CANADA-NEWFOUNDLAND and LABRADOR OFFSHORE PETROLEUM BOARD
CEA ACT SCREENING REPORT
PART A: GENERAL INFORMATION

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Screening Date	**June 30, 2011**
EA Title	Environmental Assessment of Statoil's Geophysical Program for the Jeanne d'Arc and Central Ridge/Flemish Pass Basins, 2011-2019
Proponent	Statoil Canada Limited Level II, Cormack Building 2 Steers Cove St. John's, NL A1C 6J5
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CEAA Law List Triggers	Paragraph 138(1) (b) *Canada-Newfoundland Atlantic Accord Implementation Act* (Accord Act)

Part B: PROJECT INFORMATION

On January 28, 2011, Statoil Canada Limited (Statoil) submitted a project description, *Geophysical Program for Jeanne d'Arc Basin and Central Ridge/Flemish Pass Basin, 2011-2019* (Statoil 2011) to the Canada-Newfoundland and Labrador Offshore Petroleum Board (C-NLOPB), describing its plans to undertake geophysical survey programs including seismic, electromagnetic, and localized geohazard surveys in the Jeanne d'Arc and Flemish Pass Basins from 2011 through 2019. Statoil anticipates carrying out a 3D seismic program and a small number of 2D profiles during 2011 and subsequent surveys, including geohazard and electromagnetic surveys, over the remaining eight years in the Newfoundland

and Labrador offshore. Statoil submitted the *Environmental Assessment of Statoil's Geophysical Program for the Jeanne d'Arc and Central Ridge/Flemish Pass Basins, 2011-2019* (LGL 2011a) on March 30, 2011. On May 20, 2011, the C-NLOPB requested additional information from Statoil in order to satisfy the requirements of the *Canadian Environmental Assessment Act* (CEAA). On June 2, 2011, Statoil responded to the review comments on the March 30 submission with the *Addendum to the Environmental* Statoil Canada Limited – Geophysical Program for the Jeanne d'Arc & Central Ridge/Flemish Pass Basins, 2011- 2019 2 of 24 C-NLOPB Screening Report June 30, 2011 *Assessment of Statoil's Geophysical Program for the Jeanne d'Arc and Central Ridge/Flemish Pass Basins, 2011-2019* (LGL 2011b).

The remainder of Part B summarizes the proposed project, the related environmental setting and existing human use of the area, based on the above mentioned information.

1 Description of Project

The geophysical program in 2011, as proposed by Statoil, includes a ship-based seismic program starting with a 3D survey, a small number of 2D surveys and at least one geohazard survey in the Jeanne d'Arc Basin and two in the Flemish Pass area. Other surveys (2D, 3D and controlled source electromagnetic (CSEM) will be conducted as needed in subsequent years through 2019. 4D surveys, or repeat surveys, may be conducted in some areas. Geohazard and potentially CSEM surveys will be conducted over potential drilling targets on current Statoil Exploration Licences (ELs) and in future, yet-to-be determined, locations as required during the program. As many as five geohazard surveys per year and a maximum of one or two CSEM surveys per year could occur from 2012-2019. Streamers may be deployed enroute to the Project Area. A separate route analysis will be prepared by Statoil and submitted to the C-NLOPB before this activity occurs. This route analysis will include discussions with fishing interests before transit, to avoid fixed gear fishing activities.

The Project Area includes lands held by Statoil and partners that were previously assessed and approved for seismic and geohazard surveys in 2008. However, the present EA Report Project Area has expanded to include the original 2008 seismic area in the Jeanne d'Arc Basin (42,260 km^2), plus an additional area in the Flemish Pass Basin (22,110 km^2) to the northeast that encompasses several new exploration licences (ELs). The new Project Area encompasses a 64,370 km^2 area including a 10 km buffer for vessel turning. The Study Area encompasses a 99,520 km^2 area and includes a 25 km buffer around the Project Area. The typical duration of a 2D or 3D survey could vary from 40 to >100 days. A geohazard survey in support of a drilling program is approximately four to five days up to nine to 11 days including transit and weather down time. The typical duration of CSEM surveys is 40-80 days. Seismic and CSEM surveys will occur between 1 April and 31 October of any given year. Geohazard surveys may be conducted at any time of the year.

The initial 3D seismic survey, proposed for June 2011, will comprise of survey lines running northeast southwest and spaced between 500 and 700 m apart in a 1,675 km^2 area around EL 1123 and at least 40 days in duration. The 3D seismic survey vessel will tow a dual sound source (airgun array) and 10-14 streamer(s) composed of receiving accelerometers and hydrophones. Prior to the start of the 3D program, it is anticipated that a small 2D program (three days duration) will occur adjacent to the "2011 proposed 3D Seismic Area". The 2D program will likely consist of lines running approximately east-west. One geohazard survey may be conducted in the Jeanne d'Arc Basin area and two in the Flemish Pass area. Geohazard surveys occur over a much shorter time frame using a smaller vessel and a combination of smaller scale seismic equipment, sonars, sparkers and boomers. For potential jack-up drill rig sites, geohazard data will be acquired along transects spaced 50 m apart. Transects will

be spaced 250 m apart with tie lines at 500 m at potential semi-submersible drill rig sites. Survey grids (estimated at 5 km x 5 km) will be centered at potential drill sites. Electromagnetic surveys may be conducted to better distinguish between hydrocarbons and water prior to drilling. Electromagnetic surveys entail towing an electrical source and measuring resistivity of the sea bed, typically using receivers placed on the seabed.

2 Description of Environment

The following sections provide a summary of the environmental factors described in the EA Report and Addendum. A complete description of the biological and physical environment can be found in these reports.

2.1 Physical Environment

The survey will be conducted in water depths ranging from less than 200 m in the south western portion (Region 1) to greater than 3,000 m in the northern portion (Region 2). The Study Area is highly diverse and includes several distinct types of bathymetry as characterized by depths, location and physiography. Two major current systems in the area are the Labrador Current and the North Atlantic Current. The Labrador Current is the main current in the Study Area and it transports sub-polar water to lower latitudes along the Continental Shelf of eastern Canada. The Labrador Current consists of two major branches. The inshore branch of the Labrador Current is approximately 100 km wide and is steered by the local underwater topography through the Avalon Channel. The stronger offshore branch flows along the shelf break over the upper portion of the Continental Slope. The offshore branch passes between the 400 m and 1200 m isobaths.

Air and sea surface temperatures for Regions 1 and 2 were extracted from the International Comprehensive Ocean-Atmosphere Data Set (ICOADS). The air temperature is coldest in February with a mean temperature of -0.4°C in Region 1 and 0.1°C in Region 2, and warmest in August with a mean temperature of 14.3°C in Region 1 and 12.6°C in Region 2. The sea surface temperature is warmest in August with a mean temperature of 13.7°C in Region 1 and 12.3°C in Region 2 and coldest in February and March with a mean temperature of 0.3°C in Region 1 and 1.6°C in Region 2. The mean sea surface temperature is colder than the mean air temperature from April to August, with the greatest difference occurring in the month of July.

The wind and wave climatology of the Study Area was prepared from the MCS50 hindcast data set prepared by Oceanweather Inc. for Environment Canada. The climate analysis was carried out using four grid points to represent the Project Area. The grid points are: Grid Point 10255 at 46.3°N: 48.4°W; Grid Point 11820 at 47.1°N: 47.3°W; Grid Point 13428 at 48.0°N: 46.3°W; and Grid Point 14697 at 48.8°N: 46.3°W. The Study Area experiences predominantly southwest to west flow throughout the year. West to northwest winds, which are common during the winter months, begin to shift counter-clockwise during March and April resulting in a primary southwest wind by the summer months. As autumn approaches, the winds shift slightly, becoming mainly westerly again by late fall and into winter. Low pressure systems crossing the area are more intense during the winter months. As a result, mean wind speeds tend to peak during the month of January in excess of 12 m/s. The presence of advection fog increases from April through July. The month of July has the highest percentage of obscuration to visibility, most of which is in the form of advection fog, although frontal fog can also contribute to the reduction in visibility. In August the temperature difference between the air and the sea begins to lessen and by September, the air temperature begins to fall below the sea surface temperature. As the air temperature drops, the occurrence of fog decreases.

In Region 1, the majority of wave energy comes from the west-southwest to south-southwest, and accounts for 35.9% of the wave energy at Grid Point 10255 and 36% of the wave energy at Grid Point 11820. The annual percentage frequency of significant wave heights show that the majority of significant wave heights lie between 1.0 and 4.0 metres. There is a gradual decrease in frequency of wave heights above 4.0 m and only a small percentage of the wave heights exceeding 7.0 m can be found. In Region 2, the majority of wave energy comes from the southwest, and accounts for 33.9% of the wave energy at Grid Point 13428. At Grid Point 14697 the majority of wave energy is from the southwest, accounting for 32.9% of the wave energy. The dominant wave height is between 1.0 and 3.0 metres at both grid points. There is a gradual decrease in frequency of wave heights above 3.0 m and only a small percentage of the wave heights exceeding 8.0 m can be found.

In Region 1, the area is affected by sea ice beginning the week of 8 January and lasting until the week beginning 28 May. In Region 2, the area is affected by sea ice beginning the week of 15 January and lasting until the week beginning 7 May. In Region 1, the number of iceberg sightings ranged from one in some years to a maximum of 987 in 1994. A monthly analysis shows that icebergs have been recorded within Region 1 from December to August; however, they are most prominent during April. In Region 2, the number of iceberg sightings ranged from none in some years to a maximum of 676 in 1974. A monthly analysis shows that icebergs have been recorded within Region 2 from December to August; however, they are most prominent during March in this Region.

2.2 Biological Environment

2.2.1 Species at Risk

There are a number of Species at Risk, as defined under Schedule 1 of the *Species at Risk A*ct (SARA) that are likely to be within the Study Area. The following table identifies species likely to be present and their SARA listing and Committee on the Status of Endangered Wildlife in Canada (COSEWIC) designation. A brief description of species listed as endangered or threatened on Schedule 1 is included below.

SPECIES	SARA Status	COSEWIC Status
Blue Whale (*Balenoptera musculus*)	Schedule 1 – Endangered (May 2002)	Endangered (May 2002)
North Atlantic Right Whale (*Eubalaena glacialis*)	Schedule 1 – Endangered (2003)	Endangered (May 2003)
Leatherback Turtle (*Dermochelys coriacea*)	Schedule 1 – Endangered (May 2001)	Endangered (May 2001)
Ivory Gull (*Pagophilia eburnea*)	Schedule 1 – Endangered (April 2006)	Endangered (April 2006)
Northern Wolffish (*Anarhichas denticulatis*)	Schedule 1 – Threatened (May 2001)	Threatened (May 2001)
Spotted Wolffish (*Anarhichas minor*)	Schedule 1 – Threatened (May 2001)	Threatened (May 2001)
Atlantic Wolffish (*Anarhichas lupus*)	Schedule 1 – Special Concern (2000)	Special Concern (November 2000)
Fin Whale (*Balaenoptera physaalus*)	Schedule 1 – Special Concern (May 2005)	Special Concern (May 2005)
Harbour porpoise (*Phocoena phocoena*)	Schedule 2 – Threatened (April 2006)	Special Concern (April 2006)

Humpback whale *(Megaptera novaeangliae*	Schedule 3 – Special Concern (May 2003)	
Sowerby's beaked whale (*Mesoplodon bidens*)	Schedule 3 – Special Concern (November 2006)	Special Concern (November 2006)
Atlantic cod (*Gadus morhua*)	Schedule 3 – Special Concern (May 2003)	
Loggerhead sea turtle (*Caretta caretta*)		Endangered (April 2010)
Atlantic cod (*Gadus morhua*) NL population		Endangered (April 2010)
Porbeagle shark (*Lamna nasus*)		Endangered (May 2004)
White shark (*Carcharodon carcharias*)		Endangered (April 2006)
Cusk (*Brosme brosme*)		Threatened (May 2003)
Shortfin mako shark (*Isurus oxyrinchus*)		Threatened (April 2006)
Blue shark (*Prionace glauca*)		Special Concern (April 2006)
American plaice (*Hippoglossoides platessoides*)		Threatened (April 2009)
Basking shark (*Cetorhinus maximus*)		Special Concern (November 2009)
Roughead grenadier (*Macrourus berglax*)		Special Concern (April 2007)
Roundnose grenadier (*Coryphaenoides rupestris*)		Endangered (November 2008)
Atlantic salmon (*Salmo salar*) South NL population		Threatened (November 2010)
Acadian redfish (*Sebastes fasciatus*) Atlantic population		Threatened (April 2010)
Deepwater redfish (*Sebastes mentella*) Northern population		Threatened (April 2010)
Spiny dogfish (*Pagophila ebumea*)		Special Concern (April 2010)

Blue whales likely number in the low hundreds in the NW Atlantic and have been sighted only sporadically off the NE coast of Newfoundland. They are considered rare in the Study Area. There were no sightings of blue whales in the Study Area in the Department of Fisheries and Oceans (DFO) cetacean sightings database. During a CSEM monitoring program in 2007, there were two sightings of blues whales in the Study Area, both occurred in August and in water depths of 2366 m and 2551 m (Abgrall et al. 2008). A recently proposed Recovery Strategy (DFO 2009) for blue whales is available with a long-term recovery goal to reach a total of 1000 mature individuals through the achievement of three 5-year objectives. A recovery action plan will be developed by 2014.

The total population of North Atlantic Right Whale currently numbers about 325 individuals and is considered extremely rare in the Study Area. However, there have been some relatively recent sightings of small numbers of right whales off Iceland and Norway, and it is possible that this species may occur in the Study Area. Right whales were recorded once in the Study Area; on 27 June 2003 during a Provincial Airlines (PAL) reconnaissance survey. The Recovery Strategy (Brown *et. al.* 2009) noted a goal "to

achieve an increasing trend in population abundance over three generations" via seven recovery objectives.

The Leatherback sea turtle is the largest and most widely ranging of sea turtles. There are an estimated 26,000 to 43,000 individuals globally. Adult leatherbacks are considered regular summer visitors to eastern Newfoundland, with the northernmost records occurring off Labrador at nearly 54^{o} N. Observations around Newfoundland and Labrador occur from June to November, but are most common in August and September. DFO Newfoundland Region has maintained a database of leatherback turtle sightings and entanglements in Newfoundland and Labrador. One leatherback turtle observation was recorded in the southwestern portion of the Study Area in August 2007. In the recovery strategy (ALTRT 2006) for leatherback sea turtle in the Canadian Atlantic Ocean, the recovery goal is to "achieve the long-term viability of the leatherback turtle populations frequenting Atlantic Canadian waters" via six supporting objectives. No critical habitat has been designated.

The Ivory Gull is a rare gull species that is associated with pack ice at all times of the year. Ivory Gulls occur among the pack ice of the Davis Strait, the Labrador Sea, Strait of Belle Isle, and northern Gulf of St. Lawrence. Currently, the Canadian breeding population is estimated at 500 to 600 individuals. Surveys conducted during 2002 to 2005 indicate a total decline of 80% and an annual decline of 8.4% over the last 18 years. During heavy ice winters, the Ivory Gull may occasionally reach the southern Orphan Basin and northern Grand Banks in the Study Area. The thirty-year median of ice concentration shows ice extending into the northern edge of the Grand Banks east to 48°W during late February to late March. This species is expected to be very rare in most winters in the Study Area and absent during the summer.

The northern and spotted wolffish have a very similar life history, except that the northern wolffish inhabits slightly deeper water. Atlantic wolffish is primarily demersal and inhabits shallower areas than northern and spotted wolffishes. During 1980-1984, wolffish were most concentrated on the northeast Newfoundland and Labrador shelf and banks, the southwest and southeast slopes of the Grand Banks, along the Laurentian Channel, and in the Gulf of St. Lawrence. Between 1995 and 2003, the area occupied and density within the area was considerably reduced. The species is still relatively widespread, and therefore exists in considerable numbers. A recovery strategy for the northern wolffish and spotted wolffish, and a management plan for Atlantic wolffish in Canada was published in 2008 (Kulka *et. al*., 2008).

The current estimate of fin whale for the western North Atlantic stock is 3,985 individuals. Fin whales continue to regularly occur in Newfoundland and Labrador waters, particularly during summer months. Based on the DFO cetacean sightings database, fin whales have been sighted throughout the Study Area from May to September. Fin whales were commonly observed in the Orphan Basin during the 2004 and 2005 seismic monitoring programs. It is likely that fin whales commonly occur in the Study Area at least during late spring to fall.

2.2.2 Fish and Fish Habitat

A detailed description of the plankton, benthos, and deep-water corals and sponges communities can be found in the EA Report (LGL 2011a) and EA Addendum (LGL 2011b). There are three main types of marine fish present in the Study Area: 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.

Two macroinvertebrate species, northern shrimp (*Pandalus borealis*), and snow crab (*Chionoecetes opilio*) dominate the reported landings of commercial catches within the Study Area from 2003 to 2009. Other macroinvertebrate that account for at least 0.1% of the catch weight include Stimpson's surf clam (*Mactromeris polynyma*) and Greenland cockle (*Serripes groenlandicus*). Greenland halibut (*Reinhrdtius hippoglossoidess*) is the only fish species; reported to account for at least 0.1% of total catch weight. These are described below.

The northern shrimp is distributed from Davis Strait to the Gulf of Maine. It usually occupies soft muddy substrates up to depths of 600 m in temperatures of 1°C to 6°C. Larger individuals generally occur in deeper waters. Based on DFO Research Vessel (RV) survey data collected in the Study Area in 2008 and 2009, most of the northern shrimp were caught at mean water depths ranging between 100 and 300 m during both spring and fall surveys.

The snow crab occurs over a broad depth range in the north-west Atlantic from Greenland south to the Gulf of Maine. Snow crab distribution is widespread and continuous in waters off Newfoundland and southern Labrador. Large males are most common on mud or mud/sand, while smaller crabs are common on harder substrates. Based on DFO RV survey data collected in the Study Area in 2008 and 2009, most of the snow crab was caught at mean water depths greater than 200 m.

The Stimpson's surf clam is the largest clam in the north-western Atlantic Ocean and occurs from Labrador to Rhode Island. In the Canadian part of its range, this species occurs in commercial quantities in the offshore areas of the Scotian Shelf and Eastern Grand Banks, and inshore areas off southwest Nova Scotia and in the Gulf of St. Lawrence. They appear to prefer medium to coarse sand substrate in which they burrow. Georeferenced commercial catch location data for the April to October period, 2003-2009, indicate that most surf clam catches within the Study Area occurred at the south-western part of the Study Area at locations with water depths less than 100 m.

The Greenland cockle is widely distributed throughout the Arctic Ocean and southward in varying degrees. In the Northwest Atlantic Ocean, it is found from Greenland to Cape Cod at sub-tidal depths greater than 9 m. It has been found on sandy substrates within a depth range of 6 to 18 m at various Labrador locations. It is approximately 100 mm in diameter at full growth. The life history of the Greenland Cockle is poorly understood. Georeferenced commercial catch location data for the April to October period, 2003-2009, indicate that most cockle catches within the Study Area occurred at the southwestern part of the Study Area at locations with water depths less than 100 m.

The Greenland halibut is distributed throughout cold, deep waters of the Labrador-eastern Newfoundland area, inhabiting the continental shelf and slope at depths of 200 to 600 m or more. Based on DFO RV survey data collected in the Study Area in 2008 and 2009, most of the Greenland halibut were caught at mean water depths greater than 300 m during both spring and fall surveys.

Other species that have been harvested within the Study Area during recent years include: yellowtail flounder (*Limanda ferruginea*); skate (*Raja*spp.); roughhead grenadier (*Macrourus berglax);* capelin (*Mallotus villosus*); Atlantic halibut (*Hippoglossus hippoglossus*); American plaice (*Hippoglossoides platessoides*); redfish (*Sebaste*s spp.); swordfish (*Xiphias gladius*); tunas (*Thunnus* spp.); Atlantic cod (*Gadus morhua*); and wolffishes. These are profiled in the EA Report.

2.2.3 Commercial Fisheries

The majority of the Study Area is outside Canada's 200 nautical mile (NMi) economic exclusion zone

(EEZ), overlapping portions of NAFO Unit Areas (UA) 3K, 3L and 3M. DFO data in NAFO UAs 3Le, 3Li, 3Lt, 3Lh, 3Lr, 3Ma and 3Kk are used to describe catch rates in the EA Report. Over the past several years nearly 75% of the Study Area catch has come from 3Le (61%) and 3Lt (13.5%). The domestic harvest in the Study Area has been equally dominated by shrimp and crab, though snow crab is a much higher value species. Greenland halibut, or turbot, is the third species harvested in this area, representing about 0.1% of the Study Area catch by quantity and value, an average of just over 20 tonnes on average between April and October over the seven-year period.

The commercial fisheries within the Study and Project Areas are conducted using both mobile gear (shrimp trawls) and fixed gear (crab pots and gillnets), although only a minority of the overall catch is harvested using gillnets. Crab pots are set on the seabed in strings buoyed at the surface. Crab gear generally has a highflyer (radar reflector) at one end and a large buoy at the other. Although they only account for about 0.1% of the harvest by quantity, Greenland halibut gillnets (e.g., 200 nets per boat) are also fixed gear. Shrimp are harvested with shrimp trawls, a mobile fishing gear which is essentially a modified stern otter trawl. The shrimp trawl and fixed gear fisheries generally stay apart.

2.2.4 Marine Mammals and Sea Turtles

A total of 20 marine mammals, including 17 cetacean and three seal species are known or expected to occur in the Study Area. Most marine mammals use the Study Area seasonally, and the region likely represents important foraging areas for many. Sea turtles regularly occur on the Grand Banks and adjacent waters with two species potentially occurring within the Study Area. The EA Report provides a summary of the marine mammals and sea turtles known or expected to occur in the northern Grand Banks Study Area. It also provides a summary of sightings from data sources including commercial whaling, fisheries observers, marine Mammal Observers (MMOs) on board seismic vessels, and the general public. Sighting dates ranged from 1961 to 2009.

Six species of baleen whales occur in the Study Area. Blue whales are considered rare and North Atlantic right whales are considered extremely rare. The four more common baleen whales are the Fin Whale, Sei whale (*B.borealis*), Humpback whale (*Megaptera novaeangliae*) and Minke whale (*B. acutorostrata*). Some baleen whales are present in offshore waters of Newfoundland year-round but most species presumably migrate to lower latitudes during winter months. Based on the DFO cetacean sightings database, fin whales have been sighted throughout the Study Area from May to September and seven sei whale sightings have been reported. Humpbacks are the most commonly recorded mysticete in the Study Area, with sightings occurring year-round, but predominantly during summer. Within the Study Area, minke whales were the fourth most commonly recorded mysticete in the DFO sightings database, with sightings predominantly recorded during summer months

Eleven species of toothed whales occur in the Project Area, ranging from the largest of odontocetes, the sperm whale, to the one of the smallest, the harbour porpoise. Many of these species seem to be present in the Study Area only seasonally. The eight most common toothed whales found in the Study Area include the Sperm Whale (*Physter macrocephalus*), Northern bottlenose whale (*Hyperoodon ampullatus*), Longfinned pilot whale (*Globicephala melas*), Atlantic white-sided dolphin (*Lagenorhynchus acutus*), Shortbeaked common dolphin (*Delphinus delphis*), White-beaked dolphin (*L. albirostris*), Striped dolphin (*Stenella coeruleoalba*), and Harbour porpoise (*Phocoena phocoena*). Sperm whales were regularly sighted in the deep waters of Orphan Basin during the summers of 2004-2007 but were not observed in the shallower waters of Jeanne d' Arc Basin in 2005-2007. However, they are regularly sighted in shallow coastal waters and therefore may be encountered in the Flemish Basin. There are 89 sightings of sperm whales reported in the DFO cetacean sightings database that occurred in the Study Area. Northern

bottlenose whales may occur at low densities, but year-round, throughout the deep, offshore waters of the Orphan Basin. Based on the DFO cetacean sightings database, there have been five sightings of northern bottlenose whales in the deeper waters of the Study Area from May to September. Long-finned pilot whales were the most commonly recorded toothed whale in the DFO cetacean database, occurring most months of the year and primarily in waters greater than 500 m deep in the Study Area. Atlantic whitesided dolphins occur regularly from spring to fall in offshore areas of Newfoundland, but less is known of their winter distribution. Sightings in the North Atlantic seem to coincide with the 100 m depth contour and areas of high relief; there were 21 sightings in the DFO cetacean sightings database, all in water greater than 500 m deep. There were ten sightings of short-beaked common dolphin recorded in the Study Area in the DFO database; most sightings were in waters greater than 500 m deep. White-beaked dolphins are thought to remain at high latitudes year-round and are generally observed in continental shelf and slope areas, although they also occur in shallow coastal areas. Offshore waters of Newfoundland are thought to be at the northern limit of the Striped dolphin's range. There were 13 sightings of this species recorded in the Study Area based on the DFO cetacean database. Harbour porpoises typically occur singly or in small groups of up to three individuals, occasionally occurring in larger groups. There were eleven harbour porpoise sightings in the Study Area in the DFO cetacean sightings database.

Two species of seals including harp (*Pagophilus groenlandicus*) and hooded (*Cystophara cristata*) occur in the Project Area. The area of the NE Grand Banks, slope and Flemish pass is critical for seals during spring. Harp seals are common during spring off northeast Newfoundland and southern Labrador where they congregate to breed and pup on the pack ice. The area is used extensively by Hooded Seals in May but they have left the area for the moulting ice by late May.

2.2.5 Marine Birds

The Grand Banks area supports large numbers of seabirds during all seasons. There are approximately 27 seabird species that occur in the Study Area that are described in the EA Report. Results of seabird surveys, including the more recent Canadian Wildlife Service (CWS) and monitoring programs for geophysical surveys are also included in the EA Report. The Sackville Spur, Orphan Basin and Flemish Pass are important to one or more species /groups in one or more seasons. The Orphan Knoll held high numbers of Black-legged Kittiwake (*Rissa tridactyla*) during summer. Northern Fulmar (*Fulmarus glacialis*) and gulls (*Larus* spp.) were found in the highest concentrations in the Newfoundland and Labrador Shelves region on the Sackville Spur during spring. Substantial numbers of these birds were also present in winter. Northern Fulmars, Leach‟s Storm-Petrels (*Oceanodroma leucorhoa*) and shearwaters (*Puffinus* spp.) were found in summer along the southern edge of the Orphan Basin. The Eastern Canadian Seabirds at Sea (ECSAS) surveys, initiated by the CWS, in the Flemish Pass and Flemish Cap showed local hotspots during winter and spring for Northern Fulmar, Black-legged Kittiwake, Dovekie (*Alle alle*), gulls (spring only) and murres (*Uria* spp.). Shearwaters were in high densities in summer.

2.2.6 Sensitive and Special Areas

Potential sensitive areas include: important bird areas (IBA); important coral areas; Ecologically and Biologically Significant Areas (EBSAs), Marine Protected Areas (MPAs) and MPA Areas of Interest (AOI) identified pursuant to the *Oceans Act*; and National Marine Conservation Areas (NMCAs) identified pursuant to the *National Marine Conservation Areas Act*.

There are nine significant seabird nesting sites, or Important Bird Areas (IBAs), on the southeast coast of Newfoundland from Cape Freels to the Burin Peninsula. The closest IBA is approximately 350 km from the Study Area.

The Study Area includes a portion of the Placentia Bay Grand Banks (PBGB) Large Ocean Management Area (LOMA), one of the marine regions established to form the planning basis for implementation of integrated-management plans by DFO. The EBSA in the Study Area (i.e., the Northeast Shelf and Slope) is a potential AOI for a MPA. The Northeast Shelf and Slope EBSA has an overall „low priority" rating relative to other EBSAs within the PBGB LOMA. Aspects of this EBSA are described in the EA Report. As well, the *Oceans Act* provides the Minister of DFO with a leadership role for coordinating the development and implementation of a federal network of MPAs, which can include areas within and outside of the Integrated Management (IM) area that have yet to be developed within the Region. Therefore, there remains potential for further identification of EBSAs, AOI, MPAs and other sensitive areas within the Study Area.

In 2003, as protection for the Northern cod, the Fisheries Resource Conservation Council (FRCC) recommended the establishment of an experimental "cod box" in the Bonavista Corridor. The Corridor has been identified as an area important for cod spawning and juvenile cod. The FRCC recommended that this area be protected from all forms of commercial fishery (excluding snow crab trapping) and other invasive activity such as seismic exploration. In April 2003, DFO announced that special conservation measures were required for the Bonavista Corridor, including the Bonavista Cod Box, located about 80 km North-west of the Study Area.

In 2008 and 2009, the NAFO Scientific Council identified areas of significant coral and sponge concentrations within the NAFO Regulatory Area. Based on these identifications, areas for closure to fishing with bottom contact gear were delineated. A figure is provided in the EA Addendum showing the locations of 11 of these areas that occur either within or close to the Study Area. Implementation date of the closures started on 1 January 2010.

A search of the Department of National Defence (DND) records was conducted to determine the possible presence of unexploded ordinates (UXO) within the Study Area. Although no wrecks are present within the survey area, one site is approximately 8 km from the western boundary of the Study Area. A U-520 German IXC Type U-Boat which was sunk by depth charges from a Canadian Digby aircraft on 30 October 1942. However, the exact location of the wreck is uncertain. Given the wreck's recorded location, and understanding of the seismic and geohazard survey activities to be conducted, the associated UXO risk is assessed as low. Nonetheless, due to the inherent dangers associated with UXO and the fact that the Atlantic Ocean was exposed to many naval engagements during WWII, should suspected UXO be encountered during the program, Statoil and its subcontractors will not disturb/manipulate it, will mark the location and immediately inform the Coast Guard. Some geophysical survey techniques (e.g., CSEM surveys) may utilize small dissolvable anchors. DND will be consulted by Statoil prior to any deployment of bottom mounted equipment, and adjustments will be made to the study design, if necessary.

2.2.7 Research Surveys and Vessel Traffic

In any year, DFO research surveys are conducted in NAFO 3KLM. Typically, DFO conducts a spring survey in sections of 3LNOPs (April-July), and a fall survey of 2HJ3KLMNO (September / October to December). An annual spring 3L Capelin acoustic survey may occur in the Study Area. The fall survey may employ two vessels. The deeper waters of 3L (slope areas) are typically surveyed in October, and the shallower areas in November or December. It will be necessary to maintain contact with DFO throughout each work season. The DFO Science Advisory Schedule can be accessed on-line to view activities scheduled in Canada http://www.isdm-gdsi.gc.ca/csas-sccs/applications/events-evenements/index-eng.asp

Members of the Fish, Food and Allied Workers Union (FFAW) have been involved in an industry survey for crab in various offshore harvesting locations over the past few years, such as the snow crab Industry-DFO collaborative post-season trap survey (CPS). This survey is conducted every year and starts on September 1 and may continue until November before it is completed. The set locations are determined by DFO and do not change from year to year. Many of the eastern stations fall within Statoil's Study Area, and all are within the 200 mile limit.

The Department of National Defence (DND) is likely to be transiting and conducting navy exercises within the study area during the April to October 2011 to 2019 timeframe. It will be necessary to maintain contact with DND throughout each work season.

In the summer, the main North Atlantic shipping lanes between Europe and North America lie to the north of the Grand Banks into the Strait of Belle Isle. In the winter, that traffic shifts to the main shipping lanes along the southern Grand Banks into the Gulf of St. Lawrence.

There are three existing offshore production developments (Hibernia, Terra Nova, and White Rose) on the northeastern part of the Grand Banks which fall outside of the boundaries of the Study Area. Chevron is proposing to conduct seismic programs between 2011 and 2017 in the North Grand Banks regional area. Seismic vessels will remain at least 40 km apart during surveying.

Part C: ENVIRONMENTAL ASSESSMENT PROCESS

3. Review Process

On January 28, 2011, Statoil submitted a project description *Geophysical Program for Jeanne d'Arc Basin and Central Ridge/Flemish Pass Basin, 2011-2019* (Statoil 2011). The Project requires an authorization pursuant to Section 138(1) (b) of the *Canada-Newfoundland Atlantic Accord Implementation Act* and Section 134(1) (a) of the *Canada-Newfoundland and Labrador Atlantic Accord Implementation Newfoundland and Labrador Act.* The C-NLOPB, as Responsible Authority (RA), forwarded the CEAA *Federal Coordination Regulations* (FCR) Section 5 Notification on January 10, 2011 to: DFO; Environment Canada (EC); DND; Transport Canada (TC); Natural Resources Canada (NRCan); Health Canada; and the Newfoundland and Labrador Departments of Environment and Conservation, Fisheries and Aquaculture, and Natural Resources. On February 24, 2011, the C-NLOPB notified Statoil that a screening level of assessment was required and the proponent was provided with a Scoping Document.

Pursuant to paragraph 12.4(2) of the *Canadian Environmental Assessment Act* (CEA Act), and the *Regulations Respecting the Coordination by Federal Authorities of Environmental Assessment Procedures and Requirements*, the C-NLOPB assumed the role of the Federal Environmental Assessment Coordinator (FEAC) for the screening and in this role was responsible for coordinating the review activities by the expert government departments and agencies that participated in the review.

On March 30, 2011, Statoil submitted the "*Environmental Assessment of Statoil's Geophysical Program for the Jeanne d'Arc and Central Ridge/ Flemish Pass Basins, 2011-2019*" (LGL 2011a). The C-NLOPB forwarded the EA Report on April 1, 2011 to DFO, EC, DND, and the provincial Departments of Environment and Conservation, Fisheries and Aquaculture, and Natural Resources. The FFAW and One Ocean were also provided a copy of the EA Report for review.

Comments on the EA Report were received from DFO, EC, DND and the FFAW. In order to address deficiencies in the EA Report, Statoil was required to provide a response to the EA Report review comments. Statoil responded on June 2, 2011 and the C-NLOPB forwarded the responses to DFO, EC, DND and the FFAW.

It is the obligation of the RAs to consider which physical works and undertakings, in relation to the proposed Project, fall within the scope of the Project. First, there are no associated physical works that should be included in the scope of the Project. Second, if the proposed Project were to proceed, as set out in the application, it would constitute a single Project for the purposes of subsection 15(2) of *CEAA*. For the purposes of subsection 15(3) of *CEAA*, the scoping exercise is complete because an assessment was conducted in respect of every construction, operation, modification, decommissioning, abandonment, or other undertaking proposed by Statoil that is likely to be carried out in relation to their proposed Project.

3.1 Scope of Project

The Project is generally located on the northeastern Grand Banks and off the Banks to the northeast. The geographic extent of project activities includes the 64,370 km^2 Project Area with a 10 km buffer for vessel turning. The proposed program includes a ship-based seismic program starting with a 3D seismic survey, a small number of 2D profiles, and geohazard surveys in 2011 and other surveys (e.g., 3D, 2D, ocean bottom seismic, CSEM) conducted as needed in subsequent years through 2019. This program may include repeat survey of some areas to evaluate changes in existing producing reservoirs over time typically called a "4D" survey. In addition, geohazard and potentially CSEM surveys will be conducted over potential drilling targets on current Statoil ELs and in future, yet-to-be-determined, locations as required during the program.

The proposed survey in 2011 will likely have survey lines running northeast-southwest and spaced between 500 and 700 m apart, dependent on the vessel configuration. The 3D seismic survey vessel will tow a dual sound source (airgun array) and 10-14 streamer(s) composed of receiving accelerometers and hydrophones. The 2D program will likely consist of lines running approximately east-west. The geohazard surveys will be conducted over a much shorter time frame using a smaller vessel and a combination of smaller scale seismic equipment, sonars, sparkers and boomers. The area (1,675 km^2) where seismic data are proposed to be acquired in 2011 is shown in the EA Report in Figure 1.1 (Potential 3D Seismic Area 2011). Surveying will focus on EL1123. Water depth in the survey area ranges from approximately 2,500 to 3,000 m.

Geohazard surveys will be conducted at exploratory drill sites. For potential jack-up drill rig sites, geohazard data will be acquired along transects spaced 50 m apart. Transects will be spaced 250 m apart with tie lines at 500 m at potential semi-submersible drill rig sites. Survey grids (estimated at 5 km x 5 km) will be centered at potential drill sites.

If a drilling target is identified, CSEM surveys may be conducted prior to drilling. They potentially could be conducted anywhere within the Project Area between 2012 and 2019. A typical duration for CSEM surveys is 40 to 80 days with a maximum of one or two surveys a year. This includes time to complete reconnaissance by echo sounder along all proposed source lines, deployment of receivers, sourcing of all source lines, recovering of receivers, overhead (e.g. transits, crew changes), and downtime (weather or technical). The electrical source would be towed approximately 30 m above the sea bottom. Current (about 1,200 Amperes) will be alternating and very low frequency (on the order of 0.25 Hz and will be determined on site after initial testing). Dipole receivers (i.e., antennae) are normally mounted on the sea bed in a grid pattern using anchors designed to dissolve within approximately one year. Each anchor

measures about 10-15 cm in thickness and 1 m x 1 m in area. The receivers are retrieved using acoustic releases. CSEM surveys tow gear at a slower speed than a seismic vessel (e.g., 2kts vs. 4 kts). Although specific CSEM surveys are not scheduled, they would typically cover 1,200 km^2 with as many as 200 bottom-mounted receivers employed in a grid pattern several kilometres apart. CSEM surveys do not utilize strong sound sources, however, typical seismic survey mitigations will be applied.

In 2011, it is anticipated that the 3D seismic survey will be at least 40 days in duration and the survey is expected to commence in June. Prior to the start of the 3D program, it is anticipated that a small 2D program (three days duration) will occur adjacent to the "2011 proposed 3D Seismic Area". In 2012-2019, seismic surveys may occur between 1 April and 31 October with a duration estimated at 40 to >100 days. There is potential that at least one geohazard survey may occur in 2011. As many as five geohazard surveys per year may occur in 2012-2019, with total individual survey duration of 9 to 11 days (including 4 to 5 days of data acquisition) per survey.

3.2 Boundaries

The boundaries of the Project are defined in the EA Report as follows and are acceptable to the CNLOPB.

Boundary	**Description**
Temporal	Seismic and CSEM Surveys - Between April 1 and 31 October, 2011 to 2019 Geohazard Surveys – Year round, 2011-2019
Project Area	Defined as a 64,370 km^2 area including a 10 km buffer area for vessel turning. The geographic coordinates (latitude, longitude; datum NAD83) of the approximate "corners" of the Project Area starting in the southwest corner and moving clockwise are as follows: Latitude (^oN) — Longitude (^oW) 46.0000000 — -49.5000000 48.0000000 — -49.5000000 48.0000000 — -47.2488764 48.9998187 — -47.2488646 48.9998138 — -46.8738558 49.5000000 — -46.8738484 49.5000000 — -45.7500000 47.5000000 — -45.7500000 47.5000000 — -47.0000000 46.0000000 — -47.0000000
Affected Area	The Affected Area includes the Project Area plus a 25 km buffer area around the Project Area
Regional Area	The area as defined in the Orphan Basin SEA Area (Figure 2.2 in LGL 2003) plus the Jeanne d'Arc Basin

There may also be an area of influence from the sound array. However, depending on the marine species present, this area of influence will vary in size. Hearing thresholds have been determined for a number of species (seals and odontocetes), but the threshold is not known for others (baleen whales). The sound that

is actually received by the marine species depends on the energy released from the source and its propagation (and loss) through the water column. Therefore, the hearing ability of the species and background noise will affect the amount of noise from an airgun array detected.

3.3 Scope of Assessment

For the purpose of meeting the requirements of the CEAA, the factors that were considered to be within the scope of the environmental assessment are those set out in paragraphs 16(1) (a) through 16(1) (d) of the CEAA, and those listed in the *Statoil Canada Limited – Jeanne d'Arc and Central Ridge/Flemish Pass Basins Seismic Program 2011-2019 Scoping Document* (C-NLOPB 2011a).

4. Consultation

4.1 Consultation carried out by Statoil

Consultations for Statoil's 2011-2019 geophysical program were undertaken with the following agencies, stakeholders and interest groups:

- Fisheries and Oceans Canada (DFO)
- Environment Canada (EC)
- Natural History Society (NHS)
- One Ocean
- Fish, Food and Allied Workers Union (FFAW)
- Association of Seafood Producers (ASP)
- Ocean Choice International (OCI)
- Groundfish Enterprise Allocation Council (GEAC, Ottawa)
- Clearwater Seafoods
- Icewater Seafoods

DFO did not have any significant concerns about the proposed program. The issue that the proposed program is over several years and some COSEWIC species may be designated species at risk over the life of the project was raised. Statoil is required to provide annual environmental updates to the C-NLOPB when applying for an authorization and this issue will be addressed when submitting these updates.

EC did not have specific issues or concerns with the program. The Marine Mammal Observer (MMO) will abide by agreed procedures for bird handling. EC also identified this proposed program as a good opportunity to collect additional seabird data from the area. A seabird data collection program will be undertaken and the data will be provided to EC.

Though the NHS did not have any significant concerns with the proposed survey, it reiterated ways to increase opportunities for collaborative research between seismic operators and members of the academic community. The NHS also noted its concerns about the number of MMO's that are onboard seismic survey vessels relative to the potential workload of these observers and the independence of these observers. In a follow-up response, the NHS questioned the range of noise generated by the seismic vessel.

Various aspects of the proposed geophysical program were discussed with the FFAW in early February. It was noted that the independent mobile gear fleet harvests shrimp in parts of the Study Area. Another fishery of interest in the vicinity of the Flemish Pass is a "new" cod fishery in NAFO 3M which FFAW's representative indicated has an overall quota of 10,000 tonnes. It was suggested by the FFAW that, prior to the start of the survey, Statoil representatives should meet with some independent fishing captains to provide advice to the survey vessel regarding suitable locations for deploying and testing its gear in order

to avoid grounds that are being actively fished (e.g. for either crab or shrimp). Statoil has committed to avoiding heavily fished areas and maintaining constant communication to avoid conflicts. These communications include Notices to Shipping, CBC Radio's Fisheries Broadcast and the use of a Fisheries Liaison Officer (FLO).

Statoil met with One Ocean in early February. There were no specific comments other than those noted by the FFAW. In a follow-up to that meeting, One Ocean recommended that, considering the multi-year timeframe of Statoil's exploration program, the proponent should continue to communicate with relevant fish harvesters in each year of the planned program, including the proposed 2011 survey activities. Statoil has committed to continuing consultation with the fishing industry.

OCI reported that it has a 200 tonne allocation of 3M cod that it plans to fish in 2011. The intent currently is that this allocation will be harvested in two trips, the first departing around mid-April, with a second trip departing around the end of April. In response to information provided to OCI about Statoil's proposed geophysical program, OCI could not indicate if the proposed survey would interfere with offshore shrimp vessel activities as this would depend on their respective fishing plans and ice in established shrimp grounds to the north (e.g. in NAFO Division 2K). It was also noted that OCI shrimp vessels do not usually operate in SFA 7 during the April to October period, though in some years they have harvested shrimp in October. Some of OCI‟s yellowtail grounds lie within the southwest corner of the Study Area.

It was noted by the GEAC that there were general concerns about the effect of seismic operations on various marine species, especially in the egg/larval stage, and also potential short-term effects on catch rates. Mitigative measures, or 'operational adjustments' – other than industry to industry communications about seismic vessel plans, were discussed.

The C-NLOPB are satisfied that the consultations carried out by Statoil, and reported on in the EA Report and Addendum, included all elements of the Project, and that Statoil has addressed substantive concerns about the proposed Project.

4.2 Review of the March 2011 EA Report

The C-NLOPB forwarded the EA Report on April 1, 2011 to DFO, EC, DND, and the provincial Departments of Environment and Conservation, Fisheries and Aquaculture, and Natural Resources. The FFAW and One Ocean also were provided a copy of the EA Report to review.

DFO provided comments on the EA Report on 13 May 2011. Their comments focused on the Statement of Canadian Practice (SOCP), the inclusion of corals and sponges and the assessment of electromagnetic surveys. They also had a number of specific comments pertaining to the accuracy of fish data/landings, SARA information and sensitive areas.

DND provided comments on the EA Report on 09 May, 2011. Their comments concerned the absence of their previous input provided during the Scoping Document stage.

EC provided comments on the EA Report on 17 May 2011 and requested that Statoil collect seabird data and provided protocol and proper bird-handling advice.

The FFAW provided comments on the EA report on 17 May, 2011. The key issues were: regular communication between the two industries; clarification on the handling of fishing gear; the unknown long-term effects of seismic on fish; the dynamics of the fishing industry; the designation of Atlantic cod; and the possible use of a Fisheries Guide Vessel.

The consolidated review comments were provided to Statoil on May 20, 2011. Statoil responded on June 2, 2011 and provided an EA Addendum. This EA Addendum was forwarded to reviewers for their consideration as to the adequacy of the response. All reviewers were satisfied that their comments had been adequately addressed. The C-NLOPB believes that all substantive comments within the scope of the EA have been satisfactorily addressed.

5. Environmental Effects Analysis

5.1 Methodology

The C-NLOPB reviewed the environmental effects analysis presented by Statoil in its EA Report. A Valued Ecosystem Component (VEC) based assessment, based on the interaction of project activities with VECs, was used in assessing environmental effects, including cumulative effects and effects due to accidental events. The environmental assessment methodology and approach used by the Proponent is acceptable to the C-NLOPB.

Potential adverse environmental effects, including cumulative effects, were assessed with respect to:

- magnitude of impact;
- geographic extent;
- duration, likelihood, and frequency;
- reversibility;
- ecological, socio-cultural and economic context; and
- significance of residual effects following implementation of mitigation measures.

The potential effect significance of residual effects, including cumulative effects, for each VEC was rated in this environmental screening report as follows:

0 = No Detectable Adverse Effect
1 = Detectable Effect, Not Significant
2 = Detectable Effect, Significant
3 = Detectable Effect, Unknown

These ratings, along with the likelihood of the effect, were considered in determining overall significance of residual effects.

In the EA Report and Addendum, Statoil presented information regarding the potential effects of the geophysical program activities on fish and fish habitat, commercial fisheries, marine mammals and sea turtles, sea birds, and species at risk. A summary of the effects assessment follows.

5.2 Valued Ecosystem Components/ Potential Environmental Effects

5.2.1 Fish and Invertebrates 1

The seismic and geohazard survey program will not result in any direct physical disturbance of the bottom substrate. During seismic and geohazard surveys, survey equipment is not expected to come in contact with the seafloor and deep-water corals and sponges. Therefore the negligible residual effects on fish habitat (i.e., water and sediment quality, phytoplankton, zooplankton, and benthos) are predicted to be not

significant. The dissolvable anchors for the CSEM program will affect small areas of benthic communities by altering small amounts of soft substrate to temporary hard substrates. Any effects of this temporary change are predicted to be low and thus not significant.

The potential effects of exposure to sound on fish and marine invertebrates can be either physical or behavioural. In the natural environment, fish have shown avoidance responses and swim away as an airgun array ramps up or as the survey slowly approaches. The airgun will be ramped-up, thereby allowing fish in the area to move away. Other studies referenced in the 2011 EA Report indicated that fish mortality did not result from exposure to seismic sound sources. Stress responses (physiological effects) to seismic exposure occur in fish, but these are temporary and reversible. Behavioural responses to seismic have been documented in a number of studies and are reported and discussed in the 2011 EA Report. Although research on the effects of exposure to airgun sound on marine invertebrates and fishes is increasing, many data gaps remain. Atlantic cod do have swim bladders and are therefore generally more sensitive to underwater sounds than fishes without swim bladders. Spatial and temporal avoidance of critical life history times (e.g., spawning aggregations) should mitigate the behavioural effects of exposure to airgun sound. To date, there have been no documented cases of acute mortality of juvenile or adult fish exposed to seismic sound characteristic of typical 2D and 3D seismic surveys. Limited data regarding physiological impacts on fish and invertebrates indicate that these impacts are both short-term and most obvious after exposure at close range. The physical effects of exposure to sound with frequencies >500 Hz are *negligible*, based on the available information from the scientific literature. Effects of exposure to >500 Hz sound and marine vessel sound appear to be primarily behavioural and somewhat temporary. Mitigations consistent with those outlined in the *Geophysical, Geological, Environmental and Geotechnical Program Guidelines* (C-NLOPB 2011b), will be implemented. The effects assessment concluded that physical effects on fish due to Project activities will be low in magnitude, in an area of less than 100 km^2, and of duration of one to 12 months. The likelihood of effects (behavioural and physical) is low and therefore **not significant**.

There is less knowledge of the effects of seismic sound on marine invertebrates, although some studies have been conducted on the sensitivity of certain invertebrate species to underwater sound. They may be capable of detecting vibrations but they do not appear to be capable of detecting pressure fluctuations. Snow crab, which is sensitive to the particle displacement component of sound only, will be at more than 200 m from the airguns and will not likely be affected by any particle displacement resulting from airgun discharge. Available experimental data suggest that there may be physical impacts on the fertilized eggs of snow crab and on the egg, larval, juvenile and adult stages of cod at very close range. Considering the typical source levels associated with commercial seismic airgun arrays, close proximity to the source would result in exposure to very high sound pressure levels. While egg and larval stages are not able to actively escape such an exposure scenario, juvenile and adult cod would most likely avoid it. Developing embryos, juvenile and adult snow crab are benthic and generally far enough from the sound source to receive energy levels well below levels that may have impact. In the case of eggs and larvae, it is likely that the numbers negatively affected by exposure to seismic sound would be similar to those succumbing to natural mortality. The limited studies done to date on the effects on marine invertebrates have not demonstrated any serious pathological or physiological effects. Any potential physical or behavioural impact to invertebrate species is considered to be low in magnitude, within an area of less than 100 km^2, over duration of one month to 12 months. The likelihood of effects (behavioural and physical) is low and therefore **not significant**.

The extremely low frequency (ELF) emissions of the EM source are non-ionizing radiation, exposure times are short and thus CSEM surveys are predicted to have no effect on the health of marine organisms. While it is unknown exactly what, if any effects, anthropogenic CSEM emissions (an alternating current,

AC source) may have on marine animals that use the Earth's magnetic field (a direct current, DC source), it is reasonable to predict that there would be negligible effects on navigation from brief exposures in the open ocean on the order of minutes. If there are effects from CSEM emissions, the most likely group affected would be the elasmobranchs. This group of cartilaginous fishes (e.g., sharks and rays) is electroreceptive through organs known as ampullae of Lorenzini which are extremely sensitive to AC current (i.e., AC receptors) but also can likely detect DC fields by moving back and forth through them. However, they are not predicted to be significantly affected by the electromagnetic fields generated by CSEM mainly because of attenuation, short exposure times, and the fact they regularly encounter natural electric fields stronger than those generated by CSEM. It is predicted that because the EM fields generated by CSEM attenuate with distance (<1 km) and exposure times are brief (<1 month) that any effects will be of low magnitude and hence **not significant**.

5.2.2 Commercial Fishing and DFO Research Surveys 1

Potential interactions with this VEC include a decrease in catch rates, interference with fishing gear and impact on DFO research survey trawls. As indicated above, seismic activity can result in a dispersion of fish species, and subsequently reduced catch rates for a short duration. The survey vessel will be present within Unit Areas of NAFO Divisions 3M, 3L and 3K. Seismic streamers and vessels can conflict with and damage fishing gear, particularly fixed gear (i.e. snow crab pots and turbot gillnets).

There has been substantial harvesting within NAFO Units 3Le, 3Lh, 3Li, 3Lr, 3Lt, 3Ma and 3Kk in the Study Area between 2003 and 2009. Only two species, snow crab and shrimp, made up the bulk of harvest within the Study Area during the 2003 to 2009 period. Shrimp and snow crab accounted for about 50% each of the catch by landed weight within the planned survey window. Turbot was the only groundfish species pursued with any effort in the Study Area, but it only made up 0.1% of the overall catch by weight and value. The potential for impacts on fish harvesting will, therefore, depend on the location of the surveying activities in relation to these fishing areas, and the type of fishing gear used in any given season. If the survey work is situated away from these fishing areas, the likelihood of any impacts on commercial harvesting will be greatly reduced. This interaction is not likely as the seismic surveys in 2011 are planned for the northern end of the Study and Project areas, where gillnetting for Greenland halibut is not recorded to occur. The seismic survey will be located well outside the snow crab and shrimp fishing activities, thus no direct interaction is anticipated with those harvests in 2011.

Seismic surveys can sometimes result in reduced trawl and longline catches immediately following a survey as the fish temporarily move from the area. There are various research studies on this subject as discussed in the EA Report. While some of the behavioural effects studies report decreases in catch rates near seismic arrays, there is less agreement on the duration and geographical extent of the effect, ranging from a quick return to several days, and from very localized effects to decreased catch rates as far as 15 km to 20 km away. As commercial catches area quota based, the overlap between fishing and seismic activity is unknown, but will be determined by Statoil prior to the commencement of the surveys. The effects of seismic surveys on the catchability of fish and shellfish are predicted to be negligible to low, during <1 to 1-12 months, over an area of 11 to 100 km^2 and reversible.

Statoil indicated that a number of mitigations, consistent with those outlined in the *Geophysical, Geological, Environmental and Geotechnical Program Guidelines* (C-NLOPB 2011b), will be implemented. These include: avoidance of heavily fished areas; use of a FLO on the vessel to be a communication link between the two industries and to help ensure effective communication between petroleum operators and fishers at sea; communication with fishers (via a Notice to Mariners and a Notice to Fishers) and scheduling of surveys to reduce interference with DFO research vessels; single point of contact (SPOC), and a fishing gear damage compensation plan. The CSEM survey vessel has less

potential to conflict with fishing gear or fishing vessels because it operates at lower speeds and does not tow long sets of streamers. Statoil will maintain regular communications with the FFAW and fishers before and during the 2011 survey (and those in 2012-2019) in order to keep apprised of ongoing development in the Project Area fisheries.

To avoid potential conflict with DFO Research surveys, Statoil will maintain communications with DFO personnel to keep up-to-date on the timing of planned research surveys. In addition, a temporal and spatial buffer zone will be implemented, in consultation with DFO, to reduce any potential interference with fish behavioural patterns.

Given the application of mitigation measures and the location of fishery activity, it is predicted that the effects of geophysical activities (and CSEM), including vessel movement, will be low in magnitude, within an area of less than 100 km^2, over duration of one month to 12 months and reversible. Therefore, effects to the commercial fishery are not likely and **not significant**.

5.2.3 Marine Mammals and Turtles 1

Airgun arrays used during marine seismic operations introduce strong sound impulses into the water. These sound impulses could have several types of effects on marine mammals and are a significant issue associated with the proposed seismic survey. The effects of human-generated noise on marine mammals are quite variable and depend on the species involved, the activity of the animal when exposed to the noise, and the distance of the animal from the sound source.

Marine mammals and sea turtles could likely exhibit certain behavioural reactions, including displacement from an area around an airgun array. The size of the displacement area will likely vary amongst species, during different times of the year, and even amongst individuals within a given species. There is also a risk that marine mammals and sea turtles that are very close to the seismic array may incur hearing impairment. The 2011 EA Report describes in more detail the numbers and the species of cetaceans which have been observed in, or which are considered likely to frequent, the Project Area.

The assessment of impacts is based upon the best available information; however, there are data gaps that limit the certainty of these impact predictions. The limited available data indicate that sea turtles will hear airgun sounds. There are no specific data that demonstrate the consequences to sea turtles if seismic operations do occur in important areas at important times of year. The discontinuous nature of sonar pulses makes significant masking effects unlikely however the extent of avoidance is unknown. The EA Report states that turtles might experience temporary hearing loss if the turtles are close to the airguns. There are a number of mitigations which, when applied, can reduce impacts to marine mammals and sea turtles in the vicinity of a seismic survey (e.g. ramping up of airguns, use of observers, shut-down procedures). The 2011 EA Report lists a number of mitigations that will be implemented during the geophysical program, some of which are consistent with the mitigations recommended in Appendix 2 of *The Geophysical, Geological, Environmental and Geotechnical Program Guidelines* (C-NLOPB 2011b).

It has been theorized that some species of cetaceans may use geomagnetic cues to assist their migrations (LGL 2011b). This theory is based on several studies that have related whale strandings to geomagnetic anomalies. However, this phenomenon appears to be site-specific because other studies with the same methods and species in other areas were unable to find this relationship. Given that these animals likely use a variety of navigations cues and that any exposure to CSEM emissions will be brief, likely on the order of minutes, any effect on their navigation is predicted to be negligible.

The effects on marine mammals are predicted to be negligible or of low magnitude, within an area less than 100 km^2, and over a duration of less than one month to 12 months. With the application of mitigation measures, the likelihood of effects occurring is low, and effects will be **not significant**.

The effects on sea turtles are predicted to be of negligible or of low magnitude, within an area less than 10 km^2, and over duration of less than one month to 12 months. With the application of mitigation measures, the overall likelihood of effects occurring is low, and effects will be **not significant**.

5.2.4 Marine Birds

The sound created by airguns is focused downward below the surface of the water. Above the water the sound is reduced to a muffled shot that should have little or no effect on birds that have their heads above water or are in flight. Most species of seabirds that are expected to occur in the Study Area feed at the surface or less than 1 m below the surface of the ocean. Northern Gannets (*Morus bassanus*) plunge dive to a depth of 10 m. They are under the surface for a few seconds during each dive so would have minimal exposure to underwater sound. Greater Shearwater (*Puffinus gravis*), Sooty Shearwater (*Puffinus griseus*) and Manx Shearwater (*Puffinus puffinus*) feed mainly at the surface but also chase prey briefly beneath the surface down to a distance of 2-10 m below the surface. There is only one group of seabirds occurring regularly in the Study Area that require relatively considerable time under water to secure food. They are the *Alcidae* (Dovekie, Common Murre (*Uria aalge*), Thick-billed Murre (*Uria lomvia*), Razorbill (*Alca torda*) and Atlantic Puffin (*Fratercula arctica*)). From a resting position on the water they dive under the surface in search of small fish and invertebrates. Alcids use their wings to propel their bodies rapidly through the water. All are capable of reaching considerable depths and spending considerable time under water. An average duration of dive times for the five species of *Alcidae* is 25 to 40 seconds reaching an average depth of 20 to 60 m, but murres are capable of diving to 120 m and have been recorded underwater for up to 202 seconds. The effects of underwater sounds on *Alcidae* are unknown. The effects of noise on marine birds are predicted to be negligible to low magnitude, within an area less than 10 km^2, and over duration of one month to 12 months. With the implementation of all mitigation measures outlined in the EA Report and Addendum and the *Geophysical, Geological, Environmental and Geotechnical Program Guidelines* (C-NLOPB 2011b), the effects of sound emissions on marine birds would be **not significant**.

Since lighting is required at night for safety purposes, mitigation will include routine checks for stranded birds and implementation of appropriate procedures for release that will minimize the effects of vessel lighting on birds in the Project Area. Therefore, with the implementation of mitigation, the effect of vessel lighting on Marine Birds is predicted to be low in magnitude, over a geographic extent of 1-10 km, for a duration of <1 to 12 months and therefore **not significant**.

The streamers may be solid-filled or contain a paraffinic hydrocarbon called Isopar. Typical fluid-filled streamers are constructed of self-contained units 100 m in length. Therefore, a single leak in a streamer could result in a maximum loss of 208 L of Isopar M. All seabirds expected to occur in the Study Area, except Arctic Tern, spend considerable time resting on the water. An exposure to a surface release of a kerosene-like substance under calm conditions may harm or kill individual birds. However, because potential spills will likely be small and evaporation and dispersion rapid, the magnitude (low to medium), geographic extent (<1 km^2 to 1-10 km^2) and <1 month duration of any spill is not expected to cause significant effects on seabird populations and therefore, any effects will be **not significant**.

5.2.5 Species at Risk **1**

The EA Report indicates that the area for potential surveys has no unique habitat for fish species at risk. Mitigation measures include a gradual increase in intensity of air gun discharge to allow fish to avoid the source of sound, and avoidance of seismic activities during known sensitive areas and timeframes. The dissolvable anchors could have some very small interactions with wolffish if they occur at the depths of the surveys but would be very unlikely to interfere with their dens which are in small caves and rock crevices. Effects on wolffish species at risk therefore are likely to be **not significant**.

The EA Report indicates that leatherback sea turtles may be occasional or infrequent visitors to the Study Area. Leatherback sea turtles are not known to use geomagnetic cues for navigation but if they do, they likely use a variety of other cues as well. A recovery strategy for leatherback sea turtles is available and no known critical habitat has been identified. With the implementation of mitigations as indicated above, effects on sea turtles are likely to be not significant. Therefore, effects on the Leatherback sea turtles are not likely to be adverse and therefore **not significant**.

Blue and North Atlantic Right whales are reported by LGL (2011a) to be uncommon in the Study Area and thus, interaction with project activities is unlikely. Blue and right whales are not known to use geomagnetic cues for navigation but if they do, they likely use a variety of other cues as well. The Fin whale is likely to be common in the Study Area. Even so, if these marine mammals were in the Project Area, the mitigations described above would reduce any impact. A dedicated MMO will be onboard the seismic vessel. With the implementation of mitigations, including those outlined in the *Geophysical, Geological, Environmental and Geotechnical Program Guidelines* (C-NLOPB 2011b), effects on marine mammal species at risk are likely to be **not significant**.

The Ivory Gull is an unlikely visitor in the Project Area and the risk of hearing impairment to Ivory Gull from seismic activity is low as this species would not spend considerable amounts of time below the surface of the water (as it is a surface feeder) or in close proximity to airgun pulses. As indicated above, effects on marine birds are likely to be not significant, therefore, effects on the marine bird species at risk are not likely to be adverse and therefore **not significant**.

5.2.6 Water Quality/Discharges **0**

Routine discharges, which are likely to occur during operation, are similar to those associated with many typical vessel operations. The vessels proposed for the survey will meet all Canadian regulations and standards to work in Canadian waters. Ship operations will adhere to Annex I of the *International Convention for the Prevention of Pollution from Ships* (MARPOL 73/78). Hydrocarbon concentrations associated with ship discharges are not generally associated with formation of a surface slick. They are therefore not likely to have a measurable effect on the marine environment. The waste generated by a geophysical survey vessel will be limited due to the length of the survey program and will be brought back to shore. All domestic waste will be transported to shore and all routine discharges will meet the *Pollution Prevention Regulations* of the *Canada Shipping Act*. The effect of the geophysical program operation on marine water quality should be undetectable and **not significant**.

5.3 Cumulative Environmental Effects **1**

Commercial fishing activities, by their nature, cause mortality and disturbance to fish populations and may cause incidental mortalities or disturbance to seabirds, marine mammals, and sea turtles. It is predicted that the seismic surveys will not cause any mortality to these VECs (with the potential exception of small numbers of petrels) and thus, there will be no or negligible cumulative effect from mortalities. There is some potential for cumulative effect from disturbance (e.g., fishing vessel noise) but

there will be directed attempts by both industries to mitigate effects and to avoid each other's active areas and times.

In the summer, the main North Atlantic shipping lanes between Europe and North America lie to the north of the Grand Banks into the Strait of Belle Isle. In the winter, that traffic shifts to the main shipping lanes along the southern Grand Banks into the Gulf of St. Lawrence.

The vast majority of hunting of seabirds (mostly murres) in Newfoundland and Labrador waters occurs near shore from small boats and thus, there is little or no potential for cumulative effects on this VEC. Similarly, most, if not all, seal hunting would occur inshore of the Project Area.

There is potential for cumulative effects with the Chevron Canada Limited (CCL) North Grand Banks Regional 2D and/or 3D seismic program proposed for 2011. The Statoil and CCL seismic programs have the potential to overlap in time and space. However, given the 3D nature of Statoil's seismic program and the 2D nature of CCL"s seismic program, during most of the survey period, the two seismic programs will remain relatively far apart and are not expected to create synergistic noise effects on marine mammals (and other VECs). However, there is potential that for some days the Statoil and CCL seismic programs may be operating in close proximity. During these periods, marine mammals may be exposed to noise from each of the seismic survey programs. In order to avoid acoustic interference with each other's program, seismic vessels will remain at least 40 km apart during surveying. It will be in the interests of both parties for good coordination between the two programs in order to minimize potential acoustic interference. CCL will attempt to acquire most, or all, of the seismic data near Statoil's survey area before the Statoil seismic program begins. Statoil and CCL have been in communication with each other in this regard, and Statoil is committed to ongoing communication with CCL (and other operators) in the Study Area.

With the implementation of mitigative measures and the limited spatial, and potentially temporal, overlap with other projects and activities, the cumulative environmental effect of the geophysical program, including CSEM activities, in conjunction with other projects and activities is predicted to be **not significant**.

5.4 Accidents and Malfunctions **0**

Accidental discharge of oil into the marine environment may result from improper operational procedures (e.g., improper draining of streamer reel trunks), loss of streamer fluid due to breakage, or, as a worst case, as a result of total vessel loss.

The vessel is required to carry a "Shipboard Oil Pollution Emergency Plan" pursuant to MARPOL 73/78. The Plan contains a description of procedures and checklists which govern operations involving hydrocarbons, adherence to which should prevent unintended releases. The vessel will also carry a copy of Statoil Canada Limited's "Spill Response Plan". Inspections of seismic equipment will be conducted regularly.

Effects due to accidental spills associated with the proposed operation, therefore, are considered, overall, to be detectable if they occur, but neither significant nor likely.

5.5 Follow-up Program **Required** **Yes**☐ **No**☒

The C-NLOPB does not require follow-up monitoring, as defined in the CEA Act, to be undertaken for this Project.

6. Other Considerations

The C-NLOPB is satisfied with the environmental information provided by Statoil regarding the potential adverse environmental effects which may result from the proposed project, and are satisfied with the operator's proposed monitoring and mitigative measures.

The C-NLOPB is of the view that the environmental effects from the project, in combination with other projects or activities that have been or will be carried out, are **not likely** to cause significant adverse cumulative environmental effects.

7. Recommended Conditions and /or Mitigations

The C-NLOPB recommends that the following conditions be included in the authorization if the seismic/CSEM/geohazard survey program is approved:

- *The Operator shall implement or cause to be implemented, all the policies, practices, recommendations and procedures for the protection of the environment included in or referred to in the Application and in the "Environmental Assessment of Statoil's Geophysical Program for the Jeanne d'Arc and Central Ridge/Flemish Pass Basins, 2011-2019" (LGL March 2011),the "Addendum to the Environmental Assessment of Statoil's Geophysical Program for the Jeanne d'Arc and Central Ridge/Flemish Pass Basins, 2011-2019" (LGL June 2011), and Statoil Canada Ltd. correspondence (June 22 & 29, 2011).*

- *The Operator, or its contractors, shall shut down the seismic airgun array if a marine mammal or sea turtle listed as **Endangered or Threatened** (as per Schedule 1 of SARA) is observed in the safety zone during ramp- up procedures and when the array is active. The safety zone shall have a radius of at least 500 m, as measured from the centre of the air source array(s).*

Part D: Screening Decisions

8.1 C-NLOPB Decision

The C-NLOPB is of the opinion that, taking into account the implementation of the proposed mitigation measures set out in the conditions above and those committed to by Statoil Canada Limited, the Project **is not likely to cause significant adverse environmental effects**. This represents a determination pursuant to Section 20(1) (a) of the CEA Act.

Responsible Officer *Original signed by Elizabeth Young* Date: June 30, 2011
Elizabeth Young
Environmental Assessment Officer
Canada-Newfoundland and Labrador Offshore Petroleum Board

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