ca/en/species/data.html

Figure 5.41 Pollock Distribution in the Estuary and Northern Gulf of St. Lawrence

White Hake

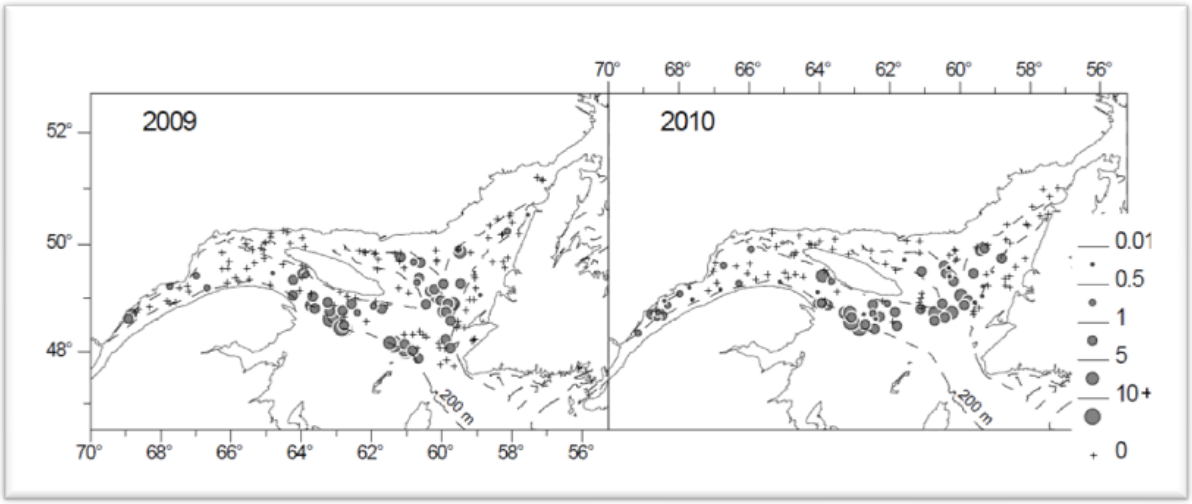
White hake is a demersal species occurring from the Middle Atlantic Bight to the Gulf. White hake spawn in the summer (June to September) (DFO 2009m). Spawning occurs in open water, with the fertilized eggs remaining near the surface. Eggs hatch in three to seven days, with larvae remaining in the water column to feed. Juveniles migrate toward coastal habitats and can often be found within beds of eelgrass, feeding on shrimps and polychaetes. Sexual maturity is reached between two and five years. During summer months the mature fish are locally distributed in inshore waters or the banks along the Laurentian Channel. During the winter months, the adults migrate to the deep waters of the Laurentian Channel in search of warmer waters (DFO 2012c). Food sources for adults include shrimp, krill and some fish. It is believed that the long pelvic fins are used to feel prey in the soft sediments that the white hake often inhabit as adults (DFO 2009m). Modelled juvenile white hake densities (from DFO RV data) for 2005 are illustrated in Figure 5.42, with current distributions from 2009 and 2010 included in Figure 5.43.



Source: Ollerhead and Lawrence 2007.

Figure 5.42 Distribution of Juvenile White Hake, 2005

The distribution of white hake in the Estuary and northern Gulf is presented in Figure 5.43, as obtained by DFO during the annual summer trawl surveys (Bourdages *et al.* 2010a, 2010b).



Source: Bourdages *et al.* 2010a, 2010b; distribution data presented as catch rate (kg/15 minute tow)

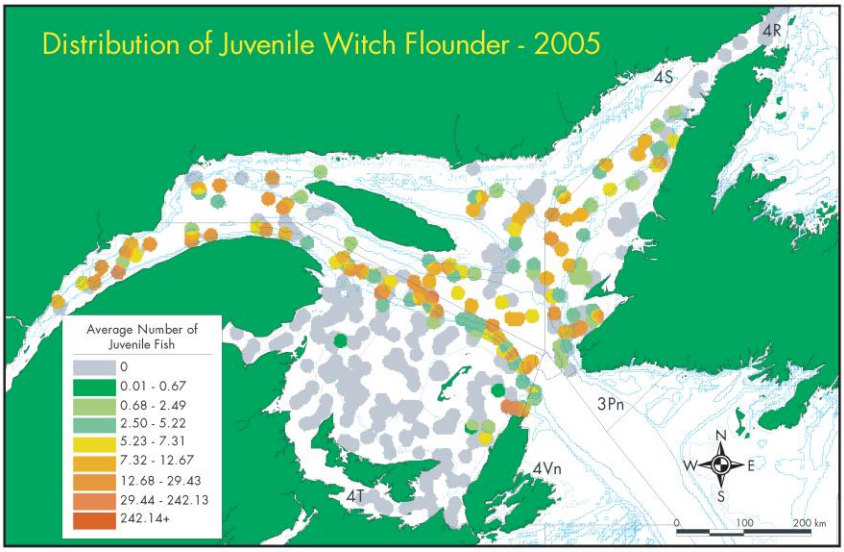
Figure 5.43 White Hake Distribution in the Estuary and Northern Gulf of St. Lawrence

Witch Flounder

Witch flounder, also known as greysole, is a demersal flatfish found in deep waters of the North Atlantic from lower Labrador to Cape Hatteras, North Carolina. Witch flounder aggregate in deep channel waters like those found in the Laurentian Channel, just southwest of St. Georges Bay, from January to February prior to spawning. Spawning occurs from spring to late summer (DFO 2009n). The fertilized eggs float and hatch after several days (Cargnelli *et al.* 1999c). The larvae undergo a pelagic existence for up to a year, feeding on plankton before the juveniles

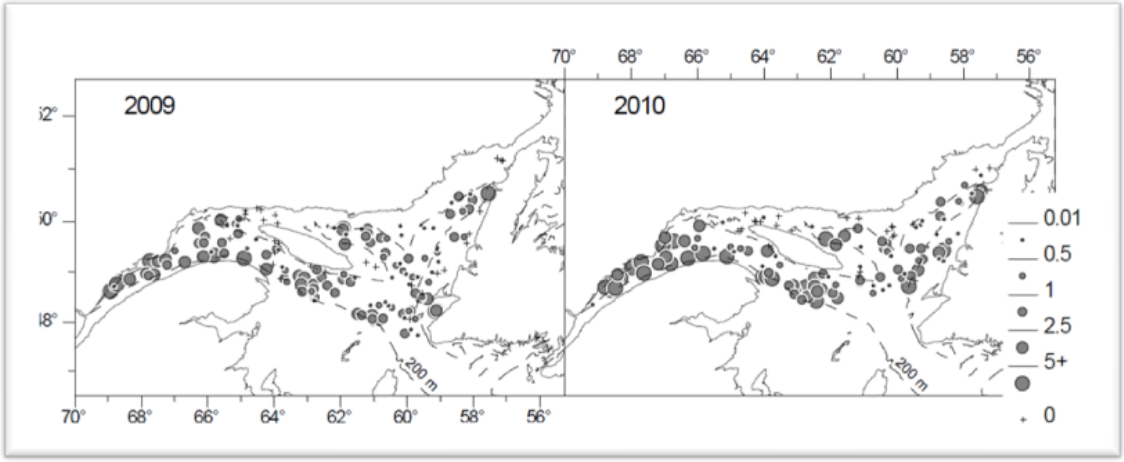
settle to the bottom to begin their demersal life. In the Gulf, witch flounder move to deep water during the winter, where feeding can cease in colder waters. Modelled juvenile witch flounder densities (from DFO RV data) for 2005 are illustrated in Figure 5.44.

Witch flounder can be found in waters up to 1,569 m off the coast of Nova Scotia, although the highest abundance is caught within 185 to 400 m (DFO 2009n). Witch flounder are sedentary and appear to undertake very minimal migrations, with the populations aggregating in spawning habitats (Cargnelli *et al.* 1999c). The small head and mouth of the witch flounder restricts the size of prey available for consumption. Main prey includes marine worms, small crustaceans, or shellfish (Cargnelli *et al.* 1999c). The distribution of witch flounder in the Estuary and northern Gulf is presented in Figure 5.45.



Source: Ollerhead and Lawrence 2007.

Figure 5.44 Distribution of Juvenile Witch Flounder, 2005

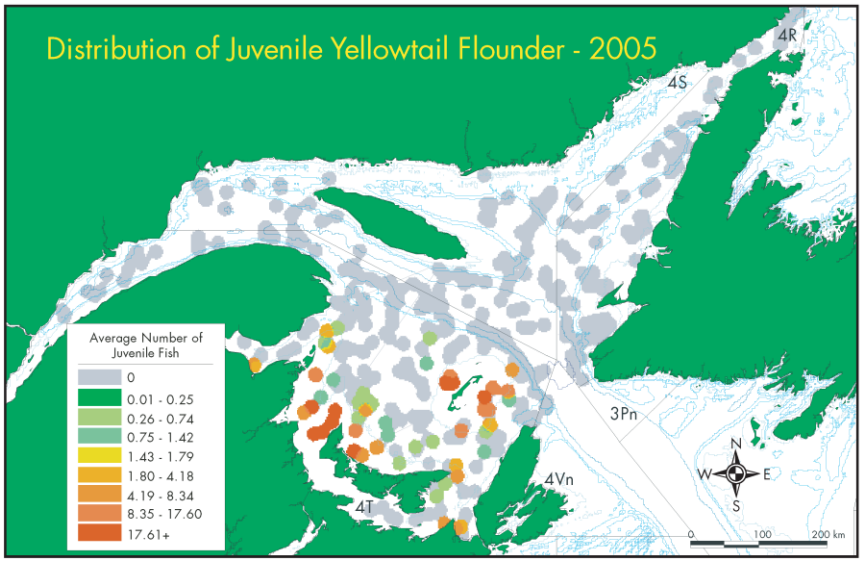


Source: Bourdages *et al.* 2010a, 2010b; distribution data presented as catch rate (kg/15 minute tow)

Figure 5.45 Witch Flounder Distribution in the Estuary and Northern Gulf of St. Lawrence

Yellowtail Flounder

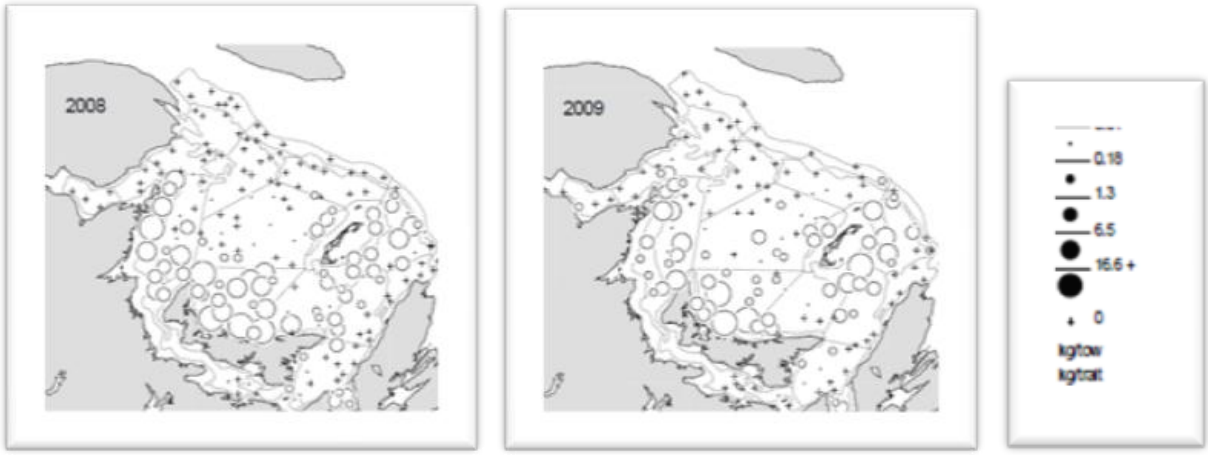
Yellowtail flounder is a demersal flatfish found in the waters from Chesapeake Bay to the Strait of Belle Isle. Yellowtail flounder are prevalent around the Magdalen Islands and within the coastal waters of New Brunswick, Prince Edward Island and Nova Scotia within the Northumberland Strait (DFO 2009o). Spawning occurs on or near the seafloor in spring to early summer (May to July) (Johnson *et al.* 1999). The fertilized eggs float to the surface and drift during development. Hatching of the eggs occurs approximately five days after fertilization (DFO 2009o). The larvae remain in a pelagic state for a short time before drifting downward. Yellowtail flounder mature after three to five years and tend to inhabit waters less than 100 m deep where the bottom is composed of sand-mud sediments (Johnson *et al.* 1999). Yellowtail flounder have recently been discovered to move off the bottom and, using mid-water tidal currents, displace from one area to another, although no clear migration patterns have been discovered. Adults tend to feed on crustaceans, polychaete worms and amphipods (DFO 2009o). Modelled juvenile yellowtail flounder densities (from DFO RV data) for 2005 are illustrated in Figure 5.46.



Source: Ollerhead and Lawrence 2007.

Figure 5.46 Distribution of Juvenile Yellowtail Flounder, 2005

The distribution of yellowtail flounder in the southern Gulf (as determined by DFO in bottom-trawl surveys (Hurlbut *et al.* 2010)) is presented in Figure 5.47.



Source: Hurlbut *et al.* 2010.

Figure 5.47 Yellowtail Flounder Distribution in the Southern Gulf of St. Lawrence

5.4.4 Biologically Sensitive Periods

The activities for the proposed Project will occur during the ice-free season. Therefore, those fish known or suspected to spawn within the vicinity of EL 1105 during ice-free periods are of highest concern for potential interactions with the Project activities. The annual spawning activities of the principal commercial fish and shellfish species recorded in or near EL 1105 are provided (Table 5.9). The Gulf fish species anticipated to spawn or mate outside the winter season include most fish such as Atlantic herring, roundnose grenadier, roughhead grenadier, marlin-spike grenadier, pollock, longfin hake, white hake, redfish, Atlantic hookear sculpin, sea raven, northern wolffish, Atlantic wolffish and spotted wolffish (Scott and Scott 1988; LGL 2005b; Rodger 2006; FishBase 2010). Spawning activities range from the deep waters preferred by the grenadiers and wolffishes (Rodger 2006; FishBase 2010), to the variable depths within which pollock will spawn (approximately 27 to 91 m), to the sea raven's use of marine sponges as spawning beds, and to the summer spawning activities of the bottom-dwelling white hake (Rodger 2006). Atlantic mackerel move inshore to spawn in the spring, primarily in the southwestern Gulf, which is outside the area of interest for this Project (Rodger 2006). Atlantic cod also spawn in the spring, although the spawning period can extend into the early fall as well. In the southwestern Gulf, cod spawning typically peaks in late June, although there is substantial diversity in spawning peaks across the population (Scott and Scott 1988). Atlantic cod also spawn at a wide range of depths, from 180 m to over 600 m (Rodger 2006). Witch flounder are known to form large pre-spawning concentrations in the Laurentian Channel (southwest of St. George's Bay) in January and February (DFO 2010m). Peak spawning in this area is anticipated to occur in late spring or early summer, based on observations of fish maturity during the January pre-spawning aggregation in the Laurentian Channel (DFO 2010m).

Potentially sensitive areas located near EL 1105, including a cod spawning area, a potential redfish larvae extrusion area and a potential redfish mating area, are discussed in Section 5.7.2. Redfish are slow growing and long-lived, deep-swimming fish that typically live at depths ranging from approximately 100 to 700 m (DFO 2010n). They stay close to the bottom during the day and move into the water column to feed at night (Rodger 2006). Redfish are

lecithotrophic viviparous with internal fertilization (LGL 2005b). This means they give birth to live young (Scott and Scott 1988). They mate in the fall but extrusion of the larvae (*i.e.*, the birth of the live young) does not occur until the spring, typically between April and July (LGL 2005b). It has been suggested that seismic and fishing activities can exert stress (prior to larval release), thereby potentially affecting the survival of redfish larvae (LGL 2007). Larval development of redfish, which precedes larval extrusion, occurs from February to June (Scott and Scott 1988). EL 1105 does not overlap physically with the delineated larvae extrusion area (LGL 2007). The recent designation of the Gulf, Laurentian Channel deepwater redfish and the Atlantic population of Acadian redfish as Endangered by COSEWIC provides further confirmation that these fish are considered sensitive species, highly vulnerable to mortality from human activities (COSEWIC 2010b).

Table 5.9 Summary of Spawning and Hatching Periods for Principal Commercial Fisheries Species with the Potential to Occur in EL 1105

Common Name	Latin Name	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec
Atlantic halibut	*Hippoglossus hippoglossus*												
Atlantic herring	*Clupea harengus*												
Atlantic haddock	*Melanogrammus aeglefinus*												
Atlantic mackerel	*Scomber scombrus*												
Atlantic cod	*Gadus morhua*												
Capelin	*Mallotus villosus*												
Greenland halibut	*Reinhardtius hippoglossoides*												
Monkfish	*Lophius americanus*												
Pollock	*Pollachius virens*												
Redfish (deepwater and Acadian)	*Sebastes mentella / Sebastes fasciatus*												
White hake	*Urophycis tenuis*												
Witch flounder (greysole)	*Glyptocephalus cynoglossus*												
Yellowtail flounder	*Limanda ferruginea*												
Lobster	*Homarus americanus*												
Snow crab	*Chionoecetes opilio*												
Northern shrimp	*Pandalus borealis*												
Rock crab	*Hemigrapsus sexdentatus*												
Whelk	*Buccinum undatum*												
Scallop	potential for multiple species												

Data sources: Scott and Scott 1988; DFO 1997, 1998, 2000a, 2000b, 2002, 2006b, 2009h, 2009j, 2010d, 2010g; Cargnelli *et al.* 1999a, 1999b; LGL 2005b; Rodger 2006; Newfoundland and Labrador Department of Fisheries and Aquaculture undated B.

- potential spawning and hatching periods
- pre-spawning aggregation in Laurentian Channel
- peak spawning period anticipated
- mating period
- overlap of spawning and mating periods

The principal commercial shellfish species in the vicinity of EL 1105 represent a range of mating and spawning periods (Table 5.9). The reproductive cycle of a lobster lasts approximately two years. Fertilization of eggs typically occurs in the summer, with hatching occurring 9 to 12 months after fertilization (DFO 2009i, 2009j). Snow crab mating occurs typically sometime from February to March, with mating pairs migrating to shallow waters in the spring. Female rock crab seems to typically extrude eggs in late October; the eggs mature over the winter and hatch the following spring or summer into free-floating larvae (DFO 2000a). Mature northern shrimp breed in the late autumn or early winter, with the eggs hatching in spring (Rodger 2006).

Scallop spawning takes place from late August to early September. Whelks inhabit most bottom types from low water levels to depths of more than 50 m (Environment Canada 2009). They have the potential to mate and spawn over long periods of time, resulting in their reproductive activities ranging over the full year.

5.5 Marine Birds

Many species of marine birds can be found in the Gulf and are divided into four groups:

- inshore / neritic birds;
- waterfowl;
- shorebirds; and
- offshore / pelagic birds.

Neritic seabirds feed in shallow waters, including shelf areas, and tend to return to land to rest over night. They include species such as cormorants, gulls and terns.

Neritic seabirds feed in shallow waters, including shelf areas, and tend to return to land to rest overnight. They include species such as cormorants, gulls and terns.

The majority of waterfowl species can be divided into seaducks, bay ducks and dabbling ducks. All of the waterfowl species found in the Gulf (with the exception of eiders) nest near fresh water. Eiders typically nest on coastal islands where fresh water is available and raise their broods in coastal waters. Outside of the breeding season, seaducks are generally found only on coastal waters or over reefs and banks where benthic prey are accessible. Seaducks have also been known to migrate over large ocean expanses and over land. Seaduck species include eiders, scoters, Bufflehead, Common Goldeneye, Red-breasted Merganser, Long-tailed Duck, and Harlequin Duck. Outside of the breeding season, bay ducks, such as Greater Scaup, forage in open freshwater or sheltered coastal waters such as bays and estuaries. Dabbling ducks are most frequently encountered in shallow freshwater but will forage in highly sheltered coastal areas such as salt marshes and estuaries. American Black Duck is the most common dabbling duck present in the Gulf. In addition to seaducks, bay ducks, and dabbling ducks, Canada Goose are attracted to deltaic areas with shallow water for foraging and rely upon open, fast-flowing water when they arrive in early spring. For nesting, this species prefers peatlands and fluvial sites in boreal regions.

Shorebirds typically nest in wetland or upland habitats and utilize coastal stopover sites for feeding and resting during migration. Whereas most shorebirds nest in inland habitats, some

species such as Willet and Piping Plover will raise their young in coastal environments. Most shorebirds forage along coastal beaches, exposed mud flats or salt marshes during migration, with high concentrations of birds often being found in associated with sites that provide an abundant food source. Such stopover sites can be crucial to the survival of many shorebirds because they provide important energy reserves that are necessary for undertaking long, uninterrupted flights. Of exception, phalaropes typically forage on the surface of the sea in areas where upwelling brings plankton to the surface and Purple Sandpipers primarily use rocky shorelines during migration, as well as overwintering. Some of the more abundant or highly represented (*i.e.*, relative to their continental populations) shorebird species found in the Gulf include Semipalmated Sandpiper, Semipalmated Plover, Greater Yellowlegs and Black-bellied Plover.

Pelagic seabirds typically feed at sea over deep waters and do not have to return to land to rest. However, they do return to land to breed on rocky cliffs and on islands. Common pelagic seabird species found in the Gulf include Northern Gannet, Great Shearwater, Northern Fulmar, Common Murre, Dovekie, Atlantic Puffin, Leach's Storm-Petrel, Wilson's Storm-Petrel, and Razorbill.

The Gulf is important to both breeding and non-breeding seabirds, including both neritic and pelagic species. Accidental spills of hydrocarbons represent the most important potential adverse effect of hydrocarbon exploration on seabirds. The most vulnerable seabirds are those that spend a considerable amount of time on the water, increasing the likelihood that they will come in contact with floating hydrocarbons. Additionally, the vulnerability of species is increased if they have low reproductive rates such that their populations are slow to recover from mortality events. Pelagic seabirds considered to be most vulnerable to oil pollution include murres, phalaropes, Dovekie, Razorbill, Atlantic Puffin, Northern Gannet, Black-legged Kittiwake and Northern Fulmar. Neritic seabirds that are considered most vulnerable include loons and grebes. Some species such as cormorants and seaducks are highly susceptible to oiling but have relatively high reproductive rates and are able to recover from mortality events more rapidly. Seabirds such as storm-petrels, terns and gulls that spend relatively little time on the water are considered to be less vulnerable. In addition to the direct effects of oiling and thermal stress, seabirds may also be indirectly affected by contamination of their food source, particularly the bioaccumulation of petrochemicals in their food source (*e.g.*, fish and aquatic invertebrates).

A list of marine birds that could potentially occur in EL 1105 and off the western coast of Newfoundland is provided in Table 5.10. These species include those that are known to regularly visit the Gulf region for breeding purposes, overwintering, or migration. Additional species which may also occur as rare vagrants to the area are not included. A discussion of seabird colonies is provided in Section 5.7.

Table 5.10 Marine Birds that may occur in the Vicinity of Exploration Licence 1105 and off Western Newfoundland[1]

Common Name	Species Name
Waterfowl	
American Black Duck	*Anas rubripes*
Greater Scaup	*Aythya marila*
Canada Goose	*Branta Canadensis*
Bufflehead	*Bucephala albeola*
Common Goldeneye	*Bucephala clangula*
Long-tailed Duck	*Clangula hyemalis*
Common Loon	*Gavia immer*
Harlequin Duck	*Histrionicus histrionicus*
Red-breasted Merganser	*Mergus serrator*
Common Eider	*Somateria mollissima*
Shorebirds	
Spotted Sandpiper	*Actitis macularius*
Ruddy Turnstone	*Arenaria interpres*
Sanderling	*Calidris alba*
Dunlin	*Calidris alpina*
Red Knot rufa ssp	*Calidris canutus rufa*
White-rumped Sandpiper	*Calidris fuscicollis*
Purple Sandpiper	*Calidris maritime*
Pectoral Sandpiper	*Calidris melanotos*
Least Sandpiper	*Calidris minutilla*
Semipalmated Sandpiper	*Calidris pusilla*
Piping Plover	*Charadrius melodus*
Semipalmated Plover	*Charadrius semipalmatus*
Killdeer	*Charadrius vociferus*
Short-billed Dowitcher	*Limnodromus griseus*
Whimbrel	*Numenius phaeopus*
Red Phalarope	*Phalaropus fulicaria*
Red-necked Phalarope	*Phalaropus lobatus*
American Golden-Plover	*Pluvialis dominica*
Black-bellied Plover	*Pluvialis squatarola*
Lesser Yellowlegs	*Tringa flavipes*
Greater Yellowlegs	*Tringa melanoleuca*
Willet	*Tringa semipalmata*
Pelagic Seabirds	
Razorbill	*Alca torda*
Dovekie	*Alle alle*
Black Guillemot	*Cepphus grille*
Atlantic Puffin	*Fratercula arctica*

Table 5.10 Marine Birds that may occur in the Vicinity of Exploration Licence 1105 and off Western Newfoundland[1]

Common Name	Species Name
Northern Fulmar	*Fulmarus glacialis*
Herring Gull	*Larus argentatus*
Ring-billed Gull	*Larus delawarensis*
Iceland Gull	*Larus glaucoides*
Glaucous Gull	*Larus hyperboreus*
Great Black-backed Gull	*Larus marinus*
Bonaparte's Gull	*Larus philadelphia*
Black-headed Gull	*Larus ridibundus*
Northern Gannet	*Morus bassanus*
Wilson's Storm-Petrel	*Oceanites oceanicus*
Leach's Storm-Petrel	*Oceanodroma leucorhoa*
Double-crested Cormorant	*Phalacrocorax auritus*
Great Cormorant	*Phalacrocorax carbo*
Great Shearwater	*Puffinus gravis*
Sooty Shearwater	*Puffinus griseus*
Manx Shearwater	*Puffinus puffinus*
Black-legged Kittiwake	*Rissa tridactyla*
Great Skua	*Stercorarius skua*
Common Murre	*Uria aalge*
Thick-billed Murre	*Uria lomvia*
Terns	
Caspian Tern	*Sterna caspia*
Roseate Tern	*Sterna dougallii*
Common Tern	*Sterna hirundo*
Arctic Tern	*Sterna paradisaea*
[1]As demonstrated by the Project "Study Area" in Figure 6.1	

5.5.1 Seasonal Distribution of Seabirds and Coastal Waterfowl

5.5.1.1 Seabirds

Information on the distribution and abundance of seabirds birds within the Gulf of St. Lawrence was primarily obtained from the PIROP (Programme Integre de Recherches sur les Oiseaux Pelagiques) and Eastern Canadian Seabirds at Sea (ECSAS) databases. Seabird observations within these databases are from ship-based surveys and were mapped according to season (Figures 5.48 to 5.63), including spring (March, April, and May), summer (June, July, and August), fall (September, October, and November), and winter (December, January, and February). Although there are differences in the survey methods used for the ECSAS and PIROP programs, data from both were integrated into common maps to convey information on the relative distribution and abundance of seabirds. Species which were evaluated separately were Dovekie, Northern Fulmar, Northern Gannet, Black-legged Kittiwake, and Great Skua.

Guilds and / or taxonomic groups were used to convey patterns for other species and included “cormorants”, “gulls”, “jaegers”, “large auks and other alcids”, storm-petrels”, “phalaropes”, “shearwaters”, and “terns”. The distribution and abundance of seabird observations made during ship-based surveys were considered with respect to the locations of large seabird colonies, but more detailed information on the location of colonies and the types and abundances of species they support are provided in Section 5.7.3.

Additional information on the densities of seabirds in the vicinity of EL 1105 and elsewhere in the Gulf was obtained from Fifield *et al.* (2009), which presents results from an offshore seabird 3.5 year monitoring program. This program was intended to assess seabird abundance and distribution in areas of eastern Canada with oil industry activity. Data from Fifield *et al.* (2009) were collected as part of the larger ECSAS initiative, which used distance sampling methods to account for varying seabird detectability. Survey effort in the Gulf of St. Lawrence marine eco-region focused on the Cabot Strait, Laurentian Channel, along the western coast of Newfoundland north to the Strait of Belle Isle and did not include any winter survey effort (Fifield *et al.* 2009). The majority of surveys were conducted from either oil industry supply ships or DFO research/fishery patrol vessels. A small number of other surveys were conducted from ferries, cargo vessels, seismic ships or sailboats (Fifield *et al.* 2009). Although the data from this study is encompassed in the larger ECSAS database, it has been referenced here because it provides a comparison to other waters of the Northeast (particularly the Scotian Shelf – Gulf of Maine, and the Newfoundland and Labrador Shelves).

Information on the spatial distribution, intensity and timing of PIROP and ECSAS survey effort is provided in Figure 5.48. Data indicate that survey effort varies considerably with season, that more effort has been directed at certain locations within the Gulf than others, and that the ECSAS and PIROP data differ in their spatial coverage. In general, ECSAS survey effort has been relatively high in summer and fall, comparatively minor in spring and negligible in winter. PIROP survey effort was relatively high during the summer months and much less in spring, fall, and winter. Although no ECSAS records are available for the Gulf during the winter months, some survey effort has been directed at more eastern waters of the Atlantic Ocean and some PIROP data is available. ECSAS surveys have been concentrated in certain areas of the Gulf, including the mouth of the St. Lawrence River, the areas located between the Magdalen Islands and the Maritime Provinces, and along the western side of Newfoundland through the Strait of Belle Isle (Figure 5.48). In contrast, ECSAS surveys have been minimal to the immediate south of Anticosti Island and the areas in and around EL 1105. PIROP data coverage is also unevenly distributed throughout the Gulf, but does provide coverage in some areas where ECSAS data is lacking. A high amount of PIROP records are from areas surrounding the Magdalen Islands, between Cape Breton Island and the southwest corner of Newfoundland, and along the western coast of Newfoundland. Very few PIROP data records themselves are located in the immediate vicinity of EL 1105 (Figure 5.48).

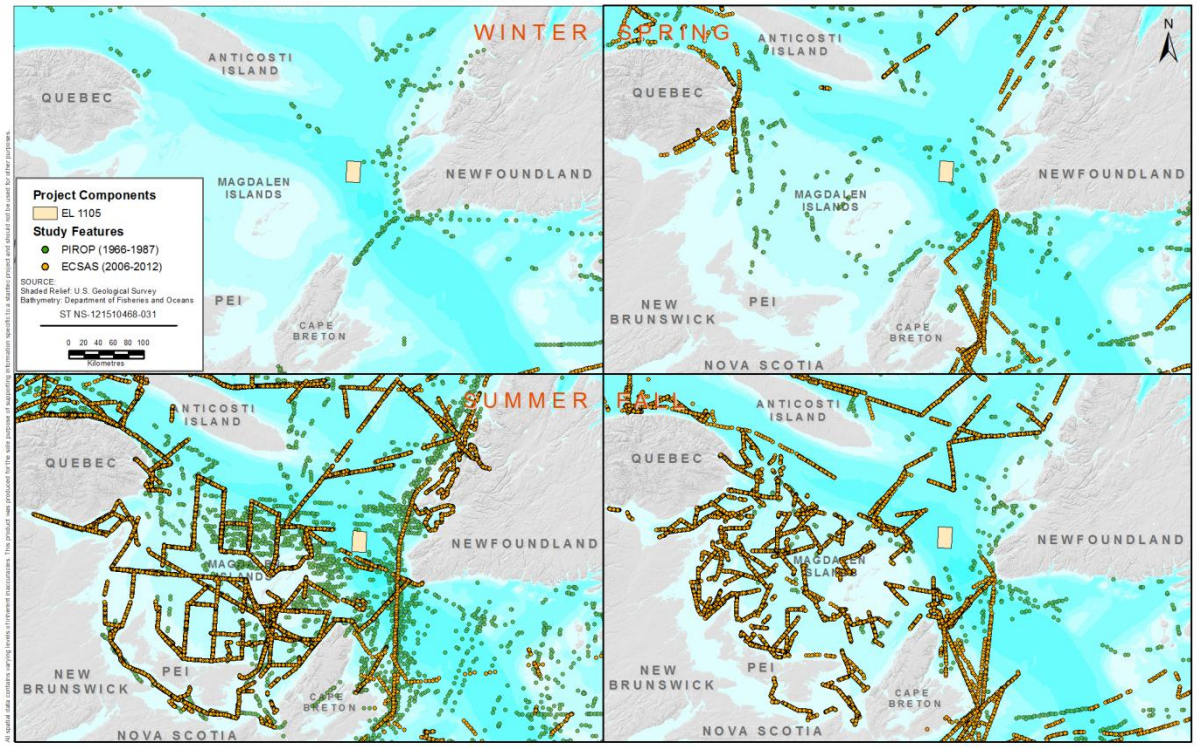


Figure 5.48 Seasonal ECSAS and PIROP Survey Effort in the Gulf of St. Lawrence

Seabirds are present throughout the Gulf during the summer months and were often encountered in relatively high abundance (Figure 5.49). Additionally, PIROP and ECSAS data indicate that a relatively high diversity of seabird species are present in the Gulf during the summer. The richness and abundance of seabirds in the Gulf during early summer (*i.e.*, June) would be promoted by several factors: seabirds that breed in the Gulf would already have arrived and begun nesting; those that breed mostly in the high Arctic such as Dovekie and Northern Fulmar would still be migrating through the Gulf; and species that breed in the South Atlantic but migrate to the North Atlantic during the austral winter (such as Great Shearwater and Wilson's Storm-Petrel) would be starting to arrive in the Gulf in June. However, given that large proportions of those species that breed in the Gulf are concentrated at colonies and their seaward extensions, at-sea observations are not necessarily indicative of species' abundance within the region at this time. By July, many seabirds are feeding nestlings and adults tend to forage more frequently in seaward extensions to colonies. This would result in a reduction in seabird abundance in areas remote from colony sites such as EL 1105. In addition, only half of the adult birds would be at sea foraging while the other half would be tending the nestlings. ECSAS data indicate that Northern Gannet, Common Murre, petrels, and Northern Fulmar are the most abundant species recorded during ship-based surveys in the Gulf during the summer months whereas PIROP data suggest that Black-legged Kittiwake, Great Shearwater, Herring Gull, and Great Black-backed Gull are the most abundant. Data from Fifield *et al.* (2009) suggest that seabird concentrations in the eastern portion of the Gulf are lower in the summer months (based on seasonal weighted median) than in either the Scotian Shelf-Gulf of Maine and the Newfoundland and Labrador Shelf ocean regions.

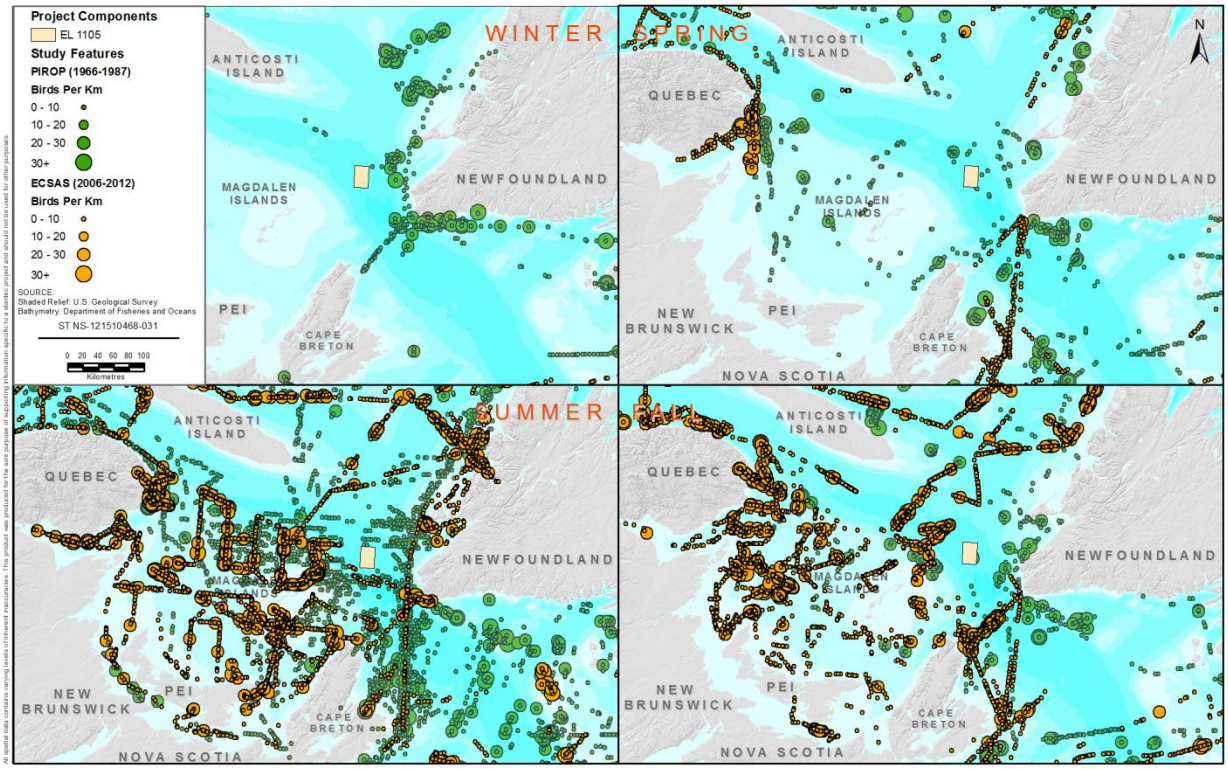


Figure 5.49 Seasonal Distribution of all Seabirds in the Gulf of St. Lawrence

Data indicate that high concentrations of seabirds may be encountered throughout the Gulf during the fall (Figure 5.49). The high abundances observed during this time are expected to primarily reflect the departure of adults and newly fledged young from local seabird colony sites and as well as an influx of wintering species. For example, ECSAS data suggest that the most abundant species during the fall are Dovekie, Northern Gannet, and Black-legged Kittiwake. The Gulf is an important nesting area for both Northern Gannet and Black-legged Kittiwake and the large numbers of these species present in the area during fall may be fledged young and adults tarrying in the Gulf before migrating. Conversely, large amounts of Dovekies recorded during this time would reflect the concentrations of this species that gather in offshore water during late fall for overwintering purposes. In addition, the relatively high concentrations of seabirds observed in the Gulf during fall would reflect the presence of migratory species and may also reflect other factors such as higher productivity and prey availability. During migration, the Cabot Strait is a likely migration pathway for pelagic seabirds moving to and from more southern localities and waterbirds which breed in more northern latitudes may be concentrated in the vicinity of the Strait of Belle Isle. Data from Fifield *et al.* (2009) suggests that the overall abundance of seabirds in the portions of the Gulf that were surveyed were higher than those recorded in the Scotian Shelf-Gulf of Maine and the Newfoundland and Labrador Shelf. Data indicate that this is largely attributable to the fact that large numbers of Northern Gannet are not present in these other areas during the fall and higher concentrations of Great Shearwater are present near the southeastern extent of the Gulf during the fall than in either the Scotian Shelf or the Grand Banks (Fifield *et al.* 2009).

Although the spatial extent of survey effort is limited for the winter months, available data indicate that high concentrations of seabirds have been encountered in association with the west coast of Newfoundland during this season (Figure 5.49). Although ECSAS records are not available for the Gulf itself, PIROP data indicate that relatively high concentrations of gulls have been recorded in winter months, particularly Great Black-backed Gull, Iceland Gull, and Black-legged Kittiwake. A number of other species are present in lesser amounts, including Northern Fulmars, Herring Gull, Glaucous Gull, Dovekie, Black Guillemot, and Thick-billed Murre. Much of the Gulf is typically ice-covered by the end of January and seabirds would tend to concentrate in areas of open water. EL 1105 is located in an area that has an average ice freeze up date of January 29 (Section 4.2.6; Figure 4.25).

Although survey effort was comparatively minimal compared to fall and summer surveys, available data demonstrate that there are high concentrations of seabirds in portions of the Gulf during spring (Figure 5.49). ECSAS data indicate that Northern Gannet, Common Murre, and Black Guillemot are the most abundant species whereas PIROP data suggest that Herring Gull, Black-legged Kittiwake, and Northern Fulmar were encountered in greatest numbers. Data from Fifield *et al.* (2009) suggest that seabird concentrations in the eastern Gulf during spring months are lower than in either the Scotian Shelf-Gulf of Maine and the Newfoundland and Labrador Shelf ocean regions. However, large concentrations of seabirds during late spring are concentrated at colonies and their seaward extensions and observations during ship-based surveys may not be necessarily indicative of their abundance within the region. For example, when ECSAS surveys were conducted in close proximity to the shores of the Gaspé Peninsula during spring, large concentrations of Northern Gannets were encountered and would be associated with the large Bonaventure Island colony in this area.

Dovekies nest in the high Arctic and do not breed in Canada in significant numbers. However, data indicate that they occur in low numbers in the Gulf during most months of the year but reach their peak densities in late fall / early winter. According to ECSAS data, Dovekies were the most abundant pelagic seabird species in the Gulf during the fall. During this time, they exhibited particularly high concentrations in areas of deeper water, such as in association with the Laurentian Channel, Jacques Cartier Passage, and the southern extent of the Strait of Belle Isle (Figure 5.50). During the spring and summer, most Dovekies are present near their northern breeding colonies, and low densities of this species would be encountered in the Gulf at that time. Although information is lacking for the area in the immediate vicinity of EL 1105, data indicate that Dovekies have been recorded in relatively high concentrations within the Laurentian Channel during winter months and late fall (*i.e.*, November), and they may be expected to be in high abundance in and around EL 1105 during that time.

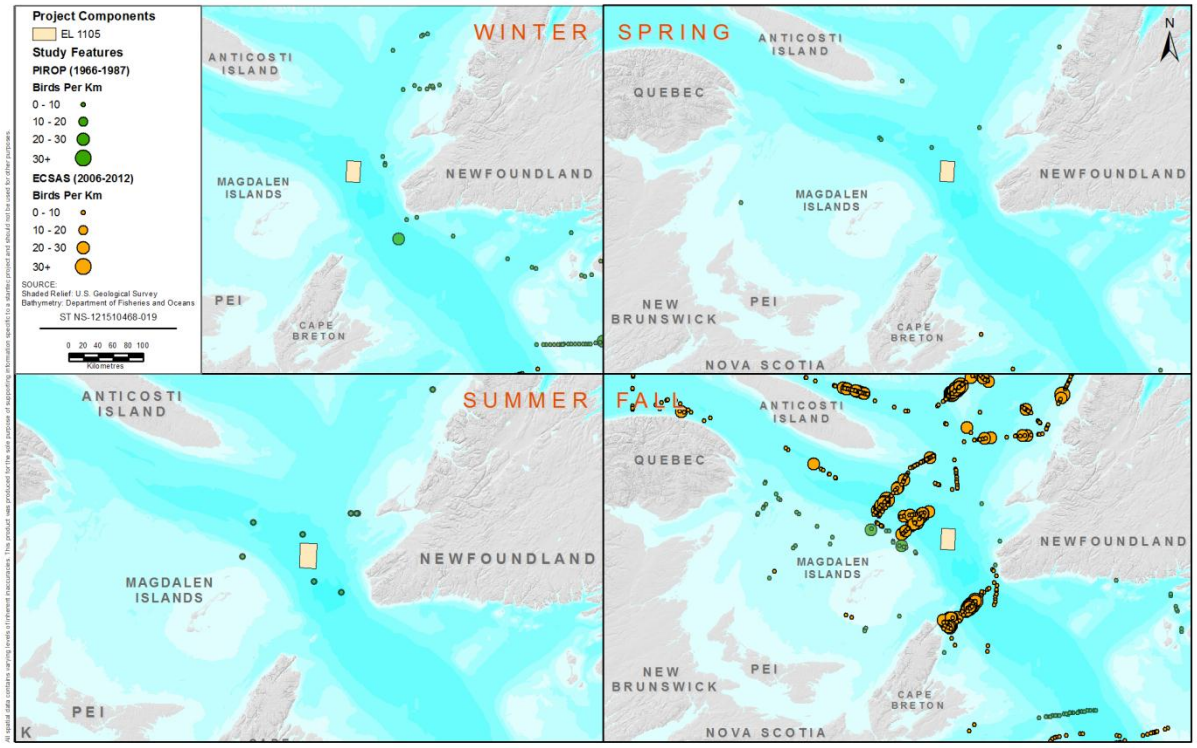


Figure 5.50 Seasonal Distribution of Dovekies in the Gulf of St. Lawrence

Black Guillemots are present in the Gulf year round. ECSAS and PIROP data indicate that the highest concentrations of this species are generally encountered in association with the coastline and in shallower portions of offshore waters, but they also frequent deeper sections of the Gulf such as the Laurentian Channel (Figure 5.51). Records of relatively high abundances for this species within the ECSAS database were often made in close proximity to the locations of known colony sites. For example, a number of relatively large Black Guillemot colonies are present on along the eastern end of the Gaspé Peninsula such as Bonaventure Island (>300 individuals) (CWS 2012) and St. Godefroi (> 200 breeding pairs) (Lock *et al.* 1994). However, other concentrations of ECSAS Black Guillemot observations, such as those associated with the Port au Port Peninsula in western Newfoundland, are not associated with any known colony sites (CWS survey data, Lock *et al.* 1994). Black Guillemots may be present within the vicinity of EL 1105 at all times of the year, although available data do not indicate that they are particularly abundant at any time due to the distance from the coastline.

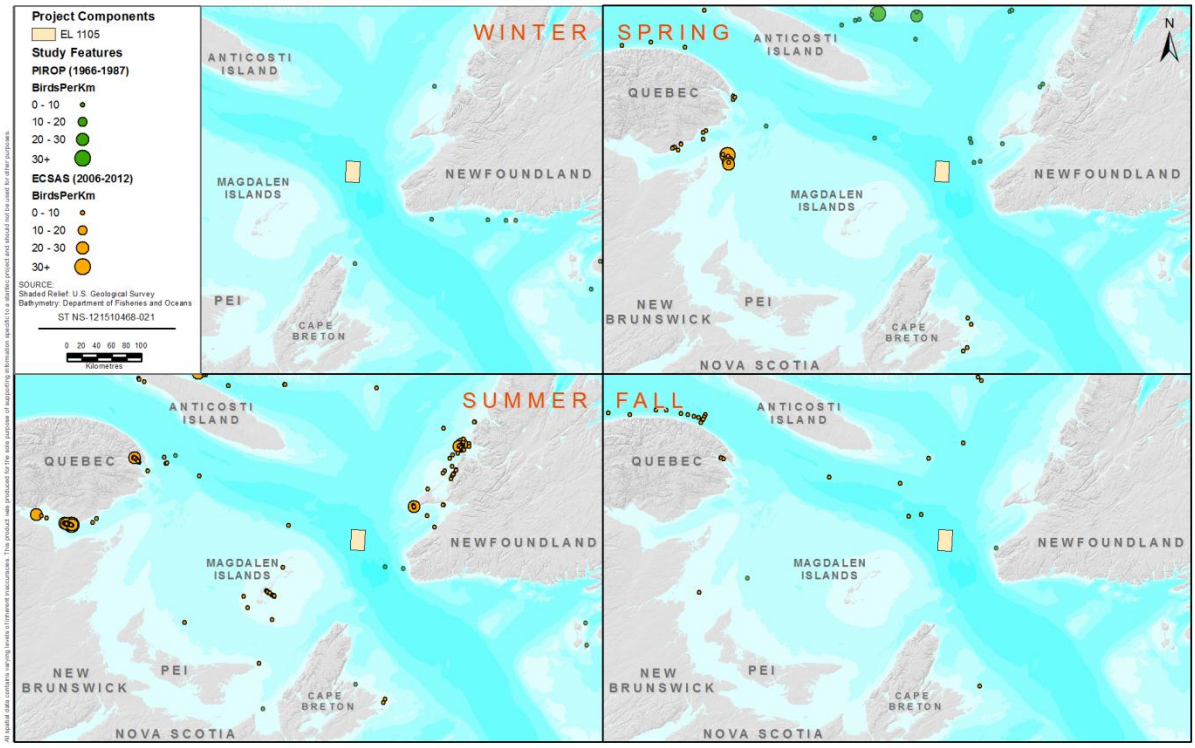


Figure 5.51 Seasonal Distribution of Black Guillemot in the Gulf of St. Lawrence

Large auks and other alcides (including Common Murre, Thick-billed Murre, Razorbill, and Atlantic Puffin) are amongst the most common groups of birds in the Gulf. As a group, they are distributed throughout the region with large concentrations being recorded both in association with coastal features and in more offshore waters, depending on the season (Figure 5.52). Common Murres were the most abundant species encountered in summer during ECSAS data collection but high numbers of Razorbills and Atlantic Puffins are also present at certain times of the year, and ECSAS data indicate that Thick-billed Murres are also frequently encountered. Common Murre and Razorbill colonies are found throughout the Gulf and the high concentrations of auks present in Figure 5.52 are often in close proximity to the nesting sites for these species. For example, the Bonaventure Island colony on the Gaspé Peninsula has been estimated to support over 50,000 Common Murres and 1,000 Razorbills (CWS 2012) and the Magdalen Islands also host relatively large colonies of these species (Lock *et al.* 1994). Thick-billed Murre colonies are comparatively few in the Gulf, but this species has been recorded to breed at several locations in the region, including at Rocher aux Oiseaux in the Magdalen Islands (Lock *et al.* 1994). Atlantic Puffin are colonial nesters during late spring and summer but were most encountered during the ship-based surveys after young have fledged in fall. Although many Common Murres, Thick-billed Murres, and Razorbills are known to overwinter in the Gulf (Sibley 2000), most Atlantic Puffins in the region migrate to more southern localities for the winter months (Sibley 2000, Tufts 1986). Large auks would be present in the vicinity of EL 1105 during all times of the year.

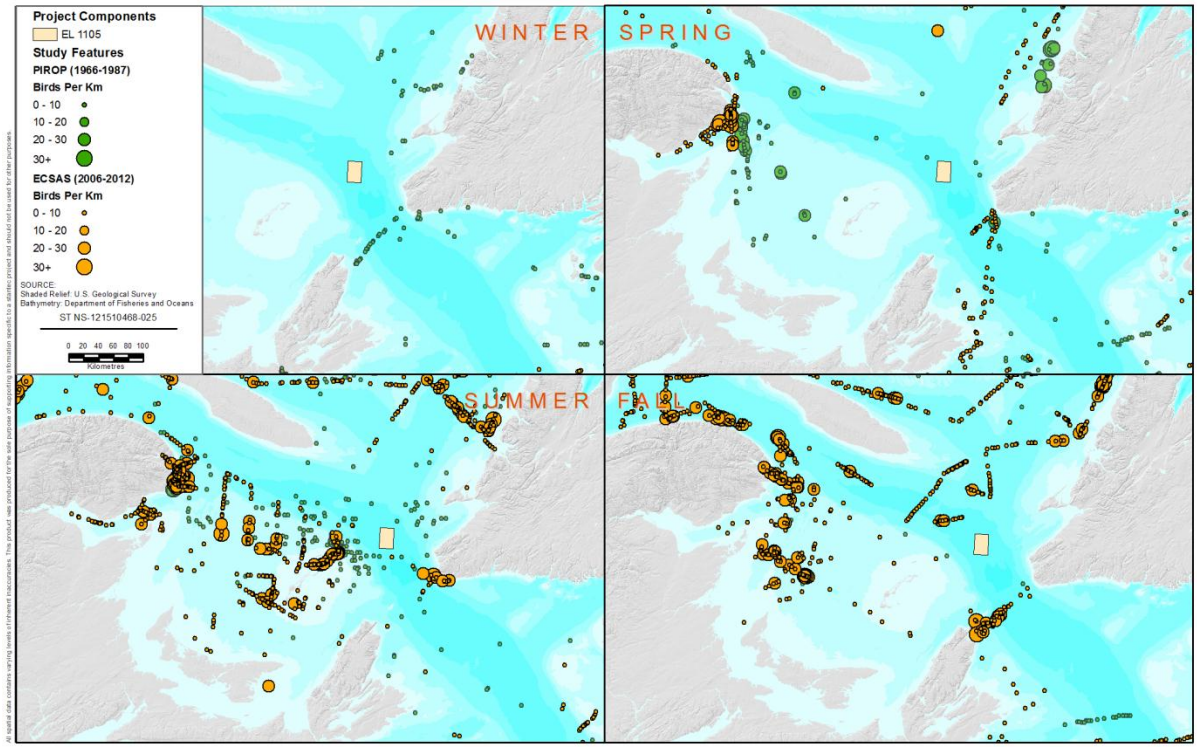


Figure 5.52 Seasonal Distribution of Large Auks and other Alcids in the Gulf of St. Lawrence

Large North American colonies of Northern Fulmar are located in the Arctic and although they do not breed in the Gulf of St. Lawrence in significant numbers (Environment Canada 2012b), they are present in offshore waters year round (Figure 5.53). Northern Fulmar numbers vary substantially over the year, with high abundances being particularly associated with summer months. During these times, they are amongst the more abundant species in the Gulf and are distributed throughout its extent, with areas of high concentrations exhibiting no particular spatial pattern with respect to proximity to certain land bodies or bathymetry. Although observed throughout much of the Gulf during spring, data indicate that they are not as abundant during this time period. However, relatively high concentrations of this species have been recorded outside the Gulf in association with the more easterly extent of the Laurentian Channel and the Atlantic Ocean. Although winter surveys are limited, available data do indicate that they may be present in the Gulf during this season, including in association with the Laurentian Channel. Furthermore, they are likely present in and around EL 1105 during all times of the year.

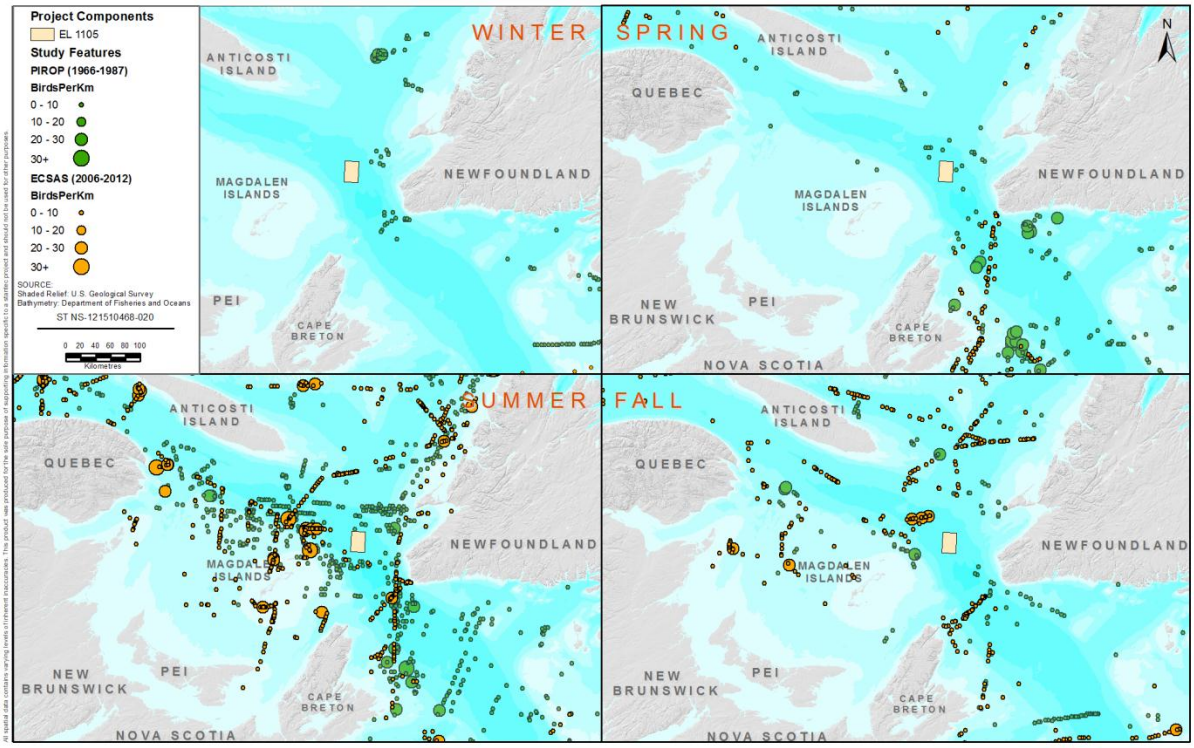


Figure 5.53 Seasonal Distribution of Northern Fulmars in the Gulf of St. Lawrence

Northern Gannets are absent from the Gulf during most of the winter and begin to return to their breeding colonies in April, with peak densities occurring in mid-summer. The greatest concentrations of Northern Gannets recorded in the Gulf during spring were located at the eastern extent of the Gaspé Peninsula (Figure 5.54), where the large Bonaventure Island colony is comprised of over 100,000 individuals (CWS 2012). However, spring survey effort for PIROP and ECSAS data was minimal throughout much of the Gulf, and Northern Gannet activity is also expected to be high at this time of the year around the Magdalen Islands were large colonies are located. In particular, a large colony of Northern Gannets is present at Rocher aux Oiseaux, located in the northern extent of the Magdalen Islands. Individuals from this colony, which has been estimated to contain over 45,000 individuals (CWS 2012), are likely responsible for many of the observations located in the southern Gulf area during the summer and fall months as Northern Gannets are known to forage several hundred kilometres from their colonies (Hamer *et al.* 2007). Additionally, Northern Gannets from the Falaise aux Goélands colony, located at the eastern end of Anticosti Island and estimated to support approximately 400 individuals (CWS 2012), also have potential to forage in the vicinity of EL 1105. Northern Gannets were recorded in abundance throughout the southern portion of the Gulf during summer and fall, particularly in the areas surrounding the Magdalen Islands and between the Magdalen Islands, the Maritime Provinces, and the Gaspé Peninsula. Aerial photo inventories conducted during the breeding season in 1999 indicated approximately 69 percent of the total North American population of Northern Gannets were located in the Gulf of St. Lawrence (Chardine 2000). Observations of this species have also been recorded in the more northern portions of the Gulf, but data indicate that such records are less abundant and generally comprised of fewer individuals. Northern

Gannets migrate to the south during winter but small numbers are recorded during Christmas Bird Counts into December (Environment Canada 2012b).

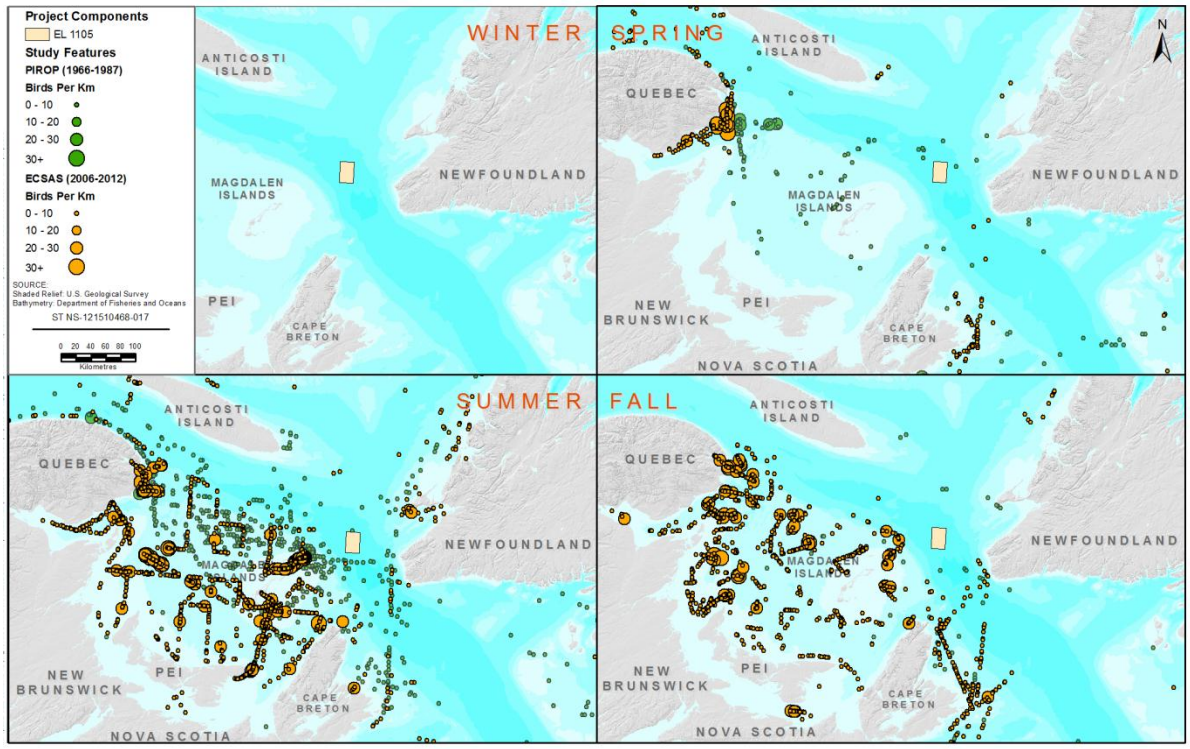


Figure 5.54 Seasonal Distribution of Northern Gannet in the Gulf of St. Lawrence

Data on the distribution and abundance of cormorants (including Double-crested Cormorant and Great Cormorant) within the Gulf indicate that they are typically restricted to coastal environments and have most commonly been recorded in the summer and fall (Figure 5.55). Although Great Cormorant are known to overwinter in the region, many migrate to more southern locations, as does the regional population of Double-crested Cormorants (Sibley 2000, Tufts 1986). The majority of the ECSAS and PIROP observations are of Double-crested Cormorants but the region is known to be important for Great Cormorants, whose North American population is centered in the eastern part of the Gulf (Lock *et al.* 1994). ECSAS data identifies large coastal concentrations of cormorants during summer months in association with the Magdalen Islands, Prince Edward Island, the eastern end of the Gaspé Peninsula, and on Cape Breton Island. Areas where high concentrations of cormorants have been observed are generally in close proximity to some of the larger colony sites. For example, over 1000 breeding pairs of Double-crested Cormorants have been estimated for the Île aux Loups Marins seabird colony located in the Magdalen Islands and the high numbers of cormorants recorded on the north side of Cape Breton during summer likely reflect proximity to the Bird Islands, which have been documented to support over a thousand pairs of Great Cormorants (Lock *et al.* 1994). Cormorant observations have been made away from coastal areas during ECSAS and PIROP surveys, but are comparably infrequent and comprised of few individuals. Although cormorants have potential to be present in the waters in and adjacent to EL 1105 throughout much of the

year, they are not expected to occur in high concentrations as a result of its distance from the coastline.

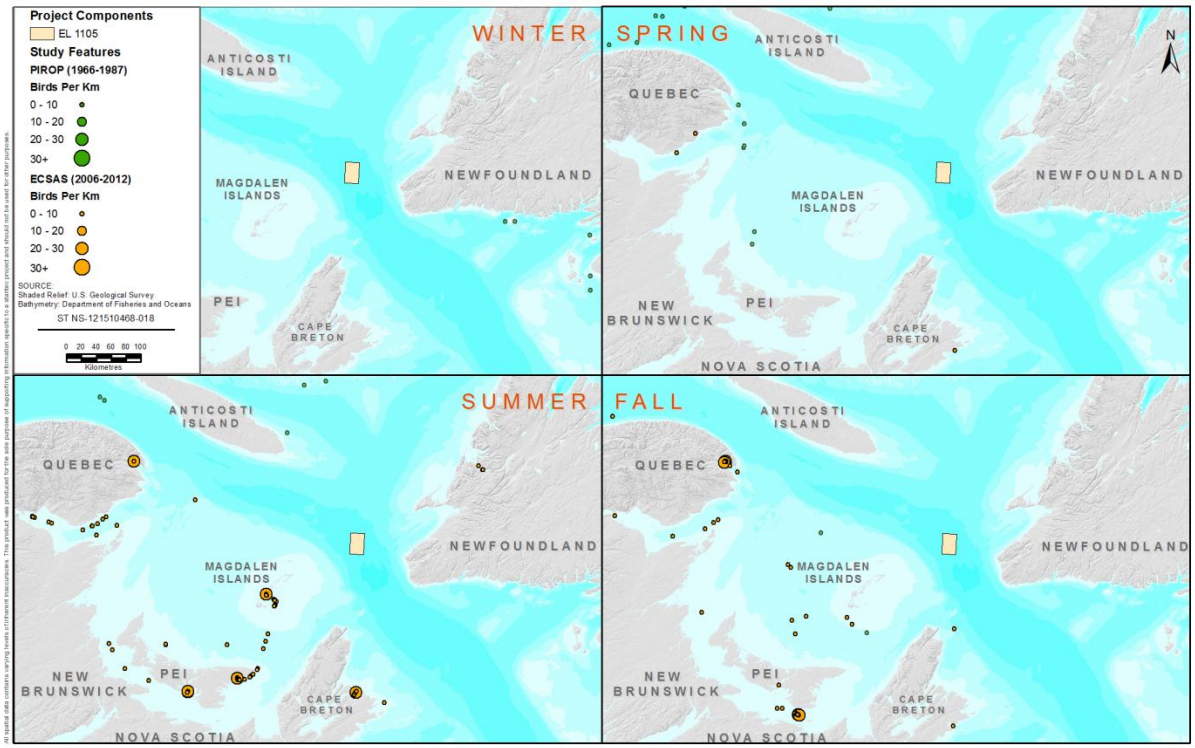


Figure 5.55 Seasonal Distribution of Cormorants in the Gulf of St. Lawrence

Jaegers (including Long-tailed, Parasitic, and Pomarine Jaeger) do not breed in the Gulf but are present in offshore waters of the region during migration. ECSAS and PIROP data indicate that they are infrequently encountered during surveys, but that they may be found throughout most of the Gulf (Figure 5.56). They may be expected to occur in low numbers in the vicinity of EL 1105 except during winter when they are found in much more southern localities. Abundances are expected to be highest in spring and fall when they are travelling between wintering and breeding grounds.

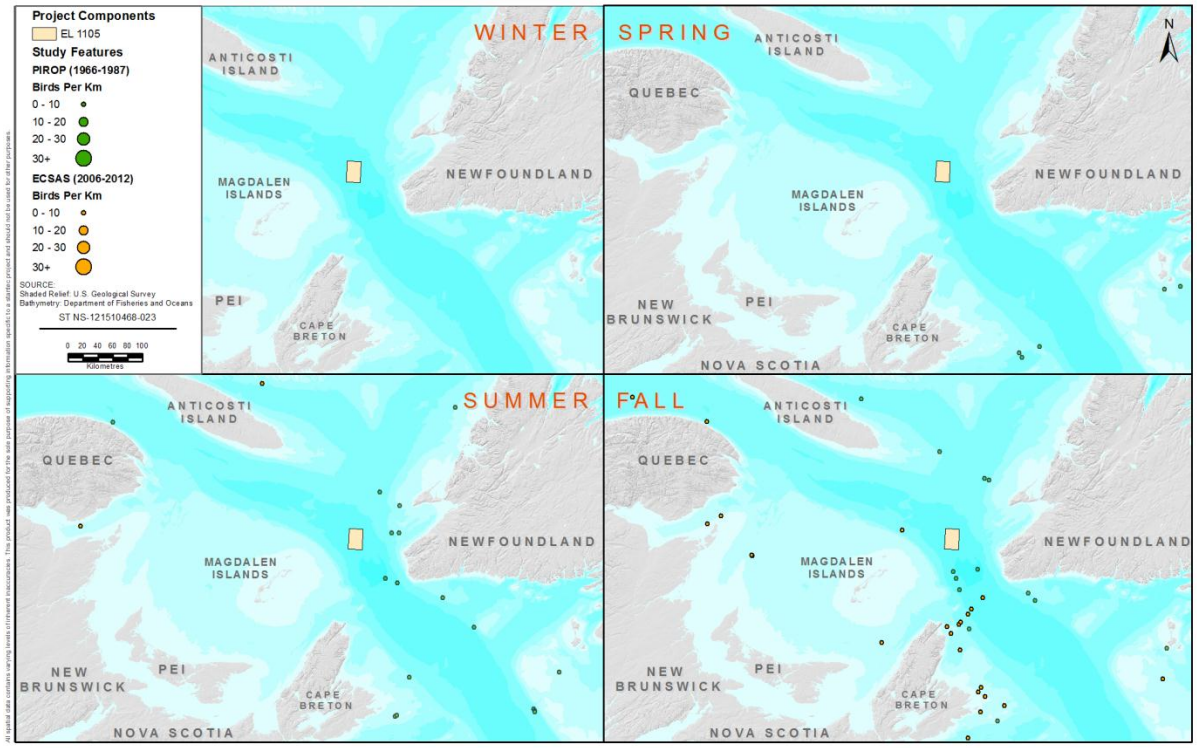


Figure 5.56 Seasonal Distribution of Jaegers in the Gulf of St. Lawrence

Great Skua are considered to be present in offshore waters of the North Atlantic during winter (Sibley 2000) and may be encountered in the Gulf of St. Lawrence during that time. Additionally, PIROP and ECSAS data indicate that this species is occasionally observed in the Gulf at other times of the year, particularly summer and fall (Figure 5.57). Although South Polar Skua is also known to occur in the offshore of the North Atlantic (Sibley 2000), no observations for this species have been recorded in the Gulf during ECSAS or PIROP surveys. Available information suggests that skua are likely to be more abundant in portions of the North Atlantic that are outside of the Gulf. Although this species has potential to be encountered in and around the waters of EL 1105 throughout much of the year, any encounters are expected to be infrequent and of few individuals.

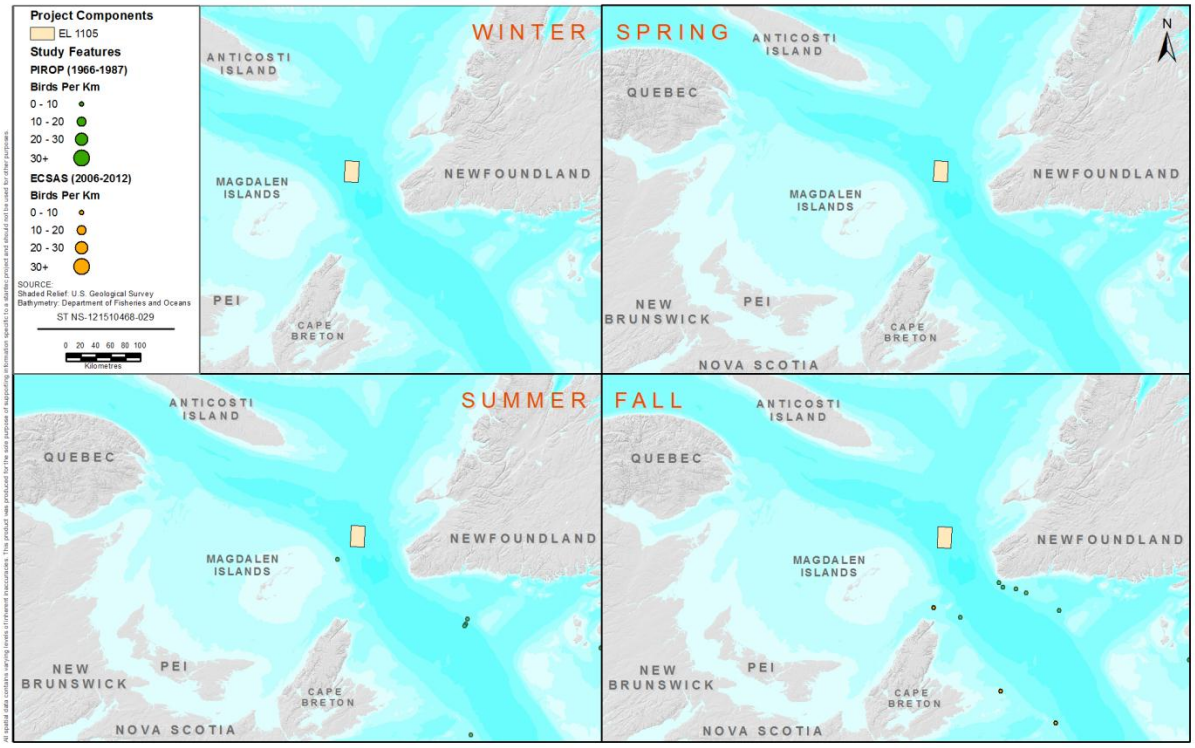


Figure 5.57 Seasonal Distribution of Greater Skua in the Gulf of St. Lawrence

Shearwaters (including Great Shearwater, Manx Shearwater, and Sooty Shearwater) are common summer visitors but spend the winter months in the southern hemisphere, where they breed. They are abundant in offshore waters in summer and fall, with few observations being made during spring (although survey effort for the Gulf has been relatively minor during this season, spring surveys have been conducted in the portion of the Laurentian Channel between Cape Breton and western Newfoundland where data indicate that shearwaters are relatively abundant at other times of the year). Although present throughout the Gulf, PIROP and ECSAS data indicate that shearwater concentrations are much higher in waters to the east of Cape Breton Island (Figure 5.58). Great Shearwater accounts for the large majority of shearwater observations in the PIROP and ECSAS database, although Sooty Shearwaters are also relatively abundant. Data indicate that shearwaters may be expected to frequent the water in and around EL 1105, especially during summer and fall.

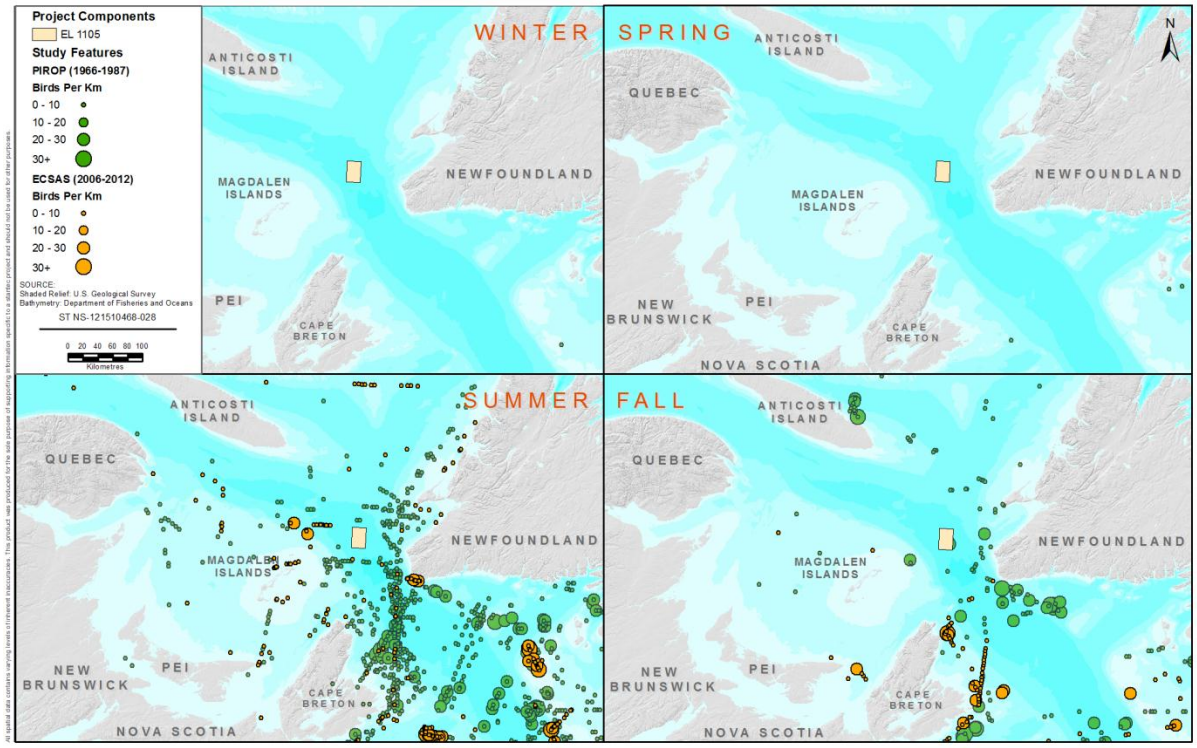


Figure 5.58 Seasonal Distribution of Shearwaters in the Gulf of St. Lawrence

Black-legged Kittiwakes are pelagic gulls that spend the majority of their time on offshore waters, except during the breeding season when they come onshore to nest. They are present year round in the Gulf and are one of the most abundant pelagic seabirds encountered during ECSAS and PIROP surveys. This species nests in colonies during spring and summer months and may be encountered foraging in the vicinity of these colonies or far offshore during this time (Figure 5.59). For example, data show large numbers of Black-legged Kittiwakes surrounding the waters of the Magdalen Islands, which host the Rocher aux Oiseaux and Île Brion colonies, both of which are comprised of thousands of individuals (CWS 2012, Lock et al, 1994). Additionally, the relatively large concentrations of this species near the Port au Port Peninsula along the western shore of Newfoundland are in close proximity to a recently documented colony on a cliff to the north of Cape St. George (EC-CWS 2013b). Although only small abundances of Black-legged kittiwakes have been recorded near the eastern point of Anticosti Island (Figure 5.59), the paucity of data in this area may reflect a lack of survey effort as this area is known to support the large Falaise aux Goélands colony, which has been recently estimated to contain over 30,000 individuals (CWS 2012). Although surveys have been minimal during winter, Black-legged Kittiwakes do overwinter in the Gulf and the limited PIROP surveys that have been conducted indicate that they are abundant during this season off the west coast of Newfoundland and in the vicinity of EL 1105. As such, this species may be expected to be relatively common in the vicinity of EL 1105 during all times of the year.

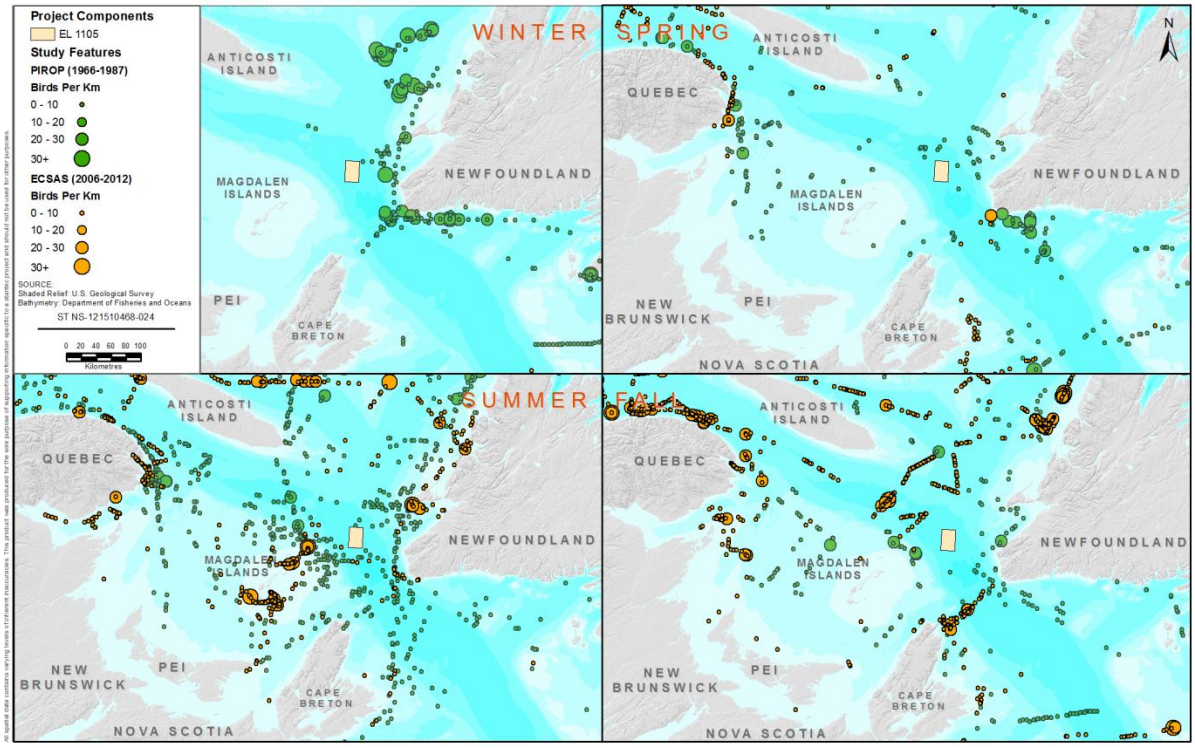


Figure 5.59 Seasonal Distribution of Black-legged Kittiwakes in the Gulf of St. Lawrence

Storm-petrels (Leach's Storm-Petrel and Wilson's Storm-Petrel) arrive in the Gulf in spring and stay until late fall. Peak densities are reached in summer as a result of the return of Leach's Storm-Petrels to their breeding colonies and an influx of Wilson's Storm-Petrels from their breeding grounds in the southern hemisphere to the North Atlantic. The majority of ECSAS and PIROP storm-petrel observations were in June, and during this time Wilson's Storm-Petrels were observed to be almost four times as abundant as Leach's Storm-petrel. The breeding range of the Leach's Storm-Petrel in the western North Atlantic is centered on Newfoundland (*e.g.*, world's largest Leach's Storm-Petrel colony reaching 3,360,000 breeding pairs at Baccalieu Island in eastern Newfoundland (Sklepkovych and Montevecchi 1989)). A number of Leach's Storm-Petrel breeding colonies have been recorded in the Gulf of St. Lawrence, such as at Île du Corossol near Sept-Îles, which hosts several hundred pairs (CWS 2012). ECSAS and PIROP data indicate that storm-petrels are present throughout much of the Gulf during the summer months (Figure 5.60) and they may be expected to be found foraging in the vicinity of EL 1105 during the extent of their stay.

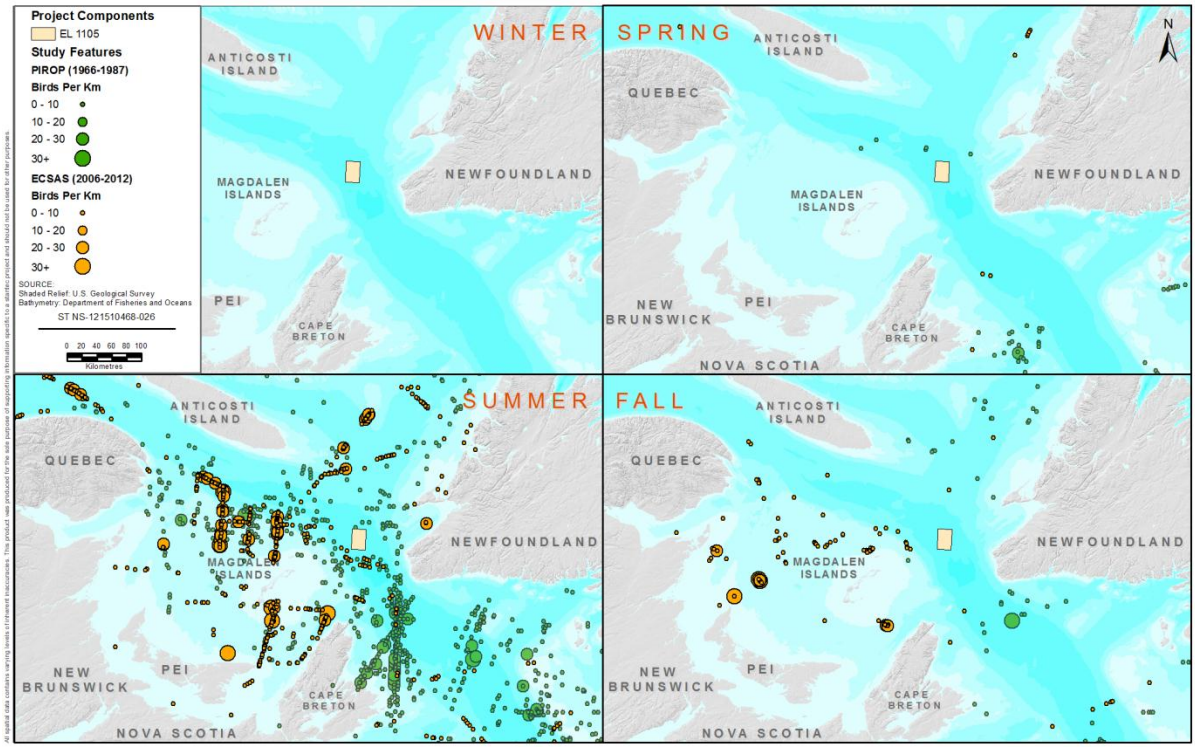


Figure 5.60 Seasonal Distribution of Storm Petrels in the Gulf of St. Lawrence

Phalaropes typically forage on the surface of the sea in areas where upwelling brings plankton to the surface. Although they are not known to breed in the Gulf, they do pass through during migration between their arctic nesting grounds and more southerly wintering areas. PIROP and ECSAS data collected in the Gulf indicate that phalaropes have been recorded within the Gulf during spring, summer, and fall (Figure 5.61). The highest concentrations of these species have been recorded during fall migration, where they occur in relative abundance in the waters off the Gaspé Peninsula. However, relatively high concentrations of these species have also been recorded near the Magdalen Islands and in the waters to the north of Cape Breton during summer months, as well as in more northern portions of the Gulf during spring (Figure 5.61). As such, data indicate that although they are generally not abundant they may be encountered throughout much of the Gulf and are likely to be intermittently present in the waters of EL 1105 and the surrounding area.

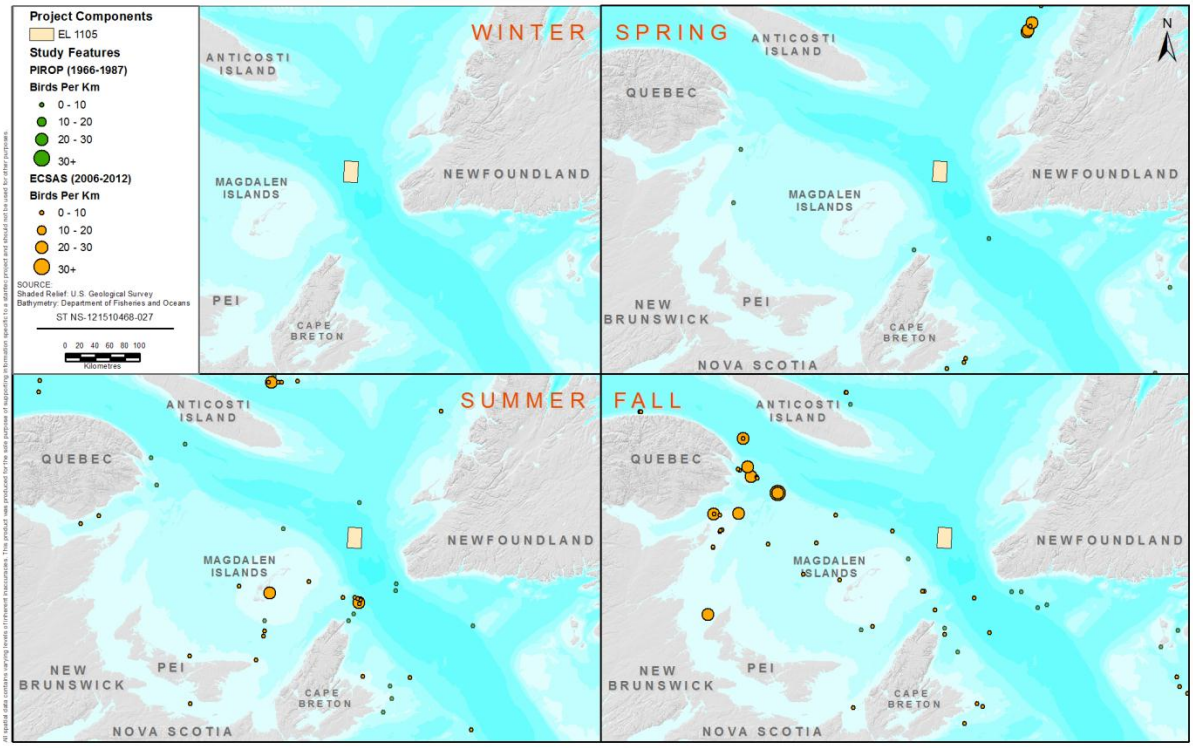


Figure 5.61 Seasonal Distribution of Phalaropes in the Gulf of St. Lawrence

As a guild, gulls are amongst the most abundant seabirds present within the Gulf, and data indicate that they are present throughout the region at all times of the year (Figure 5.62). Both large and small gulls are included in this group (with the exception of Black-legged Kittiwakes which have been examined separately), with the following species being recorded during ECSAS and / or PIROP surveys: Black-headed Gull, Bonaparte's Gull, Franklin's Gull, Glaucous Gull, Great Black-backed Gull, Herring Gull, Iceland Gull, Laughing Gull, Lesser Black-backed Gull, Ring-billed Gull, Sabine's Gull, Thayer's Gull, and Western Gull. The most abundant species recorded during ECSAS and PIROP surveys were Herring Gull and Great Black-backed Gull, both of which breed throughout the Gulf region and may be found nesting alone or in colonies along most parts of the coast. Large numbers of Iceland Gull were also observed during winter months, but this species is general absent during the summer when it travels to more northern latitudes for breeding purposes. Although seasonal patterns vary depending on the particular species, gulls (in general) are abundant in the Gulf at all times of the year, and may be expected to occur in the vicinity of EL 1105 during spring, summer, fall, and winter.

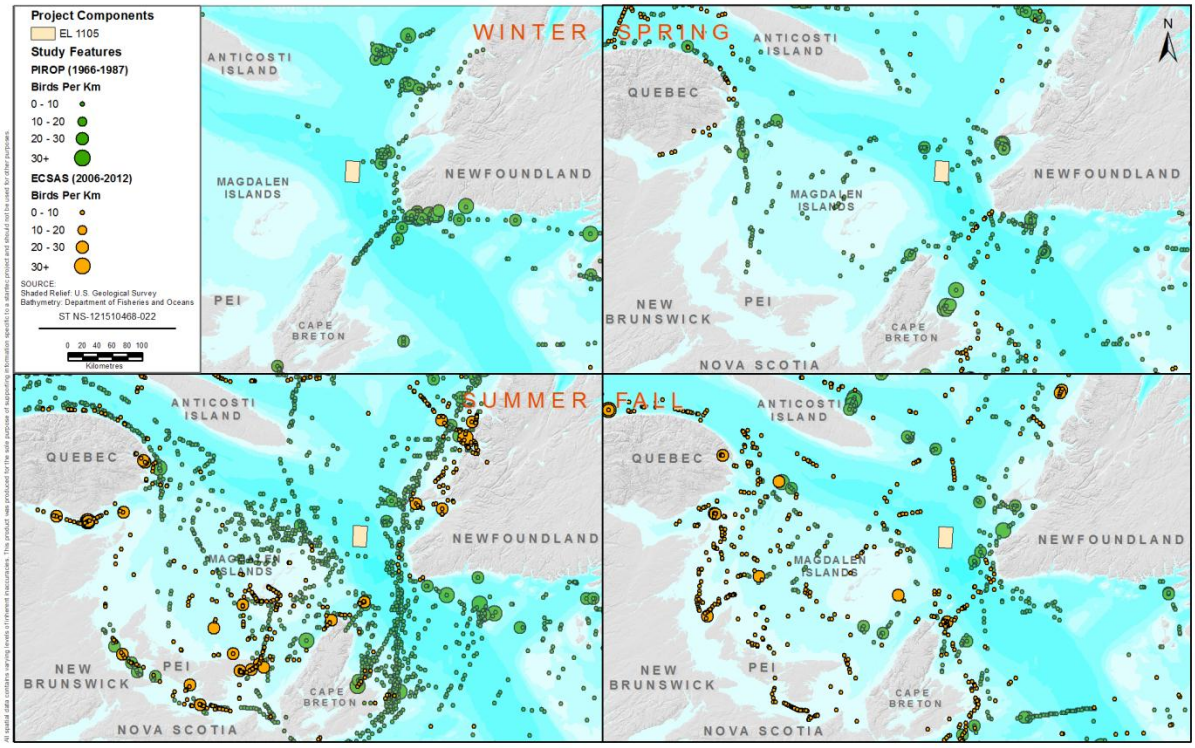


Figure 5.62 Seasonal Distribution of Gulls in the Gulf of St. Lawrence

Most terns would arrive in the Gulf during May from their more southern wintering grounds and are most abundant in the summer months, particularly in the vicinity of breeding colonies. Common Tern was the most abundant species of tern encountered during PIROP and ECSAS surveys, but Arctic Tern was also frequently encountered. Migration for Common Terns occurs during August and September (Tufts 1986) and for Arctic Terns it has been described as beginning in mid-July and to be largely completed by mid-September (Tufts 1986). Data indicate that terns may be encountered throughout the Gulf during their stay, but the highest concentrations were encountered in proximity to coastal features (Figure 5.63). Although Arctic Terns forage offshore at all seasons, Common Terns do not feed as far out to sea, being largely restricted to coastal areas (Erskine 1992). As such, these species may be expected to forage in the immediate vicinity of EL 1105 but the abundance of terns within the area is likely lessened by its distance from coastal areas where colonies may be located. Although PIROP and ECSAS data indicate that Black Tern, some unidentified noddies (*Anous spp*.) and skimmers (*Phychops sp*.), have also been recorded in the Gulf, none of these species would regularly frequent the waters in and around EL 1105.

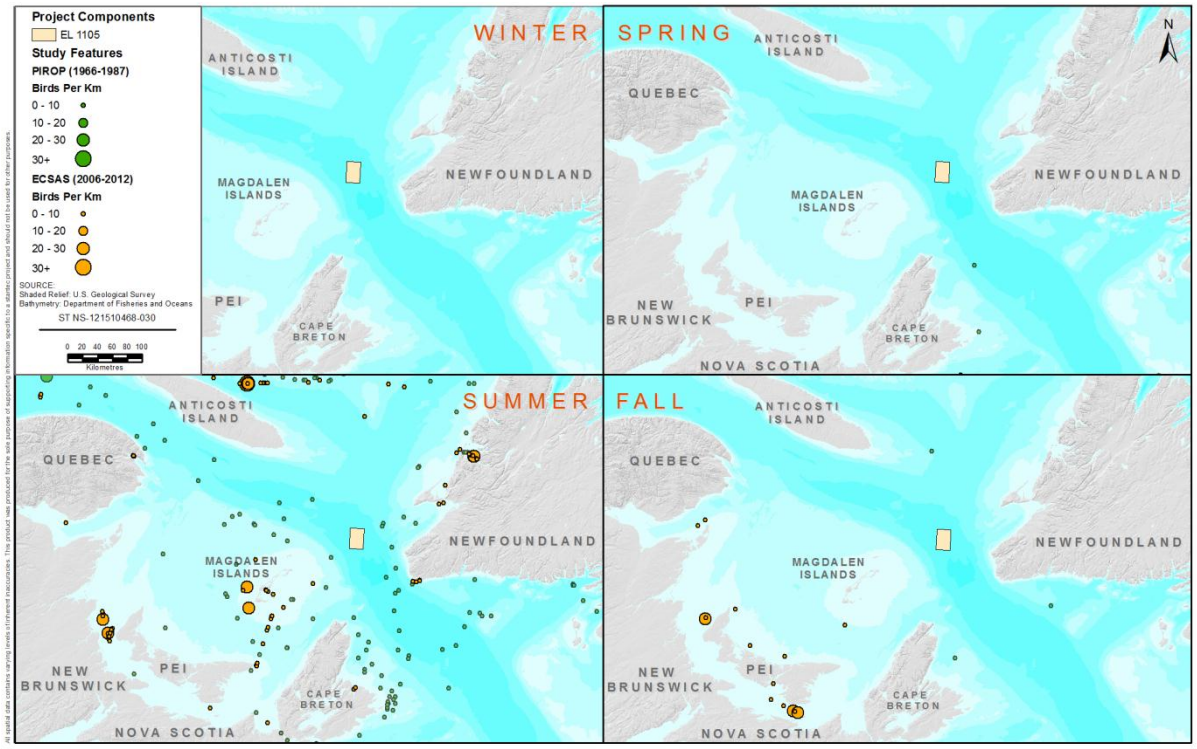


Figure 5.63 Seasonal Distribution of Terns in the Gulf of St. Lawrence

5.5.1.2 Coastal Waterfowl

During spring migration following ice-out in the Gulf, coastal waterfowl (all species) are most highly concentrated along the north shore of Québec between Sept-Îles and Les Îles Ste.-Marie, along the north shore of Anticosti Island and in the inner part of the Bay of Chaleur (Lock *et al.* 1994). For example, numerous scoters have been documented in spring along the North Shore of Quebec between Sept-Îles and Natashquan (Rail and Savard 2003). Other local areas of high concentrations are found in bays and estuaries in New Brunswick, Prince Edward Island and the Gaspé Peninsula (Lock *et al.* 1994).

During the summer, coastal waterfowl (all species) are not abundant in the Gulf. Areas of higher concentrations tend to be found along the north shore of Québec between Sept-Îles and the Mingan Archipelago, Anticosti Island, along the shores of the Gaspé Peninsula and at scattered locations along the north shore of New Brunswick and Nova Scotia (Lock *et al.* 1994; EC-CWS, unpublished data, pers. comm. 2012).

Common Eiders are the most abundant waterfowl species in coastal waters of the Gulf during the breeding season. At this time, eiders are present throughout most of the coastal waters; however, there are certain areas that support relatively large numbers of breeding birds. The area with the greatest concentration of breeding eiders is the portion of the shore of Québec from the Mingan Archipelago to the Îles Ste.-Marie and along the north shore and eastern tip of Anticosti Island (Lock *et al.* 1994). Large numbers of eider have also been observed moulting along the southern shore of Anticosti Island and the North Shore of Quebec (Rail and Savard 2003; EC-CWS, unpublished data, pers. comm. 2012). Other areas with relatively high

concentrations of eider breeding pairs within the Gulf include the eastern tip of the Gaspé Peninsula, the St. Lawrence estuary, the New Brunswick coast, and the portion of the north shore of Quebec extending from the Mingan Archipelago to Sept-Îles (Lock *et al.* 1994; The Joint Working Group on the Management of the Common Eider 2004; EC-CWS, unpublished data, pers. comm. 2012). In western Newfoundland, the islands of St. John Bay north of Port aux Choix support high numbers of nesting eiders. In addition to Common Eiders, breeding American Black Ducks are relatively abundant in coastal waters of the Gulf during the spring and summer months (Lock *et al.* 1994).

During the fall, concentrations of coastal waterfowl (all species) occur in scattered patches in sheltered bays and estuaries throughout the western half of the Gulf. High concentrations are found in Nova Scotia between Amet Sound and Baie Verte, along the south coast of Prince Edward Island, and along the north shore of Quebec at scattered locations between Sept-Îles and the Mingan Archipelago (Lock *et al.* 1994). During fall migration, eiders are most abundant along the north shore of Quebec between Sept-Îles and Les Îles Sainte-Marie and along the shore of Anticosti Island.

Ice cover in the Gulf is highly variable during winter. Consequently, the distribution of coastal waterfowl can vary substantially from year to year. Winter survey data are only available for the western half of the Gulf. In general, during the winter months, large concentrations of coastal waterfowl can occur along the north shore of Québec between Sept-Îles and the Mingan Archipelago, along the shores of Anticosti Island and along the eastern tip of the Gaspé Peninsula (Lock *et al.* 1994). Additionally, large numbers of eiders have been observed wintering offshore of the Magdalen Islands (EC-CWS, unpublished data, pers. comm. 2012).

Coastal waterfowl use nearshore habitats and are not expected to be present on a regular basis in offshore areas, such as in the immediate vicinity of EL 1105. Migrating waterfowl would pass through the area and may on rare occasions rest on the water in this area.

5.5.1.3 Seabird Colonies

The Gulf of St. Lawrence and adjacent areas of the Atlantic Ocean support hundreds of colonies of nesting seabirds, ranging in size from a few individuals to thousands of breeding pairs. For example, The *Gazetteer of Marine Birds in Atlantic Canada* (Lock *et al.* 1994) lists 136 known colonies of seabirds in the Gulf which are considered “vulnerable” to the effects of oil pollution as well as 69 tern colonies; and more recent CWS data (EC-CWS 2013a, 2013b; Rail 2009) indicate that there are additional sites for “vulnerable” seabirds, terns, and gulls within the region. Seabird colonies are patchily distributed within the Gulf, with particularly high abundances of birds being found in association with the Magdalen Islands, the Gaspé Peninsula, the northern shore of Anticosti Island, and parts of the lower north shore of Quebec.

Amongst the largest individual colonies in the Gulf are Bonaventure Island (Gaspé Peninsula), Rochers aux Oiseaux (Magdalen Islands), Falaise aux Goélands (Anticosti Island), Presqu’ile de Forillon (Gaspé Peninsula), and Refuge des Îles Sainte-Marie (lower north shore of Quebec), each of which has been documented to contain over 10,000 breeding pairs (Lock *et al.* 1994). Other sites (including groupings of neighbouring islands) in the Gulf that have hosted and potentially could host 10,000 pairs of seabirds include: Île du Corossol, Archipel Mingan, Refuge

de la Baie des loups, Refuge de la Baie de Brador, Île Blanche, Île Bicquette, Île aux Pommes, and Battures aux Loups-Marins in Quebec (EC-CWS, unpublished data, pers. comm. 2012). Additionally, Tabusintac in New Brunswick is considered to have historically hosted 10,000 pairs of breeding seabirds (EC-CWS, unpublished data, pers. comm. 2012). Of particular note is the presence of three Northern Gannet colonies (Bonaventure Island, Falaise aux Goelands and Rocher aux Oiseaux), which represents half of the Northern Gannet colonies and 69 percent of all the breeding pairs in Canada (Chardine 2000).

The locations of colonies along coastal portions of the Gulf and adjacent areas of the Atlantic that are in closest proximity to EL 1105 are provided in Figure 5.64, and include the Magdalen Islands, western Newfoundland, southern Newfoundland, Cape Breton Island, and the southern portion of Anticosti Island. Additionally, data on the types and abundances of species that are supported by each of these colonies has been provided in Table 5.11.

Of the coastal areas in greatest proximity to EL 1105, the Magdalen Islands supports the greatest concentration of breeding seabirds. More than 30 colonies are distributed throughout the archipelago, with the largest of these being Rochers aux Oiseaux colony, Île Brion, Île d'Entrée, Île du Chenal, Havre-aux-Basques, and Île Shag, each of which support more than 2000 individuals (Table 5.11). The most abundant species within the colonies of the Magdalen Islands include Northern Gannet, Black-legged Kittiwake, Common Murre, Common Tern, Razorbill, Black Guillemot, Greater Black-backed Gull, and Herring Gull (Table 5.11). The colonies of the Magdalen Islands also support breeding Roseate Terns (*i.e.*, particularly the Île du Chenal and the Pointe de l'Est colonies) and other species of conservation concern (Table 5.11).

Anticosti Island is known to support approximately 27 seabird colonies (EC-CWS 2013b). The largest of these (Falaise aux Goélands) supports particularly high amounts of Black-legged Kittiwakes (*i.e.*, 18,000 individuals). Other species which are supported by colonies of Anticosti Island include Black Guillemot, Northern Gannett, and Double-crested Cormorant, along with lesser amounts of Razorbill, Great Cormorant, Greater Black-backed Gull, and Atlantic Puffin (EC-CWS 2013b).

With the exception of the Magdalen Islands, coastal areas in the southeastern portion of the Gulf (including Cape Breton and southwestern Newfoundland) do not support as large a number of seabirds as other areas. The comparatively low numbers of certain types of seabirds on the west coast of Newfoundland and other areas of the southeastern Gulf may be attributable to a general lack of suitable nesting sites and the relatively low productivity of the waters along the coast. However, this portion of the Gulf does provide important nesting habitat for particular species. In particular, the North American population of Great Cormorant is centered in the eastern part of the Gulf, with the largest concentrations occurring in association with Cape Breton Island (Lock *et al.* 1994).

Available data indicate that there are 20 seabird colonies distributed within the portion of the west coast of Newfoundland that falls within the boundaries of the Project Study Area (*i.e.*, as identified in Figure 5.64). These colonies include those found at Shaol Point, Codroy Island, Grebes Head, Wreck Cove, Ship Cove, Crabbe River estuary (Unit 1 and 2), Cliff N of Cape St. George, Cliff S. edge of Big Cove, St. Georges River, Sandbar in St. Georges River, Ship

Island, Cape Cormorant, Gravels Pond Island, Red Island, Point Au Mal, Fox Island River, Fox Island, Shag Island, and White Rocks (Figure 5.64 and Table 5.11). These colonies are known to support nesting Black-legged Kittiwakes, cormorants, Common terns, and gulls (including Herring Gull, Greater Black-backed Gull, Black-headed Gull, and Ring-billed Gull). The two largest of these colonies (both of which are located at Cape St. George) support relatively high numbers of Black-legged Kittiwakes (*i.e.*, 501-100 pairs at "Cliff North of Cape St. George" and >100 pairs at "Cliff South edge of Big Cove"), which are generally considered to be amongst the most vulnerable seabirds to oil spills (Lock *et al.* 1994). Cormorants, which are also considered vulnerable but more resilient (Lock *et al.* 1994), are present at five of the colonies with the estimated number of breeding pairs being less than 500 for each of these sites. Common Terns nest at six of the sites and gulls at nine locations (Table 5.11). The other colonies along the west coast of Newfoundland primarily support Common Terns and various species of gulls whereas those along the southern shore of Newfoundland support (in decreasing order of overall abundance) Leach's Storm-Petrel, cormorants, Greater Black-backed Gull, Common Tern, Ring-billed Gull, Herring Gull, Black Guillemot, Black-headed Gull, and Black-legged Kittiwake (Table 5.11).

Colonies along the Gulf shore of Cape Breton Island primarily support Herring Gulls, Greater Black-backed Gulls, cormorants, and terns, with lesser amounts of Black Guillemots also being present (Table 5.11). The greatest concentrations of nesting seabirds along the Gulf coast of Cape Breton are located near Cheticamp, which primarily support nesting gulls (Table 5.11). However, relatively large amounts of cormorants are found in colonies along the Cape Breton Coast. For example, over 250 Great Cormorants have been counted at the Capes and the colony at Ingonish Island is considered to support over 250 pairs. In addition to these sites, the more eastern portion of Cape Breton contains the colonies of the Bird Islands where the largest colony of Great Cormorants in North America is located. Several other seabirds nest on the cliffs the Bird Islands are the largest concentration of Black-legged Kittiwakes, Razorbills and Atlantic Puffins within Nova Scotia. A few hundred nesting pairs of Double-crested Cormorants and Black Guillemots are also present on the Bird islands, and Leach's Storm-Petrels also breed here (IBA Canada 2012).

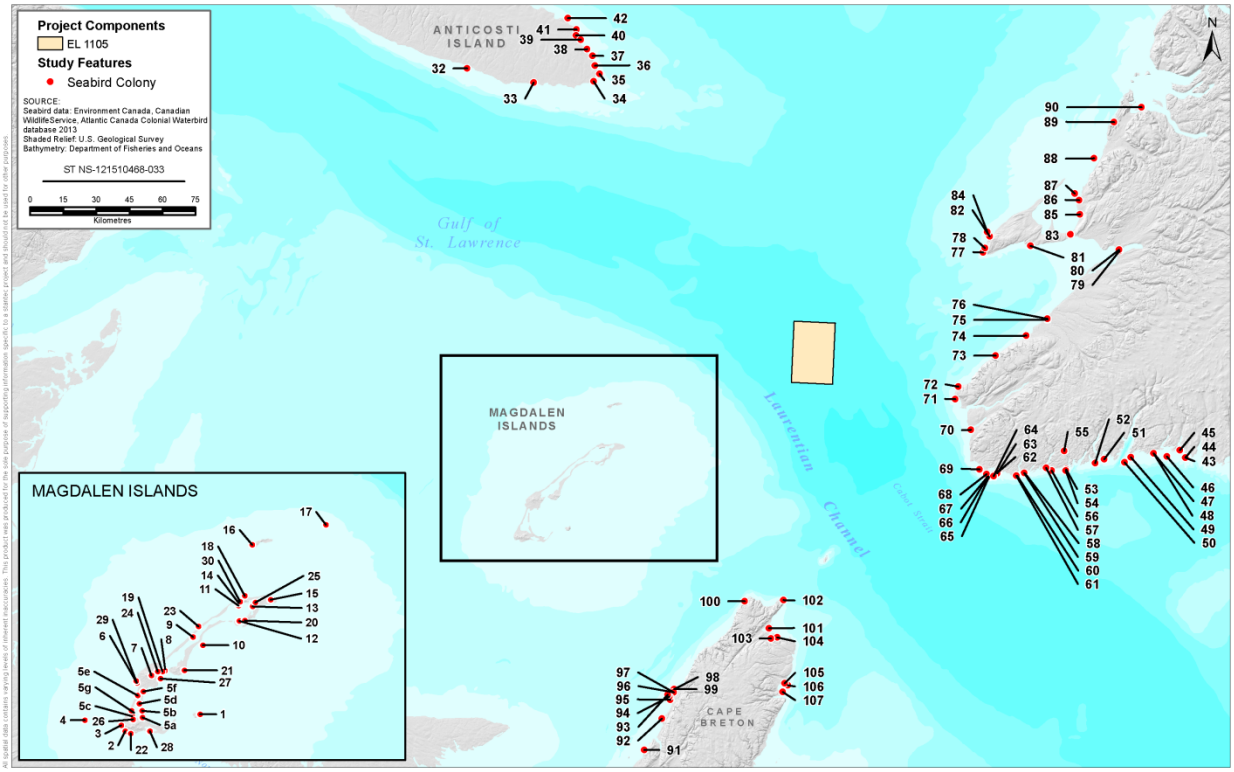


Figure 5.64 Location of Seabird Colonies in the Vicinity of EL 1105, including the Magdalen Islands, Western Newfoundland, Southern Newfoundland, Cape Breton Island, and the Southern Portion of Anticosti Island

Table 5.11 Number of Seabirds Recorded within Colonies in the Vicinity of EL 1105, including the Magdalen Islands, Western Newfoundland, Southern Newfoundland, Cape Breton Island, and the Southern Portion of Anticosti Island

Colony #	Name	Colony Size Units	Species																			Total
			GRCO	DCCO	COSP	COEI	BLKI	TBMU	COMU	RAZO	BLGU	ATPU	GBHE	NOGA	LESP	HERG	GBBG	BHGU	RBGU	COTE	ARTE	ROTE	
Magdalen Islands[1]																							
1	Île d'Entrée	Individual	280				4,614		4	334	450					8	2						5,692
2	Cap du Sud-Ouest	Individual	32				1,022			38	48					16	4						1,160
3	Cap Noir	Individual	114				22				232					6							374
4	Corps Mort	Individual	138	14			6		6	68	84					24	14						354
5	Havre-aux-Basques Lagoon Islets	Individual		1,122												42	204			1,276	22		2,666
a	Baie du Portage Islets	Individual		1,122												42	200						1,364
b	Colonie de la Planche à Voile Islet	Individual																					0
c	Pointe des Canot Islets	Individual															4			164			168
d	Îles de Travers	Individual																		2			2
e	Colonie du Nord-Ouest Islets	Individual																		836	22		858
f	Etang de la Martinique Islets	Individual																		274			274
g	Goulet du Nord Islet	Individual																					0
6	Île aux Goélands	Individual	434	908		2	334			48	34					16	6						1,782
7	Île du Cap-aux-Meules	Individual									330					8							338
8	Île aux Cochons	Individual														0	0			0			0
9	Îlets des Étroits	Individual														0	0			92			92
10	Île Shag	Individual	240	1,500			710		2	30	24					8	28						2,542
11	Îlot B of the Grande-Entrée Lagoon	Individual		1,666													18						1,684
12	Île du Chenal (Grande-Entrée Lagoon)	Individual														392	1,098			1,566	+	1	3,057
13	Île aux Loups Marins	Individual		0												0	0						0

Table 5.11 Number of Seabirds Recorded within Colonies in the Vicinity of EL 1105, including the Magdalen Islands, Western Newfoundland, Southern Newfoundland, Cape Breton Island, and the Southern Portion of Anticosti Island

Colony #	Name	Colony Size Units	Species																			Total
			GRCO	DCCO	COSP	COEI	BLKI	TBMU	COMU	RAZO	BLGU	ATPU	GBHE	NOGA	LESP	HERG	GBBG	BHGU	RBGU	COTE	ARTE	ROTE	
14	Île Rouge (Grande-Entrée Lagoon)	Individual		0							0					0	0						0
15	Pointe de l'Est	Individual														0	4	34		702	+	1	741
16	Île Brion	Individual	104	164			3,780		2,266	598	806	156			8	0	2						7,884
17	Rochers aux Oiseaux	Individual					3,778	794	6,982	1,900		2		46,922		0	4						60,382
18	Cap du Dauphin	Individual								2	30												32
19	Île Rouge (Havre-aux-Maisons Lagoon)	Individual		0												0	0						0
20	Île de Grande-Entrée	Individual									94												94
21	Île du Havre-aux-Maisons	Individual									190					236	90						516
22	Cap du Sud	Individual					84				182					24	4						294
23	Île aux Loups	Individual									42					4							46
24	Fatima (Île du Cap-aux-Meules)	Individual											112										112
25	Mont Moore (Grosse-Île)	Individual											0										0
26	Pointe des Canots (Île du Havre-Aubert)	Individual											0										0
27	Cap-aux-Meules Marina	Individual														198	74						272
28	Île du Bassin	Individual															4			1,330			1,334
29	Étang-du-Nord Wreck	Individual									4					108	2						114
30	Pointe Rockhill (Grosse-Île)	Individual											2										2
Anticosti Island[2]																							
32	Pointe Dauphiné	Individual	2	122																			124
33	Lac de la Croix	Individual															1						1
34	Baie du Naufrage	Individual														0	0						0
35	Pointe de l'Est	Individual								6		1											7

Table 5.11 Number of Seabirds Recorded within Colonies in the Vicinity of EL 1105, including the Magdalen Islands, Western Newfoundland, Southern Newfoundland, Cape Breton Island, and the Southern Portion of Anticosti Island

Colony #	Name	Colony Size Units	Species																			Total
			GRCO	DCCO	COSP	COEI	BLKI	TBMU	COMU	RAZO	BLGU	ATPU	GBHE	NOGA	LESP	HERG	GBBG	BHGU	RBGU	COTE	ARTE	ROTE	
36	Falaise aux Goélands	Individual		100			18,802			54				400									19,356
37	Cap Sandtop	Individual	0	0			0				51												51
38	Pointe Merrimack	Individual		0																			0
39	Baie Innommée	Individual	0	0			0			0	75	0				0							75
40	Baie du Renard	Individual															20						20
41	Pointe du Renard	Individual					608			32													640
42	Cap de la Table	Individual	0				0			0	359	0				0							359
Newfoundland (Southwest Coast)[3]																							
43	Black Rock, NF	Pair			101-500																		101-500
44	Smoky Island, NF	Pair																	101-500	14			115-500
45	Gull Island, NF	Pair																		10			10
46	Flat Island, NF	Pair			101-500																		101-500
47	Three Islands, south, NF	Pair															11-100						11-100
48	Three Islands, middle, NF	Pair														11-100	11-100						22-200
49	Jacques Island, NF	Pair														11-100							11-100
50	Ireland Island, NF	Pair															9						9
51	Tinker Island, Little La Poile Bay, NF	Pair																		27			27
52	Wreck Island, Garia Bay, NF	Pair													100	11-100	11-100						122-300
53	Duck Island, Rose Blanche, NF	Pair															11-100	11-100					22-200
54	Shag Rocks, NF	Pair															11-100						11-100
55	Three Islands, north, NF	Pair																		155			155
56	Pigeon Island, NF	Pair															9						9

Table 5.11 Number of Seabirds Recorded within Colonies in the Vicinity of EL 1105, including the Magdalen Islands, Western Newfoundland, Southern Newfoundland, Cape Breton Island, and the Southern Portion of Anticosti Island

Colony #	Name	Colony Size Units	Species																			Total
			GRCO	DCCO	COSP	COEI	BLKI	TBMU	COMU	RAZO	BLGU	ATPU	GBHE	NOGA	LESP	HERG	GBBG	BHGU	RBGU	COTE	ARTE	ROTE	
57	Grandy Sound, uni in, NF	Pair															9						9
58	Salmon Island, NF	Pair															1			29			30
59	Isle aux Morts, NF	Pair															9						9
60	Round Rock, NF	Pair															2			15			17
61	Garden Islands, SW, NF	Pair															11-100	11-100					22-200
62	Money Island, NF	Pair															1			98			99
63	Vardys Island, NF	Pair														11-100	9						20-100
64	Mouse Island, NF	Pair															9						9
Newfoundland (West Coast)[3]																							
65	Green Island	Pair															1-100						1-100
66	Bard Island	Pair															101-500						101-500
67	Duck Island	Pair															101-500						101-500
68	Durands Island	Pair														101-500	101-500		101-500				303-1500
69	Shag Island	Pair			101-500												1-100						102-600
70	Bay behind Shaol Point	Pair															1-100						1-100
71	Codroy Island	Pair														1-100	1-100			2			2-200
72	Grebes Head	Pair			1-100																		1-100
73	Wreck Cove	Pair			1-100																		1-100
74	Ship Cove, Uni in	Pair			1-100																		1-100
75	Crabbe River estuarty, Uni 2 in	Pair															101-500	101-500					202-1000
76	Crabbe River estuarty, uni 1 in	Pair																		50			50
77	Cliff N of Cape St. George	Pair					501-1000																501-1000
78	Cliff S. edge of Big Cove	Pair					>1000																>1000

Table 5.11 Number of Seabirds Recorded within Colonies in the Vicinity of EL 1105, including the Magdalen Islands, Western Newfoundland, Southern Newfoundland, Cape Breton Island, and the Southern Portion of Anticosti Island

Colony #	Name	Colony Size Units	Species																			Total
			GRCO	DCCO	COSP	COEI	BLKI	TBMU	COMU	RAZO	BLGU	ATPU	GBHE	NOGA	LESP	HERG	GBBG	BHGU	RBGU	COTE	ARTE	ROTE	
79	St. Georges River, uni in	Pair																	101-500	183			284-500
80	Sandbar in St. Georges River	Pair																		35			35
81	Ship Island	Pair															101-500						101-500
82	Cape Cormorant	Pair			101-500																		101-500
83	Gravels Pond Island	Pair																		240			240
84	Red Island	Pair														101-500	101-500						202-1000
85	Point Au Mal	Pair																		80			80
86	Fox Island River	Pair														1-100							1-100
87	Fox Island	Pair														1-100							1-100
88	Shag Island	Pair			101-500		1-100									101-500	1-100						204-1200
89	rock inside of White Rocks	Pair															1-100						1-100
90	Seal Island	Pair														101-500	1-100						102-600
Cape Breton [3]																							
91	Chimney Corner	Individual	78																				78
92	Cap Le Moine	Individual	2																				2
93	The Capes	Individual	257																				257
94	Cheticamp Island	Pair									10												10
95	Cheticamp Island, Causeway	Pair														338	129						467
96	Cheticamp Harbour, uni in	Pair															27			31			58
97	Cheticamp Harbour, uni in	Individual														680	129						809
98	Gros. Cap. Cheticamp Island	Individual															170						170
99	Gros. Cap. Cheticamp Island	Pair															170						170
100	Lowland Cove	Individual	15																				15
101	Lead Island	Pair		391												128	240						759

Table 5.11 Number of Seabirds Recorded within Colonies in the Vicinity of EL 1105, including the Magdalen Islands, Western Newfoundland, Southern Newfoundland, Cape Breton Island, and the Southern Portion of Anticosti Island

Colony #	Name	Colony Size Units	Species																		Total
			GRCO	DCCO	COSP	COEI	BLKI	TBMU	COMU	RAZO	BLGU	ATPU	GBHE	NOGA	LESP	HERG	GBBG	BHGU	RBGU	COTE	ARTE	ROTE	
102	Money Point	Pair	36																				36
103	South Harbour, small uni Island	Pair																		154			154
104	Yellow Head	Pair														20	8						28
105	Ingonish	Pair															35						35
106	Ingonish Island	Pair	251													504	1,188						1,943
107	Middle Head	Pair															103						103

Species Codes: GRCO=Great Cormorant; DCCO= Double-crested Cormorant; COSP= Cormorant species; BLKI=Black-legged Kittiwake; TBMU=Thick-billed Murre; COMU=Common Mure; RAZO=Razorbill; BLGU=Black Guillemot; ATPU=Atlantic Puffin; GBHE= Great Blue Herron; NOGA= Northern Gannet; LESP= Leach's Storm-Petrel; HERG=Herring Gull; GBBG= Great Black-backed Gull; BHGU=Black-headed Gull; RBGU=Ring-billed Gull; COTE= Common Tern; ARTE= Arctic Tern; ROTE= Roseate Tern
[1] Rail, J.-F. 2009[2]
EC-CWS 2013a
[3] EC-CWS 2013b

5.6 Marine Mammals and Sea Turtles

Marine mammals present in the Gulf can be subdivided into two orders - Cetacea (whales, dolphins, and porpoises) and Pinnipedia (seals). A total of 22 species of marine mammals and sea turtles can be found in the Gulf (LGL 2007) and may be expected to occur with varied frequency in EL 1105. A list of these species is provided in Table 5.12, noting that the species which are considered at risk are also addressed in Tables 5.1 and 5.2.

Table 5.12 Marine Mammals and Sea Turtles Potentially Present Within or Near the Project

Common Name	Latin Name	Potential Occurrence in relation to the Project
Cetaceans		
Mysticetes (Toothless or Baleen Whales)		
North Atlantic right whale[A]	*Eubalaena glacialis*	Uncommon
Minke whale	*Balaenoptera acutorostrata*	Common
Fin whale[A]	*Balaenoptera physalus*	Common
Sei whale	*Balaenoptera borealis*	Uncommon
Blue whale[A]	*Balaenoptera musculus*	Seasonally Common
Humpback whale	*Megaptera novaeangliae*	Common
Odontocetes (Toothed Whales)		
Harbour porpoise[A]	*Phocoena phocoena*	Common
Atlantic white-sided dolphin	*Lagenorhynchus acutus*	Common
White-beaked dolphin	*Lagenorhynchus albirostris*	Common
Long-finned pilot whale	*Globicephala melas*	Common
Killer whale[A]	*Orcinus orca*	Uncommon
Beluga[A]	*Delphinapterus leucas*	Uncommon
Northern bottlenose whale	*Hyperoodon ampullatus*	Uncommon
Sperm whale	*Physeter macrocephalus*	Common
Common (short-beaked) dolphin	*Delphinus delphis*	Common
Pinnipedea		
Harp seal	*Phoca groenlandica*	Common
Hooded seal	*Crystophora cristata*	Common
Grey seal	*Halichoerus grypus*	Common
Harbour seal	*Phoca vitulina*	Uncommon
Sea Turtles		
Leatherback turtle[A]	*Dermochelys coriacea*	Seasonally Common
Loggerhead turtle[A]	*Caretta caretta*	Uncommon
Kemp's ridley turtle	*Lepidochelys kempii*	Rare
Green sea turtle	*Chelonia mydas*	Rare
[A] At-risk species discussed in Section 5.2		

Profiles on each of the above listed species can be found in Sections 3.6.1 to 3.6.4 of the 2005 Western Newfoundland SEA document (LGL 2005b), and Section 3.5.1.3 of the 2007 Western Newfoundland SEA Amendment document (LGL 2007). A brief summary of the information presented in these sections is provided below in terms of species distribution. Note that any species considered at risk are described in Sections 5.2.3 and 5.2.4.

The Ocean Biogeographic Information System (OBIS) is a database that can be consulted to obtain a census of marine life and can be used as a resource for scientists. Recognized science institutes or survey programs can submit recorded observations to contribute to this online database. Records of observations can be retrieved from the OBIS website (OBIS 2011). For the purposes of this study, an area was analyzed ranging from northern Nova Scotia and Magdalen Islands, northward to the southwest Newfoundland, including EL 1105. Data obtained from OBIS, including the species and individuals recorded in this area and the year in which they were observed is provided in Table 5.13.

Table 5.13 Marine Mammals and Sea Turtles Observed in the Vicinity of the Project

Common Name	Latin Name	Total Number of Individuals Recorded through OBIS in the Vicinity of the EL 1105	Year and Number of Individuals Recorded with OBIS[A]	Total number of individuals recorded by DFO in the SEA and Amendment Area[B]
Cetaceans				
Mysticetes (Toothless or Baleen Whales)				
North Atlantic right whale	*Eubalaena glacialis*	1	1969	1
Minke whale	*Balaenoptera acutorostrata*	4	1964 (3), 1976 (1)	130
Fin whale	*Balaenoptera physalus*	5	1969 (1), 1973 (1), 1999 (3)	43
Sei whale	*Balaenoptera borealis*	0		1
Blue whale	*Balaenoptera musculus*	1	1998	47
Humpback whale	*Megaptera novaeangliae*	2	1987 (1), 1993 (1)	191
Odontocetes (Toothed Whales)				
Harbour porpoise	*Phocoena phocoena*	108	1969 (85), 1999 (23)	96
Atlantic white-sided dolphin	*Lagenorhynchus acutus*	75	1975 (1), 1995 (74)	133
White-beaked dolphin	*Lagenorhynchus albirostris*	0		49
Long-finned pilot whale	*Globicephala melas*	51	1971 (10), 1977 (12), 1978 (12), 1982 (4), 1986 (13)	92
Killer whale	*Orcinus orca*	0		5
Beluga	*Delphinapterus leucas*	1	1999	18
Northern bottlenose whale	*Hyperoodon ampullatus*	0		Not recorded

Table 5.13 Marine Mammals and Sea Turtles Observed in the Vicinity of the Project

Common Name	Latin Name	Total Number of Individuals Recorded through OBIS in the Vicinity of the EL 1105	Year and Number of Individuals Recorded with OBIS[A]	Total number of individuals recorded by DFO in the SEA and Amendment Area[B]
Sperm whale	*Physeter macrocephalus*	2	1968 (2)	2
Common (short-beaked) dolphin	*Delphinus delphis*	133	1971 (125), 2005 (8)	108
Pinnipedea				
Harbour seal	*Phoca vitulina*	0		Not recorded
Grey seal	*Halichoerus grypus*	0		Not recorded
Harp seal	*Phoca groenlandica*	9	1973 (9)	Not recorded
Hooded seal	*Crystophora cristata*	0		Not recorded
Sea Turtles				
Leatherback turtle	*Dermochelys coriacea*	2	1995 (1), 2002 (1)	Not recorded
Loggerhead turtle	*Caretta caretta*	0		Not recorded
Kemp's ridley turtle	*Lepidochelys kempii*	0		Not recorded

Source:
[A] OBIS 2011;
[B] DFO 2007, in LGL 2007 (these are sightings within a approximately 100 to 150 km of EL 1105)

During the geohazard survey program that was carried out between October 12 and 15, 2010, a Marine Mammal Observer was onboard the vessel to identify and note the behaviour of any marine mammals and sea turtles present when the seismic survey was being conducted. Four sightings totalling 11 marine mammals were made over the course of the survey program (LGL 2010). In only one of the four sightings was it possible to identify the marine mammals to the species level (four long-finned pilot whales swimming on October 14). For the other three sightings, two of these were unidentified swimming dolphins (a group of two dolphins on October 13 and a group of four dolphins on October 14), and the third sighting at a distance of approximately 1.2 km was the blow of an unidentified whale observed on October 14. All marine mammal sightings occurred in water depths ranging from 462 to 487 m (LGL 2010). No sea turtles were sighted during the survey. The sightings of long-finned pilot whales and dolphins support the findings in Table 5.13 in that they are two of the more common marine mammals likely to be present in EL 1105.

5.6.1 Mysticetes (Toothless / Baleen Whales)

Of the 15 cetacean species found in the Gulf, there are six species of baleen whales (fin, minke, blue, humpback, sei and the northern right whale). The majority of these species use the Gulf as feeding grounds, with the Laurentian Channel and the Magdalen Islands being popular areas (DFO 2005a). Humpback, fin and minke whales are less common off the west and southwest coasts of Newfoundland than elsewhere off the coasts of the Island (LGL 2005b). Humpback whales feed in the Gulf during the summer; however, the majority of their sightings have been in

the northeastern part of the Gulf. They prefer to breed in waters that have a temperature between 24°C and 28°C and therefore conduct their breeding in southern latitudes during the winter (DFO 2011j). There is evidence that fin whales are present in the Gulf from July to September and tend to migrate through the Laurentian Channel to winter off northern Nova Scotia. Minke whales have also been observed in the Gulf from July to September but are more frequent in the northern Gulf (LGL 2005b). Blue whales can be found in the Gulf from January through November; however, they would most likely only be considered common for EL 1105 from August to October (LGL 2005b). North Atlantic right whales are only occasionally sighted in the Gulf and have been seen in the spring and fall seasons in the lower north shore, and to the east of the Gaspé Peninsula (DFO 2011j). They are however, rare to waters off western Newfoundland (LGL 2005b). Sei whale sightings in the vicinity of the EL 1105 have also been limited (LGL 2007).

In 2007, a cetacean distribution study was conducted by DFO, and one area ranged from southwest Newfoundland to the Magdalen Islands, which included EL 1105. Several species of Mysticetes were spotted, including blue, humpback and minke whales (Lawson and Gosselin 2009).

Species profiles for the three not at risk species of baleen whales that may occur in the area are described in the following sections. At risk species are described in Section 5.2.3.

5.6.1.1 Humpback Whale

The humpback whale is the most common whale species in Newfoundland waters. Like most whale species, the humpback whale migrates to high-latitudes during the summer and low-latitudes during the winter months (Winn and Reichley 1985). During the summer, approximately 900 humpbacks are thought to use the Southwest Shoal of the Grand Banks to feed on capelin (Whitehead and Glass 1985). The Newfoundland population of Humpback whales is estimated at 1,700 to 3,200 individuals (Whitehead 1982), while the Northwest Atlantic population is estimated at 5,505 individuals (Katona and Beard 1990), and the entire North Atlantic population is estimated at approximately 11,570 individuals (Baird 2003). Aerial surveys conducted in 1995 and 1996 noted 21 individuals sighted along the north shore shelf mainly in the Strait of Bell Isle and on the north side of the Esquiman Channel. There are records of humbacks as far west as the Laurential Channel (Kingsley and Reeves 1998).

Humpbacks are common in coastal waters, occurring in groups of several individuals while feeding on capelin, herring, krill and shrimp. Humpback whales undergo seasonal migrations from high-latitude feeding areas in the summer (*i.e.*, Canadian waters) to low-latitude breeding and calving grounds (COSEWIC 2003c).

Humpbacks from western and eastern North Atlantic use the West Indies as the primary breeding and calving grounds with small numbers breeding and calving in the Cape Verdes (COSEWIC 2003c). There are three feeding stocks located in Eastern Canada: the Gulf of Maine, the Gulf of St. Lawrence, and the Newfoundland and Labrador stocks. There is some interchange between feeding stocks and juveniles from all three stocks mixing in the mid-latitude feeding area.

5.6.1.2 Minke Whale

Minke whales also commonly occur within the Gulf and EL 1105. Minke whales are common in the waters of Newfoundland and Labrador during the summer but occur worldwide. The size of the Canadian East Coast stock population of minke whales is not well known, but the best available estimate is approximately 3,300 individuals (Waring *et al.* 2009), which does not include all of the minke whales range in the Northwest Atlantic. An estimate of 1,000 minke whales was made in the Gulf during one summer, 600 of which were seen in the northern Gulf (Kingsley and Reeves 1998). A 2007 survey resulted in an estimated abundance of 360 minke whales in the Gulf (Lawson and Gosselin 2009). Minke whales are more commonly sighted during the summer months in Newfoundland waters, but some may stay in the winter. They are commonly seen nearshore in approximately 200 m of water (Hooker *et al.* 1999), but occur offshore in deeper waters. The minke whale diet consists of capelin and sand lance (Naud *et al.* 2003), but they are also known to eat planktonic crustaceans, herring, mackerel and occasionally squid.

5.6.1.3 Sei Whale

Available information suggests that sei whales are not likely as common near EL 1105 as other baleen whale species. Sei whales are often observed in open, pelagic waters and along the edge of the continental shelf of the Northwest Atlantic (COSEWIC 2003d). They feed on schooling fish and squid, but mostly copepods and euphausiids (COSEWIC 2003d). Although their occurrence may be sporadic from year to year, they migrate northward along the continental slope during the summer months and return along the slope during the fall months (Mitchell 1974; Mitchell and Chapman 1977). The sei whale is rarely seen visiting shallow banks close to the coast and tends to occur well offshore (Proctor and Lynch 2005).

The North Atlantic stock and the Nova Scotia stock of sei whale are considered different subspecies in Atlantic Canada with a possibility of a third stock found off Labrador (COSEWIC 2003d). The Atlantic population of the sei whale is considered data deficient by COSEWIC. The western North Atlantic population was estimated to be between 1,393 to 2,248 animals in the late 1970s, and this is still considered the most accurate information (COSEWIC 2003d). No sei whales were reported in the Cape Breton, Gulf and Scotian Shelf survey areas during a 2007 survey (Lawson and Gosselin 2009).

5.6.2 Odontocetes (Toothed Whales)

As presented in Table 5.13, there are nine species of toothed whales that could potentially be found in the vicinity of EL 1105. The sperm whale, long-finned pilot whale, Atlantic white-sided and common dolphin and harbour porpoise are likely to be common in the western Newfoundland offshore region, whereas the northern bottlenose whale, killer whale,white-beaked dolphin, and beluga are likely to be uncommon in this area (LGL 2005b). The distribution of sperm whale is based highly on their social structure, whereby adult females and young are typically found in tropical and subtropical waters and adult males in higher latitude waters. Sperm whales are generally distributed over areas of steep underwater topography, as are the long-finned pilot whales. Sperm whales are capable of diving to depths greater than 1,200 m to feed and can stay submerged for greater than two hours at a time, but the majority of

their dives last approximately 30 minutes. The majority of the sightings of the Atlantic white-sided dolphin in the Gulf were also recorded in areas with steep bottom topography. Evidence suggests that the harbour porpoise is common to the northern portion of the Gulf from July to September; however, sightings also show this species to be present in the southern and central portions of the Gulf as well (LGL 2005b). It has been noted that a distinct population of harbour porpoise exists in the Gulf and that the species is generally seen close to coastlines (DFO 2011j).

Similarly, the beluga population within the Gulf is also believed to be isolated from other beluga populations (DFO 2011j). The Gulf population doesn't appear to migrate far, as they are uncommon beyond the boundaries of the Gulf.

The cetacean distribution study completed in 2007 (Lawson and Gosselin 2009), which includes the waters off southwest Newfoundland out to and including EL 1105, observed several species of Odontocetes, including harbour porpoise, long-finned pilot whale and the Atlantic white-sided dolphin.

The not at risk toothed whales that have the most potential to occur in and around the area are described in the following sections. At-risk species are described in Section 5.2.3.

5.6.2.1 Atlantic White-sided Dolphin

The Atlantic white-sided dolphin is common from Labrador to Cape Cod with spotty occurrences south of Cape Cod to Maryland (Proctor and Lynch 2005). The North Atlantic population is estimated at several hundred thousand (Reeves *et al.* 1999). Those in the western North Atlantic may be comprised of three distinct populations: Gulf of Maine; Gulf of St. Lawrence; and Labrador Sea populations (Palka *et al.* 1997). A population estimate of 12,000 individuals was made during one summer in the Gulf, but the estimate varied greatly during the next summer (Kingsley and Reeves 1998). A 2007 survey resulted in an estimated abundance of 1,044 Atlantic white-sided dolphins in the Gulf (Lawson and Gosselin 2009).

The Atlantic white-sided dolphin usually travels in groups numbering between 50 and 60, but sometimes number in the hundreds (Reeves *et al.* 1999). They are usually spotted near feeding groups of whales and seabirds and feed on squid and herring. They are most likely to occur near EL 1105 during summer and fall. The Atlantic white-sided dolphin is not listed under *SARA* and was declared not at risk by COSEWIC in 1991.

5.6.2.2 White-beaked Dolphin

The white-beaked dolphin has a more northern distribution than the white-sided dolphin and is more common north of the Gulf of Maine and very rare south of Cape Cod (Proctor and Lynch 2005). The total population in the North Atlantic could be as high as a few hundred thousand individuals (Reeves *et al.* 1999). Although they are genetically distinct, white-beaked dolphins do occur on both sides of the North Atlantic (Kinze 2002), with the largest population off Labrador and southwestern Greenland. In surveys conducted in 1996 and 1997, a total of 147 individuals were observed and the overall population was estimated around 2,500 individuals (Kingsley and Reeves 1998). In the 2007 survey, there were no sightings of this species in the

survey area which includes EL 1107; however, this species was the second most common species recorded in the survey zone just north of this (*i.e.*, the zone which includes the Strait of Belle Isle) (Lawson and Gosselin 2009).

The white-beaked dolphin feeds mainly on squid, although it will also take fish. The white-sided dolphin was declared not at risk by COSEWIC in 1998 and is not listed under SARA.

5.6.2.3 Long-finned Pilot Whale

As indicated in Table 5.13, long-finned pilot whale are common in the Gulf and in EL 1105. In the 2007 survey, 15 pilot whales were sighted in the survey area which includes EL 1105 (Lawson and Gosselin 2009). The Newfoundland population of long-finned pilot whales has been estimated to be between 4,000 and 12,000 individuals with a world-wide estimate of 750,000 individuals. Long-finned pilot whales would be common off the southwest coast of Newfoundland during the summer (Kingsley and Reeves 1998). They are frequently observed along shelf breaks, offshore, but may occur coastally as well. Groups of long-finned pilot whales are occasionally found stranded on beaches. They commonly come close to shore, especially if squid are abundant in the area.

Long-finned pilot whales are a very social species and most often are seen in groups of 10 to 20 individuals, but may also appear in groups of hundreds (Proctor and Lynch 2005). This species favours cold waters near the continental shelf well offshore. Squid and pelagic schooling fish species are the primary prey of the long-finned pilot whale. It is considered not at risk and has not been assessed by COSEWIC and is not listed under SARA.

5.6.2.4 Sperm Whale

Sperm whales are considered common (LGL 2005) and are occasionally seen in the Gulf. Sperm whales range widely through the world's oceans and males are found off both coasts of Canada and are considered not at risk by COSEWIC. The worldwide population is reasonably large despite historical large reductions by commercial whaling which was discontinued in 1972 in Canada. The population of sperm whales in the western North Atlantic has been estimated to be approximately 4,800 animals. They are most commonly found feeding in the waters above submarine canyons and along the edge of the continental shelf in very deep water (Proctor and Lynch 2005). This species routinely dives to depths of hundreds of metres and is capable of remaining submerged for longer than two hours but most dives probably last a half-hour or less (Rice 1989). The sperm whales diet consists of squid and fishes (Reeves and Whitehead 1997).

5.6.3 Pinnipeds (Seals)

There are four species of seals potentially found near and within EL 1105 (harp, hooded, grey and harbour; Table 5.13). Both the harp and hooded seals are migratory species, whereas the harbour and grey seals are year-round resident species (DFO 2005a). The harp seal is likely common in the western Newfoundland offshore area during late fall to early spring and rare during other times of the year (LGL 2005b). There are two herds within the North Atlantic, with one breeding on drifting Arctic ice packs off the coast of southern Labrador, and a second herd primarily breeding off the Magdalen Islands (DFO 2011j). The hooded seal is likely to be

common offshore western Newfoundland in the spring and rare during other times of the year. Both the harbour and grey seals are likely to be common in the western Newfoundland offshore regions, with the distribution of the harbour seal being continuous in the Gulf and that of the grey seal to be more concentrated in the south (LGL 2005b). One of the three main breeding locations for the grey seal is on ice in the southern Gulf region (DFO 2011j).

Three of the four species of seal is hunted commercially on the Atlantic coast of Canada (the exception being the harbour seal). Ice conditions often determine the amount of hunting effort in any given area, however, the majority of the seal hunt occurs off the north and east coasts of Newfoundland and off southern Labrador. The majority of the sealing in this area occurs between late March and the end of April (DFO 2008a).

The four species of seals known to occur in the Gulf and in EL 1105 are described in the following sections.

5.6.3.1 Harp Seal

Harp seals whelp during the spring in the Gulf and in an area off southern Labrador and Northern Newfoundland (known as the “Front”) (Sergeant 1991; DFO 2000d). Individuals from these two areas spend the summer months in the Canadian Archipelago, Davis Strait and Baffin Bay and then migrate approximately 10,000 km south along the Newfoundland and Labrador coast and Gulf (Whitaker 1996). In recent years, there has been an apparent change in their distribution as more harp seals are occurring south of this area. McAlpine *et al.* (1999) documented an increase in extralimital occurrences (south of normal range) of harp seals in the northern Gulf of Maine. The total population in 2004 was estimated at 5.9 million (ICES 2005).

Once considered to be Arctic cod (DFO 2000d), capelin now appears to be the primary food source for harp seals (DFO 2012c). Diet of the harp seal tends to vary with age, season, year and location (Kapel 2000; Nilssen *et al.* 2000).

5.6.3.2 Hooded Seal

Like the harp seal, the majority of the hooded seal population in the Atlantic whelp in the “Front” in mid-to late March (Lyderson and Kovaks 1999). The southern Gulf is also one of several whelping habitats for the hooded seal. Congregations occur in March and April near Prince Edward Island and the Magdalen Islands for pupping and breeding. They then migrate northward to the sub-Arctic and Arctic (to the waters off Greenland) to feed during the summer (Lydersen and Kovacs 1999). Hooded seals are widely distributed throughout the western North Atlantic in the winter and spring (Stenson and Sjare 1997; Kovacs 2002); however, some individuals may remain in Atlantic waters year round. Population estimates are on the order of 500,000 seals (Kovacs 2002), a small portion of which whelps in the southern Gulf (Hammill 1993). Hooded seals feed on benthic invertebrates, Greenland halibut, redfish, Arctic cod and squid. The area of the EL 1105 is part of the highly preferred hooded seal habitat, particularly males, when present in the Gulf of St. Lawrence (Lesage *et al.* 2007 and Bajzak *et al.* 2009).

5.6.3.3 Grey Seal

The Northwest Atlantic stock of grey seals occurs in the Gulf, off Nova Scotia and Newfoundland and Labrador. Grey seals on the Grand Banks are likely from the Sable Island and Gulf breeding populations. The largest breeding colony occurs on Sable Island, with a range of 208,000 to 223,000 individuals (Trzcinski *et al.* 2005) and the Gulf population (which pups on the ice in the southern Gulf) is estimated at 52,500 (Hammill 2005), which accounts for all of the pup production in the Northwest Atlantic. Grey seals also congregate in the Gulf, between the eastern end of Prince Edward Island and Cape Breton Island and on the ice in St. George's Bay, for pupping and breeding from mid-December to late February (Stobo and Zwanenburg 1990). Grey seals will most likely occur in the Gulf and EL 1105 during July and August but could potentially be present year round (Stenson 1994).

Grey seals are benthic and pelagic predators of at least 40 species including Atlantic cod, herring, squid and mackerel (Benoit and Bowen 1990; Hammill *et al.* 1995).

5.6.3.4 Harbour Seal

Harbour seals are year-round residents of the Gulf, the St. Lawrence estuary and coastal Newfoundland (Burns 2002). The primary prey of harbour seals in Newfoundland waters are winter flounder, Arctic cod, shorthorn sculpin (*Myoxocephalus scorpius*) and Atlantic cod, with some regional variability (Sjare *et al.* 2005). Harbour seals are common in nearshore shallow waters near river mouths or at particular haul-out sites. Pupping is expected to occur in May or June and pups are nursed for approximately 24 days (Bowen *et al.* 2001). The pups spend time in the water with the mother following weaning.

They are expected to occur in coastal waters off northwestern Newfoundland year round, but are considered uncommon in offshore areas like EL 1105 (Table 5.13). The eastern Canadian population of harbour seals was estimated as 30,000 to 40,000 individuals in 1993 (Burns 2002). Harbour seals are not listed by SARA and considered to have data gaps by COSEWIC, insufficient to determine the status of the population; however, the east coast population appears to be increasing (Baird 2001).

5.6.4 Sea Turtles

There are four species of sea turtles that could potentially be found within the Gulf and in the vicinity of EL 1105 (Table 5.13). The leatherback and loggerhead sea turtles are considered at-risk species and are discussed in Section 5.2.4. The presence of the Kemp's ridley turtle in the offshore area of western Newfoundland is considered to be rare, and therefore the presence of Kemp's ridley in EL 1105 would be considered very rare (LGL 2005). The Kemp's ridley is listed as Endangered by US National Marine Fisheries Service (NMFS) and United States Fish and Wildlife Service (Plotkin 1995). Kemp's ridley are the smallest (40 to 50 kg) and rarest of all sea turtles within the Newfoundland area (Cook 1984). Juvenile turtles prefer shallow water and they move into deeper water as they grow (Ogren 1989). Kemp's ridley rarely range beyond the Gulf of Maine, although juveniles have been sighted along the southeast coast of Newfoundland near St. Mary's Bay and along southern Nova Scotia (Ernst *et al.* 1994). However, the number

of Kemp's ridley turtles that may visit the area is unknown. They feed primarily on crabs, but occasionally they eat molluscs, fish, shrimp and vegetation (Shaver 1991).

The presence of green turtles (*Chelonia mydas*) in the offshore area of western Newfoundland would be considered rare with very few records of this species occurring north of New York in the United States. Juvenile green turtles generally occupy areas where sea surface temperature is normally higher than Atlantic Canada. Sigthings of a green turtle and green turtle-loggerhead turtle hybrid in nearshore waters off Nova Scotia represent the most northerly confirmed records of green turtle in the northwest Atlantic (James *et al.* 2004).

5.7 Sensitive Areas

The sensitive areas identified in the vicinity of EL 1105 are indicated in Figure 5.65.

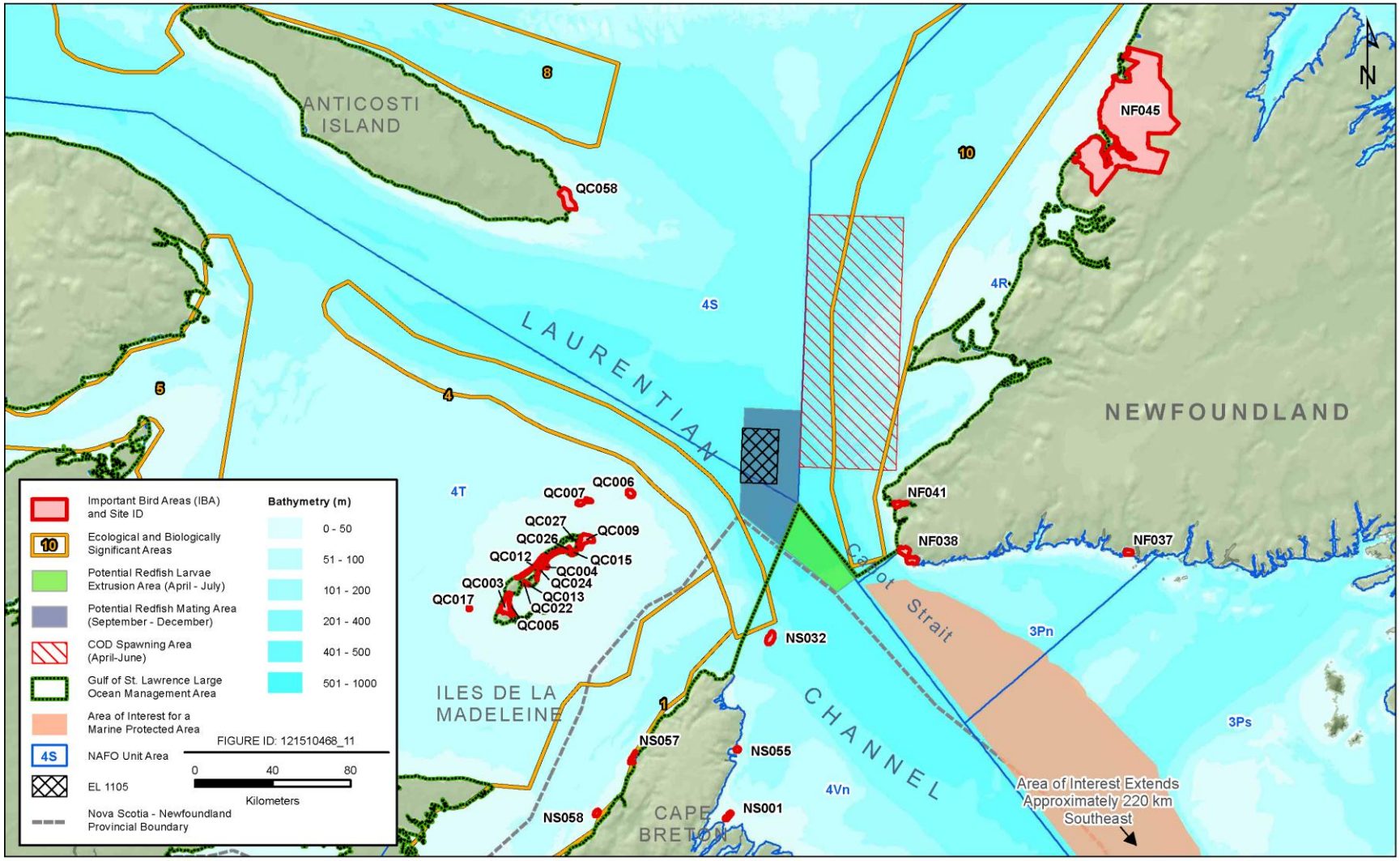


Figure 5.65 Sensitive Areas Located near Exploration Licence 1105

5.7.1 Ecologically and Biologically Significant Areas

Protection of marine sensitive areas is provided by DFO's *Oceans Act*. The *Oceans Act* allows for the development of a national oceans strategy based on the principles of sustainable development, integrated management and the precautionary approach. The Act also authorizes DFO to provide enhanced protection to marine areas which are determined to be ecologically or biologically significant (DFO 2004c). EL 1105 is within an area currently being considered as part of an Integrated Management process for the Gulf of St. Lawrence Large Ocean Management Area (GSL-LOMA) (DFO 2009p). As part of this plan, DFO has identified ecologically and biologically significant areas (EBSAs), which may require specific management measures. Some EBSAs are put forward as Areas of Interest for Marine Protected Area status and other EBSAs are considered for protection under other management tools. The potential management implications of the identification of these EBSAs are still being determined through ongoing planning processes within DFO. Within the GSL-LOMA, ten areas have been designated as EBSAs based on pre-established criteria, including primary criteria of uniqueness, aggregation and fitness consequences and secondary criteria of resilience and naturalness (DFO 2004c).These areas include:

- Western Cape Breton;
- St. George's Bay;
- Northumberland Strait;
- the southern fringe of the Laurentian Channel;
- the south-western coast of the Gulf;
- the lower estuary;
- western Anticosti Island;
- northern Anticosti Island;
- the Strait of Belle Isle; and
- the west coast of Newfoundland.

These EBSAs form the planning basis for implementation of integrated-management plans (DFO 2009q). While the EBSAs themselves are considered to significantly contribute to the Gulf of St. Lawrence ecosystem, areas outside of the EBSAs should not be considered ecological or biological unimportant. It is possible that sensitive populations were not entirely included in the EBSAs (DFO 2007b). In addition, over time the EBSA are subject to re-evaluation (DFO 2012c). The areas closest to the proposed Project include the southern fringe of the Laurentian Channel and the west coast of Newfoundland.

The southern fringe of the Laurentian Channel EBSA covers approximately 5,941 km^2 and is illustrated in Figure 5.65 as EBSA 4 (DFO 2007b, 2009q). This area is characterized by its average to maximum uniqueness, average concentration and adaptive values for pelagic fish and for its low to average uniqueness and average concentration and adaptive values for groundfish. However, this area only partially covers an important wintering area for the Atlantic cod, leaving out the southern slope in the Cabot Strait. The middle of the channel also serves as wintering areas for a number of groundfish species. The southeastern boundary of this area overlaps slightly with the Cape Breton Channel (EBSA 1 in Figure 5.65), which serves as a

migration corridor for southern Gulf stock such as Atlantic cod, coastal white hake and other groundfish species during the spring and fall. This area also serves as feeding grounds for witch flounder and deep water white hake. The north-eastern boundary of this area is also important for marine mammals (DFO 2007b, 2009q).

In 2010, the Laurentian Channel to the southeast of Cabot Strait and approximately 100 km from the Project was announced as an Area of Interest for potential designation as a Marine Protected Area (MPA) under the *Oceans Act* (DFO 2011k). This Area of Interest is located to the south of Newfoundland within the Placentia Bay-Grand Banks LOMA (DFO 2009q) and is approximately 17,950 km^2, or 50 percent of the Laurentian Channel area (Figure 5.65). Designation of this area of the Laurentian Channel as an Area of Interest was determined on the basis of identified ecological and biological significance in that it contains the highest concentration of black dogfish in Canadian waters and is the only place where their young occur. It is also determined to be an important spawning, nursery and feeding area for a variety of species (including porbeagle shark, smooth skate, monkfish, pollock, and white hake) and a migration route for marine mammals moving in and out of the Gulf (DFO 2011k). In addition, this Area of Interest provides overwintering habitat for cod and redfish stocks whose populations have been identified as either Threatened or Endangered.

The west coast of Newfoundland EBSA covers approximately 18,238 km^2 and is illustrated in Figure 5.65 as EBSA 10 (DFO 2007b, 2009q). This area is characterized for its maximum uniqueness, concentration and adaptive values for groundfish, its low to average uniqueness, average to maximum concentration and adaptive values for pelagic fish and its low to maximum uniqueness, concentration and adaptive values for marine mammals. Groundfish populations concentrate in a number of areas found within or partially within this EBSA. Western Newfoundland serves as the main area for juvenile Atlantic cod, redfish, American plaice and Atlantic wolffish. The Esquiman Channel, which is not entirely covered by this EBSA, is used as a migration corridor for Atlantic cod and redfish. This corridor can be heavily populated during spring and fall. The Esquiman Channel serves as a refuge area for Atlantic herring and a summer feeding ground for the Atlantic herring, spiny dogfish, silver hake and pollock. This area also serves as the principal cod spawning area and capelin and Atlantic herring larvae are also in abundance. Serving as a feeding area for marine mammals, the northern and southern most areas of the EBSA are most significant in terms of the diversity and biomass of marine mammals observed (DFO 2007b).

On December 11, 2011, Quebec's Minister of Sustainable Development, Environment and Parks announced an agreement to conduct a study on the creation of an MPA around the Magdalen Islands. The study, jointly funded by Parks Canada and the Province of Quebec (Government of Quebec 2011), is currently underway.

5.7.2 Other Marine Sensitive Areas

In addition to the EBSAs and candidate MPAs, there are a few other potentially sensitive areas located near EL 1105, as outlined in the 2005 and 2007 Western Newfoundland SEA and updates (LGL 2005b, 2007), which include a cod spawning area, a potential redfish larvae extrusion area and a potential redfish mating area. The location of each of these areas is presented in Figure 5.65.

The cod spawning area is located west of the Port au Port Peninsula and is closed to groundfish fishing between April 1 and June 15. This area was originally established in 2002 and was resized since then (LGL 2007).

As identified in Section 5.2, redfish mate during the fall (September to December), and as illustrated in Figure 5.65, the Project lies within the boundaries of the redfish mating area. Redfish larvae extrusion also occurs approximately 30 km away from the Project, , as illustrated in Figure 5.65; this occurs during April to July.

In addition to those presented in Figure 5.65, a number of sites within the Gulf have been assigned various designations to recognise their ecological importance. For example, there are many provincial wildlife habitats designated by the Province of Quebec on the Magdalen Islands, some of which are also recognized as Important Bird Areas, National Wildlife Areas, or Migratory Bird Sanctuaries (refer to Section 5.7.3 for more information on sensitive areas related to birds).

5.7.3 Important Bird Areas

Coastal locations designated as Important Bird Areas (IBAs) for marine birds, on the basis of bird populations, global or national significance, and/or conservation status, were identified within a range of approximately 200 km to the Project (Figure 5.65). These IBAs are presented in Table 5.14 and are mostly found on the Magdalen Islands. Each of these IBAs lies more than 75 km away from the Project. A number of Piping Plover habitat locations, though not designated as IBAs, were also identified on the coast of Newfoundland (Stephenville Crossing, Sandy Point, Flat Pay Peninsula, Searston, Little Codroy, East of Windsor Point, J.T. Cheeseman Provincial Park, Jerret Point-Windsor Point, Big Barrachois, Second) (LGL 2007).

The IBAs closest to the Project include four colonies in the Magdalen Island Archipelago and one colony in southwestern Newfoundland. The nearest colony of vulnerable seabirds to EL 1105 is the large seabird colony on Rocher aux Oiseaux at the northeastern edge of the Magdalen Island Archipelago (QC006). This colony is the third largest seabird colony in the Gulf. It is one of only three seabird colonies in the Gulf that supports a breeding population of Northern Gannets and is the second largest Northern Gannet colony in Canada. This colony also supports large numbers of Black-legged Kittiwakes and Common Murres, as well as small numbers of Thick-billed Murres and Atlantic Puffins. In addition to being recognized as an IBA, Rochers aux Oiseaux colony is also a designated Migratory Bird Sanctuary.

The colony on Île Brion (QC007) is also a large seabird colony consisting mainly of Black-legged Kittiwakes, along with smaller numbers of Black Guillemots, Atlantic Puffin, Razorbill, Great Cormorants and Common Murres. The next closest colony of vulnerable seabirds in the Magdalen Island Archipelago is a large Double-crested Cormorant colony located on Île aux Loups Marins (QC027).

The closest coastal IBA to EL 1105 along the western coast of Newfoundland is the Codroy Valley Estuary. This estuary is an important breeding and staging site for numerous waterfowl species in Newfoundland. In particular, the area supports large amounts of Canada Goose and

has also been found to support Wood Duck, Green-winged Teal, American Black Duck, Northern Pintail, Gadwall, Lesser and Greater Scaup, and Common and Red-breasted Merganser. This site also has the first breeding record in Newfoundland for Northern Shoveler, and is the provincial stronghold for breeding American Wigeon and Blue-winged Teal.

A number of the IBAs presented in Figure 5.65 provide habitat for Species at Risk. In particular, coastal sites of the Magdalen Islands and western Newfoundland are known to support Piping Plover (Table 5.14). Additionally, a number of areas which provide critical habitat for Piping Plover but are not currently designated as IBAs are known throughout the Gulf. For example, additional sites that have been designated as critical habitat for Piping Plover along the coast of Newfoundland include Stephenville Crossing, Sandy Point, Flat Pay Peninsula, Little Codroy, J.T. Cheeseman Provincial Park, Big Barrachois, and Second Beach (Environment Canada 2012b).

Table 5.14 Important Bird Areas for Marine Birds in and adjacent to the Gulf

Location	Site ID*	Size (km^2)	Important Bird Area	Bird Species
Newfoundland				
Burgeo	NF037	10.4	Big Barasway	Piping Plover
Port aux Basques	NF038	40.3	Grand Bay West to Cheeseman Provincial Park Beach	Piping Plover
Doyles	NF041	13.6	Codroy Valley Estuary	American Black Duck American Green-winged Teal American Wigeon Blue-winged Teal Canada Goose Common Goldeneye Common Merganser Greater Scaup Northern Pintail Northern Shoveler Red-breasted Merganser Ring-necked Duck Piping Plover
Rocky Harbour	NF045	1865.1	Gros Morne National Park	Common / Arctic Tern Harlequin Duck
Nova Scotia				
Inverness, Cape Breton	NS057	9.6	The Capes	Black-legged Kittiwake Great Cormorant
St. Paul Island	NS032	20.3	St. Paul Island	Leach's Storm-Petrel
Bird Islands, Cape Breton	NS001	10.9	Bird Islands	Atlantic Puffin Black Guillemot Black-legged Kittiwake Double-crested Cormorant Great Cormorant Leach's Storm-Petrel Razorbill
Ingonish, Cape Breton	NS055	5.7	Ingonish Island	Great Cormorant

Table 5.14 Important Bird Areas for Marine Birds in and adjacent to the Gulf

Location	Site ID*	Size (km^2)	Important Bird Area	Bird Species
Margaree, Cape Breton	NS058	8.1	Margaree Island	Great Cormorant Razorbill
Québec				
Magdalen Islands	QC003	32.8	Lagune du Havre aux Basques et Plage de l'Ouest	American Black Duck Arctic Tern Black-bellied Plover Black-headed Gull Caspian Tern Common Tern Great Cormorant Greater Yellowlegs Hudsonian Godwit Least Sandpiper Lesser Yellowlegs Piping Plover Red Knot (Low Arctic) Roseate Tern Semipalmated Plover Semipalmated Sandpiper Shorebirds Short-billed Dowitcher Whimbrel White-rumped Sandpiper
Magdalen Islands	QC004	3.3	Île Shag	Black Guillemot Black-legged Kittiwake Great Black-backed Gull Great Cormorant Herring Gull
Magdalen Islands	QC005	7.2	Plages de la Martinique et de Havre-Aubert	Common Tern Piping Plover
Magdalen Islands	QC006	12.3	Les Rochers aux Oiseaux	Atlantic Puffin Black-legged Kittiwake Common Murre Northern Gannet Razorbill Thick-billed Murre
Magdalen Islands	QC007	16.6	Île Brion	Arctic Tern Atlantic Puffin Black Guillemot Black-legged Kittiwake Common Eider Common Murre Common Tern Great Black-backed Gull Great Cormorant

Table 5.14 Important Bird Areas for Marine Birds in and adjacent to the Gulf

Location	Site ID*	Size (km^2)	Important Bird Area	Bird Species
				Herring Gull Horned Grebe Leach's Storm-Petrel Merlin Northern Gannet Piping Plover Razorbill
Magdalen Islands	QC009	31.4	Île de l'Est	American Black Duck American Golden-Plover Arctic Tern Black-bellied Plover Blue-winged Teal Caspian Tern Common Tern Common/Arctic Tern Great Black-backed Gull Greater Scaup Greater Yellowlegs Herring Gull Horned Grebe Least Sandpiper Lesser Yellowlegs Northern Gannet Piping Plover Red-breasted Merganser Ring-necked Duck Roseate Tern Sanderling Semipalmated Sandpiper Short-billed Dowitcher Whimbrel White-rumped Sandpiper
Magdalen Islands	QC012	20.6	Plage de l'Hopital	Piping Plover
Magdalen Islands	QC013	2.9	La Pointe	Piping Plover
Magdalen Islands	QC015	4.6	Bassin aux Huitres	Piping Plover
Magdalen Islands	QC017	3.1	Rocher le Corps Mort	Black Guillemot Great Black-backed Gull Great Cormorant Herring Gull
Magdalen Islands	QC022	0.2	Île Paquet	Common Tern Common/Arctic Tern Great Black-backed Gull Herring Gull Roseate Tern
Magdalen Islands	QC024	23.2	Dune du Sud	Great Cormorant Northern Gannet

Table 5.14 Important Bird Areas for Marine Birds in and adjacent to the Gulf

Location	Site ID*	Size (km^2)	Important Bird Area	Bird Species
				Piping Plover
Magdalen Islands	QC026	4.2	Ilot C	Common Tern Great Black-backed Gull Herring Gull Horned Lark Northern Gannet Northern Pintail Piping Plover Roseate Tern Semipalmated Plover
Magdalen Islands	QC027	1.0	Île aux Loup Marins	Double-crested Cormorant Great Black-backed Gull Great Blue Heron Herring Gull
Anticosti Island	QC058	52.6	Falaise aux Goelands / Pointe de l'Est	Atlantic Puffin Black-legged Kittiwake Common Murre Great Cormorant Northern Gannet
* Refer to Figure 5.65 for location. Source: http://www.ibacanada.com				

In addition to the IBAs for marine birds listed in Table 5.14, there are several wildlife habitats (designated under the Conservation et mise en valeur de la faune act) (Act respecting the conservation and development of wildlife) on the Magdalen Islands, some of which are included in the different IBA, National Wildlife Areas (NWA), or Migratory Bird Sanctuaries (MBS); they are as follows.

- 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.

5.8 Commercial Fisheries and Other Uses

5.8.1 Commercial Fisheries

The Gulf is commercially fished by fleets from Quebec and all four Atlantic provinces; there has been no foreign fleet, with the exception of Saint Pierre and Miquelon, since they were excluded after the first cod collapse in the 1970s (DFO 2005e). Management of the commercial fishing activity in the Gulf by DFO is conducted through the Quebec, Maritimes, Gulf and Newfoundland and Labrador Regional offices (DFO 2011l). Many of the major species are fished according to quota systems (*i.e.*, groundfish and crab), while others are fished according to availability (*i.e.*, herring and mackerel) or specific season lengths (*i.e.*, lobster and crab). Licenses and quotas are set by DFO for individual species management areas, NAFO divisions and subdivisions. The NAFO Unit Areas are illustrated in Figure 5.66. EL 1105 is located mostly in NAFO area 4Ss, but overlaps with 4Tf. The wellsite is located in 4Ss. In terms of this environmental assessment, all major fish groups including groundfish, pelagic and shellfish fished within NAFO Unit Areas 4Ss, 4Tf, 4Rd, 4Vn and 3Pn were included.

Directed fisheres include those for mackerel, herring, American eel, skate, porbeagle shark, Atlantic halibut, cod, Greenland halibut, witch flounder, winter flounder, yellowtail founder, monkfish, redfish, lobster, shrimp, snow crab, rock crab, toad crab, Atlantic razor clam, scallop, soft-shell clam, squid, surf clam and whelk. Fisheries caught as by-catch include spiny dogfish, blue shark, Shortfin mako shark, American plaice, wolffish (catfish), haddock, sculpins, tomcod, white hake, and windowpane flounder.

5.8.1.1 Fisheries in Northwest Atlantic Fisheries Organization Unit Areas 4Ss, 4Tf, 4Rd, 4Vn and 3Pn

Landings data for NAFO Unit Areas 4Ss, 4Tf, 4Rd, 4Vn and 3Pn for 2004, 2005, 2006, 2007, 2008, 2009, 2010, and 2011 were acquired from DFO from the Quebec, Gulf and the Newfoundland and Labrador regions. These data are presented in Tables 5.15 to 5.19 and represent the most up-to-date verified data at the time of writing (December 2012). The NAFO Unit Areas 4Ss, 4Tf, 4Rd, 4Vn and 3Pn cover an area substantively more expansive than EL 1105. However, general information on trends associated with the fishery for this division could provide insight and knowledge for the general region in which the Project and associated supply vessel activity will occur.

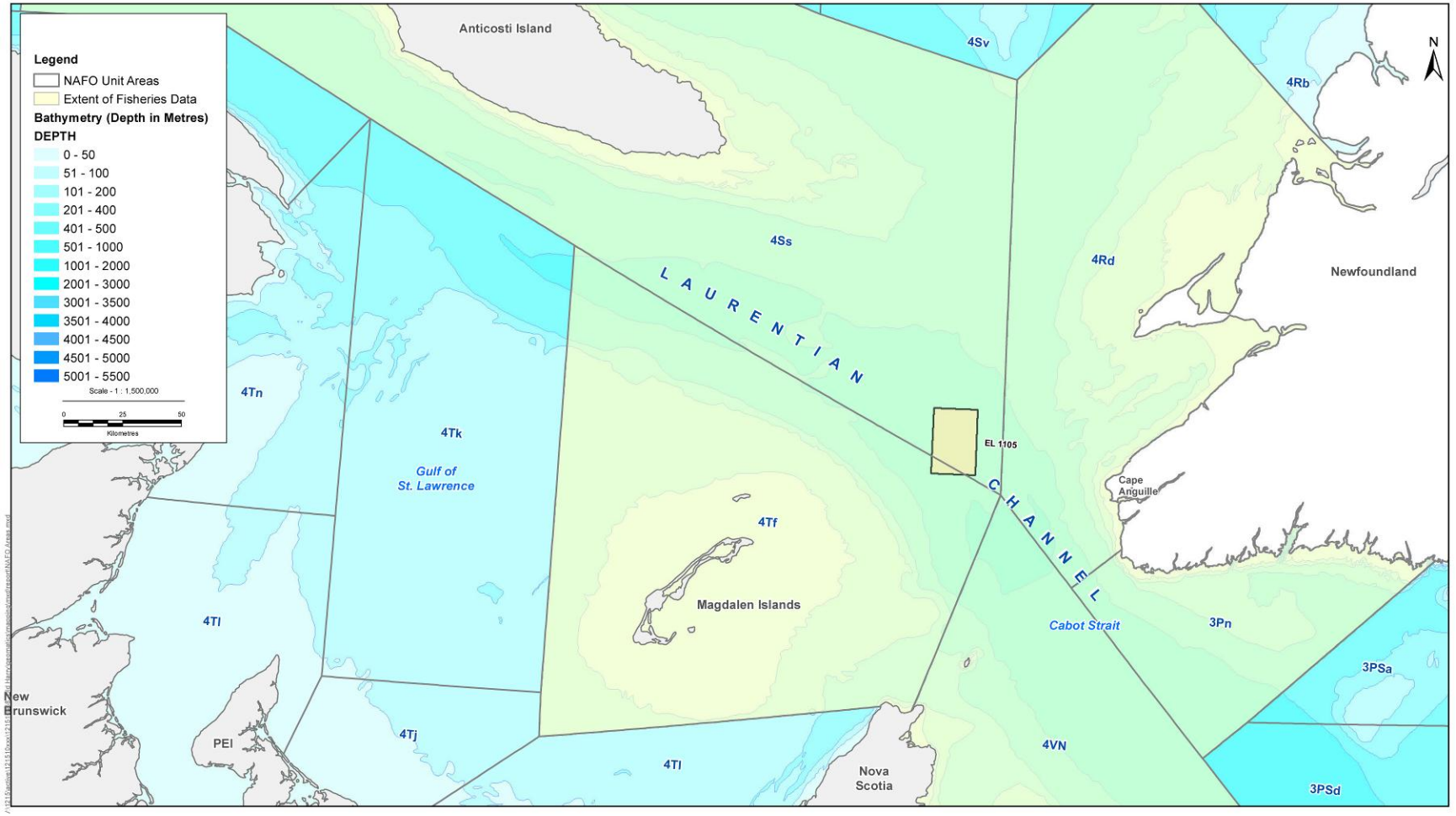


Figure 5.66 Northwest Atlantic Fisheries Organization Unit Areas

Table 5.15 Landed Value of Fisheries Harvest for Northwest Atlantic Fisheries Organization Unit Area 4Ss, 2004 to 2010

Species	2004		2005		2006		2007		2008		2009		2010	
	Weight (kg)	Landed Value ($)	Weight (kg)	Landed Value ($)	Weight (kg)	Landed Value ($)	Weight (kg)	Landed Value ($)	Weight (kg)	Landed Value ($)	Weight (kg)	Landed Value ($)	Weight (kg)	Landed Value ($)
Pelagic														
Herring	512	235	277	54	39	16	18	8	37	11	170	83	143	70
Eel					26	25								
Skate					218	55								
Spiny Dogfish	2	1	1	1										
Mackerel													250	85
Blue Shark													36	73
Groundfish														
American plaice	175	125	291	207	23	20	779	531	5,199	4,429	1,877	1,369	2,751	1,831
Atlantic halibut	23,159	137,672	19,608	110,776	10,381	60,403	36,665	210,653	27,462	155,859	28,011	155,699	9,696	56,800
Catfish	10	3	17	6									484	373
Cod	9,946	14,943	11,012	13,210	11,969	13,003	14,176	20,497	14,974	22,961	14,686	21,878	14,033	19,546
Greenland halibut	26,709	55,856	46,925	98,739	11,615	19,348	288,837	539,224	198,853	386,068	189,519	386,791	199,007	424,435
Witch Flounder					166	257	51	85					15	12
Monkfish	22	20	151	95	45	51	229	133	609	378	434	166	529	214
Redfish	15,843	10,484	53,267	44,173	49,696	40,923	19,498	17,036	4,787	3,167	10,782	7,915	45,805	30,778
White hake	163	89	189	104	163	60	179	119	114	72	457	256	613	361
Shellfish														
Lobster	68,067	993,501	94,160	1,378,438	93,650	1,206,846	109,479	1,524,675	133,555	1,520,234	140,760	1,343,132	166,188	1,509,274
Shrimp	11,449,450	14,419,491	11,016,469	14,808,063	9,246,339	2,546,569	4,031,118	5,615,584	7,017,315	7,890,467	4,912,372	5,042,714	4,557,661	4,937,273
Snow crab	153,032	975,918	172,253	569,625	146,095	325,702	184,869	703,294	190,841	742,805	205,591	628,900	167,773	510,815
Scallop	2,157	4,433												

Source: G. Bernard, pers. comm. 2011,

Table 5.16 Landed Value of Fisheries Harvest for Northwest Atlantic Fisheries Organization Unit Area 4Tf, 2004 to 2010

Species	2004		2005		2006		2007		2008		2009		2010	
	Weight (kg)	Landed Value ($)	Weight (kg)	Landed Value ($)	Weight (kg)	Landed Value ($)	Weight (kg)	Landed Value ($)	Weight (kg)	Landed Value ($)	Weight (kg)	Landed Value ($)	Weight (kg)	Landed Value ($)
Pelagic														
Mackerel	976,216	392,024	729,175	417,778	1,331,365	640,537	583,131	281,310	429,494	230,658	363,494	180,631	281,487	174,653
Herring	3,016,469	785,280	1,158,558	388,073	155,913	62,877	55,065	14,925	121,413	48,703	148,907	35,016	523,926	405,019
Eel	55	17	35	37	26	26	17	34	23	28				
Skate	654	654	1,626	353	1,435	743	943	482	1,119	607			541	154
Shortfin Mako							55	111	52	104				
Portbeagle							354	709	424	849	328	656		
Spiny Dogfish	8,315	4,687	45	61	101	94	6	6	16	20	3	3		
Blue Shark			37	37	32	29			24	27				
Mako Shark	170	169	160	320	100	200	544	533	23	23	249	249		
Groundfish														
American plaice	184,104	152,466	128,167	101,569	198,205	168,997	137,328	114,177	34,481	27,056	30,253	25,534	54,449	86,232
Atlantic halibut	33,546	209,101	41,847	269,631	27,644	182,074	28,764	191,115	50,855	360,403	67,831	474,168	40,554	333,564
Catfish	16	12	43	63	244	226	126	139	44	40			4	3
Haddock	728	706	1,419	2,564	1,256	2,291	1,435	1,969	1,208	1,657	176	306	24	44
Cod	737,334	921,980	1,150,657	1,220,984	1,308,453	1,572,404	476,005	627,128	680,364	905,947	74,134	92,877	15,697	26,852
Greenland halibut	21,739	46,240	42,517	61,642	53,089	80,207	21,073	35,246	16,069	27,916	36,685	69,592	10,516	21,882
Witch Flounder	228,747	262,561	365,383	340,009	429,025	511,741	310,232	366,395	276,076	297,806	140,472	92,878	14,356	16,592
Monkfish	180	136	3,901	1,929	1,297	647	975	506	2,710	1,922	5,658	2,259	1,054	319
Polluck	502	293	2,169	1,175	10,724	10,496	3,876	2,458	736	455	14	9	81	8
Redfish	99,575	73,525	522	269	1,270,577	341,799	66,335	55,507	275,615	240,161	369,205	251,250	169,844	108,677
Sculpins	163	5	786	150	108	46	675	255	215,964	189,039	3,369	600	2,745	275
Tomcod	109	42	100	57	8	2	83	88	72	70	109	100	18	18
White hake	19,655	13,654	17,913	12,331	11,086	7,402	6,088	4,359	17,826	11,391	18,964	15,513	4,202	2,368
Windowpane flounder	23,551	17,935	51,576	42,112	22,165	23,959	104,498	104,498	67,057	87,208	85,268	126,610	134,418	201,090
Winter flounder	151,942	103,889	174,070	153,681	160,959	164,417	121,699	139,663	111,928	140,313	153,970	205,967	242,556	340,078
Yellowtail	309,383	128,792	168,450	132,820	181,366	191,872	141,824	165,177	91,350	118,799	101,476	144,166	185,829	276,475
Shellfish														
Lobster	2,486,112	2,486,112	2,453,010	34,370,076	2,459,173	31,177,933	2,481,499	33,316,778	2,625,401	29,773,860	2,669,184	23,774,569	3,033,042	25,803,902
Snow crab	7,268,029	48,002,316	8,790,766	38,383,413	6,243,323	17,432,383	2,428,454	26,516,893	5,579,765	24,596,638	4,127,544	14,860,833	782,234	3,001,827
Rock crab	678,724	530,816	781,631	596,235	766,703	636,937	802,518	657,700	644,257	566,208	621,079	546,374	610,465	537,209
Toad crab			165,354	122,388	197,078	155,583	195,776	152,133	165,368	127,603	142,992	108,094	181,379	119,710
Atlantic razor clam	11,874	26,173	26,374	58,150	10,354	22,829	21,437	47,259	11,766	25,942	18,116	21,782	24,015	40,790
Scallop	139,843	253,444	239,516	474,963	148,396	399,520	385,827	10,402,011	314,464	621,925	485,541	948,566	371,061	737,753
Soft shell clam			87	228	407	958	506	521	988	2,124	521	1,816	889	3,112
Squid					320	46			6	13				
Stimpson's surf clam	21,283	16,423	8,159	8,111	8,873	7,165	16,713	12,896	7,576	5,846			7,529	5,797
Surf clam	95,878	68,575	140,014	140,925	126,653	123,419	156,567	165,493	174,307	188,088	288,805	305,460	258,495	213,819
Whelk	367,733	334,805	441,714	446,397	394,942	415,447	381,915	404,620	352,386	388,482	23,353	15,414	150,472	132,415

Source: B, Levesque, pers. comm. 2011

Table 5.17 Landed Value of Fisheries Harvest for Northwest Atlantic Fisheries Organization Unit Area 4Rd, 2004 to 2010

Species	2004		2005		2006		2007		2008		2009		2010	
	Weight (kg)	Landed Value ($)	Weight (kg)	Landed Value ($)	Weight (kg)	Landed Value ($)	Weight (kg)	Landed Value ($)	Weight (kg)	Landed Value ($)	Weight (kg)	Landed Value ($)	Weight (kg)	Landed Value ($)
Pelagic														
Mackerel	9,533,066	9,802,555	7,012,557	7,228,536	7,110,085	7,162,036	7,935,416	8,071,914	4,423,152	4,433,815	13,817,259	13,703,505	3,852,313	3,885,715
Herring	7,565,099	7,535,150	7,646,778	7,666,599	7,537,987	7,527,922	374,913	358,480	11,058,093	10,955,138	4,134,037	4,159,051	8,508,237	8,518,377
Eel	13,800	13,800	15,288	15,288	10,406	10,406	14,825	14,825	5,531	5,531	9,790	9,790	4,975	4,975
Skate	11,209	5,627	6,202	2,171	9,607	4,875	12,074	5,003	10,169	4,465	6,918	4,369	28	8
Shortfin Mako											9	9		
Portbeagle											464	368		
Mako Shark	2,406	1,545	1,383	901	1,713	1,152	202	123	164	112	626	425		
Capelin	60,958	60,793	345,640	346,167	755,673	773,910	72,999	72,999	4,083,326	3,920,263	531,430	523,966	171,513	171,813
Groundfish														
American plaice	62,253	55,209	103,916	90,893	52,670	42,272	72,655	63,825	41,743	35,337	77,207	72,882	53,224	50,830
Atlantic halibut	35,197	27,501	52,142	58,899	39,397	31,533	22,828	68,687	32,233	87,973	22,472	34,903	30,141	24,212
Atlantic wolffish	5,909	4,917	6,894	5,871	3,387	2,129	4,536	3,137	4,319	2,914	7,783	6,263		
Catfish			223	82			17	3						
Haddock	2,831	1,988	9	2	20	11	3	2	20	8	17	10	24	9
Cod	347,362	300,006	764,692	701,328	1,166,051	1,114,206	556,121	455,169	828,966	806,554	593,498	497,897	221,510	180,402
Cusk	34	29	12	0	9	7			5	0	14	0	36	18
Greenland halibut	2,511	1,250	5,435	4,513	2,974	3,126	1,750	935	2,217	1,753	1,951	1,335	355	731
Lumpfish	26,320	26,320	21,291	21,073	29,998	29,998	1,273	1,273	179	179				
Witch Flounder	406,796	376,214	475,390	486,300	412,128	435,122	427,218	408,348	300,847	285,585	244,097	235,960	109,264	102,649
Monkfish	778	712	1,243	704	333	196	87	77	32	12	416	341	754	513
Polluck	221	171	60	31	17,407	14,360	140	112	818	670	2,326	1,769	193	90
Redfish	205,964	165,733	381,018	361,001	98,145	95,147	1,780	1,183	54,299	50,663	90,358	88,857	135,105	115,414
White hake	12,551	9,360	8,089	5,746	3,729	2,513	5,635	3,586	7,508	3,962	2,415	1,743	3,049	2,152
Winter flounder	49	45	214	214	265	262	157	143	2,619	2,404	39	39		
Shellfish														
Lobster	263,479	236,479	347,720	347,720	351,275	351,275	333,039	333,039	403,391	403,391	343,450	343,450	321,106	321,106
Snow crab	337,842	335,555	84,652	84,521	44,796	44,847	24,126	24,022	58,691	58,338	110,557	109,144	51,563	50,749
Rock crab	238	238												
Atlantic razor clam														
Scallop	12,289	1,481	1,118	135			301	36	6,777	816				
Squid	29	0												

Source A.M. Russell, pers. comm. 2011

Table 5.18 Landed Value of Fisheries Harvest for Northwest Atlantic Fisheries Organization Unit Area 4Vn, 2004 to 2010

Species	2004		2005		2006		2007		2008		2009		2010	
	Weight (kg)	Landed Value ($)	Weight (kg)	Landed Value ($)	Weight (kg)	Landed Value ($)	Weight (kg)	Landed Value ($)	Weight (kg)	Landed Value ($)	Weight (kg)	Landed Value ($)	Weight (kg)	Landed Value ($)
Pelagic														
Mackerel	10,372	4,667	125,206	77,874	221,537	177,536	367,032	164,066	110,548	90,415	51,364	37,937	6,248	0
Herring	1,483,885	328,357	650,785	267,685	218,498	86,671	72,238	24,310	201,720	39,501	4,719	2,478	1,037	0
Eel											10,571	44,935		
Elvers											45	0		
Skate			92	42	0	0	1,942	676						
Shortfin Mako														
Portbeagle	938	1,276	349	445	682	567	1,219	1,050			414	0	184	0
Spiny Dogfish			7,329	3,223							1	0		
Blue Shark	46	61	74	119	37	61	36	59						
Mako Shark	173	184	42	47	242	369					256	0	283	0
Alewives / Gaspereau					3,346	735	13,580	6,644	17,890	944	11,164	898	4,848	0
Argentine					4	0								
Smelts							41	45						
Swordfish	162	1,375							100	637			147	0
Bluefin Tuna			737	12,636	4,471	87,672	2,149	35,768	1,994	40,569			626	9,868
Capelin														
Groundfish														
American plaice	10,880	17,925	16,355	18,928	22,302	36,041	15,279	22,770	6,448	9,675	3,194	3,166	1,381	450
Atlantic halibut	37,660	325,611	43,684	384,443	40,996	381,954	45,600	455,471	55,314	524,952	78,881	811,175	66,906	127,895
Atlantic Wolfish			0	0					176	74	35	12	90	0
Catfish	485	216	181	79	94	38	87	39						
Haddock	824	866	1,263	1,580	4,105	6,211	179	245	302	468	507	832	308	26
Cod	240,086	426,627	242,889	505,969	231,590	487,485	169,983	341,985	129,088	241,867	34,693	65,873	24,200	51,698
Cusk	82	51	56	49	103	89	16	14	11	11	23	20	496	0
Greenland halibut	240,168	426,678	242,945	506,018	231,693	487,574	169,999	341,999	129,099	241,878	34,716	65,893	24,696	51,698
Lumpfish														
Hagfish (Slime Eel)					1,014	1,003	590	584	1,165	1,153			1,451	0
Witch Flounder	235,798	235,923	313,678	411,164	262,872	161,497	284,453	236,571	190,182	138,628	74,427	61,616	108,548	0
Monkfish	912	1,119	2,691	4,110	2,303	2,233	2,795	3,090	1,069	1,640	931	1,337	938	1,294
Polluck	221	90	141	77	37	33	100	89	47	34	2,096	1,850	279	0
Redfish	950,756	566,500	612,383	368,187	545,169	319,418	523,611	374,741	609,093	422,261	866,758	566,676	648,675	326,235
Scuplins					14	6								
Tomcod														
White hake	60,118	26,149	53,687	43,696	75,382	67,783	40,402	35,659	27,072	27,180	26,989	28,674	24,039	28,005
Silver Hake					8	6								
Windowpane flounder														
Winter flounder														
Yellowtail														
Shellfish														
Lobster	1,760,065	22,918,017	1,938,030	26,838,518	1,861,542	23,922,207	1,914,371	25,237,346	2,732,636	29,439,474	2,138,212	19,491,984	2,430,430	21,855,904
Snow crab	1,893,730	12,525,138	868,673	3,659,076	665,885	1,870,679	342,448	1,555,360	426,103	1,921,460	786,402	2,703,414	856,854	3,380,480
Rock crab	282,790	200,113	232,416	171,169	245,966	205,547	200,759	209,004	164,224	127,634	174,404	124,510	166,900	5,755
Toad crab	14,341	9,466	9,667	5,601	2,802	1,849	12,768	7,023						
Jonah crab	946	1,250			1,229	27	182	4	375	1	269	1	634	3
Stone crab	8	8												
Propellor crab					1,738	192								
Cockles					737	0								
American Oysters	18,981	27,914	28,291	23,764	14,187	11,915	3,254	2,735	640	544			1,661	0
Atlantic razor clam														
Scallop	35,305	61,297	18,595	25,395	26,435	35,633	33,832	45,533	42,553	61,023	34,734	58,720	46,297	1,182
Soft shell clam			58	256									2,044	3,591
Squid														
Sea Urchin	61,719	180,345	63,653	160,847	63,056	128,500	64,150	128,835	56,852	127,885	82,647	256,290	85,264	6,585
Shrimp	2,044,848	3,145,858	1,141,667	1,306,012	613,705	566,931	89,372	83,661	220,785	236,313	10,665	10,337	132,744	140,227
Stimpson's surf clam					27,143	4,872								
Surf clam														
Whelk									10	10				

Source: J. Walcott, pers. comm. 2011.

Table 5.19 Landed Value of Fisheries Harvest for Northwest Atlantic Fisheries Organization Unit Area 3Pn, 2004 to 2010

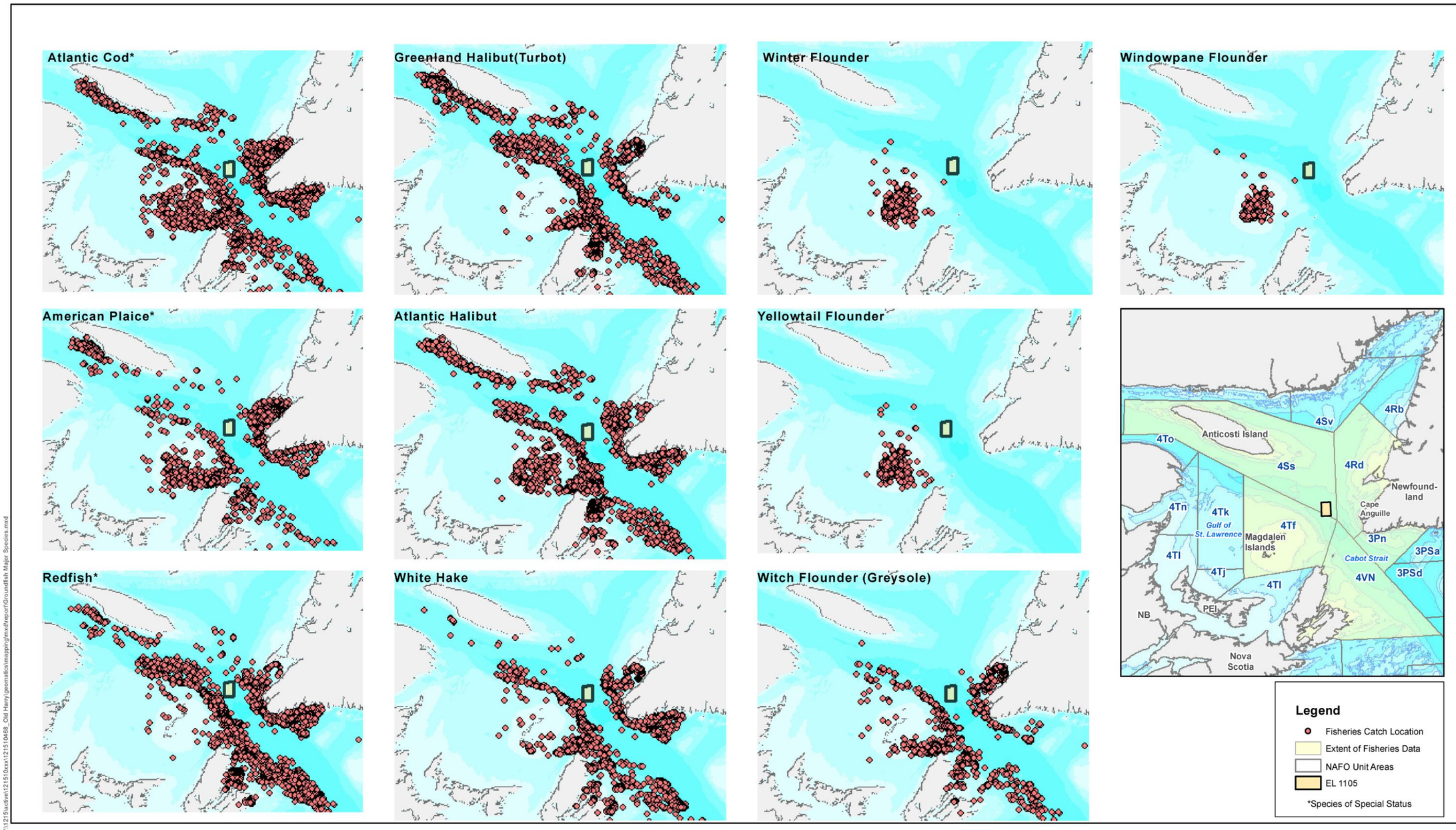
Species	2004		2005		2006		2007		2008		2009		2010	
	Weight (kg)	Landed Value ($)	Weight (kg)	Landed Value ($)	Weight (kg)	Landed Value ($)	Weight (kg)	Landed Value ($)	Weight (kg)	Landed Value ($)	Weight (kg)	Landed Value ($)	Weight (kg)	Landed Value ($)
Pelagic														
Mackerel	29,499	29,499	81,688	81,688	76,863	76,863	51,581	51,581	5,928	5,928	5,024,020	4,935,831	4,222,271	4,286,451
Herring	42,582	42,582	100,834	100,834	90,399	90,399	82,491	82,491	8,594	8,594	79,030	80,089	9,371	9,371
Eel	6,294	6,294	3,207	3,207	2,985	2,985	2,569	2,569	2,462	2,462			1,251	1,251
Skate	11,018	6,016	8,561	4,798	6,824	4,576	9,927	6,598	10,034	7,227	7,610	3,929	5,644	2,806
Shortfin Mako			10	10	9	9	15	15	19	19	6	6	67	65
Portbeagle			28	28	105	70					237	181	491	425
Mako Shark	671	465	1,413	991	527	365	1,355	914	1,406	994	1,454	989	797	528
Groundfish														
American plaice	8,908	8,713	11,254	10,901	9,285	9,005	10,455	10,294	10,014	9,845	11,472	11,177	6,307	6,190
Atlantic halibut	28,959	22,772	22,007	17,312	17,280	13,614	29,600	23,135	42,944	33,752	61,204	48,673	46,277	36,082
Atlantic wolffish	9,437	8,657	19,038	9,065	4,710	4,242	5,312	4,811	8,983	8,265	13,655	12,701		
Catfish	3	3												
Haddock	11	10	3	2			2	1	107	90	64	39	83	68
Cod	778,662	645,324	849,090	707,271	1,208,134	1,000,530	1,080,830	899,013	1,130,827	941,797	1,356,757	1,124,237	703,822	584,728
Cusk	383	283	69	57	87	30	83	61	299	220	123	84		
Greenland halibut	705	701	1,128	1,112	1,487	1,428	1,173	1,120	953	893	1,235	1,202	378	368
Lumpfish	89,075	89,075	56,001	56,001	59,361	59,361	4,403	4,403	197	197				
Witch Flounder	7	10	3	3			1	0	6	0	1	0	31	3
Monkfish	142	109	223	104	91	38	54	39	272	228	43	36	173	83
Polluck	5,717	5,088	1,795	1,488	1,648	1,226	2,546	2,093	2,776	2,331	6,015	4,734	2,104	1,602
Redfish	182,029	179,403	51,812	54,544	165,881	158,284	19,230	21,540	50,572	55,045	22,905	21,617	55,642	55,934
White hake	74,874	61,859	44,887	37,216	15,864	13,104	36,004	30,014	46,658	38,586	27,320	22,538	20,920	36,082
Winter flounder	1	1	7	6	121	110			36	33	3	3		
Yellowtail			51	51	19	17							16	16
Shellfish														
Lobster	12,932	12,932	28,808	28,808	47,954	47,954	93,954	93,954	153,264	153,264	127,342	127,342	13,844	138,438
Snow crab	1,461	1,461	520	520	2,066	2,066	2,987	2,987	1,325	1,325	649	703	1,039	957
Squid	5	0												

Source: A.M. Russell, pers. comm. 2011.

During this time period, the majority of the harvest for NAFO Unit Areas 4Ss and 4Tf was landed in the Quebec region, for 4Rd and 3Pn it was landed in Newfoundland and for 4Vn it was landed in Nova Scotia. During this time period, no fish catch data were landed in the Gulf region for NAFO Unit Areas 4Rd and 3Pn. For the entire NAFO Unit Area 4Ss, the landings were dominated: by shrimp, lobster, snow crab and Greenland halibut in 2004, 2005, 2006, 2007, 2008 and 2009; and by shrimp, snow crab, lobster, Greenland halibut and redfish in 2010. For the entire NAFO Unit Area 4Tf, the landings were dominated: by snow crab, lobster and herring in 2004 and 2005; by snow crab, lobster and mackerel in 2006; by lobster, snow crab and rock crab in 2007, 2009 and 2010; and by lobster, snow crab and cod in 2008. For the entire NAFO Unit Area 4Rd, the landings were dominated: by mackerel, herring and witch flounder in 2004; by mackerel, herring and cod in 2005, 2006 and 2009; by mackerel, witch flounder and cod in 2007; by herring, mackerel and capelin in 2008; and by herring, mackerel and lobster in 2010. For the entire NAFO Unit Area 4Vn, the landings were dominated: by redfish, lobster, snow crab and rock crab in all years between 2004 to 2010 and in addition by herring, cod, Greenland halibut, witch flounder and shrimp in 2004; by mackerel, herring, cod, Greenland halibut, witch flounder and shrimp in 2005, 2006 and 2008; by mackerel, cod, Greenland halibut and witch flounder 2007; and by witch flounder and shrimp in 2010. For the entire NAFO Unit Area 3Pn, the landings were dominated: by cod, redfish and lumpfish in 2004; by cod, herring and mackerel in 2005; by cod, redfish and herring in 2006; by cod, lobster and herring in 2007; by cod, lobster and redfish in 2008; by mackerel, cod and lobster in 2009; and by mackerel, cod and redfish in 2010. All catch data reported have been fished between April and December of each year.

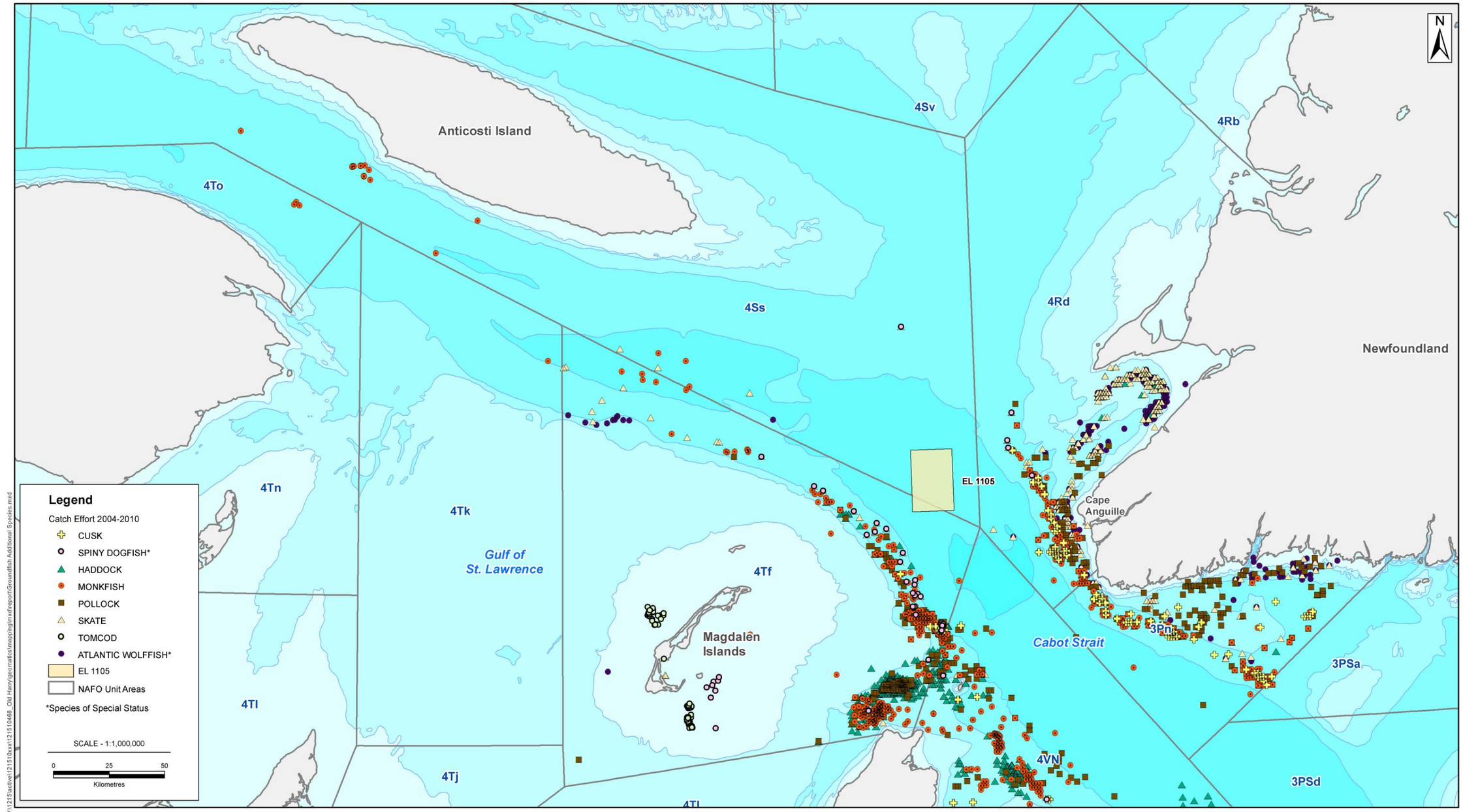
The fishing effort in NAFO Divisions 4Ss, 4Tf, 4Rd, 4Vn and 3Pn (*i.e.*, divisions surrounding EL 1105) are presented in Figures 5.67 to 5.70 by species, geo-referenced by latitude and longitude. Note that not all of the catch data summarized in Tables 5.15 to 5.19 included harvest location coordinates and as such, the commercial fishery figures may not illustrate the same information as portrayed in the tables. Fisheries species of special status in the Gulf are also indicated in Figures 5.67 to 5.70, if applicable.

As is evident in Figures 5.67 to 5.70, there is minimal fishing effort within and surrounding the Project. No harvesting locations were recorded within EL 1105. The closest harvest location to the Project is located just approximately 10 km to the southwest of EL 1105, and was recorded for redfish. Between 10 and 12 km from the EL 1105, a couple of harvest locations were recorded for redfish and one for each cod and white hake. However, in general, the fishing effort can be summarized in the immediate vicinity of the Project as low.



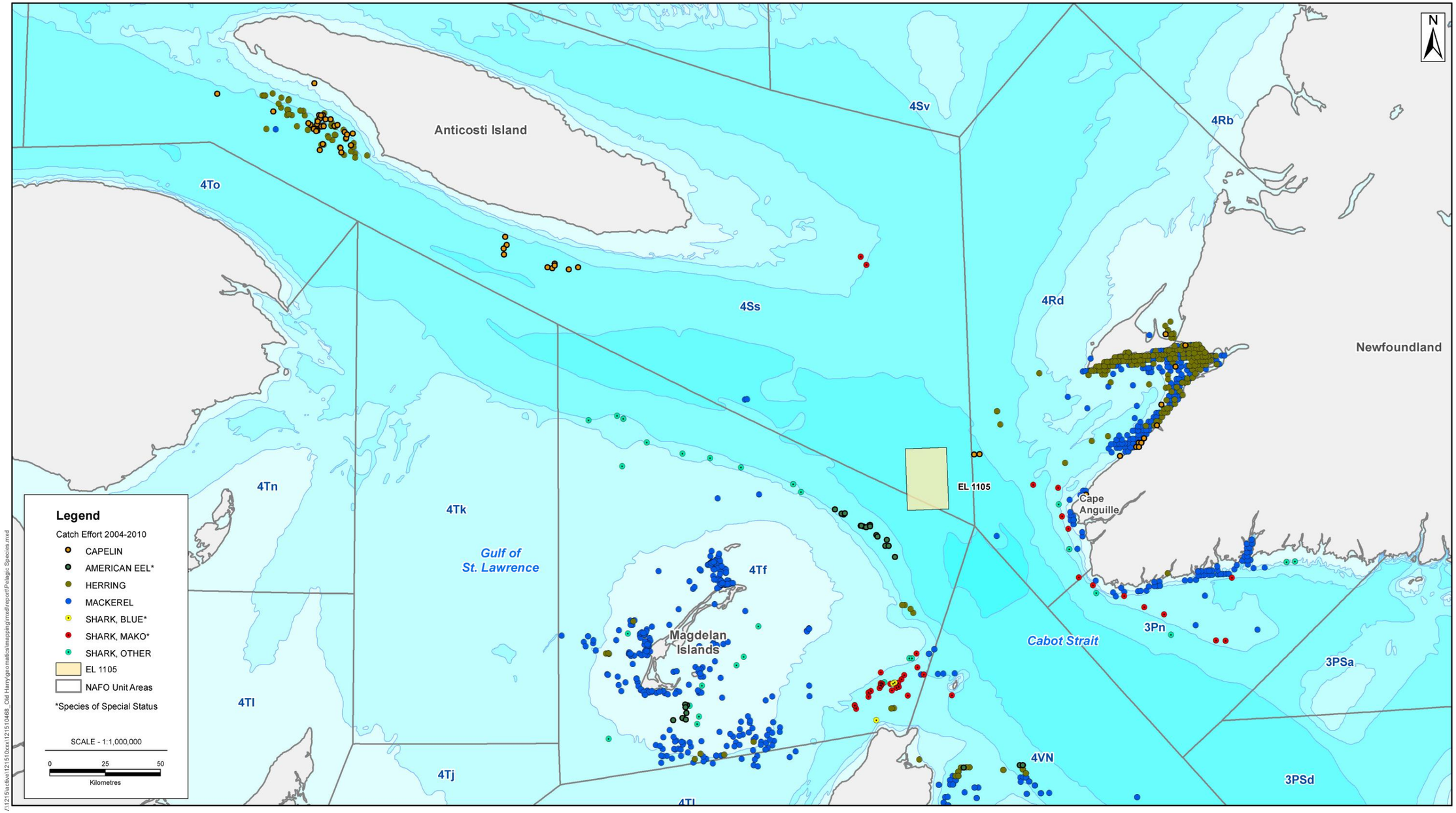
Source: G. Bernard, pers. comm. 2011, L. Legere, pers. comm. 2011, B, Levesque, pers. comm. 2011, A.M. Russell, pers. comm. 2011, and J. Walcott, pers. comm. 2011.

Figure 5.67 Groundfish Fisheries Effort for Major Species, 2004 to 2010



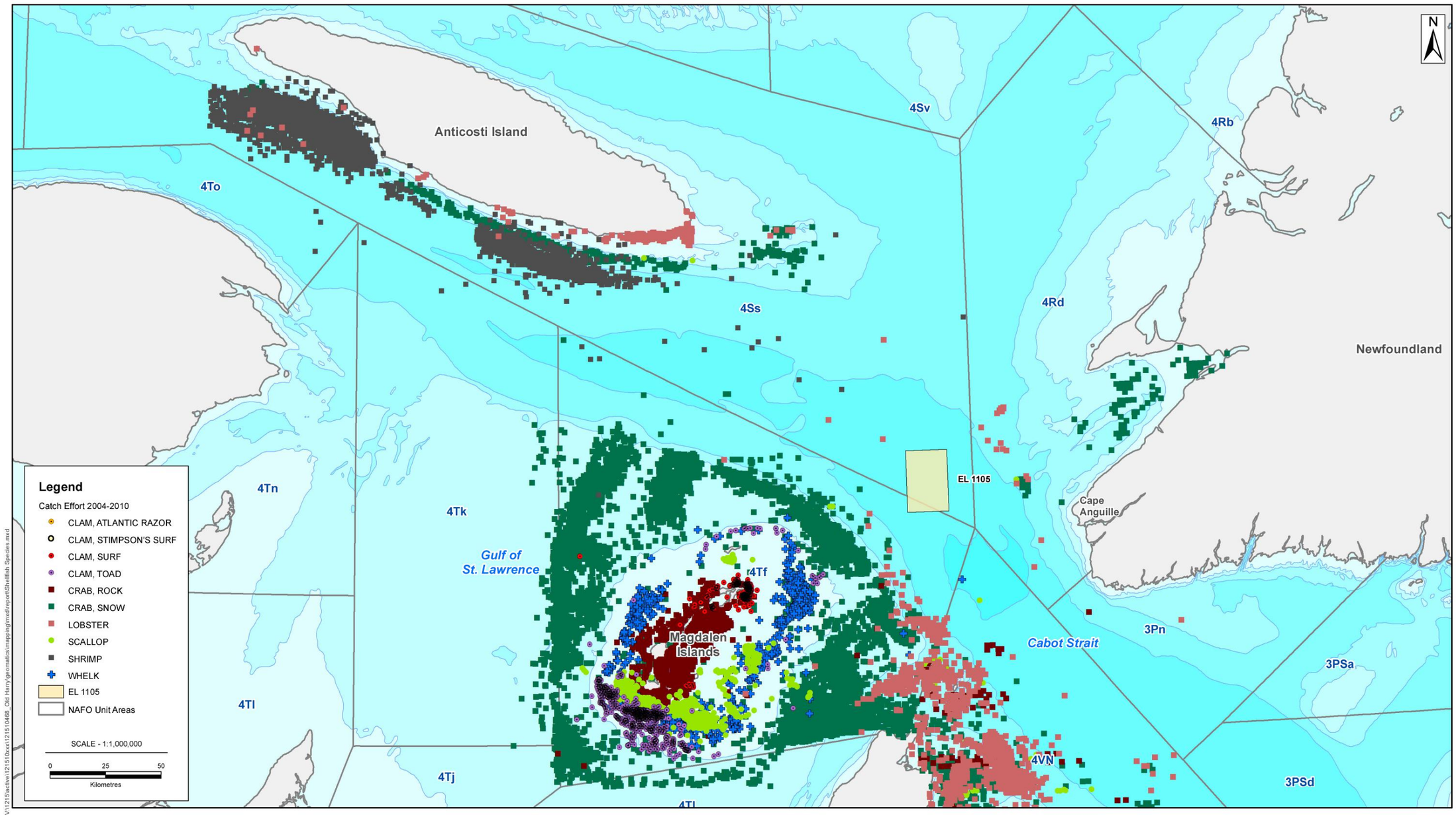
Source: G. Bernard, pers. comm. 2011, L. Legere, pers. comm. 2011, B, Levesque, pers. comm. 2011, A.M. Russell, pers. comm. 2011, and J. Walcott, pers. comm. 2011.

Figure 5.68 Groundfish Fisheries Effort for Additional Species, 2004 to 2010



Source: G. Bernard, pers. comm. 2011, L. Legere, pers. comm. 2011, B, Levesque, pers. comm. 2011, A.M. Russell, pers. comm. 2011, and J. Walcott, pers. comm. 2011.

Figure 5.69 Pelagic Fisheries Effort, 2004 to 2010



Source: G. Bernard, pers. comm. 2011, L. Legere, pers. comm. 2011, B, Levesque, pers. comm. 2011, A.M. Russell, pers. comm. 2011, and J. Walcott, pers. comm. 2011.

Figure 5.70 Shellfish Fisheries Effort, 2004 to 2010

5.8.1.2 Principal Commercial Fish and Shellfish Species

On the basis of the landed weight data collected and analyzed for the years 2004 to 2011 for NAFO Unit Areas 4Ss, 4Tf, 4Rd and 3Pn (Tables 5.19 to 5.23), the main fish and shellfish species commercially fished in the vicinity of EL 1105, (*i.e.*, those that reported the highest landed weights) included mackerel, herring, cod, deepwater redfish, witch flounder, Greenland halibut, lobster, shrimp, snow crab and rock crab. There are currently only three enterprises of approximately 60 license holders participating in the redfish fishery. There are no authorized redfish fisheries in NAFO Unit area 4Ss, and Variation Order 2010-056 results in closures of the redfish fishery from June 15 to December 31, 2010, for a range of vessel types in NAFO Unit Areas 4To, 4Tn, 4Tk (Theriault 2010, L. Légère pers. comm. 2010); the closure boundaries have the potential to stretch into a portion of 4Tf. The snow crab fishing season in area 12F starts in April / May and continues into early summer (DFO 2010g).

Species descriptions for the majority of the fish and shellfish species listed above are provided in Section 5.4 of this EA Report and in Sections 3.41 and 3.4.2 of the 2005 Western Newfoundland SEA (LGL 2005b).

5.8.1.3 Historical Fisheries

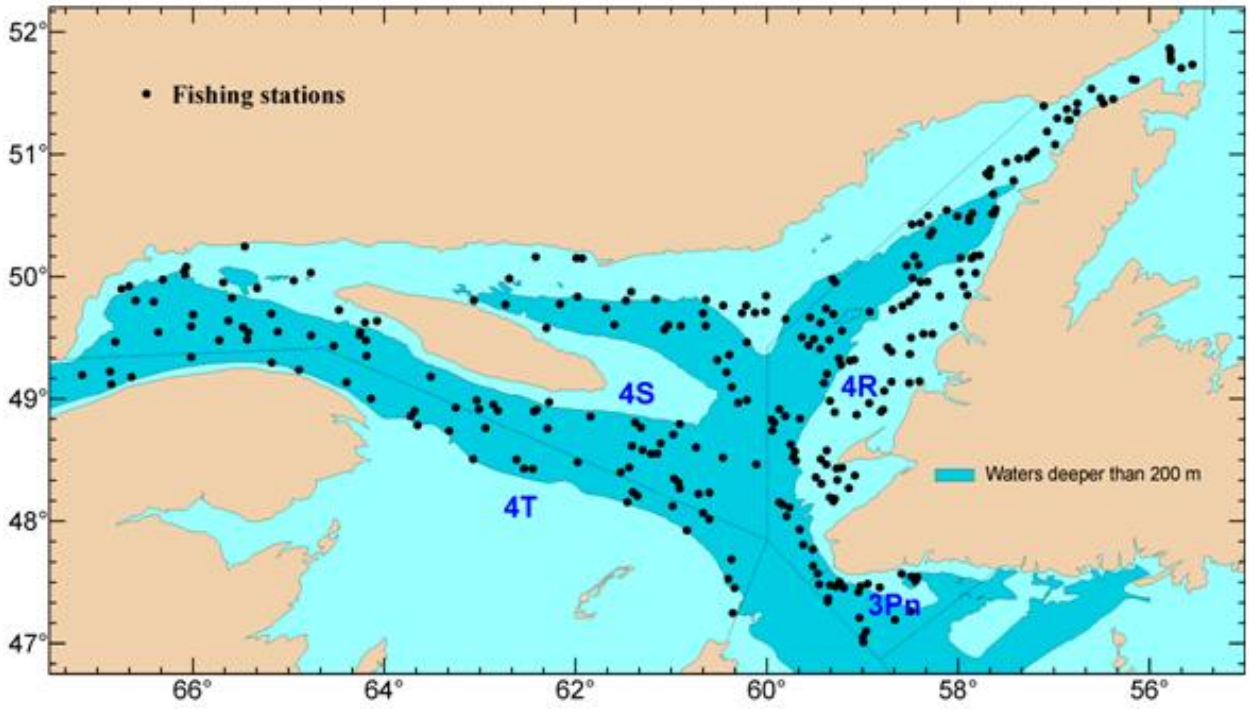
Although the fishing effort for the Atlantic cod in the vicinity of the Project is low (refer to Figure 5.67), this species has been over-exploited in offshore western Newfoundland waters in the past. The commercial cod fishery began in the 1600s or earlier. According to DFO, cod landings in Newfoundland between the 1600s and the 1800s ranged from 100,000 to 400,000 t annually. In the 1950 to 1970s, cod landings averaged 900,000 t and peaked at 2,000,000 t. In the early 1970s, all cod stocks in the Northwest Atlantic were placed under a quota regulation (DFO 2010o). In the late 1980s to early 1990s, landings of cod started to decline significantly and in 1993 a moratorium on the cod fishery was imposed. The southern Gulf cod fishery was closed from September of 1993 to May of 1998, when it re-opened with a total allowable catch (TAC) of 3,000 t. The TAC was increased to 6,000 t in 1999 to 2002. In 2003, the cod fishery closed again and re-opened in 2004 with TAC of 3,000 TAC. In 2005 and 2006, the TAC was 4,000 t, and in 2007, 2008 and 2009 it was at 2,000 t (Swain *et al.* 2009; DFO 2009r).

During the time period of 1960 to 1994, the commercial fishery of white hake was historically considered the third or fourth most important groundfish fishery in the southern Gulf. During this time, landing values averaged 5,675 t (DFO 2005c). However, a moratorium on the directed fishery for white hake in NAFO Unit Area 4T was established in 1995 due to a substantial decline in landing values (DFO 2005c). The only landings of white hake from this Unit Area are a result of by-catches. As of 2012, the moratorium on white hake is still in force (DFO 2010p).

Historical fisheries offshore western Newfoundland and in the Gulf have been described in further detail in in Section 3.4.4.2 of the 2005 Western Newfoundland SEA (LGL 2005b) and Section 3.3.2.1 of the 2007 Western Newfoundland SEA Amendment (LGL 2007).

5.8.1.4 Sentinel Fisheries

The mobile gear Sentinel Fisheries Program (St. Lawrence Global Observatory 2010) follows a depth-stratified random survey plan. The northern Gulf is divided into depth strata because depth is known to have an influence on the distribution of fish and invertebrate species. The mobile survey generally consists of 300 stations randomly selected within those strata with all strata sampled, because results from this survey are used for multiple species with different depth preferences (Figure 5.71).



Source: SLGO 2010

Figure 5.71 Distribution of Stratified Random Tows Performed during the July 2010 Survey

Nine trawlers, five from Newfoundland and Labrador and four from Quebec, conduct the survey. At each pre-determined station, the vessel performs a standard 30 minutes tow at 2.5 knots. The boats participating in the survey use a 300 star balloon trawl mounted on a rock hopper footgear. The trawl mesh size is 145 mm, with a liner of 40 mm in the codend.

The 16th annual July sentinel survey was conducted in the northern Gulf between June 30 and July 19, 2010. A total of 280 fishing stations were successfully carried out (Figure 5.71), including 21 stations in 3Pn, 129 in 4R (including 10 tows in the 10 to 20 fathoms strata), 100 in 4S and 30 in 4T; this represented 93 percent of the sampling target.

Data collected per set of information included length, weight, sex and maturity for a certain number of fish for each species. In addition, samples of otoliths, liver, gonads and stomach may also be collected. Fish samples are also collected and frozen for diverse studies. Finally, water temperature and fishing depth data are collected using a Vemco sensor installed on the trawl.

Cod, redfish, Greenland halibut (turbot) and Atlantic halibut catches for the 280 successful tows of the 2010 July survey are presented in Table 5.20. In 2010, American plaice, thorny skate and shorthorn sculpin were the other main fish caught.

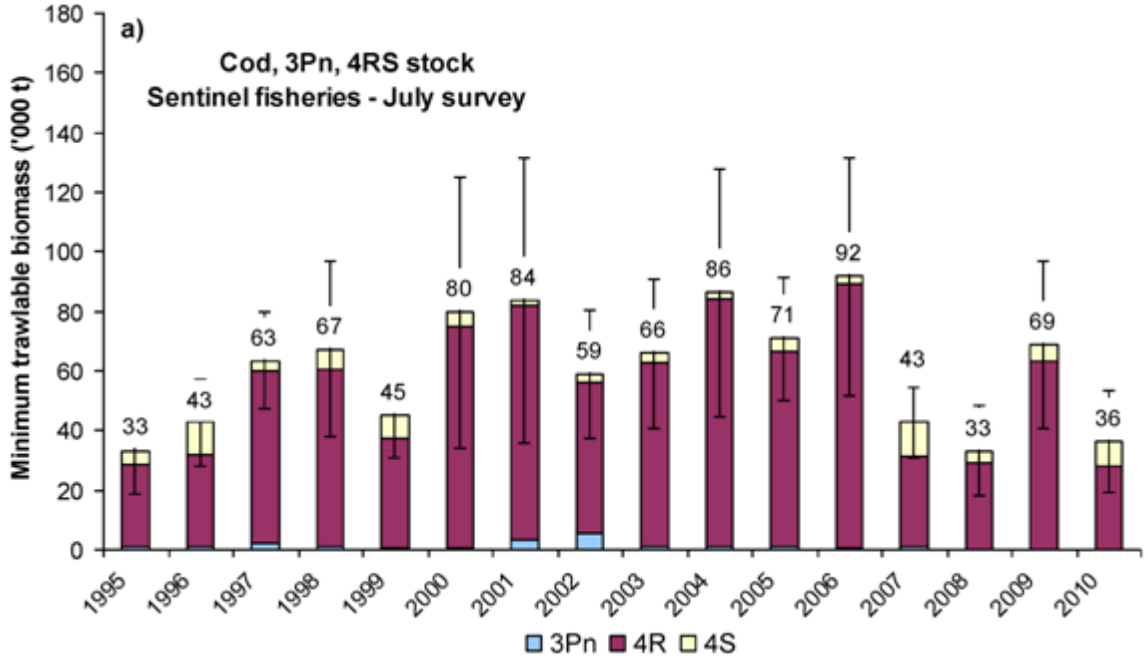
Table 5.20 Cod, Redfish, Greenland Halibut and Atlantic Halibut Catches for the July 1995 to 2010 Surveys (3Pn, 4RST)

Year	Sets Survey	Survey Catches (kg)				Sets Total	Total Catches (kg)				
		Cod	Redfish	Turbot	Halibut		Cod	Redfish	Turbot	Halibut	Other
1995	311	6,477	11,457	649	84	326	6,598	11,662	675	84	4,716
1996	272	7,254	16,921	1,300	114	332	12,108	27,169	1,502	150	8,593
1997	285	8,642	12,358	1,206	27	313	11,271	13,582	1,397	80	5,848
1998	289	7,719	16,154	1,472	17	320	12,196	36,231	1,668	113	7,198
1999	294	5,487	12,623	1,703	42	335	19,396	17,177	2,079	129	4,031
2000	291	7,893	7,574	1,583	97	324	16,963	10,486	1,932	126	5,454
2001	275	10,238	7,603	1,342	120	317	16,476	14,421	1,814	208	4,194
2002	261	7,729	8,101	1,486	113	293	18,551	8,849	3,090	160	4,155
2003	296	13,741	6,400	1,693	44	326	14,040	6,616	3,512	72	3,590
2004	280	14,072	8,245	2,015	216	317	15,655	13,295	2,567	271	6,670
2005	285	9,662	6,785	2,977	226	303	10,023	7,802	3,649	402	8,652
2006	295	13,174	5,106	2,748	335	325	15,332	5,963	3,624	577	6,647
2007[A]	291	6,431	6,797	2,976	382	297	6,435	6,836	2,977	399	3,905
2008[A]	289	9,931	4,310	2,594	456	293	9,931	4,341	2,604	456	2,743
2009[A]	282	8,939	3,605	1,701	521	285	8,940	3,605	1,716	521	3,921
2010[A]	280	7,137	4,059	1,935	395	284	7,137	4,059	1,965	395	2,689

Source: SLGO 2010
A No discretionary tows.

Cod

The July sentinel survey series for water deeper than 20 fathoms (1 fathom = 1.8 m) (1995 to 2009) suggests an increase in the minimum trawlable biomass for cod between 1995 and 2001, followed by stable period up to 2006 (Figure 5.72). Substantial decreases were observed in 2007 and 2008, followed by an increase in 2009. The estimate of 36,478 t in 2010 is a marked decrease, bringing the index level close to the lowest values observed in the series (33,000 t in 1995 and 2008).



Source: SLGO 2010

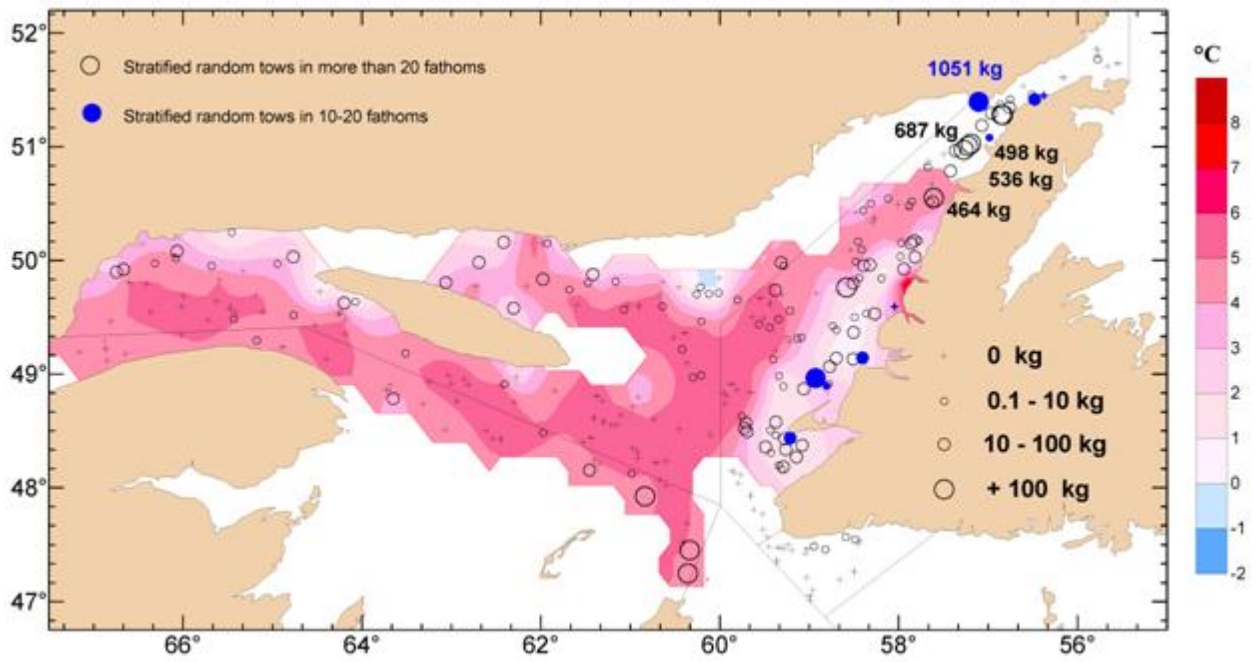
Figure 5.72 Minimum Trawlable Biomass Index for Cod (July sentinel mobile survey in Subdivision 3Pn and Divisions 4RS (1995 to 2010))

Three inshore strata with depths ranging from 10 to 20 fathoms were added in 2003 for 4R. These strata were added to examine cod outside the zone previously sampled by trawlers in the July mobile gear sentinel survey. Ten tows were done in these strata by four trawlers during the July 2010 survey. The cod catches varied between 0 and 1,051 kg for a 30-minute standard tow. Six of the ten tows reached the 30-minute duration, while the other four lasted less than 30 minutes because of bad bottom (trawl hooked at the bottom). The global biomass index (including the 10 to 20 fathoms strata) is 45,323 t for 2010; this value is the lowest observed since sampling began in 2003.

The catch distribution shows that cod is located primarily in 4R along the west coast of Newfoundland (Figure 5.72). In 2010, the cod concentration remains low in 4S and 3Pn. Of the 280 tows performed as part of this survey in 2010, five had catches of cod of more than 400 kg and they were all located in 4R. Only one large catch occurred in the 10- to 20-fathom strata. The largest catches for 4S and 3Pn were 61 and 3 kg, respectively.

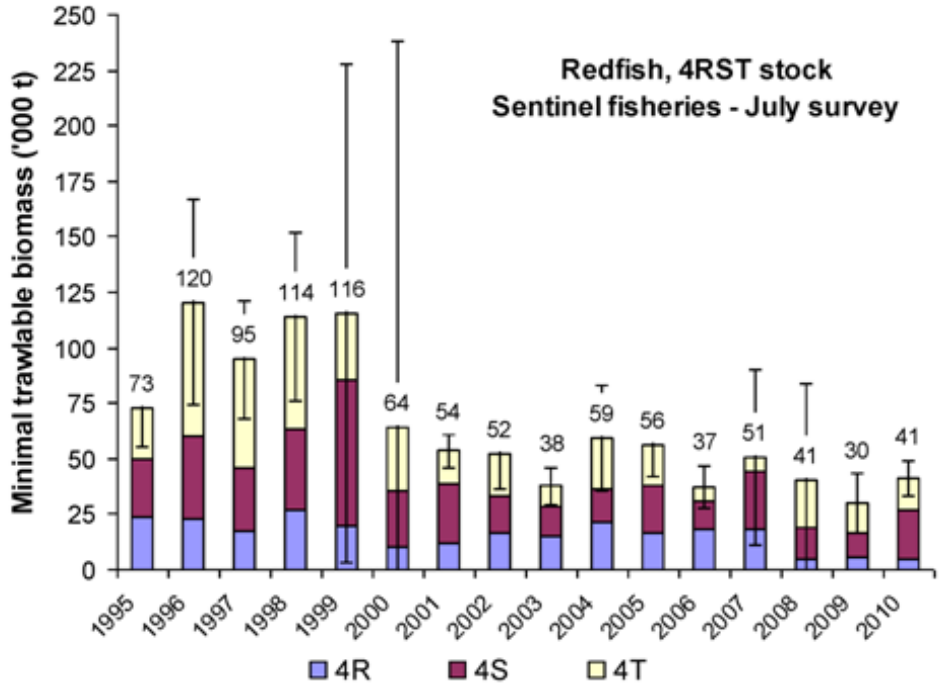
Redfish

For Unit 1 redfish stock (4RST Divisions), the July sentinel survey series (1995 to 2010) shows a higher minimum trawlable biomass between 1996 and 1999, followed by decrease biomass from 2000 until 2009 (Figure 5.74). In 2010, the minimum trawlable biomass estimate increased (primarily in 4S) to 41,283 t but remains among the lowest values of the series.



Source: SLGO 2010
Note: Catches greater than 400 kg are noted on map.

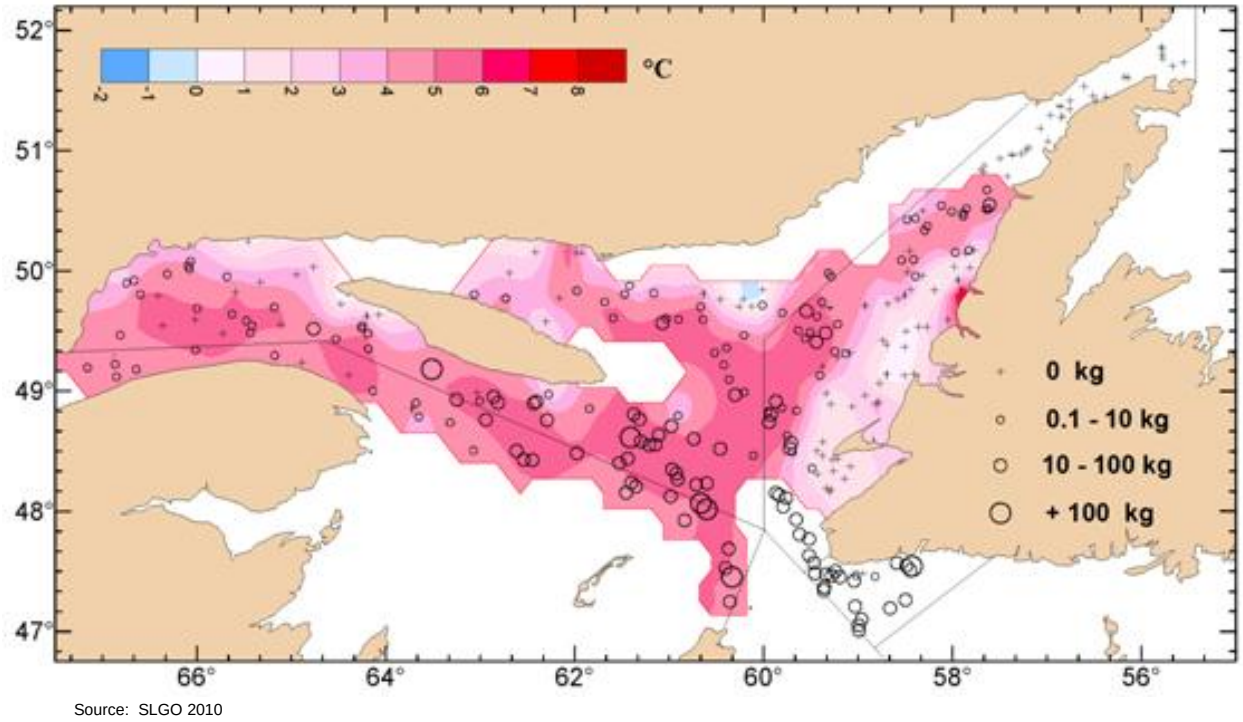
Figure 5.73 Bottom Temperature and Observed Catch Rate (kg/standard tow) Distribution of Cod for the July 2010 Stratified Random Survey in 3Pn and 4RST



Source: SLGO 2010

Figure 5.74 Minimum Trawlable Biomass Index for Redfish in 4RST Based on the July Stratified Random Survey (1995 to 2010)

Redfish were concentrated for the most part in the channels of the northern region of the Gulf (Figure 5.75). In July 2010, some concentrations of redfish were found in 3Pn. This area is not part of the redfish stock of Unit 1 management (4RST) between the months of June to December.



Source: SLGO 2010

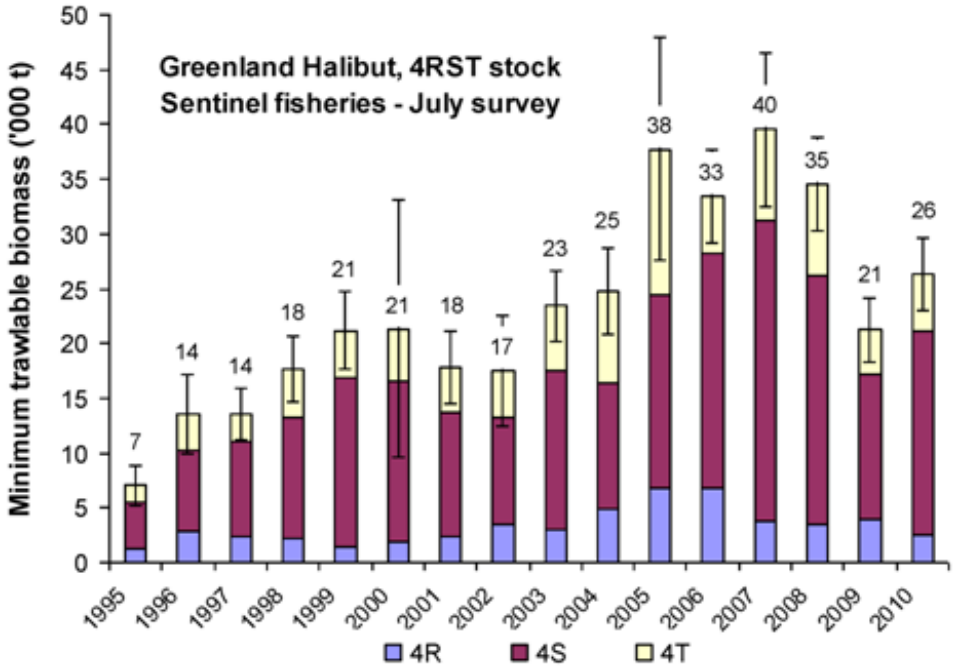
Figure 5.75 Bottom Temperature and Catch Rate (kg/standard tow) Distribution of Redfish for the July 2010 Stratified Random Survey in 3Pn and 4RST

Greenland Halibut

The July sentinel survey series (1995 to 2010) showed a general increase in turbot biomass from 1995 to 2005 that remained relatively stability up to 2008, followed by a substantial decrease in 2009 and an increase in 2010 (Figure 5.76). The 2010 value compares to those observed in 2003 and 2004. Turbot was concentrated mostly in the Estuary and in the Laurentian Channel, around Anticosti Island and in the northern portion of the Esquiman Channel (Figure 5.77). The distribution of turbot is overall similar to those of earlier years.

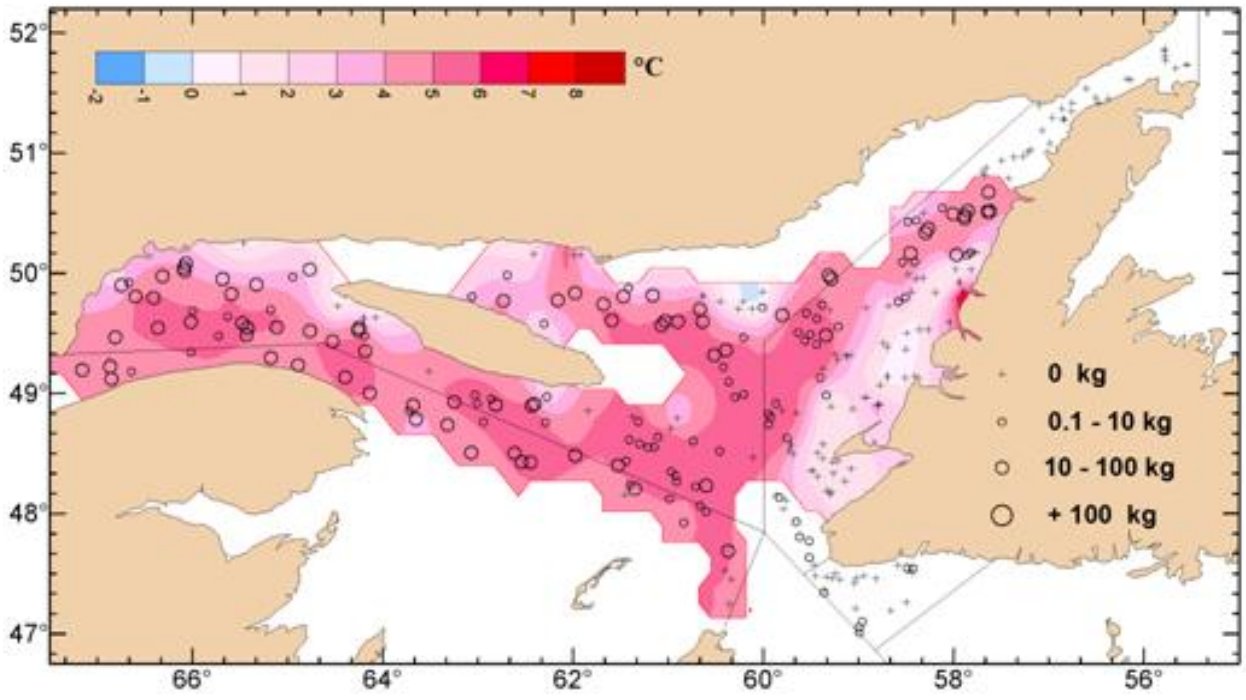
Atlantic Halibut

The July sentinel survey series (1995 to 2010) showed a substantial increase in biomass from 2004 to 2010 (Figure 5.78); biomass was low and stable between 1995 and 2003. The 2010 value compares to those observed in 2007. Atlantic halibut was concentrated mostly in the Esquiman Channel (Figure 5.79).



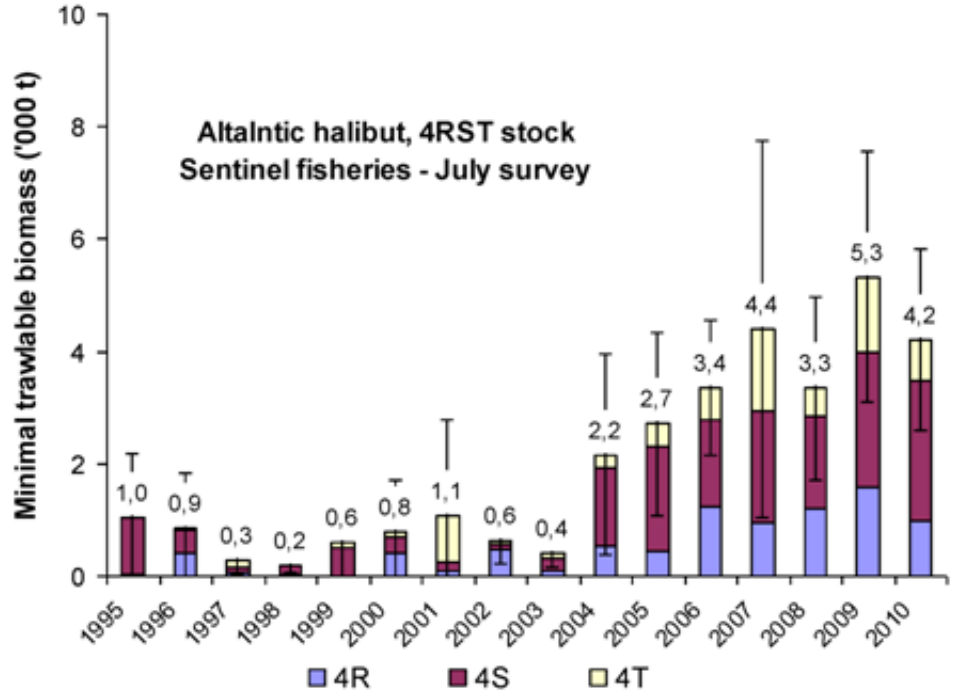
Source: SLGO 2010

Figure 5.76 Minimum Trawlable Biomass Index for Greenland Halibut Based on the July Stratified Random Survey (1995 to 2010)



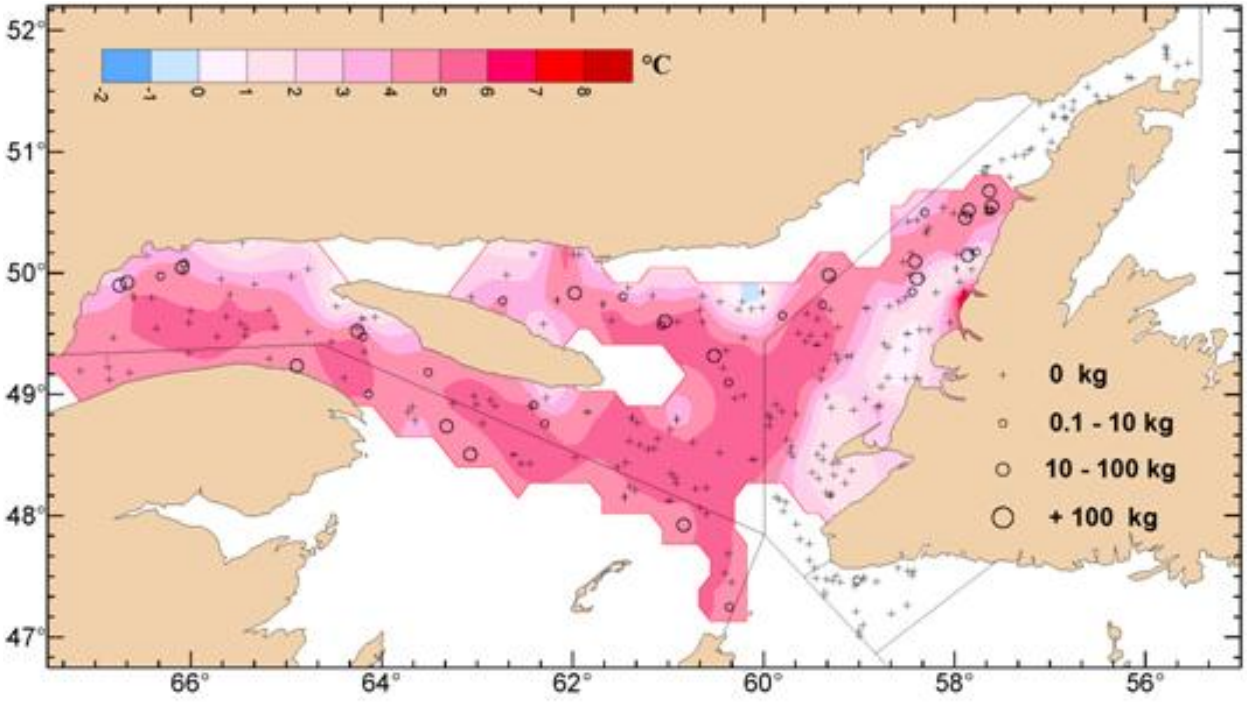
Source: SLGOy 2010

Figure 5.77 Bottom Temperature and Catch Rate (kg/standard tow) Distribution of Greenland Halibut for the July 2010 Stratified Random Survey in 3Pn and 4RST



Source: SLGO 2010

Figure 5.78 Minimum Trawlable Biomass Index for Atlantic Halibut Based on the July Stratified Random Survey (1995 to 2010)



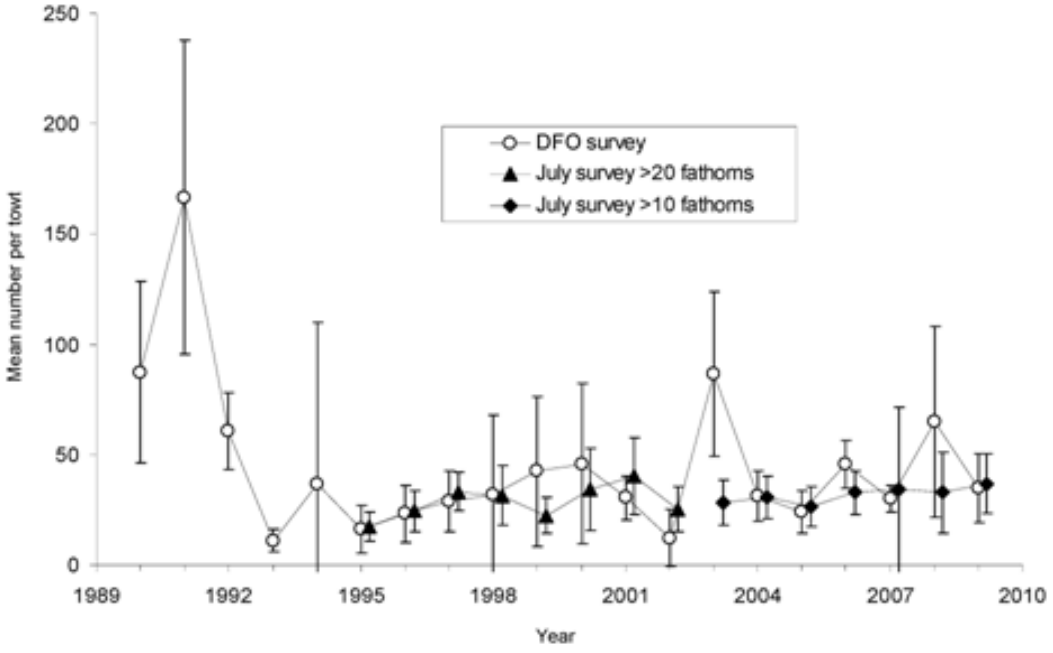
Source: SLGO 2010

Figure 5.79 Bottom Temperature and Catch Rate (kg/standard tow) Distribution of Atlantic Halibut for the July 2010 Stratified Random Survey in 3Pn and 4RST

5.8.1.5 Research Vessel Data

The trends in the main species caught in the northern Gulf DFO research vessel (RV) survey during 1990 to 2008 indicate that turbot, Atlantic halibut and shrimp increased during the last 10 years and are currently at relatively high abundance levels. Redfish remains at low abundance following intensive fishing in the 1980s and early 1990s. Herring and capelin abundance seems relatively healthy. Simulations using abundance data from RV surveys and diet data from various sources has suggested that intensive fishing during the 1980s and early 1990s removed most of the large piscivorous fish trophic level (*i.e.*, cod and redfish), which has left marine mammals as the dominant top predators in the northern Gulf during the 2000s (DFO 2010a).

The DFO RV survey began in 1990 on the *CCGS Alfred Needler* and since 2004 has been carried out on the *CCGS Teleost* (DFO 2010a). The results of the RV survey indicate a sharp decline in cod abundance during 1991 to 1993, followed by an increase until 2000. The timing of the increase corresponded to the period of the first moratorium during 1994 to 1996 (Figure 5.80). Abundance then fluctuated with little trend from 2001 to 2009. An abnormal low value occurred in 2002 and a high value occurred in 2003.

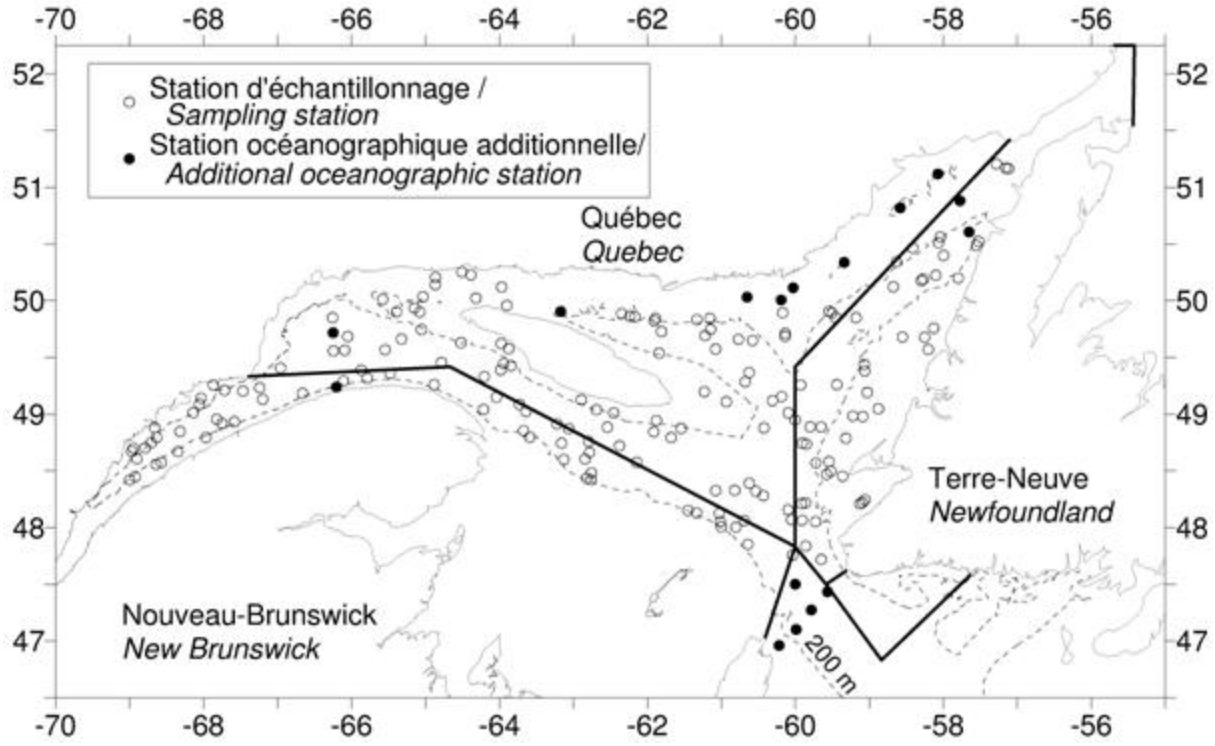


Source DFO 2010a

Figure 5.80 Mean Number per Tow for the August DFO RV and the July Sentinel Mobile Surveys

In 2009, the annual summer survey for the assessment of abundance and distribution of groundfish and shrimp in the northern Gulf was conducted from July 31 to August 31 onboard the *CCGS Teleost* (Bourdages *et al.* 2010a) (Figure 5.81). In 2009, the abundance and biomass indices of many species have decreased as compared to the previous years. Indices for redfish,

black dogfish and longfin hake are among the lowest values. Greenland halibut indices are similar to the early 2000s, a decrease of approximately 30 percent. Meanwhile, indices for other species (cod, northern shrimp, Atlantic halibut, thorny skate, white hake, American plaice, witch flounder and snow crab) in 2009 are comparable to the average of 2004 to 2008 years, even though a decrease was observed compared to 2008. The geographic distributions of catches recorded for the different species in 2009 show the same pattern as observed for the previous seven years.



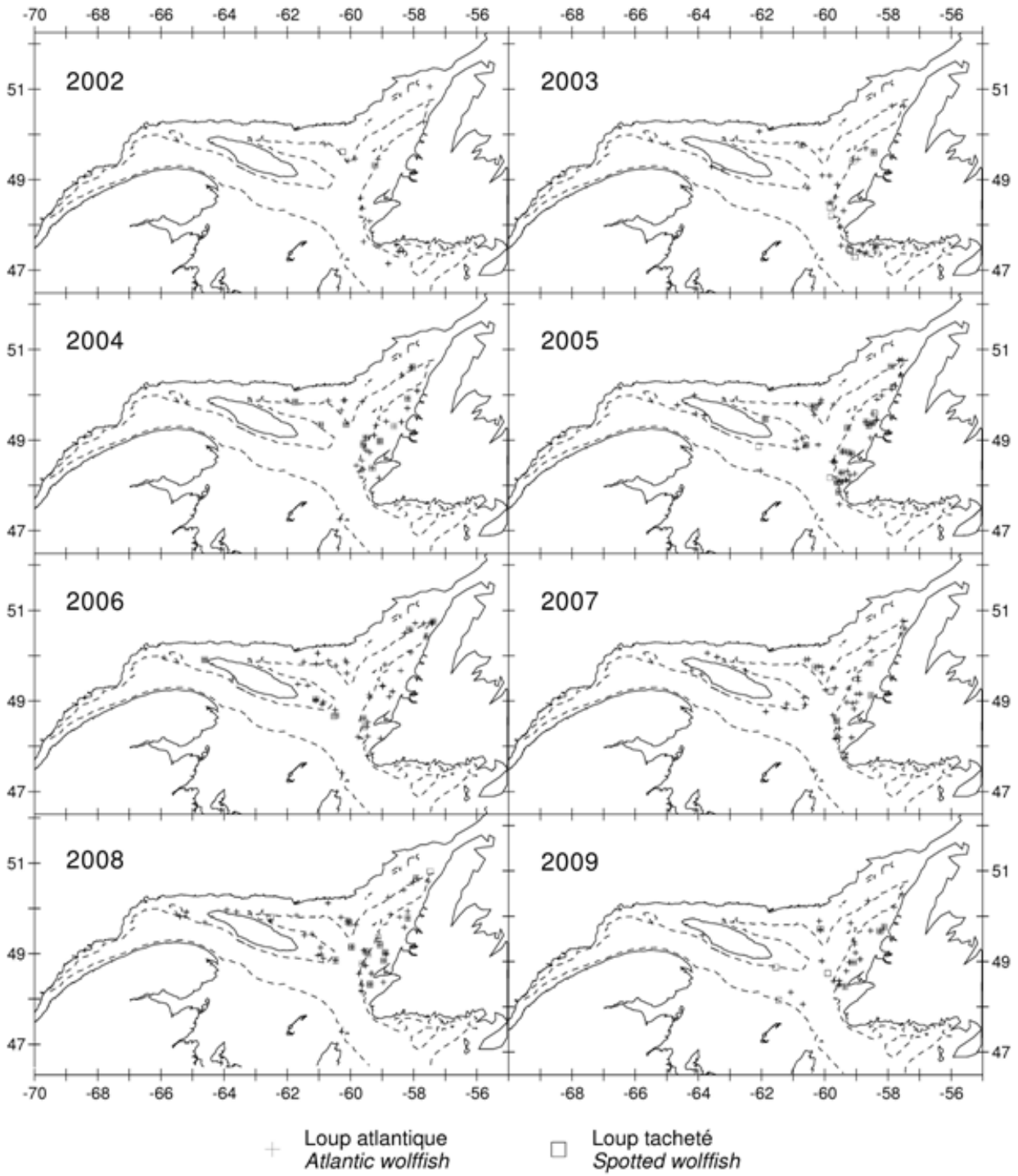
Source: Bourdages *et al.* 2010a

Figure 5.81 Locations of Sampling Stations for the 2009 Survey

Atlantic and spotted wolffish, both SARA-listed species, are caught primarily at the 200 m isobaths off western Newfoundland, Beauge Bank, near Anticosti Island and in the southern Laurentian Channel (Figure 5.82). The number of wolffish per tow when caught was between a few individuals to a maximum of 20 (Bourdages *et al.* 2010a, 2010b).

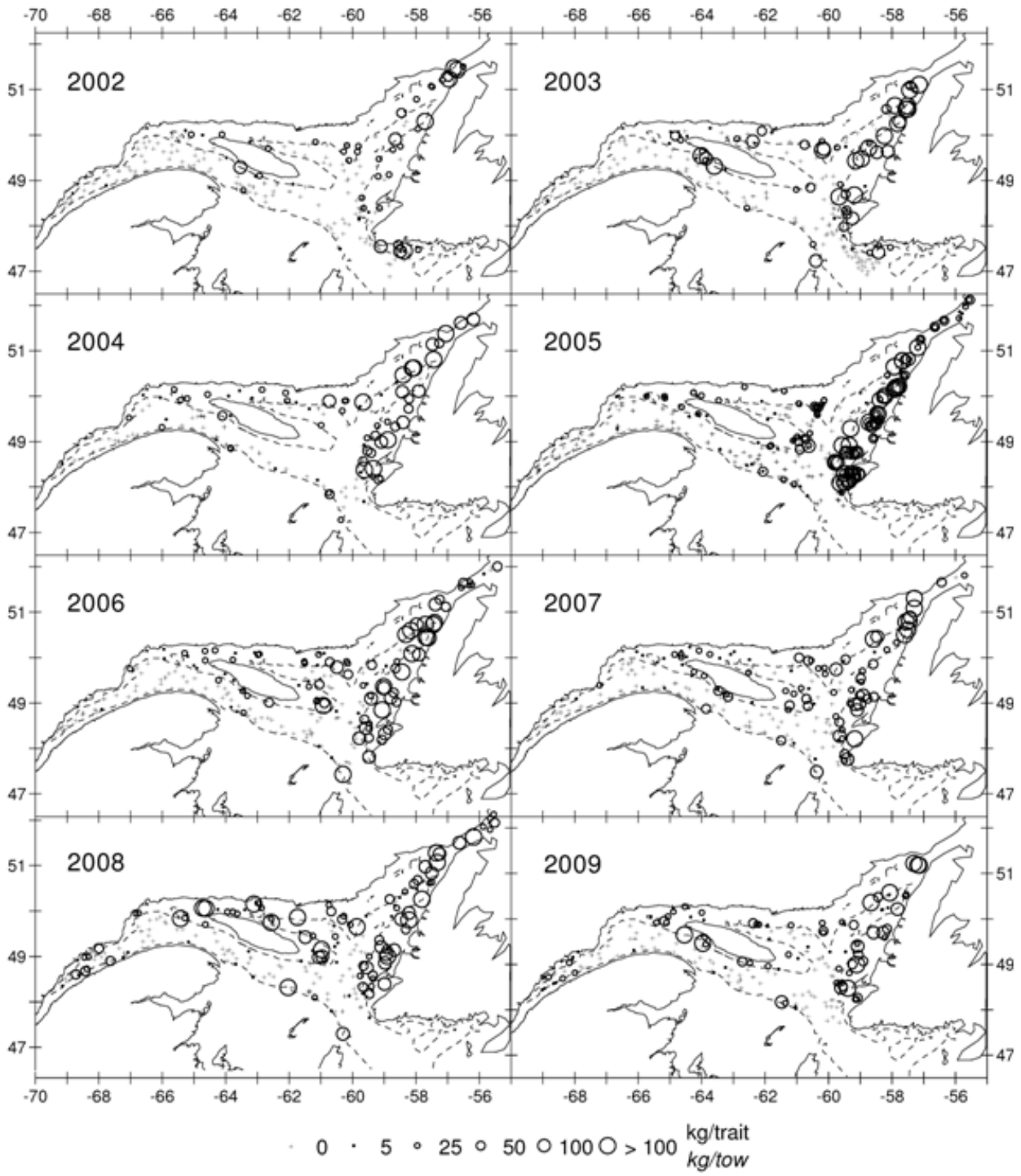
The mean number and weight of cod (a COSEWIC assessed species) per tow have remained low but stable since the fishery reopened in 1997 (Bourdages *et al.* 2010a, 2010b). The most substantial cod catches in 2009 (and previous years) were mostly caught along the west coast of Newfoundland (NAFO Division 4R) (Figure 5.83).

American plaice (a COSEWIC assessed species) fluctuated without notable trends in mean numbers and weights from 1990 to 2003 (Bourdages *et al.* 2010a). Numbers remained stable from 2004 to 2008, with the mean number per tow increasing slightly in 2009 (Figure 5.84). A shift towards smaller-sized individuals has been observed since 2007. American plaice are found throughout the Estuary and Northern Gulf.



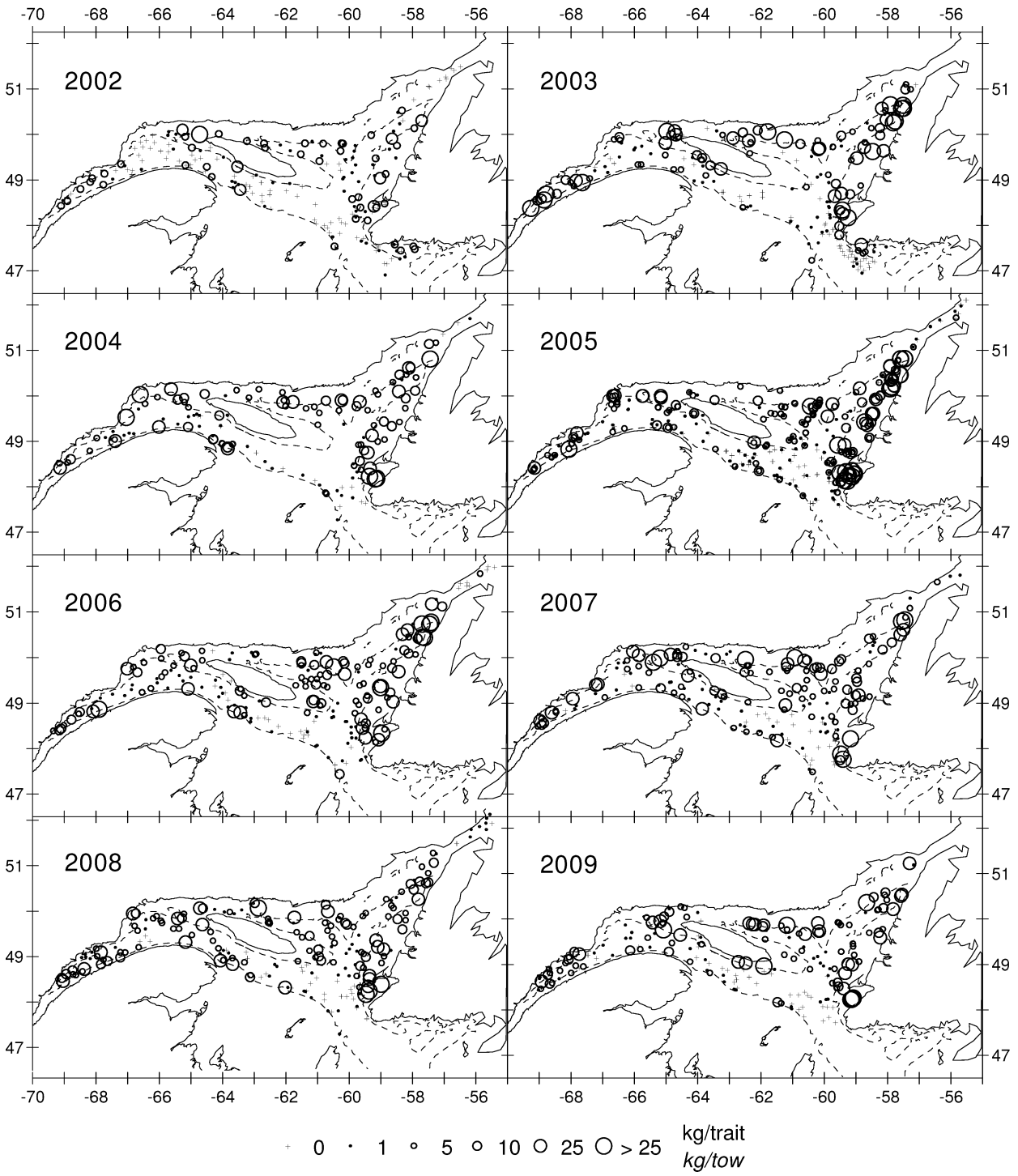
Source: Bourdages *et al.* 2010a

Figure 5.82 Atlantic Wolffish and Spotted Wolffish Catch Locations from the Survey for the 2002 to 2009 Period



Source: Bourdages *et al.* 2010a
Note: The "+"symbol indicates a zero.

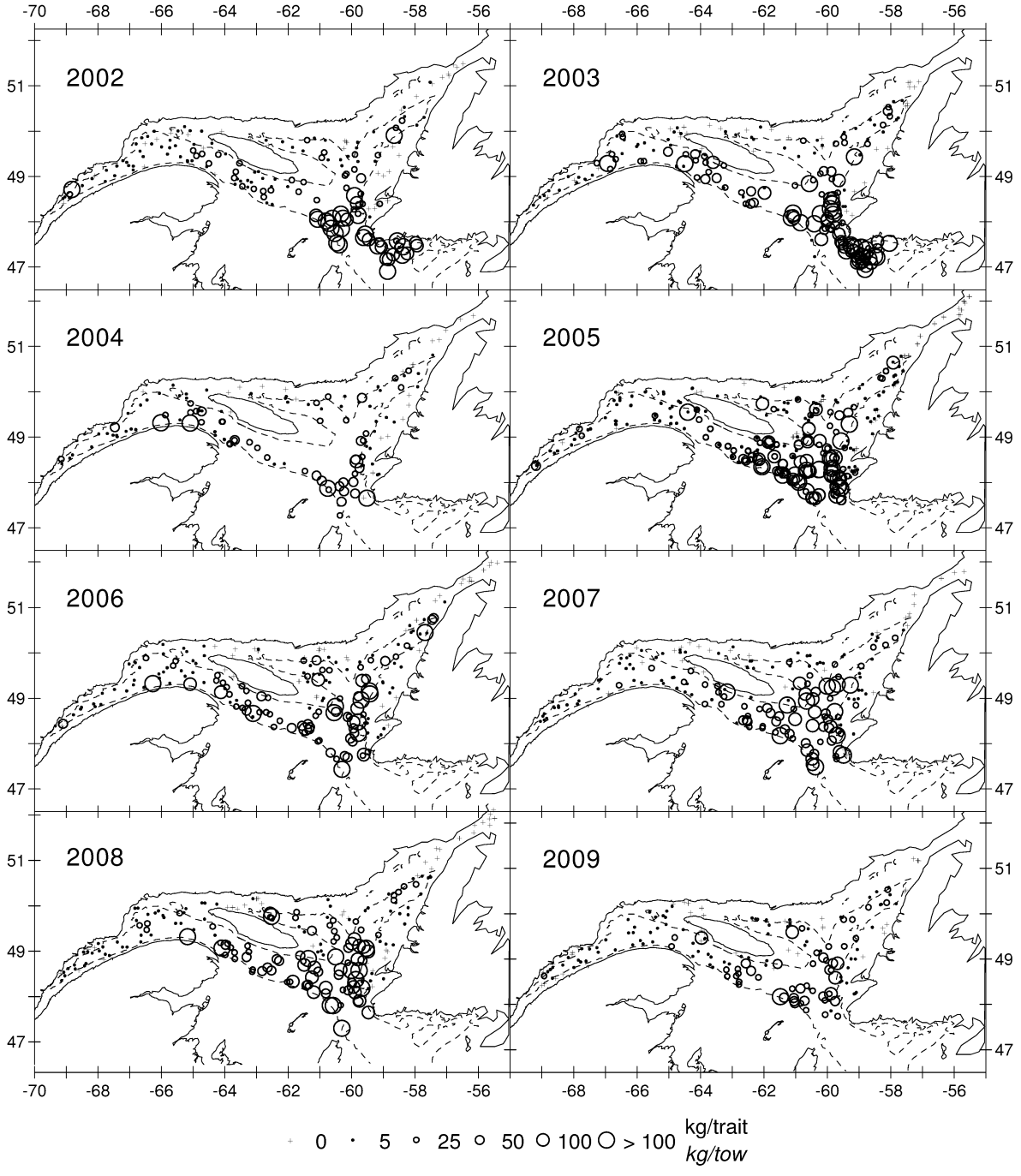
Figure 5.83 Cod Catch Rate (kg/tow) Distribution from the Survey for 2002 to 2009



Source: Bourdages *et al.* 2010a
Note: The "+"symbol indicates a zero.

Figure 5.84 American Plaice Catch Rate (kg/tow) Distribution from the Survey for 2002 to 2009

Redfish (two COSEWIC assessed species) mean number and weight per tow dropped between 1990 to 1996, after which the values have remained steady but low until 2005, when it increased due to good recruitment from the 2003 year class (Bourdages *et al.* 2010a, 2010b). The 1988 and 2003 were strong year classes that were observed in 1990 to 1992 and 2005 to 2007, after which they quickly declined. The main Gulf redfish concentrations are at the entry and north of Cabot Strait and South of Anticosti Island in the Laurentian Channel (Figure 5.85).



Source: Bourdages *et al.* 2010a
Note: The "+"symbol indicates a zero.

Figure 5.85 Redfish Catch Rate (kg/tow) Distribution from the Survey for 2002 to 2009

Mean number and weight of Greenland halibut per tow has shown an upward trend in the 1990s and since the early 2000s, this increase has been less pronounced (Bourdages *et al.* 2010a, 2010b). The 2009 abundance and biomass are the lowest of the last 10 years. The main concentrations of Greenland halibut were mostly observed west, south and north of Anticosti Island and were also seen in the Esquiman Channel (Figure 5.86).

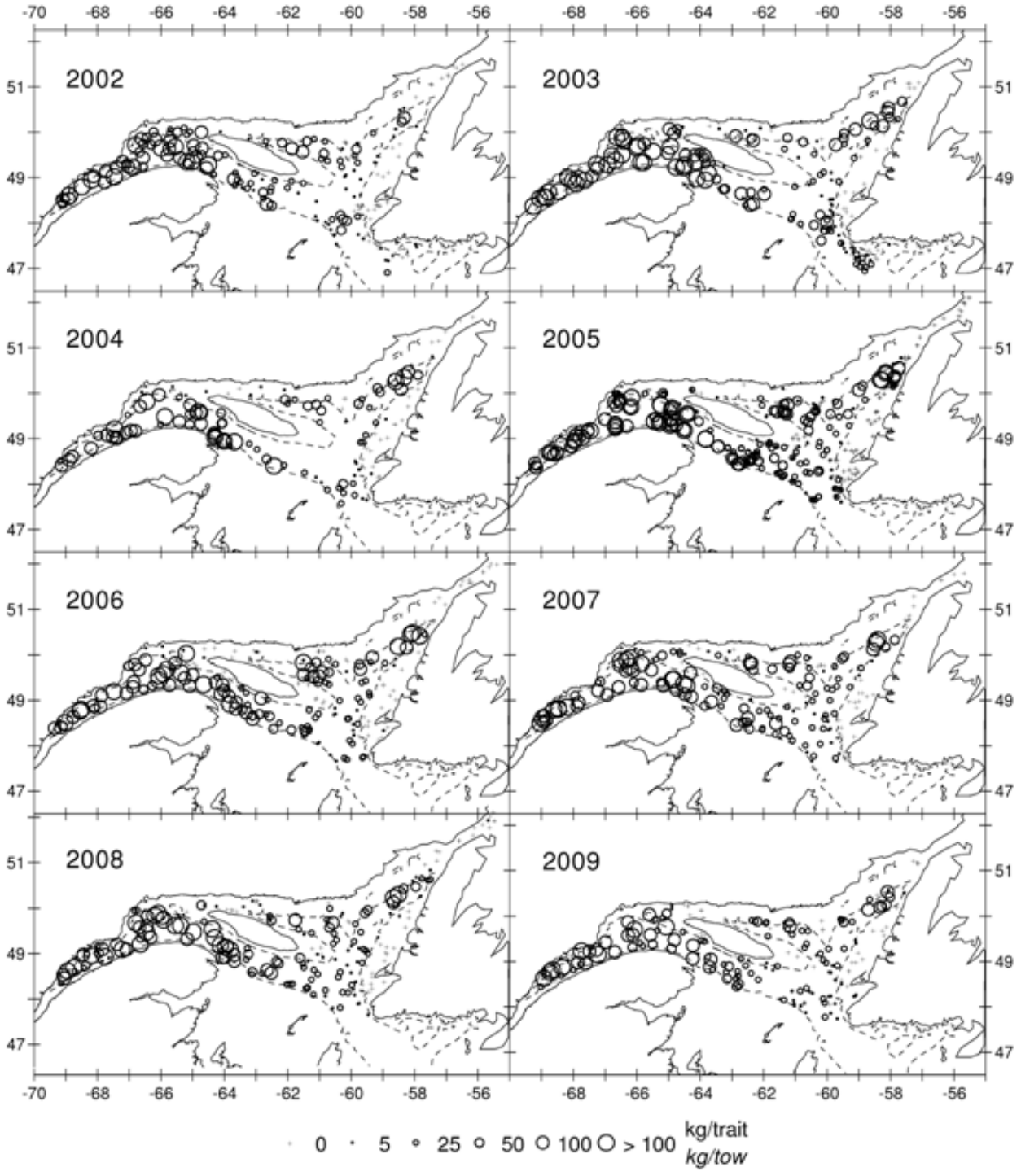
Atlantic Halibut mean weight and numbers were low during the 1990s and have steadily increased until 2008, followed by approximately 33 percent decrease in 2009 (Bourdages *et al.* 2010a, 2010b). However, the Atlantic halibut abundances were the highest from 2006 to 2009. The largest catches are from the channel areas along the 200 m isobaths and in the Sept-Îles and estuary areas (Figure 5.87).

Herring caught during the survey represent two spawning stocks and are found throughout the area (Bourdages *et al.* 2010a, 2010b). The highest catches are from the St. Lawrence Estuary, along the Laurentian channel, between Anticosti Island and Newfoundland as well as in the Strait of Belle Isle (Figure 5.88). In 4R, the probability of finding herring varied for 1990 to 1998 (21 to 41 percent), and increased until 2001 (73 percent), then dropped again until 2004 (26 percent). Probabilities have increased reaching 50 percent in 2007 and remained steady since. The 4s annual variations in catch probabilities were similar to 4R.

Capelin catches are the highest in the St. Lawrence estuary, around Anticosti Island and in the Strait of Belle Isle (Figure 5.89). Catch probabilities have fluctuated substantially since 1990, reaching the lowest value in 2006 (23 percent) and have risen to 51 percent (2008) and 42 percent (2009). Catch probabilities for 4S are less variable, with an increasing trend observed between 1990 and 2000, decreasing slightly until 2003 and have remained between 70 to 80 percent since 2002 (Bourdages *et al.* 2010a, 2010b).

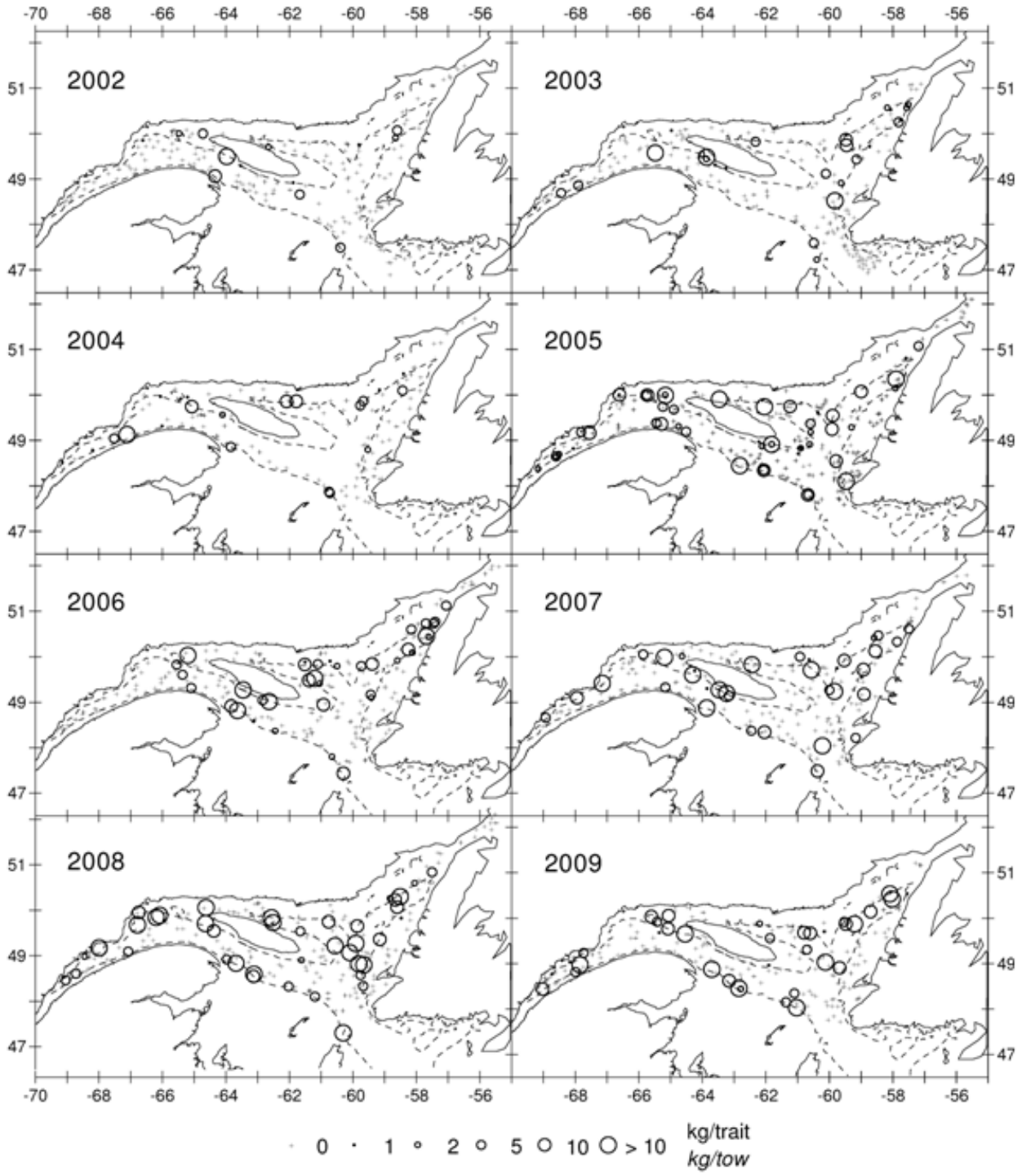
Black dogfish mean numbers and weights per tow have varied considerably over the years and large confidence intervals are often associated with the largest values as a result of the species gregarious nature and limited spatial distribution (Figure 5.90). The 2009 values are among the lowest of the data series. The largest dogfish concentrations were found in the deep upstream portion of the Laurentian Channel and in the St. Lawrence Estuary in 2002 to 2007. In 2009, the concentrations were limited to the Cabot Strait area and the southern part of the Laurentian Channel (Bourdages *et al.* 2010a, 2010b).

Thorny skate mean number and weights exhibited fluctuations between 1990 to 2002, with the means numbers decreasing since 2003, but the mean weight has remained stable over the this timeframe (Figure 5.91). Therefore, thorny skate are less abundant but larger (Bourdages *et al.* 2010a, 2010b).



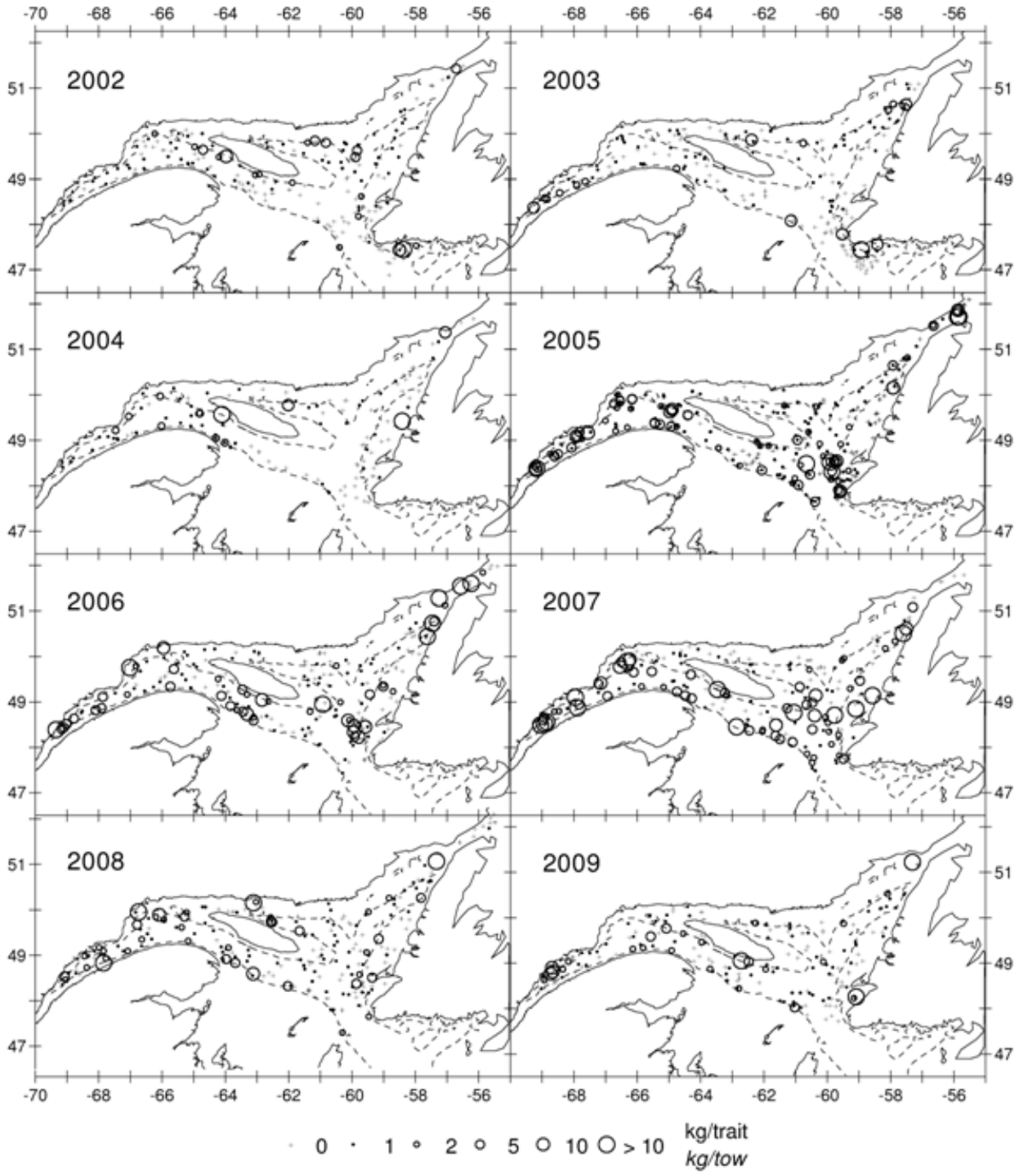
Source: Bourdages *et al.* 2010a
Note: The "+"symbol indicates a zero.

Figure 5.86 Greenland Halibut Catch Rate (kg/tow) Distribution from the Survey for 2002 to 2009



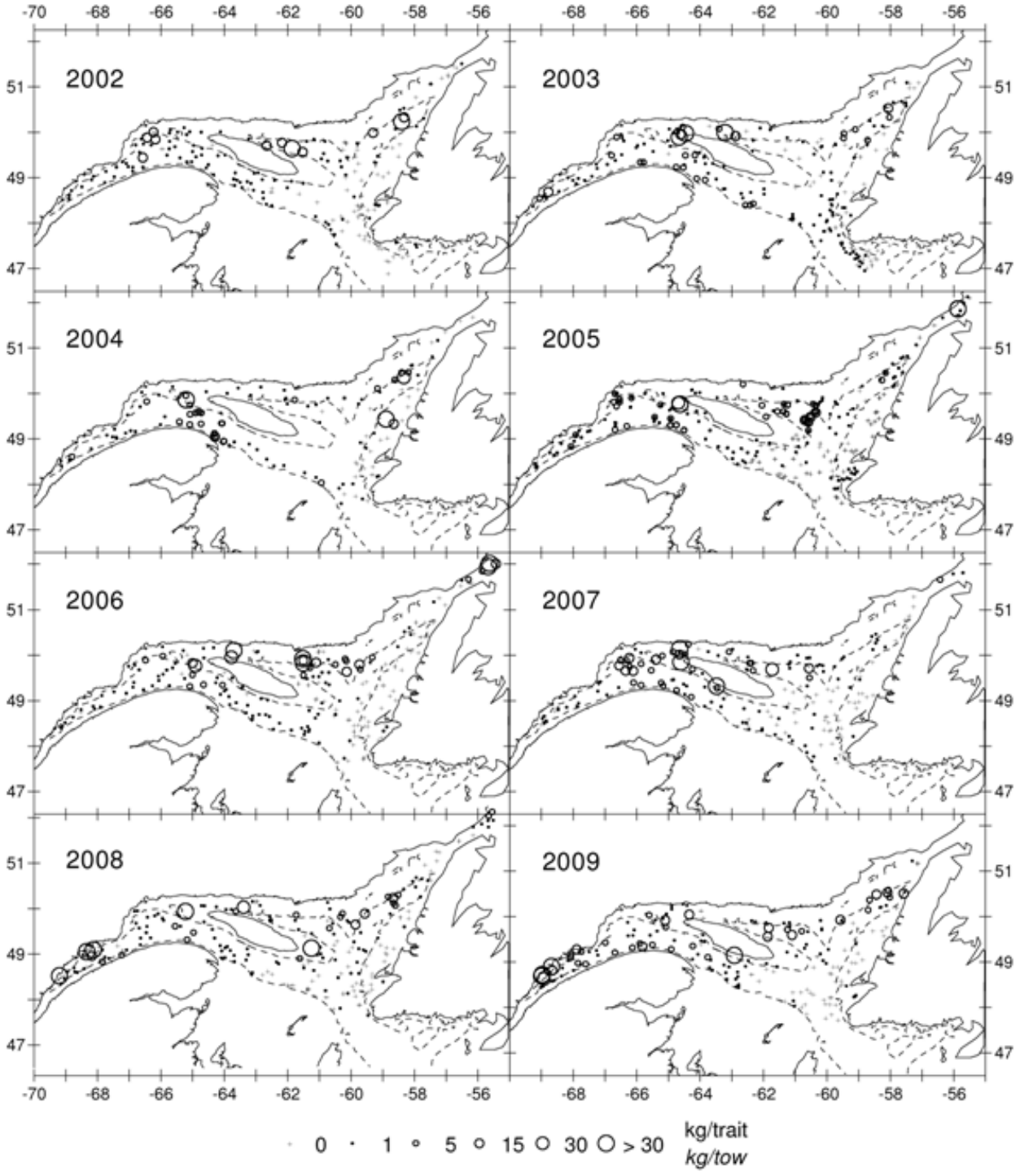
Source: Bourdages *et al.* 2010a
Note: The "+"symbol indicates a zero.

Figure 5.87 Atlantic Halibut Catch Rate (kg/tow) Distribution from the Survey for 2002 to 2009



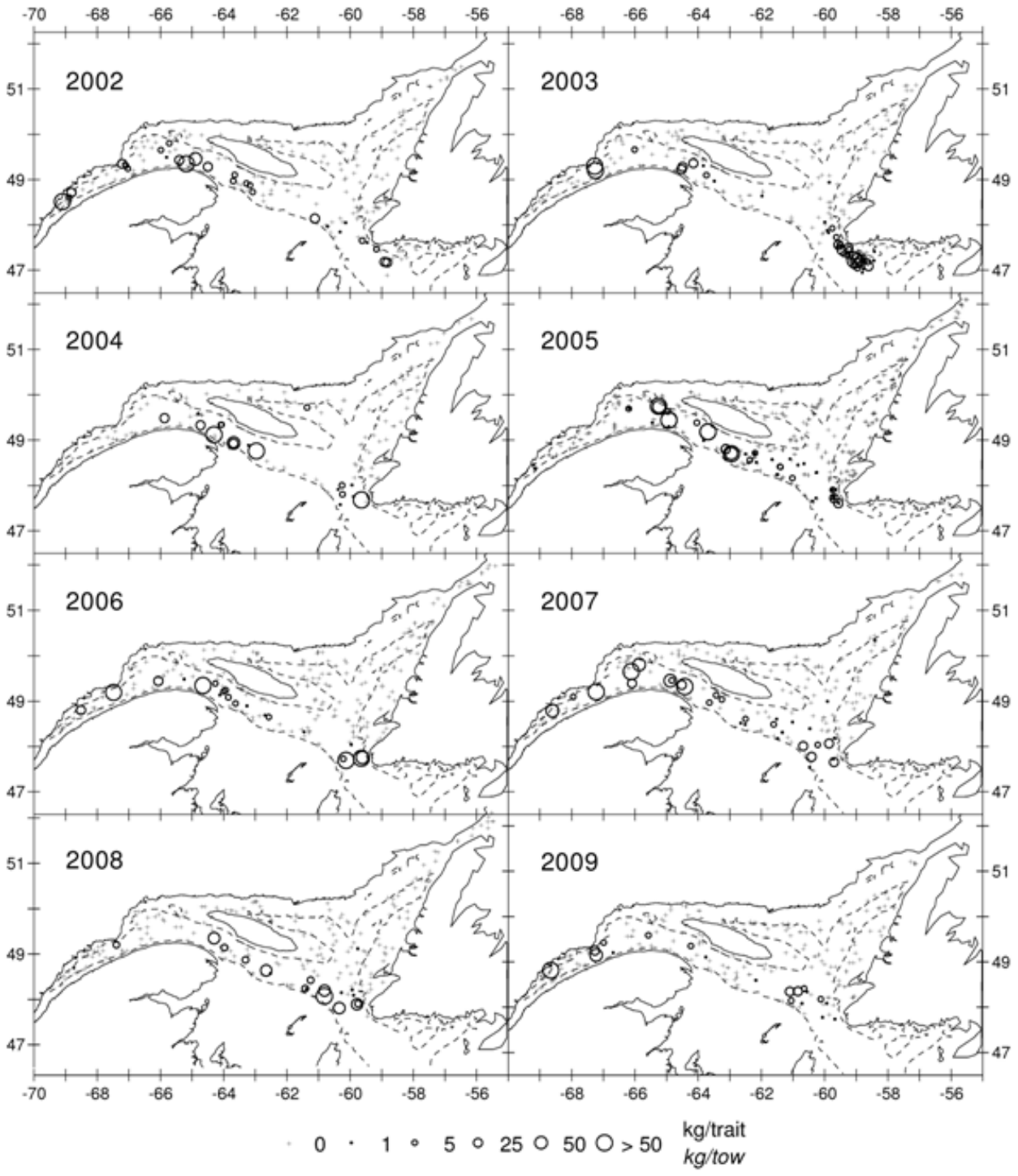
Source: Bourdages *et al.* 2010a
Note: The "+"symbol indicates a zero.

Figure 5.88 Herring Catch Rate (kg/tow) Distribution from the Survey for 2002 to 2009



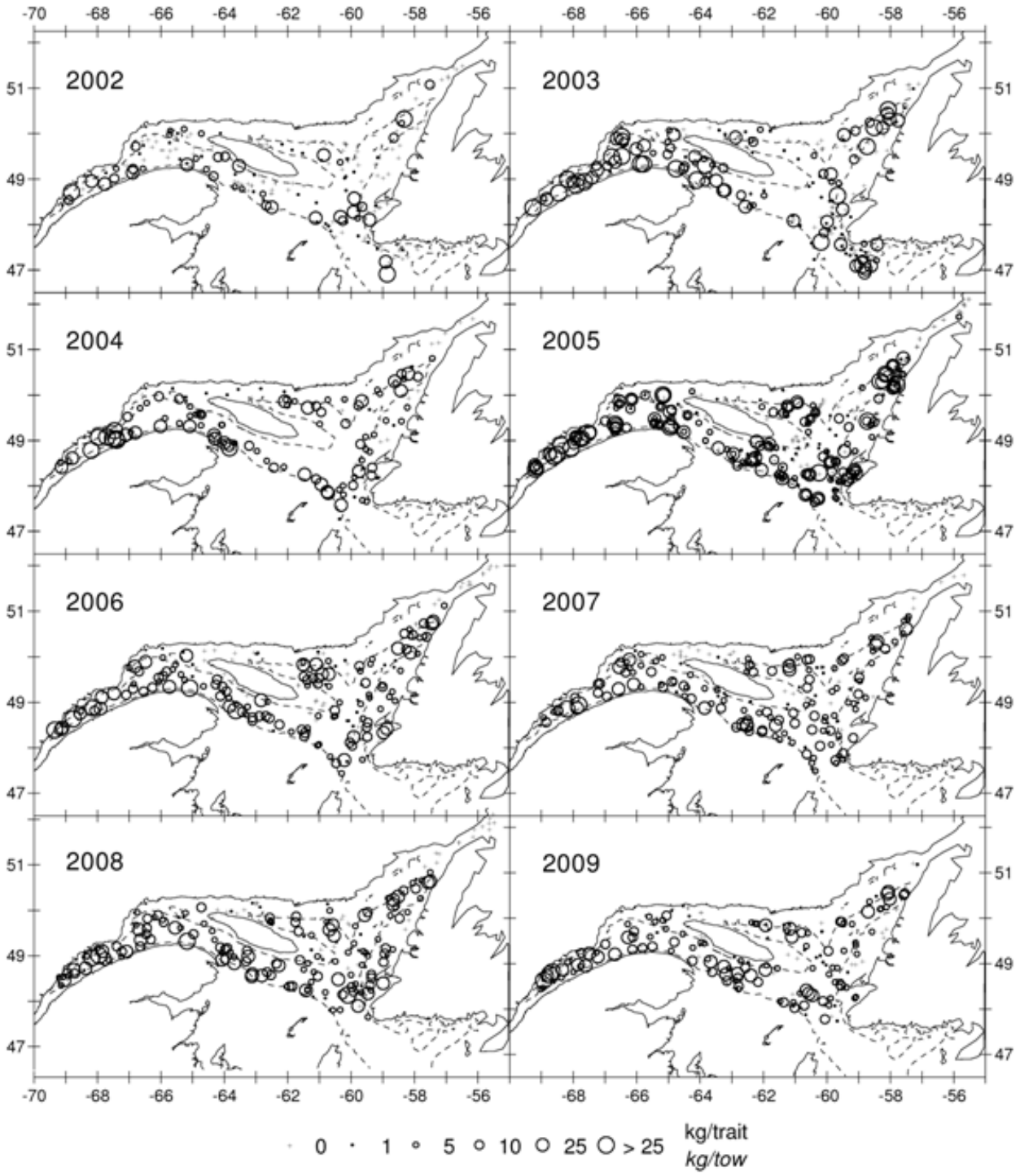
Source: Bourdages *et al.* 2010a
Note: The "+"symbol indicates a zero.

Figure 5.89 Capelin Catch Rate (kg/tow) Distribution from the Survey for 2002 to 2009



Source: Bourdages *et al.* 2010a
Note: The "+"symbol indicates a zero.

Figure 5.90 Black Dogfish Catch Rate (kg/tow) Distribution from the Survey for 2002 to 2009



Source: Bourdages *et al.* 2010a
Note: The "+"symbol indicates a zero.

Figure 5.91 Thorny Skate Catch Rate (kg/tow) Distribution from the Survey for 2002 to 2009

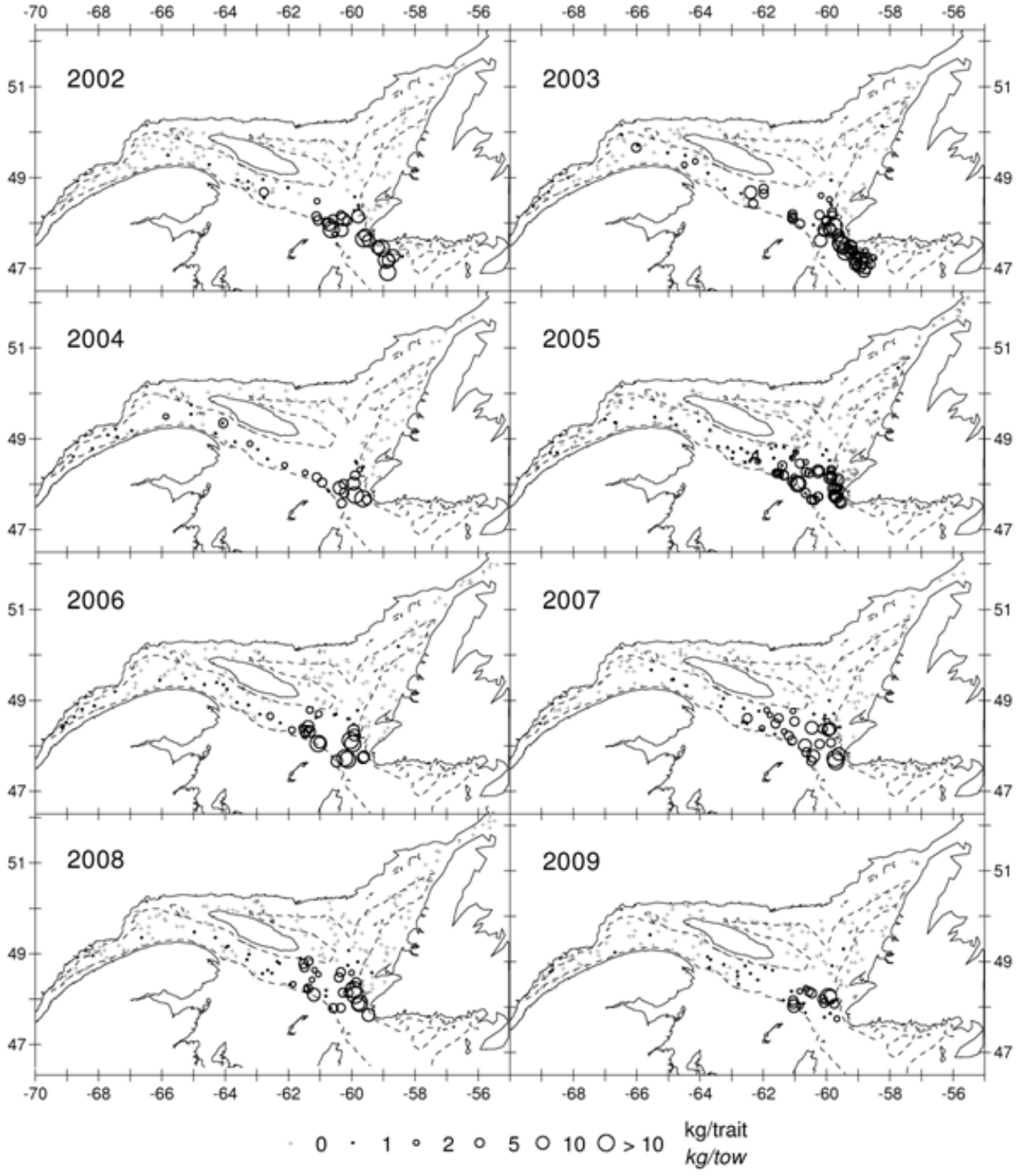
Longfin hake exhibited a sharp drop in the mean number and weight between 1990 and 1993, and has fluctuated since this period (Bourdages *et al.* 2010a, 2010b). There was a slight increase in the late 1990s but numbers have subsequently dropped sharply and have remained relatively stable since 2003. The 2009 values are the lowest for this survey (Figure 5.92). Longfin hake are found primarily in the southern portion of the Gulf, with highest catches in the southern Laurentian Channel and near Cabot Strait.

White hake mean numbers and weights dropped sharply from 1990 to 1993 and have fluctuated thereafter (Bourdages *et al.* 2010a, 2010b). The indices recorded between 2003 and 2009 were among the survey's lowest (Figure 5.93). Since 2003, the strongest concentrations are found along the 200 m isobaths in the southern flank of the Laurentian Channel and offshore St. Georges Bay.

Witch flounder are relatively homogenous covering the northern Gulf, with mean number and weights having decreased between 1990 and 1993. These values remained stable until 1999, followed by two upward and downward waves between 2000 and 2003 and were again stable between 2004 and 2009 (levels comparable to 1994 to 1999 levels). Values in 2009 were below the 1990 to 2008 average. The largest concentrations are along the southern slope and the head of the Laurentian Channel (Figure 5.94). In 2009, good catches were noted at the Head of the Esquiman Channel which is seldom observed (Bourdages *et al.* 2010a, 2010b).

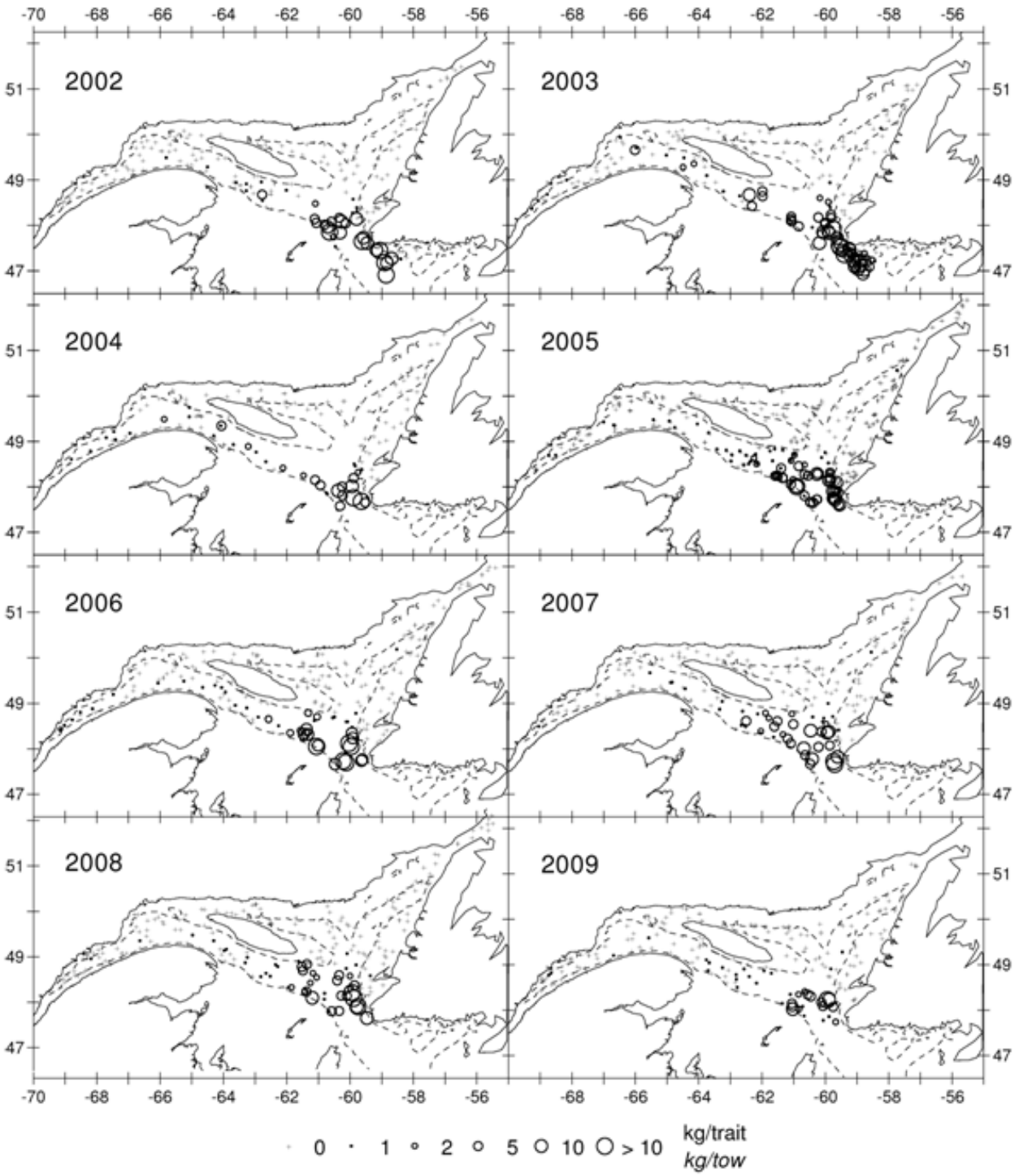
Northern shrimp mean number and weights per tow are similar to 2006 and 2008 observations, with 2009 values lower than those observed in 2003 but higher than pre-2002 values (Bourdages *et al.* 2010a, 2010b). The catches were highest along the channels and west of Anticosti Island (Figure 5.95).

The 2009 RV survey data indicates the presence of a large but stable biomass of snow crab (Figure 5.96), with the 2002 to 2009 data catch distribution revealing that snow crab are not abundant at depths greater than 200 m. Catches were made for all stations less than 200 m in depth (Bourdages *et al.* 2010a, 2010b).



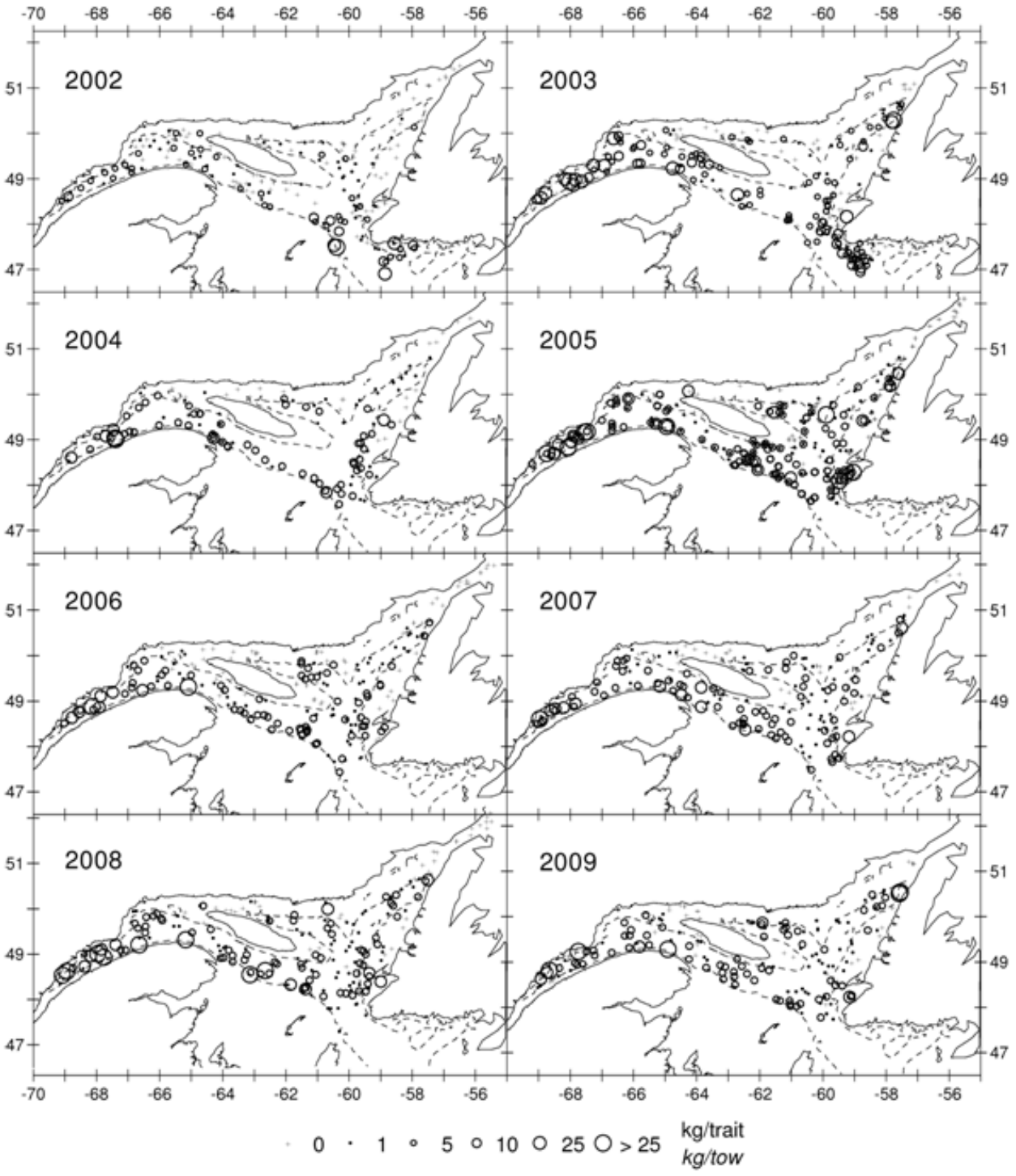
Source: Bourdages *et al.* 2010a
Note: The "+"symbol indicates a zero.

Figure 5.92 Longfin Hake Catch Rate (kg/tow) Distribution from the Survey for 2002 to 2009



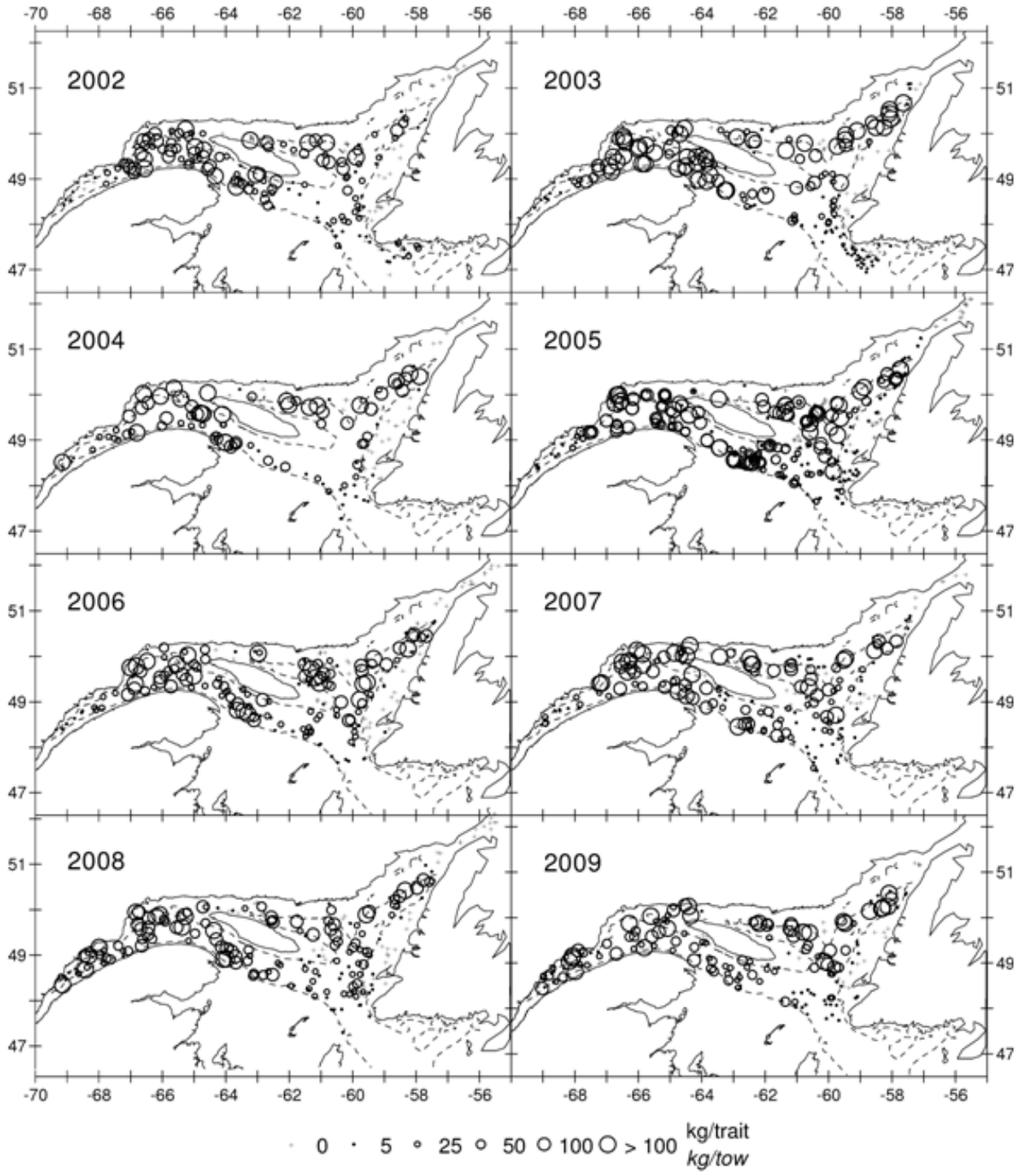
Source: Bourdages *et al.* 2010a
Note: The "+"symbol indicates a zero.

Figure 5.93 White Hake Catch Rate (kg/tow) Distribution from the Survey for 2002 to 2009



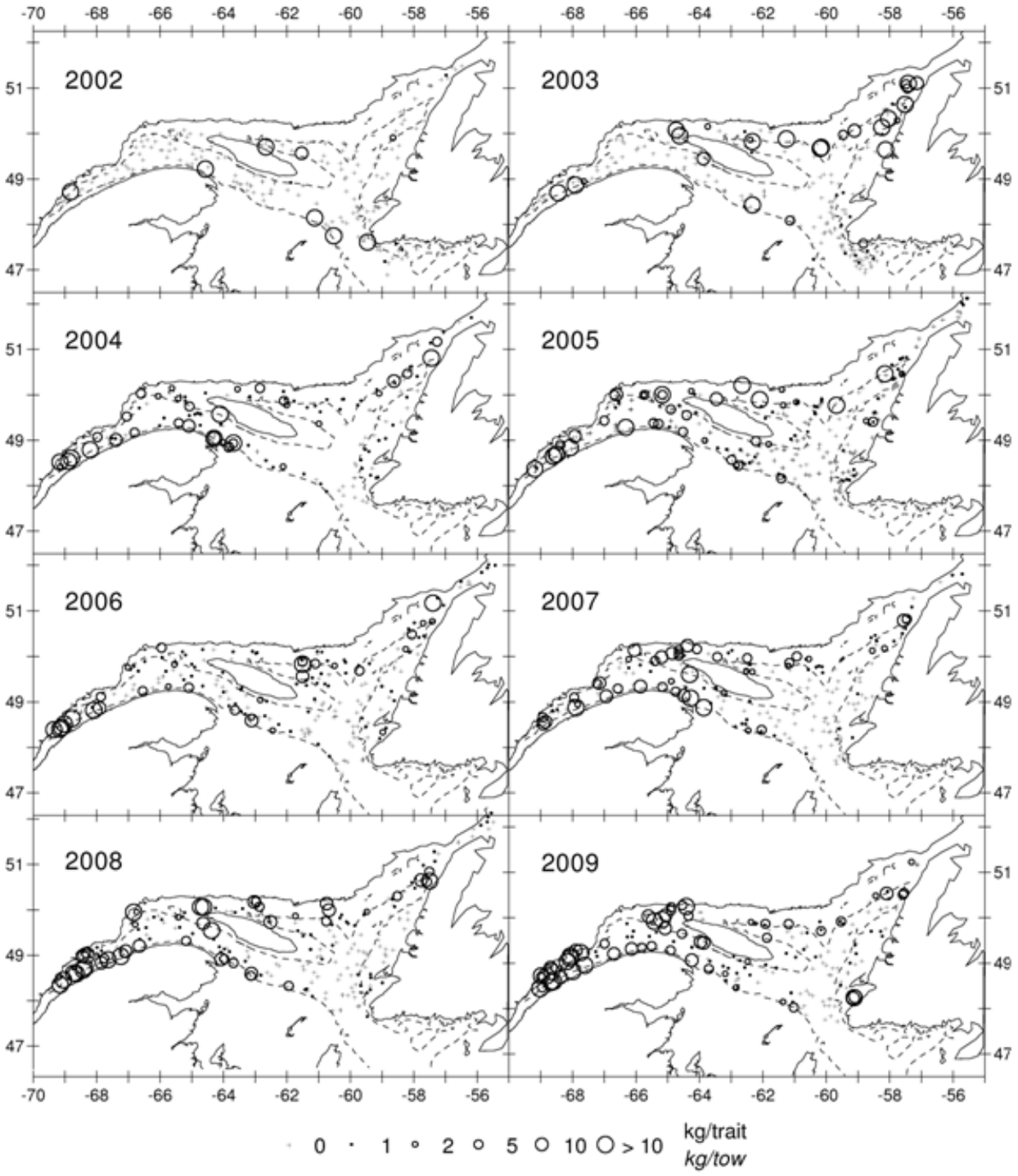
Source: Bourdages *et al.* 2010a
Note: The "+"symbol indicates a zero.

Figure 5.94 Witch Flounder Catch Rate (kg/tow) Distribution from the Survey for 2002 to 2009



Source: Bourdages *et al.* 2010a
Note: The "+"symbol indicates a zero.

Figure 5.95 Shrimp Catch Rate (kg/tow) Distribution from the Survey for 2002 to 2009



Source: Bourdages *et al.* 2010a
Note: The "+"symbol indicates a zero.

Figure 5.96 Snow Crab Catch Rate (kg/tow) Distribution from the Survey for 2002 to 2009

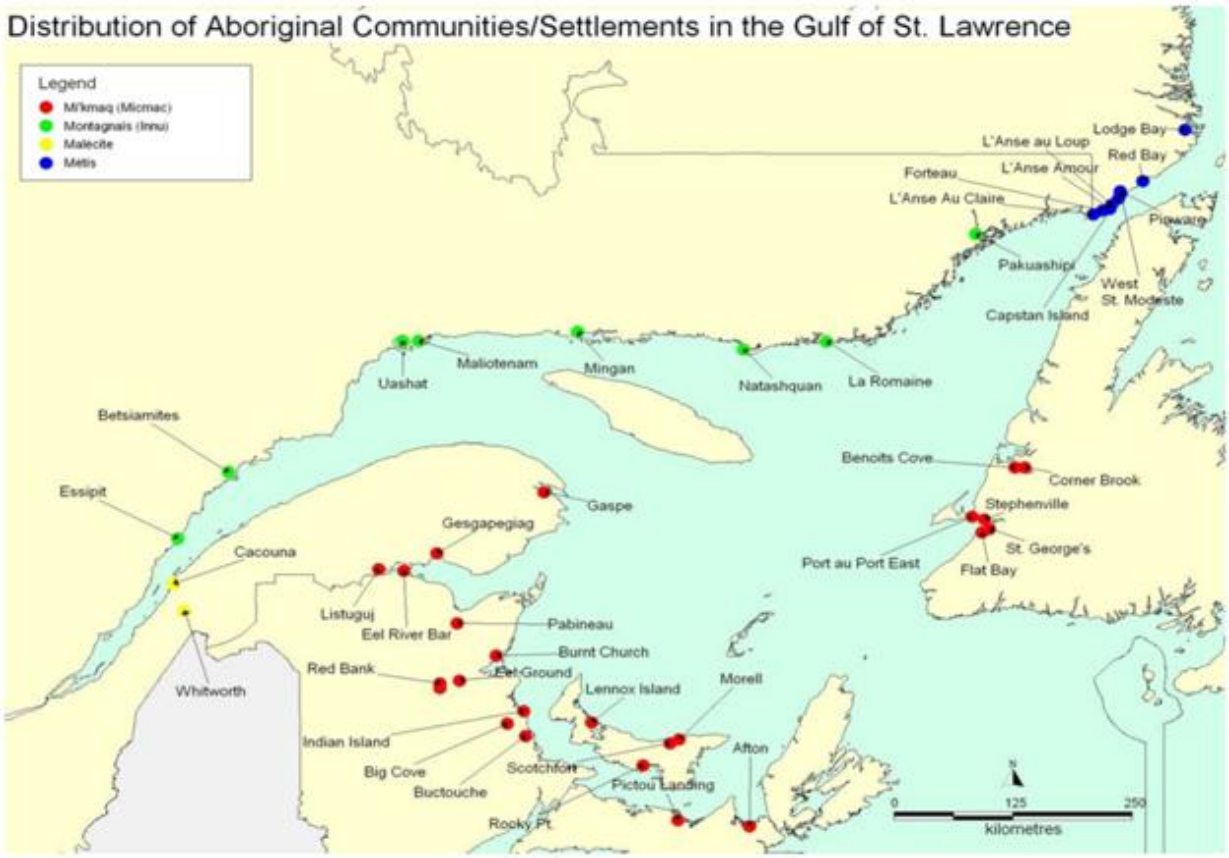
5.8.2 Aboriginal Fisheries

In 1999, the Supreme Court of Canada handed down its decision in the Marshall case, which essentially agreed that the Treaties signed in 1760 and 1761 by Mi'kmaq and Maliseet communities include a communal right to hunt, fish and gather natural resources in pursuit of a “moderate livelihood” (DFO 2011n; Gaudet and Leger 2011). In response, DFO began to negotiate interim fishing agreements in order to provide First Nations communities with the opportunity to enter commercial fisheries (though some communities already held Communal Commercial Fishing Licenses at this time). The number of licenses held by First Nations is divided into Communal Fishing Licenses that grant permission to fish for food and social and ceremonial purposes, and Communal Commercial Fishing Licenses that allow fishers from First Nations to sell their catch. The distribution of Aboriginal communities in the Gulf is illustrated in Figure 5.97.

The Allocation Transfer Program is a process for voluntary retirement of commercial fisheries licence holders and the re-issuance of such licences to appropriate aboriginal groups. The program is therefore designed to provide aboriginal groups with employment and income while not placing additional burdens on existing resources (DFO 2011n).

The main species harvested in aboriginal fisheries in the Gulf are snow crab, lobster, rock crab, alewife / Gaspéreau, mackerel, shrimp and smelt. In 2007, $22 million in revenue was generated through the Communal Commercial Fishing License program in the Gulf Region, and $15 million was generated in the Quebec-Maritime Region (DFO 2011n). Snow crab and lobster are the most valuable species (Gaudet and Leger 2011).

The Qalipu Mi’kmaq First Nation Band (QMFNB) is sole owner of a company named Mi’kmaq Commercial Fisheries Inc. In NAFO Division 4R, QMFNB owns five core enterprises with vessels under 39’11”. All five possess a groundfish licence, with four having a lobster licence, and three possessing a crab quota. There are pelagic fixed gear licences associated with three of the enterprises as well. One of the enterprises that the QMFNB possesses holds a groundfish licence that is currently being used by an Aboriginal person (DFO 2011m).



Source: Alexander *et al.* 2010

Figure 5.97 Location of Aboriginal Communities with the Gulf of St. Lawrence Region

The Aboriginal Aquatic Resource and Oceans Management program provides funding to qualifying Aboriginal groups to establish aquatic resource and oceans management bodies. For eligible groups, funding was available to obtain access to commercial fishery opportunities (including vessels and gear) and to build the capacity of groups to take advantage of aquaculture opportunities. One such body has been set up for Western Newfoundland, whereby the QMFNB and Conne River Band have formed the Mi'kmaq Alsumk Mowimsikik Koqoey Association (MAMKA). MAMKA holds four enterprises with vessels less than 39'11". All four of these enterprises hold a lobster licence, with two of them holding a groundfish and snow crab quota. There are also pelagic fixed gear licences associated with three of the enterprises (DFO 2011m).

During the Western Newfoundland SEA (LGL 2005b) public consultation process, Mi'kmaq groups from the area reiterated the province's requirement to notify Aboriginal peoples about any land development issues. Historically, in the 16th and 17th centuries the Mi'kmaq created a "Domain of Islands" in the Gulf (Heritage NF 1997). However, there are no known active Aboriginal fishing grounds in the vicinity of EL 1105. It is anticipated that commercial fishing licenses are issued to Aboriginal peoples fishing in the 4Ss, 4Tf, 4Rd and 3Pn NAFO Unit Areas, but there is no known commercial fishing activity within the boundaries of EL 1105 (refer to Figures 5.68 to 5.70). Therefore, the only expected interaction is in relation to the Project's supply vessel traffic.

5.8.3 Other Uses

5.8.3.1 Recreational Fisheries

Statistics from the Maritime, Gulf and Newfoundland and Labrador regions suggest that recreational fishing has declined in recent years, though the value to the provinces has increased. From 2000 to 2006, the Maritime Provinces experienced a decline (23 percent) in the total number of days anglers spent fishing; however, the total expenditures per day associated with angling increased by 22.9 percent on average (Gaudet and Leger 2011). Pinfold (2009) reported on the estimated participation of anglers and revenue in the Maritime Provinces and Quebec (Table 5.21). The most commonly fished species include Atlantic salmon in some areas (Miramichi River), striped bass, chain pickerel, Gaspéreau, yellow perch, Atlantic sturgeon, trout species, shad species, smelt, eel and white perch. There are specific federal and provincial regulations governing recreational fishing including licensing, catch limits, gear restrictions, size limits, fishing season and area closures.

Table 5.21 Estimated Number of Saltwater Recreational Fishing Days for All Anglers (resident and visitors), Estimated Expenditure per Day and Total Expenditure per Year (2005)

Province	Number of Participation Days	Expenditures per day ($)	Total Expenditures ($000)
Quebec	197,444	120	54,271
Nova Scotia	198,802	98	19,273
New Brunswick	40,838	114	7,013
Prince Edward Island	61,515	52	2,137
Source: Adapted from Pinfold 2009			

In Newfoundland and Labrador, recreational fishing may take place in coastal and inland waters. Coastal water fishing for Atlantic salmon is on a catch-and-release basis and may be done year round and without a licence. Salmon Fishing Areas (SFAs) of the western Newfoundland region are SFA 12 (Fox Point-Port aux Basques), SFA 13 (Cape Ray-Cape St. Gregory) and SFA 14A (Cape St. Gregory-Cape Bauld). A multi-year Atlantic Salmon Management Plan (2007 to 2011) that was developed with the collaboration of user groups and stakeholders contains elements of adaptive management strategies and river classification.

Of the 186 scheduled salmon rivers in Newfoundland and Labrador, 47 occur in the western Newfoundland. These rivers offer a great variety of angling opportunities in pristine settings. SFA 14A tops the list with 21 scheduled salmon rivers, with SFA 13 and SFA 12 following with 18 and 8 scheduled salmon rivers respectively. The salmon river catch data for 2007 are presented by coastal area in Table 5.22.

Table 5.22 Salmon River Catch Data for Western Newfoundland Coastal Areas, 2009

River	Effort (Rod Days)	Catch	Catch per Unit Area
Bay St. George / Port au Port			
Bear Cove River	10	0	0.00
Little Codroy River	151	31	0.21
Great Codroy River	3,751	1,087	0.29
Highlands River*	136	24	0.18
Crabbe's Brook*	979	270	0.28
Middle Barachois Brook*	135	44	0.33
Robinsons River*	1,464	677	0.46
Fischell's River*	610	269	0.44
Flat Bay Brook*	1,927	662	0.34
Little Barachois Brook*	302	99	0.33
Southwest and Bottom Brooks*	2,448	734	0.30
Harry's River*	2,792	730	0.26
Fox Island River	109	39	0.36
Serpentine River	849	315	0.37
Cook's Brook	Closed to angling		
Humber River*	13,102	4,362	0.33
Hughes Brook	36	3	0.08
Goose Arm Brook	47	6	0.13
Southern Labrador			
Forteau River	177	18	0.10
L'Anse au Loup River	No Data Available		
Pinware River	1,688	971	0.58

Source: DFO 2010
* Rivers with watershed management plans in place.

Atlantic salmon catch data for SFA 13 and SFA 14A for 1996 to 2007 are summarized in Figure 5.98. These data show a decline in catches for in the western Newfoundland.

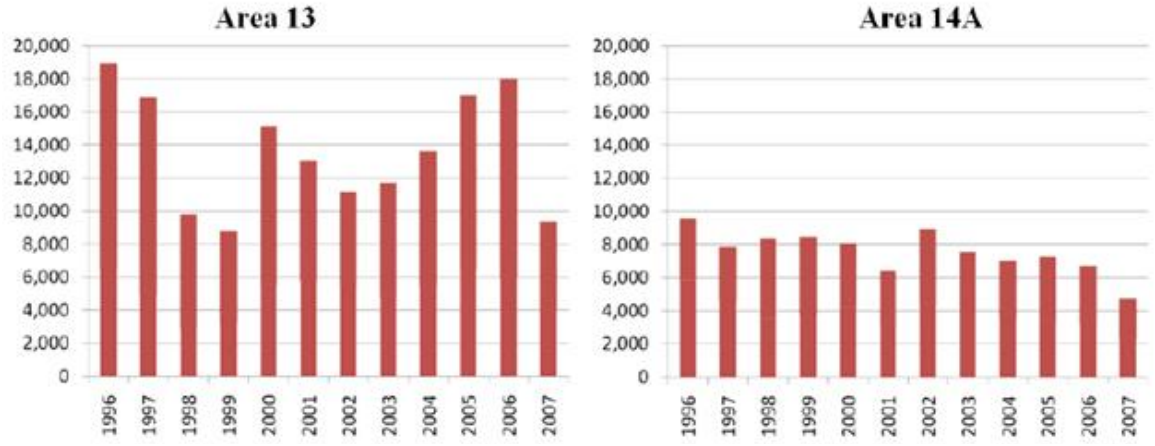


Figure 5.98 Atlantic Salmon Catch Data for Salmon Fishing Areas 13 and 14A, 1996 to 2007

5.8.3.2 Aquaculture

Marine aquaculture remains as an important industry throughout the Gulf, particularly as the number of commercial fisheries has declined. Aquaculture has experienced rapid growth in eastern Canada over the last two decades in response to a growing demand for seafood, declining wild stock fisheries and technological improvements in fish farming practices. Approximately 1,741 (2010) active aquaculture sites exist within the Gulf (Table 5.23), with the large majority concentrated in Prince Edward Island and the Gulf coast of New Brunswick (Figure 5.99). In New Brunswick, most of these sites are located between Caraquet Bay and Miramichi Bay, and in Nova Scotia most of the sites occur along the north shore from Pugwash to St. Georges (Alexander *et al.* 2010). Shellfish account for 99 percent of aquaculture in the Gulf, with oyster and blue mussel being the most important species, though finfish are typically more valuable (Alexander *et al.* 2010). The majority of finfish (Atlantic salmon / rainbow trout) operations in the Gulf 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 Quebec North Shore. Other species of growing importance include quahaug, clams, scallop and sea urchin. The total value of aquaculture in the Gulf in 2001 was $292 million, over half of which is Atlantic salmon ($199 million) and the remainder is trout ($41.2 million), blue mussel ($30.5 million), oysters ($9.5 million) and 'other' ($11.4 million) (quahaug, scallop, clam, sea urchin, Arctic char, Atlantic cod, haddock) (Alexander *et al.* 2010; Gaudet and Leger 2011).

Table 5.23 Active Shellfish and Finfish Aquaculture Sites in the Gulf of St. Lawrence

Province	Shellfish	Finfish	Total Sites
Gulf New Brunswick	520	0	520
Gulf Nova Scotia	65	11	76
Prince Edward Island	1,095	0	1,095
Gulf Quebec	49	1	50
TOTAL	1,677	10	1,741
Source: Gaudet and Leger 2011, Alexander *et al.* 2010			

The main species targeted for aquaculture production in Newfoundland and Labrador are Atlantic salmon, steelhead, Atlantic cod and blue mussels. On the whole, western Newfoundland, with its shorelines exposed to heavy winds and long ice-bound seasons, is not as suitable for aquaculture as other areas of the Province, particularly the South Coast. This is particularly true for Atlantic salmon, which do not grow well in temperatures below 4°C.

Four aquaculture sites were active within the region during the 2011-2012 fiscal year. Two operations were involved in salmonid aquaculture, one in Daniel's Harbour, and one in Stephenville (Newfoundland and Labrador Department of Fisheries and Aquaculture 2012). Two operations for shellfish were also active for shellfish aquaculture during the 2011-2012 fiscal year.

Source: Alexander *et al.* 2010

Figure 5.99 Distribution of Aquaculture Sites in the Gulf of St. Lawrence (2003)

There remain several conflicts and concerns associated with aquaculture in Canada, including: escapement of farmed stock and potentially invasive species; spreading of disease and parasites to wild fish stocks; eutrophication near sites; the use of chemicals and antibiotics; and benthic smothering. The industry is regulated by both federal and provincial legislation. A lease or license is required to operate any aquaculture facility. Aquaculture industry is expected to continue to grow and be a major economic contributor to local communities in Gulf, particularly as demand for seafood increases, and farming of new species (sea cucumber, sea urchin, seaweed) develops (Alexander *et al.* 2010).

5.8.3.3 Seal Hunting

The commercial seal hunt in Atlantic Canada dates back over 200 years. The industry grew throughout the 20th century, largely to meet the demand for fur (Alexander *et al.* 2010). Today the number of sealers is greatly reduced, but the hunt remains a valuable economic and cultural practice in the Gulf and Newfoundland and Labrador regions (Table 5.24). In the Gulf, two species are harvested: harp seal and grey seal. The commercial hunt occurs annually from November 15 to June 14, with the majority of sealing occurring between March and May in the Gulf, though sealing does occur along the Quebec North Shore in January and February. The

estimated landed value (based on average prices paid to sealers) of harp seals (Atlantic Canada) in 2001 was $5.5 million; however, the value increased to $21 million in 2002 due to extremely favourable market conditions. In recent years, personal use sealing licenses have been issued to residents adjacent to sealing areas in Newfoundland and Labrador (south of 53°N latitude), the Quebec North Shore, the Gaspé Peninsula and the Magdalen Islands(Alexander *et al.* 2010, Gaudet and Leger 2011).

Table 5.24 Number of Seal Hunting Licenses issued in 2007 for the Gulf Region

Province	Professional License	Assistant License
Gulf New Brunswick	2	5
Gulf Nova Scotia	21	21
Prince Edward Island	23	15
TOTAL	46	41
Source: Licensing Unit, DFO Gulf Region (Moncton)		

Seal hunting has represented an important source of income to residents of the western Newfoundland and southern Labrador region during a time of year when employment opportunities are extremely limited. The majority of seals taken in Newfoundland and Labrador waters are either harp or hooded seals, although ringed and bearded seals are also landed, as are harbor seals and grey seals in small numbers. Approximately 70 percent of the commercial hunt occurs on the Front in the northwest Atlantic off the northeast coast of Newfoundland while approximately 30 percent occurs in the Gulf. The majority of sealing occurs from late March through April and may extend into May. In addition to the commercial seal hunt, residents are allowed to take up to six seals for personal consumption.

The number of seals harvested annually varies greatly from year to year. A combination of factors contributed to the relatively low turnout in 2010, most notably the poor ice conditions, which made access to seal patches extremely difficult in certain areas, especially in the Gulf. Changes in market prices, demand for fur, the Canadian dollar and trade with the European Union greatly influence the number and value of the seals hunted each year.

5.8.3.4 Bird Hunting

Summaries of the Regulations for Migratory Game Bird Hunting season dates, bag and possession limits are set by the federal government. The main groups of birds hunted in coastal zones are the seaducks (eiders, scoters and Long-tailed Ducks), Common and Thick-billed Murres, mergansers, geese and snipe. There is no open season for Harlequin Ducks in Atlantic Canada or Quebec.

Common and Thick-billed Murres (referred by residents as “turrs”) are seabirds that have been hunted in Newfoundland and Labrador since early settlement. Residents of the province are the only people in North America, other than Aboriginal peoples, who legally can hunt turrs. The turr hunt, pursued traditionally for food, has become recognized in recent years as a recreational activity. It is generally known, and substantiated by studies conducted by Canadian Wildlife Service, that fewer people engage in turr hunting today than 30 years ago - a trend particularly

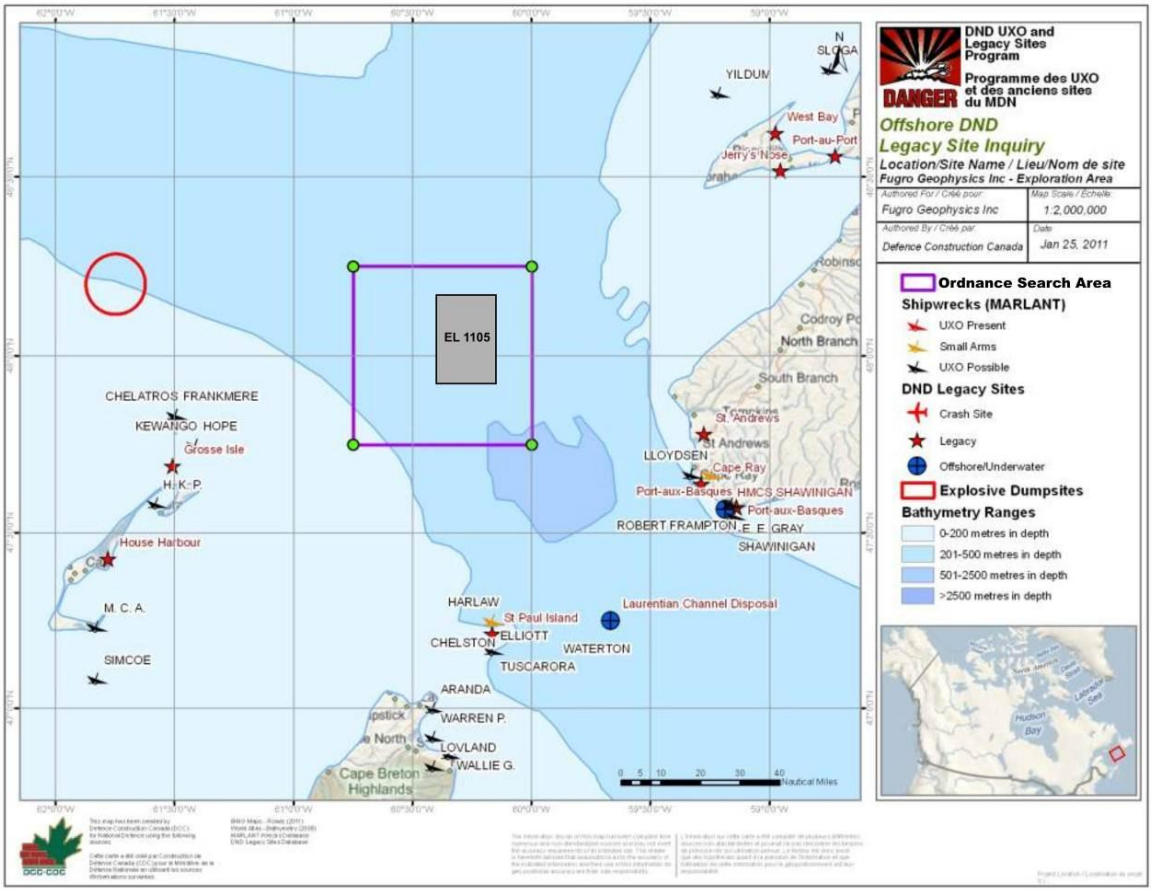
evident in the younger generation. Turr hunting is still conducted in coastal areas of western Newfoundland and southern Labrador. The hunting dates for turrs occur around early October to mid-March, depending upon the area, and are designed to take into consideration the migratory patterns of turrs along the shores of the Province.

5.8.3.5 Petroleum Industry

There are no anticipated active petroleum industry sites within the vicinity of Old Harry Prospect. While there are several exploration licences in the coastal waters of western Newfoundland, none exist in the offshore Old Harry Prospect area other than those held by Corridor Resources.

5.8.3.6 Military Use

The Department of National Defense (DND) may use the general area and is likely to be operating in the vicinity of the Project in a non-interference manner during the 2012 and 2014 timeframe (C.L. Giffin, pers. comm.). DND also confirms that there are no shipwrecks or DND Unexploded Explosive Ordnances Legacy Site within EL 1105 (Refer to Figure 5.100) (C.L. Giffin, pers. comm.).

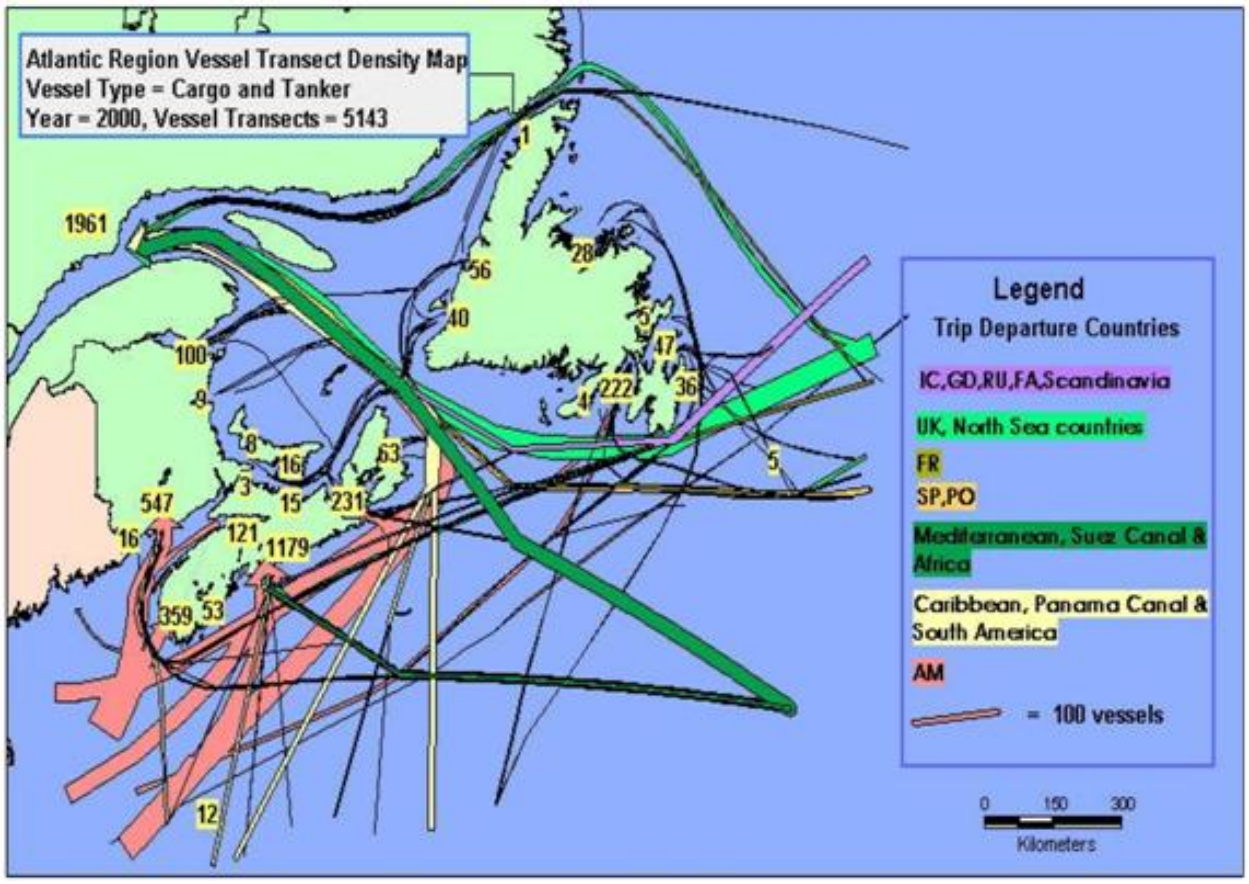


Source: Defence Construction Canada 2011

Figure 5.100 Shipwrecks and DND Unexploded Explosive Ordnance Legacy Sites

5.8.3.7 Marine Traffic

The Gulf region contains one of the major seaways of the world, and the majority of ship traffic enters and exits via the Cabot Strait (or Strait of Belle Isle in summer) bound for the St. Lawrence Seaway (Figure 5.101). The Gulf accommodates approximately 6,400 commercial vessel transits annually supporting domestic and international trade and transport (Alexander *et al.* 2010). More than 40 ports throughout the Gulf accommodate vessel traffic; however, Charlottetown, Prince Edward Island is the only major port within the Gulf. In addition, a number of major commercial ferry routes exist throughout the Gulf including: North Sydney, Nova Scotia to Port aux Basques, Newfoundland; St. Barbe, Newfoundland to Blanc Sablon, Quebec; Caribou, Nova Scotia to Wood Islands, Prince Edward Island; Souris, Prince Edward Island to Cap aux Meules, Quebec; and within Quebec, a number of coastal ferries service ports along the Quebec North Shore (Alexander *et al.* 2010, Gaudet and Leger 2011). Contamination of marine areas from bilge, ballast and wastewater disposal, marine safety and transport of foreign and invasive species are potential concerns within the marine transportation industry.



Source: Geocentric Mapping Consulting 2002, in Alexander *et al.* 2010
The arrow width represents vessel counts in the shipping corridor (traffic density); the color indicates the countries and continents of origin. Major ports are represented by a specified number of inbound transects.

Figure 5.101 Atlantic Inbound Vessel Transect Density Map: Inbound Cargo and Tanker Shipments in 2000

The Project is adjacent to the major shipping route that traverses the St. Lawrence River estuary and across the Gulf immediately south of Anticosti Island (LGL 2005b). Traffic density in this vicinity is four to eight ships per day, many of which are container vessels (LGL 2005b). DFO carries out stock assessment surveys and research activities throughout the maritime marine environment, which may overlap with proposed Project activities. The DFO Science Advisory Schedule can be accessed online to determine if there are any DFO activities scheduled to overlap with the Project. This online resource included activities scheduled through the month of March 2013, but no later, at the time of writing this report.

Vessel traffic in the area of the proposed Project is an important consideration. The main navigation lane between the Cabot Strait and the St. Lawrence River is in the vicinity of the Project. The majority of vessels enter the Gulf through the Cabot Strait. However, there may be other vessel traffic along shipping routes through the Strait of Canso and the Strait of Belle Isle. The main shipping lanes through the Gulf to Montreal overlap with the proposed work. Additional global shipping lanes exist in close proximity to EL 1105, including those routes between the Maritimes and Europe, the Maritimes and the US and within the Atlantic Provinces (GeoCommons 2010).

5.8.3.8 Tourism and Recreational Activities

Marine tourism and recreation is an industry experiencing growth throughout the Gulf, including increased cruise ship activity, offshore excursions (whale watching and marine tours), recreational boating, and recreational use of coastal areas (hiking, diving, kayaking). Owing to the climate, much of marine recreation and tourism activities occur from spring to fall.

Charlottetown, Prince Edward Island, is the only major port in the Gulf. The 2011 cruise ship season was from May 2 to October 20, 2011 and during that time, 41 ships, with a total of 67,298 passengers and 28,563 crew (Charlottetown Harbour Authority Inc. n.d.) arrived in port. For 2007, the average expenditure was $60.68 per passenger and $41.80 per crew member, which resulted in an estimated $3.3 million in passenger expenditures and $736,000 in crew expenditures (Gaudet and Leger 2011). Owing to the large size and capacity of modern cruise ships, these vessels are estimated to produce 400,000 gallons of wastewater per day. Similar to other large ocean vessels, cruise ships have the potential to transport non-native species and contaminate marine areas through bilge, ballast and wastewater disposal (Alexander *et al.* 2010).

There is a growing interest in a wide variety of marine-related recreation, with sea kayaking, in particular, growing in popularity among residents as well as visitors. Yachting is focused principally in the Bay of Islands and to a lesser extent the Gros Morne National Park area. The Bay of Islands Yacht Club has been active for many years. The waterfront at Norris Point and a new inn at Neddy's Harbour are attracting boaters to the Bonne Bay area. There is a Humber Valley Rowing Club that uses a section of coastline near Brakes' Cove in Humber Arm. Scuba diving as a sport has been popular in the Bay of Islands, Port au Port Bay and in Port aux Choix. Recreational boating occurs throughout much of the inshore areas of the Gulf and includes powerboats, sailboats and manually operated boats (canoes, kayaks and other rowboats). Recreational boating has the potential to adversely affect the marine environment through pollution, as well as interactions with marine mammals, sea turtles and marine birds.

There has been growth in other recreational activities in the region as well, including swimming, camping, hiking, whale and bird watching (DFO 2011e) and cottage development (Alexander *et al.* 2010). DFO (2011e) reports that marine-related tourist trips remained stable in the Maritimes-Gulf region between 2000 and 2006, while spending decreased overall, except in Prince Edward Island, which had an increase of 3.6 percent in spending from 2003 to 2006. However, the Quebec-Gulf region experienced increases of 40 percent from 2000 to 2006, with the largest growth in Gaspé.

The dramatic coastal scenery of the western Newfoundland region and the abundant opportunities for viewing whales are some of the attractions that make the region popular for sightseeing and leisure hiking. Over decades, local communities combined have been pouring hundreds of thousands of dollars into the construction and signage for coastal trails from the Codroy Valley estuary to the headlands of the Labrador Straits. One of the two best places for bird watching in the entire province is the Codroy Valley estuary and the municipal wetlands of Stephenville Crossing.

A network of national, provincial, municipal and private parks and historic sites as well as a number of conservation areas exist throughout the Gulf. These areas conserve and protect a number of important ecological and cultural areas, but at the same time, many of these areas attract large numbers of people (refer to Section 5.7.1).