5 ENVIRONMENTAL EFFECTS ASSESSMENT

This Chapter includes an assessment and evaluation of the potential environmental effects of the Project on the identified VECs, each of which is covered in a separate subsection that follows the overall Environmental Assessment structure and methodology outlined previously (see Chapter 3).

5.1 Project Components, Activities and Key Environmental Considerations

ExxonMobil is proposing to undertake offshore oil and gas exploration over its recently acquired Exploration Licences and other areas of interest off Eastern Newfoundland. These exploration activities will take place annually over the 2015-2024 period, generally within the May – November timeframe, and may include 2D and 3D seismic surveys, as well as wellsite geohazard, geochemical, geotechnical and environmental survey activities. No ExxonMobil proprietary 3D surveys are planned in 2015. After receiving several unsolicited multi-client speculative 3D seismic proposals for the EL 1135 area, ExxonMobil is working with a vendor on a 3D acquisition program for that area. If opportunity arises, ExxonMobil would consider 2015 geochemical and/or related bathymetric surveys for Flemish Pass (EL 1135) and Carson Basin (EL 1136) as part of this Project.

An overview description of the proposed Project, including each of its key components and activities, was provided in Chapter 2. The various aspects of the Project that are particularly relevant to the environmental effects assessment include the following:

- The presence and movement of the survey vessels and other supporting ships (as required);
- The underwater sound energy generated by the 2D and 3D seismic source arrays and other Project related noise (vessels and equipment);
- The collection of core, grab and geotechnical samples from the seabed, including associated equipment mobilization, use and retrieval;
- Lighting on Project vessels and on-board equipment, and other associated air emissions (engine exhausts);
- The generation of solid and liquid waste materials and their management; and
- Potential accidental spills or the loss of equipment or other materials into the marine environment.

Based on these main Project elements, some key environmental considerations that may be associated with such marine exploration activities are listed below, with a primary focus on the VECs identified previously (adapted from Amec 2014):

- Potential injury or mortality of marine biota resulting from exposure to seismic sound energy at very close range;
- Possible avoidance by marine biota of locations that would otherwise be used, due to underwater noise or other disturbances during the survey program. This could alter the

presence and abundance of marine animals as well as disturbing their movements, feeding, communication, and/or other activities;

- Attraction of marine biota to Project vessels and their lighting or other environmental discharges, with an associated increase in the potential for injury, mortality, contamination or other interactions;

- Possible contamination of marine biota and their habitats as a result of environmental discharges due to planned Project activities and/or accidental events;

- Changes in the availability, distribution or quality of feed sources or habitats as a result of Project activities and their environmental emissions or any associated seabed disturbance;

- Potential effects on fisheries, other marine activities and special areas due to possible biophysical effects on the marine environment (including resource abundance, distribution or quality);

- Potential damage to fishing gear, vessels or other equipment and infrastructure as a result of direct interactions with survey equipment, activities or environmental discharges; and

- Reduced access to preferred fishing or other marine areas during survey activities in certain locations, with possible decreases in activity success, efficiency, value or enjoyment.

5.2 Study Areas for the Environmental Assessment

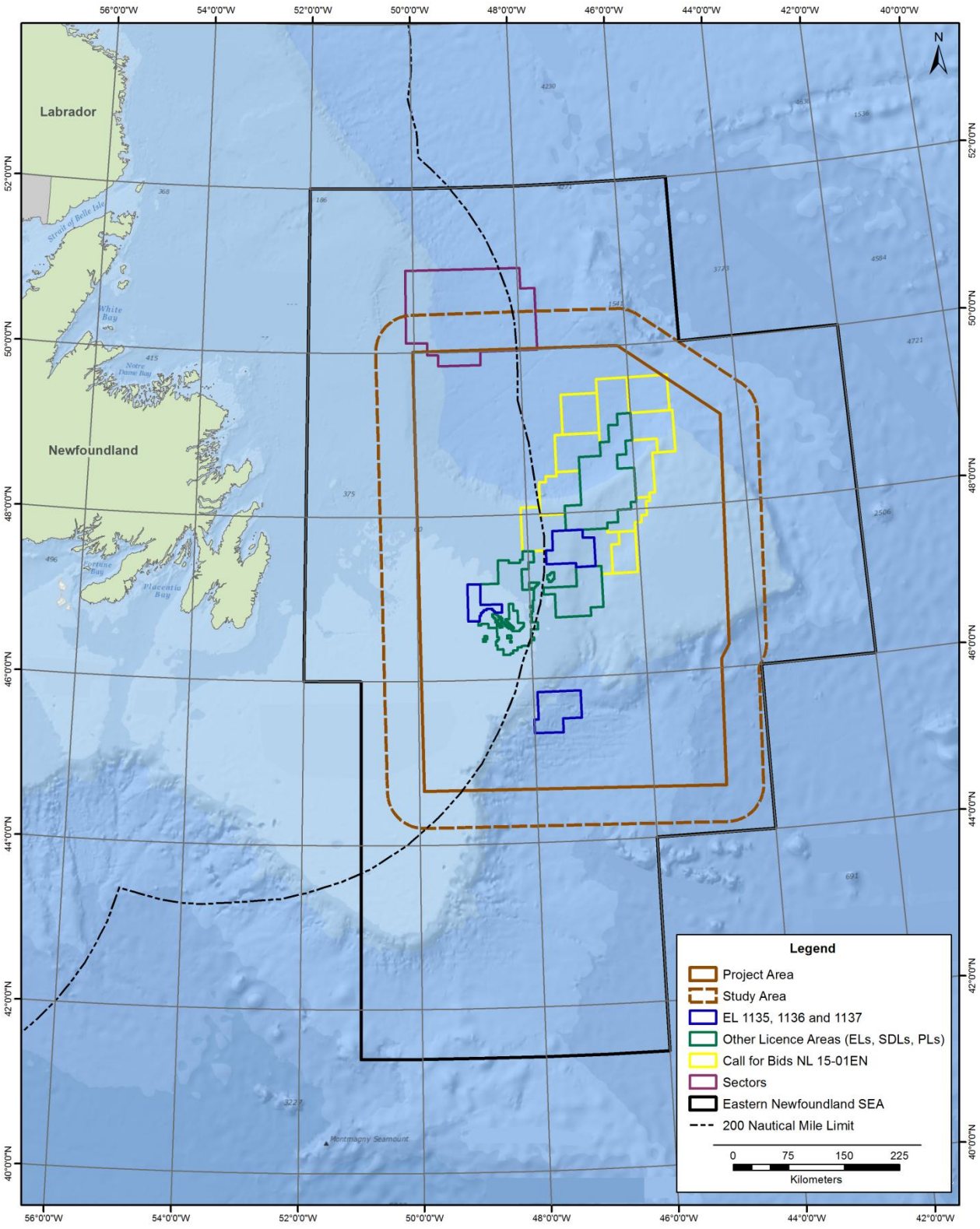
As described previously, the Environmental Assessment (for all VECs) generally focuses upon a number of spatial boundaries, (Figure 5.1) including the:

Project Area, which encompasses the overall marine area within which the proposed Project survey activities will take place; and

Study Area, which fully encompasses the Project Area and the likely environmental zone of influence of any Project related emissions and other disturbances (conservatively set at 50 km beyond the Project Area).

In addition to the above described generic spatial boundaries for the Project and its Environmental Assessment, the environmental effects assessment also considers the particular characteristics, distributions and movements of the individual VECs under consideration, including the larger *Regional Areas* within which they occur and function (as presented in Chapter 4).

Figure 5.1 Project Area and Environmental Assessment Study Area



In terms of these larger *Regional Areas*, ecological characteristics and extents (distributions and movements) for the biological VECs vary between the various species and species groups that occupy the Study Area, due to difference in their life histories, ranges, habitat preferences, movement patterns and other key requirements and activities. Marine biota are present in the Study Area throughout the year, with many species occupying particular areas (habitats) and moving in and out of the area at different times according to their particular characteristics, habitat preferences and seasonal activities. Existing and available information on the presence and geographic and seasonal occurrence of marine fish, birds, mammals and reptiles in and near the region is presented in Chapter 4, which indicates that many species have widespread distribution patterns, although ranges and activities vary considerably.

The Environmental Assessment therefore assesses potential effects to marine biota (individuals and populations) which are known or likely to use the Study Area during the period of planned survey activities, including those that occur in the water column or near the water's surface or seafloor. In conducting the assessment, particular consideration has been given to the overall timing of species presence within the Study Area, as well as any particularly important or sensitive time periods. The environmental effects assessment also considers the nature, extent and timing of likely Project-VEC interactions and the associated spatial and temporal zones of influence of Project-related disturbances in the marine environment.

For Protected and Sensitive Areas, the environmental effects assessment includes consideration of the location, size and extent of any such areas that overlap in whole or part with the Study Area, as well as the overall geographic characteristics and distributions of the ecological and/or socio-cultural components and processes that have been relevant to the identification / designation and overall integrity and value of these areas.

The environmental effects assessment for Marine Fisheries and Other Activities likewise includes consideration of the overall geographic extent and distribution of fishing and other human activities within and adjacent to the Study Area, as well as the seasonality of particular activities, including any key times of the year and associated core areas.

The temporal boundaries for the Environmental Assessment encompass the likely timing and duration of Project-related (in-field) activities in the Project Area, as well as the likely duration of any resulting environmental effects. In conducting the assessment, special consideration is also given to timing of VEC presence within the Study Area, including any particularly important or sensitive periods.

5.3 Environmental Planning, Management and Mitigation

Each of the potential environmental issues and interactions that may be associated with the proposed Project can be avoided or otherwise mitigated through the use of good planning and sound operational practices and procedures, supported by standard mitigations that are well established and outlined in relevant regulatory procedures and guidelines. These mitigations have been routinely and successfully applied to similar marine exploration programs off Eastern Newfoundland and elsewhere in recent years. These planning and management measures, in combination with ExxonMobil's own environmental management systems and associated policies, plans and procedures, are designed to ensure that the Project will not result in adverse environmental effects.

These environmental planning, management and mitigation measures are considered integrally in the environmental effects assessments that are presented in this Chapter. This includes those that have been "built-in" to the Project through its on-going planning and design in order to proactively avoid or reduce potential environmental issues (Chapter 2) as well as the other VEC-specific environmental protection measures which are further identified and described in this Chapter.

The C-NLOPB's *Geophysical, Geological, Environmental and Geotechnical Program Guidelines* (C-NLOPB 2012) include various requirements and measures related to environmental planning, mitigation, monitoring and reporting that are intended to help avoid or reduce the potential effects of seismic noise in the marine environment, as well as interactions with other ocean users and other issues. These Guidelines include the *Statement of Canadian Practice with Respect to the Mitigation of Seismic Sound in the Marine Environment* (DFO 2007), which set out a series of mitigation and monitoring requirements that pertain to these activities, including measures related to the:

- Planning of seismic surveys;
- Establishment and monitoring of a safety zone;
- Prescribed marine mammal observation and detection measures;
- Prescribed start-up procedures; and
- Prescribed shut-down requirements.

In planning and implementing the proposed Project, ExxonMobil has been and will continue to be guided and informed by these and other such requirements and approaches, as well as the various mitigation measures that have been identified through the Eastern Newfoundland SEA prepared by the C-NLOPB (Amec 2014).

The following mitigation measures will be implemented to avoid or reduce any potential adverse environmental effects resulting from the Project:

- Project survey activities are in locations that avoid the potential for adverse interactions with on-land or near shore environmental components or activities.
- Operational planning will also include attempting to avoid any known and observed significant aggregations of marine animals where possible in the planning and conduct of the marine exploration activities that comprise this Project.
- Seismic sound levels will be kept at the minimum level possible for the survey, based on the vessel's seismic sound source capability and associated requirements.
- A 30 minute observation for the presence of marine mammal will be followed by a gradual "ramp-up" procedure of the seismic source array over a minimum 20 minute period at the commencement of seismic survey activity, to allow any mobile marine animals to move away from the area.

- A planned shut-down of the seismic sound sources or reduction to firing the smallest, single source element during survey line changes and maintenance activities. During line turns a single source element will be fired at least once every 30 minutes.

- During the seismic surveys a “safety zone” will be established that will comprise a circle with a radius of at least 500 m as measured from the center of the air source array. During daylight hours a qualified Marine Mammal Observer (MMO) will continuously observe the safety zone starting at least 30 minutes before seismic source array start up when the safety zone is visible, and will maintain a regular watch of the safety zone at all other times when the array is active.

- Once operational, the sound source array will be shut down immediately if either of the following is observed by the MMO within the 500-m safety zone: 1) a marine mammal or sea turtle listed as Endangered or Threatened on Schedule 1 of the *Species at Risk Act*; or 2) any other marine mammal or sea turtle that has been identified in the Environmental Assessment process as a species for which there could be significant adverse effects.

- The Project will be planned and implemented so as to avoid or minimize environmental discharges and emissions from planned operations and activities. This will be achieved through compliance with relevant regulations and standards and company procedures regarding material selection and use, waste management, discharge prevention and management and other potential liquid, solid or air emissions.

- Project equipment selection will include the planned use of gel filled or solid streamers to prevent potential hydrocarbon spills into the marine environment in the event of a streamer tear or break.

- The amount, duration and frequency of lighting used on offshore vessels and equipment will be minimized to the degree possible, while at the same time ensuring and maintaining a safe work environment. This will occur particularly during periods when migratory birds are especially vulnerable to disturbance and associated effects (such as during spring and fall migration and in inclement weather).

- Protocols and programs will be established and implemented for the collection and release of any marine birds that become stranded on offshore installations, which will be implemented by qualified and experienced personnel and in compliance with associated regulatory guidance and applicable CWS Permit requirements.

- Prior to undertaking seabed sampling work in areas that have been identified as having a high probability of occurrence of corals and sponges (see Section 4.2) a representative seabed characterization (reconnaissance) drop camera / video system survey transect will be acquired to investigate the potential presence of these sensitive benthic organisms.

- All Project vessels will have spill prevention procedures and materials in place. This will include appropriate equipment and procedures to help prevent such accidental spills into the marine environment, as well as an Oil Spill Response Plan in the unlikely event of a spill.

- Communications and coordination procedures with regulatory authorities, stakeholders and key ocean users will be used throughout the operational life of the Project. This will include:

    - On-going information gathering on key fishing areas and times and continued monitoring of fishing activity (through the presence on a Fisheries Liaison Officer (FLO) on the acquisition vessel and review of DFO VMS data and other sources) and associated survey and logistical planning to minimize interference with fishing activities;

    - The presence, active participation and advice of the FLO on board the seismic ship, and a shore-based Single Point of Contact (SPOC). The FLO will be a FFAW – Unifor member, and will be responsible for communicating with fishing vessels at sea and relaying information to shore as needed. FLOs will serve as the primary at-sea liaison between the commercial fishing industry and the seismic survey program.

    - The issuance of Notices to Mariners and other notifications and direct industry communications (e.g., CBC Fisheries Broadcast) throughout the periods of Project operations;

    - Regular communication of planned survey activities with key industry representatives, and on-going liaison with FFAW / One Ocean contacts;

    - A standby or guard vessel will be used to scout for hazards and for interacting and communicating with other users of the area about the survey and associated equipment (especially streamers), and to assist in communicating and working with active fishers in the area (if any). The guard vessel will also provide a means for towing the seismic vessel in the case of a loss of propulsion.

    - Appropriate spatial and temporal avoidance of active fisheries science survey areas through on-going discussion and coordination with DFO and industry contacts.

- Establishment and implementation of a Fishing Gear Damage or Loss Compensation Program and communication of this and its associated procedures (through SPOC and otherwise), should there be gear damage caused by direct interactions with seismic streamers or other Project equipment, or in the unlikely event of an offshore spill.

These and other planned mitigation measures to avoid or reduce any potential adverse effects that may result from the proposed Project are identified and described as part of the environmental effects assessment for each of the individual VECs under consideration.

The Project's likely environmental effects are assessed and their significance is evaluated with consideration of the various mitigation measures outlined above, and within the above described spatial and temporal boundaries.

5.4 Definition and Determination of Environmental Effects Significance

Evaluating the significance of the predicted environmental effects of a proposed project involves first defining what a significant environmental effect is, and then evaluating whether a project's potential environmental effects are significant or not significant.

Significance definitions are developed and used on a VEC-specific basis within this Environmental Assessment, which generally incorporate the principles of sustainability and other relevant concepts and considerations as appropriate.

Significant environmental effects are those adverse effects that will cause a change in the VEC that will alter its status or integrity beyond an acceptable and sustainable level. An environmental effect that does not meet the defined criteria is considered not significant.

For the purposes of this Environmental Assessment, significant environmental effects on the various biological VECs under consideration (Marine Fish and Fish Habitat, Marine / Migratory Birds, Marine Mammals and Sea Turtles and associated Species at Risk) are defined as those that are likely to cause one or more of the following:

- Mortality or life-threatening injury to a designated (protected) species at risk, or destruction or alteration of the critical habitat of any such species;

- Effects to more than 10 percent of marine animals within the Study Area, such that size, health, ecological function and/or sustainability of a population would be measurably and adversely affected; or

- Destruction of, or displacement of marine biota from, important feeding or reproduction areas, migratory routes or other essential habitats, during time periods and for durations over which the size, health, ecological function and/or sustainability of a population would be measurably and adversely affected.

For the Protected and Sensitive Areas VEC, significant environmental effects are defined as those that are likely to cause an adverse change in one or more of the important and defining ecological and socio-cultural characteristics of such an area, resulting in a decrease in its overall integrity and/ or value.

Finally, significant environmental effects on the Marine Fisheries and Other Activities VEC are defined as follows:

- Those that are likely to cause a detectable reduction in the overall economic returns generated from fisheries or other commercial activities within the Study Area over one or more years; or

- Those that would result in a decrease in overall activity levels and/or the enjoyment or cultural value of recreational activities for a community or region over multiple years.

In the VEC-specific environmental effects assessments that follow, these criteria and definitions are used to describe and evaluate the significance of both Project-specific and cumulative environmental effects.

5.5 Marine Fish and Fish Habitat: Environmental Effects Assessment

Fish and their habitats are relevant considerations in any assessment of proposed projects and activities that occur within, and which may affect, the marine environment, as a result of the ecological and/or socioeconomic importance of many fish and invertebrate species and populations. This VEC includes finfish and shellfish, as well as plankton, algae and other benthos given the key interrelationships between these various ecological components and their habitats.

An overview of fish and fish habitat in the Study Area was provided in Section 4.2.1, including information on the life histories and known habitat preferences and reproduction and movement patterns of the species that are known or likely to occur within the region. This information has been used to identify and evaluate the key potential interactions of the Project with this VEC and any resulting environmental effects and required mitigations to avoid or reduce these.

5.5.1 Potential Environmental Issues, Interactions and Existing Knowledge

The potential environmental interactions between offshore oil and gas exploration activities and marine fish and their habitats may be both direct and indirect in nature, and can include the following (adapted from Amec 2014):

- Possible injury or mortality due to exposure to seismic signals at very close range, especially in the case of immobile fish species or life stages;

- Behavioural changes by fish and invertebrates in response to insonification of the water column as a result of seismic energy, which could displace individuals and alter feeding, migration, predator avoidance and reproduction activities;

- Interference with (and the masking of) sounds that originate from and/or are interpreted by marine fish, such as in communication and the identification and detection of predators and prey; and

- Potential disturbance to or contamination of fish and invertebrates and their habitats due to environmental discharges during routine activities or other Project related disturbances.

An overview of the potential interactions between each of the main Project components and activities and the various key indicators and parameters that have been identified for this VEC is presented in Table 5.1, in order to help focus and frame the environmental effects assessment.

Table 5.1 Marine Fish and Fish Habitat: Potential Project-VEC Interactions

Project Component / Activity	Key Indicators and Parameters				
	Presence and Abundance	Habitat Availability and Quality	Feeding (Availability and Quality)	Migration and Reproduction	Health (Individuals or Populations)
Presence of Vessels / Equipment	●	●		●	
Seismic Sound	●	●	●	●	●
Other Sound (vessels,	●				

Project Component / Activity	Key Indicators and Parameters				
	Presence and Abundance	Habitat Availability and Quality	Feeding (Availability and Quality)	Migration and Reproduction	Health (Individuals or Populations)
equipment)					
Seabed and Environmental Sampling Activities	●	●			●
Air Emissions					
Lighting	●				
Solid Waste					
Liquid Waste					●
Potential Accidental Spills	●	●	●		●

The possible effects on this VEC resulting from sound in the marine environment due to offshore geophysical surveys may be behavioural (avoidance, other changes in distribution or activities) or involve injury to or mortality of individual fish. A considerable amount of research has been conducted on the effects of offshore seismic surveys (including various sound types and intensities) and other anthropogenic activities on marine fish. This has included scientific research, monitoring studies and anecdotal reports of observed reactions by various fish species.

Although overall knowledge and understanding of the effects of seismic and other anthropogenic noise on marine fish and invertebrates remain incomplete in some areas, the effects of seismic activities and other noise sources have been documented in a variety of fish and invertebrate species in numerous studies. It should be noted, however, that many of the studies occur within a laboratory setting with captive animals, and the documented effects may not replicate natural conditions. Table 5.2 provides a more detailed overview of this literature and associated sources / references.

- Studies indicate that plankton, eggs or larval mortality (if it occurs) would be limited to within a few metres of a seismic array. There is little indication or evidence that direct physical damage to fish occurs at distances greater than several meters from the source, particularly due to the avoidance behaviour exhibited by mobile marine organisms.

- A variety of behavioural responses by marine fish to seismic source arrays have been reported in the literature and through anecdotal reports. For the most part, however, any such responses (if they do occur) are localized and temporary, and likely of low ecological significance (except possibly in instances where key habitats or life stages such as reproductive activity are significantly and repeatedly affected).

- Recent reviews also reiterate, however, that research results and observations have not always provided clear or consistent findings, and that our knowledge of the effects of anthropogenic noise on fish and invertebrates remains incomplete.

- Seismic activity has been shown to influence catch rates of fish in some areas. The observed effects of seismic activities appear to vary, however, by species, gear type and other factors. In some cases catches have appeared to temporarily decrease while in others they did not change or even increased during seismic activities.

- Seismic sound levels and their observed effects vary depending upon levels and the distance away from the source, and the effects of seismic exposure also appear to vary by species and particular life stage. Behavioural responses of fish typically begin to occur at sound levels above 155 dB, whereas auditory damage starts at 180 dB, transient stunning at 192 dB and internal injuries may start to occur at 220 dB. Some invertebrate species show injury at levels as low as 217 dB while others can experience louder noises with no observable consequence.

- Depending on seismic source levels and accounting for sound attenuation in the marine environment, behavioural effects could occur from less than one kilometer to dozens of km from a seismic vessel's location.

Table 5.2 Potential Environmental Effects on Marine Fish and Fish Habitat: Summary of Existing Knowledge

Potential Issue / Interaction	Overview of Relevant Studies
Seismic Noise: Potential Fish Mortality or Injury	A variety of studies have investigated potential injury to fish as a result of seismic air source arrays, such as damage to hearing structures (e.g. Popper et al 2005) and/or mortality of fish, fish eggs or larvae (e.g. Parry and Gason 2006). Most studies have found that stationary fish affected by seismic surveys had to be located very close to the seismic array (usually, caged close to the source and subjected to multiple passes of the array) to be affected (see McCauley et al 2003 and Turnpenny and Nedwell 1994 for a review). Studies using caged fish have also noted that the response of the fish is usually a strong attempt to move away from the sound (e.g. McCauley et al 2003). The effects of seismic surveys on marine phytoplankton, zooplankton and the planktonic life stages of various marine fish species have also been investigated (see, for example, Dalen et al 2007 for a review). Mortality of fish, fish eggs, and larvae has been observed only within a few metres of seismic air source arrays (Kostyuchenko 1973; Dalen and Knutsen 1987; Matishov 1992; Kosheleva 1992; Holiday et al in Turnpenny and Nedwell 1994; Parry and Gason 2006) and immediate mortality is unlikely (Worcester 2006). High intensity seismic noise can have lethal or sublethal effects on plankton at short range (less than 5 m; Ostby et al 2003, in Boertmann and Mosbech 2012). Davis et al (1998) estimated up to one percent of the ichthyoplankton in the top 50 m of the water column within close proximity to the sound source could be killed during 3-D seismic survey off Nova Scotia. Kenchington et al (2001) also estimated a plankton mortality rate of six percent if they were concentrated in the upper 10 m in close proximity to the sound source. In Norway, it was estimated that 0.45 percent of planktonic organisms in the top 10 m of water could be killed by High intensity seismic noise (Sætre and Ona 1996). Mortality of fish eggs, caused by exposure to seismic array noise, was very low compared to natural mortality and was considered not significant to fish recruitment (Sætre and Ona 1996). Payne et al (2008) indicated there was no evidence for delayed mortality or egg loss in snow crab exposed under the conditions of an actual seismic program in deep waters off Cape Breton. In snow crab, over a period of days to several months, there were no effects of delayed mortality or damage to mechanosensory systems associated with animal equilibrium and posture. There was also no evidence of leg loss or other appendages (Payne et al 2008). A snow crab test group exposed to seismic sound showed elevated bruising of the

Potential Issue / Interaction	Overview of Relevant Studies
	hepatopancreas; bruising of ovaries; dilated oocytes with detached chorions (DFO 2004). The timing and location of seismic activity and proximity to the array is a key factor in the likelihood and potential degree of effect. Seismic air source arrays operating in areas and times of strong seasonal stratifications or upwelling may affect more planktonic material because of their high densities (Boudreau et al 2001). Although it is evident that fish often respond to sounds emitted from seismic air source arrays (see below), little direct physical damage to fish occurs at distances greater than a few meters from the source. Due to the avoidance behaviour by free-swimming fish, they typically do not suffer physical damage from seismic surveys (Gausland 1993). Indeed, there are no documented cases of fish mortality under exposure to seismic sound under field operating conditions (DFO 2004; Payne 2004), nor have FLOs or other seismic ship's personnel reported observing dead fish around survey operations. Overall, exposure to seismic sound is considered unlikely to result in direct fish mortality (DFO 2004).
Seismic Noise: Behavioural Responses	When exposed to an operating seismic array, mobile marine fish may exhibit a variety of responses, including alarm responses and temporary avoidance of the area (eg, McCauley et al 2000a, 2000b). When exposed to an operating seismic air source arrays, mobile marine fish may swim deeper, mill in compact schools or become more active (eg, Slotte et al 2004). Given the opportunity, fish will generally avoid areas where noise levels exceed their threshold of hearing by 30 dB or more (ICES 1995). Indeed, behavioural reactions to exposure to seismic noise have been widely documented in marine organisms (DFO 2004).There are well documented observations of fish and invertebrates exhibiting behaviours that appeared to be in response to exposure to active seismic air source array noise levels. These include startle responses, changes in swimming direction and speed, or changes in vertical distribution (Blaxter et al 1981, Schwartz and Greer 1984, Pearson et al 1992, McCauley et al 2000a, 2000b, Wardle et al 2001, Hassel et al 2003). Gadoids, for example, have been shown to leave the area during seismic surveys (Skalski et al 1992, Løkkeborg and Soldal 1993, Engås et al 1996, Slotte et al 2004, Parry and Gason 2006). Species such as cod, rockfish and whiting (*Merlangius merlangus*) have been reported to change depth in response to seismic noise (Pearson et al 1992; Wardle et al 2001). Other studies have found that many species of fish dive to avoid intense sound (Protasov 1966, Schwartz and Greer 1984, Knudsen et al 1992). McCauley et al (2000 a, b) describes a more intense "generic" fish alarm startle response of seeking shelter in tight schools and moving near the bottom. Anthropogenic noise appears to have a more pronounced effect on larger fish (Engås et al 1996) and invertebrates (Wale et al 2013) than smaller individuals. In contrast, other studies indicate that fish do not change behaviour when exposed to an active seismic air source array (eg, Pickett et al 1994; Wardle et al 2001; Andriguetto-Filho et al 2005). Wardle et al (2001), for example, report that neither finfish nor invertebrates showed signs of moving away from a reef on the west coast of Scotland after four days of seismic air source array firing. Similarly, Pena et al (2013) indicated that feeding herring were undeterred by seismic acquisition activity as they approached to within 2 km of seismic survey operations. Snow crab located 50 m from a seismic source did not exhibit alarm responses,

Potential Issue / Interaction	Overview of Relevant Studies
	changes in physiology (Christian et al 2004), nor did they show evidence for effects on egg hatch time (Payne et al 2008). Hawkins and Popper (2014) illustrate that seemingly similar species respond differently to the same anthropogenic noise source. They also indicate that the response can differ within a species depending on the time of day and other factors. Some studies indicate that any behavioural changes that do occur are very temporary while others imply that marine animals might not resume pre-seismic behaviours or distributions for several days (Engås et al 1996, Løkkeborg 1991, Skalski et al 1992). Most available literature (Blaxter et al 1981, Dalen and Raknes 1985, Pearson et al 1992, McCauley et al 2000a, 2000b, Davis et al 1998) indicates that the effects of noise on fish are brief and if the effects are short-lived and outside a critical period, they are expected not to translate into biological or physical effects. However, Slabbekoorn et al (2010) and Hawkins et al (2014b) emphasize that the understanding of anthropogenic noise effects on fish remains incomplete. Radford et al (2014) recently reviewed the effects of anthropogenic noise on fish communication. They highlight that communication plays an important role in the ecology of many fish (e.g. territorial disputes, mating, predatory attacks, aggregating for spawning) and masking these sounds could affect survival and reproductive success. Furthermore, non-masking sounds have the potential to stress fish and/or reduce performance of many activities. These authors emphasize that there remains relatively little empirical data regarding seismic effects on fish, particularly given the vast number of species involved and that such effects varies across fish taxa, based on their physiology, ecology and adaptation.
Seismic Noise: Observed Effects on Fish Presence (and Fishing Activity)	A number of studies have documented changes in fishing success rates during and following nearby seismic survey activity. Skalski et al (1992), for example, cite seismic activity as a contributing factor for decreased fish abundance, and Lokkeborg (1991) observed reduced catches in fish for days following 2D/3D seismic survey exposure as a result of changes in fish behaviour. Similarly, Engås et al (1996) documented reduced catches within several kilometres that continued for days after seismic activity stopped. Catches for some species / gear types (such as gillnet catches of orange rockfish and halibut) have actually increased during seismic activity, whereas others (such as longline catches of haddock) have been observed to decrease. At larger scales, regions with seismic survey activity had decreased catches for only a few species for certain gear types (eg, saithe and haddock with gill nets; Vold et al 2009). Parry and Gason (2006) found no evidence of seismic noise effects on catch rates of Australian rock lobster. The potential effects of seismic survey activity on fish catch rates therefore appear to vary by species and gear type (Hirst and Rodhouse 2000; Lokkeborg et al 2012; Worcester 2006; Vold et al 2012). More locally, fishers that utilize the EA Study Area have also expressed concern that seismic survey activity may affect catch rates and the results of research surveys (Amec 2014).

Potential Issue / Interaction	Overview of Relevant Studies
Seismic Noise: Sound Levels that may Affect Fish and Invertebrates (Physical or Behavioural)	Studies of fish reactions to anthropogenic noise in the marine environment have produced a range of results across different sound levels and between species. For context, container shipping and oil platform production can reach levels of 198 dB; Ross 1976. Subtle behavioural changes of rockfish exposed to seismic sounds, for example, commenced at 149 dB and alarm response became significant at 168 dB (Pearson et al 1992). Eastern striped grunter displayed persistent C-turn startle responses at 182 – 195 dB (McCauley et al 2000a,b), whereas various fish showed startle responses to noises ranging from 183 - 207dB (Wardle et al 2001). The onset of 'alarm' behaviours typically begin at 156 – 161 dB (McCauley et al 2000 a,b) Blaxter et al (1981) found that schooling herring changed direction with a sudden noise level of 144 dB re 1 µPa. Lokkeborg and Soldal (1993) estimated that avoidance behaviour in fish occurs between 160 and 171 dB re 1 µPa. Engas et al (1996) noted that mild behavioural effects can extend to tens of kilometres from the seismic source. This is supported by DNV Energy (2007, in Hurley 2009) which states that scare effects have been demonstrated in a radius of more than 30 km from the seismic sound source. Some select examples of studies which have investigated the physical damage to fish are a result of exposure to different levels of seismic sound are provided below. It is noteworthy that many of these studies were conducted in the laboratory and therefore may not always reflect effects experienced by free ranging organisms in the wild. • Cod eggs exposed to seismic shots (202 – 220 dB) showed no signs of injury (Dalen and Knutsen 1987). • Matishov (1992) showed that five day old cod experienced delimitation of retina at 250 dB. • Cod larvae (220 dB) and fry (234 dB) were shown to experience immediate mortality, but eggs showed no signs of injury (Dalen and Knutsen 1987) • Pollock eggs (242 dB) show delayed mortality (Booman et al 1996). • No injury to red mullet eggs occurred at 210d B but eight percent were injured at 230 dB (Kostyuchenko 1973). • Swimbladders of anchovy larvae were ruptured at 238 dB (Holiday et al, in Turnpenny and Nedwell 1994). • Kostyuchenko (1973) reported more than 75 percent survival of fish eggs at 0.5 m from the source (233 db at 1 m) and more than 90 percent survival at 10 m from the source. • Kosheleva (1992) reported no obvious physiological effects of fish beyond 1 m from a source of 220 to 240 dB. • Hastings (1990) reported that lethal threshold for fish occurs at 229 dB

Potential Issue / Interaction	Overview of Relevant Studies
	and a stunning effect in the 192 to 198 dB range. • At 217 dB, Matishov (1992) observed shell damage in Iceland scallops while urchins lost 15 percent of their spines. • No detectable differences were observed in mussels, crustaceans or periwinkles within 30 days after exposure to 229 dB seismic arrays (Kosheleva 1992). • At 231.dB, Dungeness crab larvae molt times and long term survival was not affected (Pearson et al 1994). • Brown Shrimp exposed to 190 dB showed no injury (Webb and Kempf 1998). In recent research, Hawkins et al (2014a) studied the response of mackerel and sprat schools to repeated impulsive sounds. Incidence of response increased with sound levels but responses were different across species (mackerel changed depth while sprat dispersed). The sound level where 50 percent of fish schools responded was 163.2 and 163.3dB re 1mPa2 (peak to peak) and 135 and 142dB re 1mPa2 for single strike for sprat and mackerel respectively.
Seismic Noise: Ability of Fish and Invertebrates to Detect	Many fish species and invertebrates are capable of emitting noise that share frequencies with those of seismic noise (Myrberg 1980; Turnpenny and Nedwell 1994; Engen and Folstad 1999, Hawkins and Amorin 2000; Slabbekoorn et al. 2010). Some species use acoustic communication during reproduction, agonistic encounters and predator interactions (Slabbekoorn et al. 2010). Some fish are also able to distinguish and interpret competing sounds (MMS 2004). Marine invertebrates typically lack organs that detect pressure waves but some species (e.g. marine crabs) have statocysts that are capable of sound detection through particle motion (Popper et al 2001; Morley et al. 2014). Organisms that rely exclusively on particle motion (most invertebrates) to detect sound are more resilient to anthropogenic noise exposure (Morley et al. 2014) Hearing sensitivities of finfish are reviewed by Popper and Carlson (1998) and Popper et al (2003). Cod, salmon, America plaice and herring have hearing sensitivities between 80 and 200 Hz, with a sensitivity threshold at 80 to 100 dB re to 1µPa (Mitson 1995). Laboratory studies show that some crustaceans (e.g. Norway lobster) will respond to sounds that are within the frequency range of that used in seismic surveys (Goodall et al. 1990). Deep water species and those lacking swim bladders may be less vulnerable to effects from seismic survey activities (Boertmann and Mosbech 2012).

This summary is intended to provide a brief overview of the known and likely environmental issues and interactions, as background and context for predicting Project effects and for identifying and proposing mitigation. More detailed reviews of such information are available through other sources, including the Eastern Newfoundland SEA (Amec 2014), as well as other sources.

5.5.2 Environmental Effects Assessment

The following provides an assessment and evaluation of the potential effects of the Project on Marine Fish and Fish Habitat, including the associated vessel traffic, seismic source energy, seabed and other environmental sampling activities and the various potential environmental emissions associated with vessel operations that may be associated with the planned Project activities.

Mitigation measures to prevent or reduce adverse effects upon this VEC were identified and summarized in an earlier section of this Chapter, and these are considered integrally within and throughout the environmental effects analysis as applicable.

5.5.2.1 Vessel and Equipment Use

The various proposed exploration activities that comprise this Project will involve vessel traffic in the Project Area within the May – November period over multiple years. This will include the presence and movements of the seismic survey vessel itself as well as any associated support ships. As is the case for all marine traffic, the operation of these vessels will introduce a number of potential disturbances into the environment, including the noise, lights and other possible emissions that are typically associated with such activities.

Although the presence of these marine vessels may result in some degree of attraction, avoidance or other behavioural responses by individual fish (depending upon the species involved), marine fish will likely not be disturbed by Project-related vessel activity, due to its transitory nature and thus its short-term presence at any one location, and because the Project's vessel movements will create noise types and levels that are similar to daily and frequent marine traffic in the area. During seismic survey operations, due to the acoustic outputs of the seismic source arrays, vessel noise will not be a material or detectable contributor to any Project-related noise and its possible effects on marine biota.

Other potential environmental emissions from survey vessels and equipment relate to the possible release of environmental discharges such as deck drainage, liquid and solid wastes, air emissions from exhausts, and other possible sources of environmental discharges from offshore vessels. Any such potential discharges to the marine environment will be managed through strict adherence to applicable regulations and standards (Chapter 2), designed to prevent adverse effects to fish and their habitats. Gel filled or solid streamers eliminate the risk of fluid discharges into the marine environment during seismic survey programs. Although the likelihood that a Project vessel will result in the introduction and spread of an invasive species is low, all Project vessels – in the unlikely event that one is carrying ballast - would comply with the requirements of the *Canada Shipping Act*, including the associated *Ballast Water Control and Management Regulations,* and measures will be taken to minimize biofouling on the ships' hulls and seismic array. Atmospheric emissions during offshore activities would originate from vessel exhaust, although these would be negligible overall. Each of the vessels involved in this Project will manage and dispose of their waste products in accordance with applicable regulations and standards, and will have a Waste Management Plan in place that will be strictly adhered to throughout the life of the Project.

The offshore seismic survey activities that are planned to be undertaken as part of this Project will not result in any direct contact with the seabed, and will therefore not physically disturb benthic animals or their habitats. Although core, grab and seabed samples may also be acquired to determine seabed sediment characteristics, as well as other geochemical and environmental data acquisition using a

towed seabed camera / video system, gravity or piston core, box corer or water sampler, these activities have a very short duration, and those which involve contact with the seabed will have a very small footprint (ranging from approximately 0.10 – 6 m in radius). Prior to undertaking seabed sampling work in areas that are protected and/or have been identified as having a high probability of occurrence of corals and sponges (see Section 4.2) a representative seabed characterization (reconnaissance) drop camera / video system survey transect will be acquired to investigate the potential presence of these sensitive benthic organisms.

Again, because the proposed 2D and 3D seismic exploration programs that are the subject of this assessment will not result in the recovery of petroleum resources, the potential for, and possible magnitude of, any accidental spill are relatively low. Indeed, these would be of no greater likelihood or potential volume than for any other marine vessel of similar size. Each of the vessels involved in this Project will use, store and handle fuels, oils and other such materials in an environmentally acceptable manner, in accordance with applicable regulations and standards. The vessels will have appropriate equipment and procedures in place to prevent any such accidental spills into the marine environment, as well as an Oil Spill Response Plan in the unlikely event of a spill.

5.5.2.2 Seismic Sound Energy

As summarized previously, a variety of physiological and behavioural responses by marine fish to seismic sound have been reported in the literature and through anecdotal reports. Previous studies indicate that such effects vary by species, life stage, intensity of sound, distance from seismic source and in the case of fishing effects, by gear type. Individual species differ in their sensitivity and reactions to underwater noise, with some groups of organisms (such as finfish) having elevated vulnerability due to the presence of hearing organs and/or air filled structures (swim bladders), whereas many invertebrates show much more limited effects of exposure to seismic survey activity, typically even at very close range. More mobile fish species and life stages are able to avoid possible effects of seismic survey noise exposure by moving away from the seismic source array, whereas some larval stages and immobile species may be unable to avoid such exposure. Even in very close proximity (a few metres), however, these have been shown to exhibit only modest levels of mortality, particularly in comparison to natural causes. There is no indication that any direct physical damage to fish occurs at distances greater than several meters from the source. The avoidance behaviour exhibited by mobile fish species further reduces the potential for such effects, and there have been no reports of observed fish mortality under exposure to seismic survey activity in the field.

A range of behavioural response to seismic air source array noise have been observed and reported, however, including altered distributions and changes in activity such as increased refuge seeking or schooling. Although past studies and reports that these have not provided definitive or consistent findings, any such responses (if they do indeed occur) are expected to be somewhat localized (up to several kilometres from the source) and temporary in nature. The use of a gradual “ramp-up” or soft-start procedure over a minimum 20 minute period allows mobile marine animals to move away from the area if they are disturbed by the underwater sound levels associated with the seismic survey. This will help to further avoid fish injury or morality, as will the planned shut-down of the seismic array (reduction to the smallest source element, firing intermittently) during line changes and any required maintenance activities.

The localized and short-term nature of these underwater disturbances at any one location and time during the seismic survey program also considerably reduces the potential for adverse effects to this

VEC. With the seismic survey acquisition vessel moving continuously, the re-occurrence interval of firing the seismic source array within a one kilometre radius of a particular survey point in a 2,000-5,000 km^2 3D survey block would be greater than 24 hours, and could be greater than 48 hours based on an acquisition speed of 4.5 knots and 3-4 hour line turns, given that the lines are acquired in a widely separated "racetrack" type pattern. This minimizes the potential for localized and repeated environmental disturbances at a particular location, and affecting a particular environmental receptor.

It is therefore very unlikely that any fish will be displaced from key habitats or disrupted during key activities over extended areas or periods, or be otherwise affected in a manner that causes negative and detectable effects to fish populations in the region.

A summary of the predicted (residual) environmental effects of the Project on Marine Fish and Fish Habitat is provided in Table 5.3 below.

Table 5.3 Marine Fish and Fish Habitat: Residual Environmental Effects Assessment Summary

Project Activity and Potential Effect(s)	Environmental Effect Descriptors						
	Nature	**Magnitude**	**Extent**	**Duration**	**Frequency**	**Reversibility**	**Certainty**
Presence of Vessels / Equipment • Disturbance	A	L	2	1	1	R	H
Seismic Sound • Potential injury • Disturbance	A	L	2	1	1	R	H
Other Sound (Vessel, etc) • Disturbance	A	L	2	1	1	R	H
Seabed and Environmental Sampling Activities • Disturbance	A	L	1	1	1	R	H
Air Emissions • Exposure / contamination	A	N	2	1	1	R	H
Lighting • Attraction / disturbance	A	N	2	1	1	R	H
Solid Waste • Exposure / contamination	N	-	-	-	-	-	H
Liquid Waste • Exposure / contamination	A	N	2	1	1	R	H
Potential Accidental Events • Exposure / contamination	A	L	2	1	1	R	H
Overall, Resulting Effect(s) of Project on the VEC • Project effects, if they occur, are likely to entail low level, localized, and ephemeral disturbance to				**Evaluation of Significance** • The proposed Project is not likely to result in significant adverse environmental effects on			

Project Activity and Potential Effect(s)	Environmental Effect Descriptors						
	Nature	**Magnitude**	**Extent**	**Duration**	**Frequency**	**Reversibility**	**Certainty**
individual fish and invertebrates. • The Project is not anticipated to have material, negative effects on any species, especially, at the population level.				Marine Fish and Fish Habitat			

Nature / Direction:	**Magnitude**:	**Geographic Extent**:	**Duration**:	**Frequency**:
A = Adverse	N = Negligible or No Effect	1 = < 1 km^2	1 = < 1 month	1 = <11 events/year
N = Neutral or No Effect	L = Low	2 = 1-10 km^2	2 = 1-12 months	2 = 11- 50 events/year
P = Positive	M = Medium	3 = 11-100 km^2	3 = 13-36 months	3 = 51-100 events/year
	H = High	4 = 101-1,000 km^2	4 = 37-72 months	4 = 101-200 events/year
		5 = 1,001-10,000 km^2	5 = > 72 months	5 = >200 events/year
		6 = >10,000 km^2		6 = Continuous

Reversibility:	**Certainty in Prediction:**
R = Reversible	L Low
I = Irreversible	M Moderate
	H High

NOTES

- In all cases, the above referenced effect descriptors refer to the resulting environmental effect to a particular environmental receptor, not to the Project activity or associated disturbance that creates the effect.
- The residual environmental effects predictions that are summarized above include integral consideration of the mitigation measures described in the preceding sections and in detail in Section 5.3

As described and summarized above, the proposed Project is not likely to result in significant adverse environmental effects on Marine Fish and Fish Habitat.

5.6 Marine / Migratory Birds: Environmental Effects Assessment

A variety of bird species occur within the Study Area and in adjacent marine and coastal regions, including seabirds and other avifauna that inhabit the region at particular or extended periods for breeding, feeding, migration and other activities. A number of important habitats for birds have also been identified at locations along the coastline of Eastern Newfoundland, adjacent to but well outside of the proposed Project Area.

5.6.1 Potential Environmental Issues, Interactions and Existing Knowledge

The main potential environmental interactions between offshore oil and gas exploration activities and Marine / Migratory Birds include (adapted from Amec 2014):

- Attraction of, or disturbance to, birds as a result of the presence and movement of survey and supply vessels and their associated disturbances (lights, noise), including possible injury or mortality (strikes, strandings, disorientation, increased energy expenditure);
- Potential injury as a result of exposure to seismic noise within the water column (particularly diving birds) or other associated disruptions to and changes in their feeding and other behaviours;
- Changes in the availability, distribution and/or quality of food sources or habitats for birds; and
- Changes in the presence, abundance, distribution or health of birds as a result of exposure to marine spills, which may affect individuals (physical exposure, ingestion), populations and important habitats.

An overview of the potential interactions between each of the main Project components and activities and the various key indicators and parameters that have been identified for this VEC is presented in Table 5.4.

Table 5.4 Marine / Migratory Birds: Potential Project-VEC Interactions

Project Component / Activity	Key Indicators and Parameters				
	Presence and Abundance	Habitat Availability and Quality	Feeding (Availability and Quality)	Migration and Movements	Health (Individuals or Populations)
Presence of Vessels / Equipment	●	●	●	●	
Seismic Sound		●	●	●	●
Other Sound (vessels, equipment)	●		●	●	
Seabed and Environmental Sampling Activities	●			●	
Air Emissions					●
Lighting	●		●	●	
Solid Waste					
Liquid Waste			●		●
Potential Accidental Spills		●	●	●	●

A summary overview of some existing and available information from the literature and other sources regarding these potential environmental interactions and effects is provided below. Table 5.5 provides a more detailed overview of this literature and associated sources / references.

- Although there has been limited research to date on the physiological and behavioural effects of seismic sound on marine birds, studies and observations reported in the literature to date do not indicate that birds are directly and adversely affected by underwater sounds.

- Of particular concern in relation to planned and routine offshore oil and gas activities, lights can attract night-flying seabirds and possibly result in injuries or death.

- Particularly sensitive times for potential effects on migratory birds include the spring and fall migration periods, as well as during specific meteorological conditions such as fog or inclement weather.

- Discharges from offshore vessels, such as spills and waste materials, may also interact with birds both directly and indirectly.

Table 5.5 Potential Environmental Effects on Marine / Migratory Birds: Summary of Existing Knowledge

Potential Issue / Interaction	Overview of Relevant Studies
Vessels and Associated Environmental Emissions	Marine birds have long been observed to be attracted to offshore vessels as well as petroleum drilling and production platforms in or near the marine environment, which may lead to injury or mortality through collisions with equipment and infrastructure (Baird 1990; Montevecchi et al 1999; Wiese and Montevecchi 2000). In addition to direct interactions and any associated bird injury or mortality, the lighting and other environmental disturbances associated with offshore vessel traffic can affect marine birds through behavioural changes such as the avoidance of disturbed areas (Bramford et al 1990), as well as disorientation which can lead to increased energy expenditures, changes in feeding or migration patterns, and increased susceptibility to predation (Wiese et al 2001; Jones and Francis 2003; Schummer and Eddleman 2003). Similar behavioural (and resulting health-related) effects may also occur as a result of aircraft overflights (Ellis et al 1991; Komenda-Zehnder et al 2003). The effects of lighting on marine birds may be increased during times of poor weather, such as fog and drizzle, although in such situations coastal lighting can be more of an influence as birds fly closer to land (Chaffey 2003, Weir 1976, Blomqvist and Peterz 1984). Moisture droplets in the air during conditions of drizzle and fog refract the light and increase the illuminated area, enhancing the attraction of vessel lighting for birds (Wiese et al 2001).Collisions of migrating seabirds (e.g., shearwaters, dovekies, murres and Leach's storm-petrel) are also often more of an issue with structures such as lighthouses, communication towers, illuminated buildings and large stationary offshore platforms (Gauthreaux and Belser 2006; Montevecchi 2006). Operational discharges from all marine vessels and other offshore activities may lead to sheens of crude oil and other substances on the water's surface, and avifauna (especially pelagic seabirds) that are exposed to such materials can be

Potential Issue / Interaction	Overview of Relevant Studies
	subject to changes in their feather weight and microstructure (O'Hara and Morandin 2010) and other effects. Of particular concern is the overall (cumulative) effects of chronic small scale oil discharge from seagoing vessels, which can be an important cause of seabird mortality (Wiese and Roberston 2004).
Seismic Sound	There have been no known studies that have tested the levels of sound that cause injury to marine birds, although temporary hearing impairment can occur in avifauna that are exposed to sound in air (Saunders and Dooling 1974). The available evidence suggests that avian hearing underwater is poorer than in air, given that the avian middle ear constricts under the increased pressure associated with diving (Dooling and Therrien 2012). Unlike some other marine animals, seabirds do not communicate vocally underwater, and a heightened auditory sensitivity in water is thus unlikely to have developed. A number of sources also indicate that there is no evidence of negative behavioural effects on various bird species resulting from seismic sound (see, for example, Davis et al 1998; MMS 2004). Stemp (1985) found no evidence of seismic survey related effects on marine bird mortality or distributions in the Davis Strait, and Parsons (1980, in Stemp 1985) reported that shearwaters were observed within 30 m of seismic source array with their heads underwater and demonstrating no response. Research in the Irish Sea also indicated no evidence that seabirds were attracted to or repelled by offshore seismic survey activity (Evans et al 1993), and Lacroix et al (2003) studied moulting Long-tailed Ducks (*Clangula hyemalis*) in the Beaufort Sea and found no changes in movements or diving behaviour during seismic surveys. Turnpenny and Nedwell (1994) also refer to other data in which trained observers reported no behavioural effects on guillemot, fulmar and kittiwake species that were monitored during seismic surveys. Deep-diving birds (such as the alcids - murres, dovekies, puffins) and other bird species that spend considerable amount of time underwater, swimming or plunge diving for food may be at somewhat higher risk of injury or disruption due to exposure to underwater noise during seismic exploration. These species dive from a resting position on the water in search of small fish and invertebrates, and are capable of reaching great depths (20 to 60 m) and spending considerable time (25 to 40 seconds) underwater (Gaston and Jones 1998). Unlike fish or marine mammals, diving birds typically place their heads under the water suddenly in pursuit of prey, and could therefore potentially be exposed to high noise levels without the benefit of a steady gradient or associated ramp up procedures. Consequently, they would find it difficult to predict or avoid excessively high sound levels in the water column. This interaction may be further accentuated by the known attraction of many bird species to offshore vessels.

Again, this summary is intended to provide a brief overview of the known and likely environmental issues and interactions, as background and context for predicting Project effects and for identifying and proposing mitigation. More detailed reviews of such information are available through other sources, including the Eastern Newfoundland SEA (Amec 2014), as well as other sources.

5.6.2 Environmental Effects Assessment

The following sections provide an assessment and evaluation of the potential effects of the Project on Marine / Migratory Birds.

Mitigation measures to prevent or reduce adverse effects upon this VEC were identified and summarized in an earlier section of this Chapter, and these are considered integrally within and throughout the environmental effects analysis that follows, as applicable.

5.6.2.1 Vessel and Equipment Use

The implementation and conduct of the proposed offshore exploration program will involve vessel use (presence and movements), including the seismic survey vessel, other survey ships and equipment, and support vessels within the Project Area at various times over multiple years.

As described previously, a key potential issue related to offshore vessels and installations and marine birds relates to their associated lighting sources, which can attract or otherwise affect birds, and thus disrupt their activities and increase the potential for injury or mortality. On-board lighting will be required for any and all Project activities that occur at night, and these must be in place and activated for safety and regulatory compliance reasons. Marine birds can be attracted to offshore lighting, and some avifauna (such as storm-petrels and other species) can fly into vessel lights and other equipment resulting in possible injury or mortality due to strikes / strandings. Birds may also be affected through disorientation and associated energy expenditure, which may interfere with foraging, migration or other important activities and requirements in the life histories of certain species. The distance at which Project-related lighting in the offshore environment will be visible (and thus, its likely zone of influence) will be influenced by on site and time specific factors, and any such disturbances appear to occur most frequently during periods of drizzle and fog. During Project operations, efforts will be made to minimize the use of high-intensity work lights in the evening, and lighting may be turned off in inclement weather where this is possible and practical without affecting Project activities or posing any safety risks to the vessel, its crew or other marine users. Overall, the planned presence of Project related vessels and equipment in the Project Area would be a negligible addition to the total amount of lighting in this region, especially as compared to the fishing boats, commercial traffic and other vessel movements that regularly move to and through the Study Area throughout the year.

The marine bird species that occupy the Study Area will therefore not likely be disturbed by Project-related vessel activity (or any associated aircraft use, if required), due to its transitory nature (and thus, its short-term presence at any one location), and because it is generally in keeping with the overall marine traffic that has occurred throughout the region for years. Regular checks will also be undertaken, and as described above, protocols for the collection and release of any birds that become stranded will be implemented, by qualified and experienced personnel and in accordance with applicable regulatory guidance and requirements and ExxonMobil's associated CWS bird handling permit. The planned geophysical survey area is quite far offshore, and therefore the Project is not expected to interact with or otherwise adversely affect coastal breeding colonies.

Other potential environmental emissions from offshore survey vessels and equipment relate to the possible release of environmental discharges such as deck drainage, liquid and solid wastes, air emissions from exhausts, and other possible sources of environmental discharges. As indicated

previously, these will be managed through strict adherence to applicable regulations and standards (Chapter 2), which will prevent adverse effects upon birds and other marine biota.

Atmospheric emissions would originate from vessel exhausts would be negligible overall and well within applicable regulatory standards. The organic wastes and other materials that may be generated and discharged by offshore vessels and activities can also attract birds, which may increase the potential for interactions, as well as affecting predation, increasing the possibility of exposure to contaminants, and other disturbances. The inadvertent release of inorganic wastes can also result in harmful effects through ingestion or entanglement. As discussed previously, each of the vessels involved in this Project will manage and dispose of their waste products in accordance with applicable regulations and standards, and will have a Waste Management Plan in place that will be implemented and adhered to throughout the duration of the Project.

Other potential environmental discharges from offshore vessels and equipment relate to the possible release of oily water and others substances through deck drainage, bilge water and other possible sources of emissions. These will again be managed through strict adherence to applicable environmental regulations and standards (Chapter 2). There will be limited amounts of marine fuel and oils onboard the survey and support vessels that could potentially be spilled into the ocean, and so the potential for a marine spill and associated pollution incident is considered to be very low for this proposed Project. Each of the vessels involved in this Project will use, store and handle fuels, oils and other such materials in an environmentally acceptable manner, in accordance with applicable regulations and standards.

In terms of possible accidental events and malfunctions, because the proposed exploration program that is the subject of this assessment will again not result in the recovery of petroleum resources, the potential for, and likely magnitude of, any accidental spill are relatively low. Indeed, these would be of no greater likelihood or potential volume than for any other marine vessel of similar size. The vessels will have appropriate equipment and procedures in place to prevent any such accidental spills into the marine environment, as well as an Oil Spill Response Plan in the unlikely event of a spill.

5.6.2.2 Seismic Sound Energy

Marine birds are unlikely to be adversely affected by the underwater sound energy that is associated with marine seismic surveys, as there is little or no potential for interaction between avifauna and seismic sound in the water column. Surface feeding and diving birds are not likely be negatively affected, as seismic pulses are directed downward and highly attenuated at the surface.

Interactions and adverse effects on marine avifauna are therefore unlikely. Any disturbances would be intermittent and short-term at any one location, and will therefore not have adverse effects upon individuals or populations. Because the Project activities will be located far offshore, any birds in coastal locations and at nesting sites will not be subject to any disturbance due to noise from seismic activities. No changes in the presence, abundance or concentration of prey or potential displacement from key foraging areas are anticipated.

A summary of the predicted (residual) environmental effects of the Project on Marine / Migratory Birds is provided in Table 5.6 below.

Table 5.6 Marine / Migratory Birds: Residual Environmental Effects Assessment Summary

Project Activity and Potential Effect(s)	Environmental Effect Descriptors						
	Nature	**Magnitude**	**Extent**	**Duration**	**Frequency**	**Reversibility**	**Certainty**
Presence of Vessels / Equipment • Disturbance	A	L	2	1	1	R	H
Seismic Sound • Disturbance	A	N	1	1	1	R	H
Other Sound (Vessel, etc) • Disturbance	A	N	2	1	1	R	H
Seabed and Environmental Sampling Activities • Disturbance (Vessels and Equipment)	A	N	1	1	1	R	H
Air Emissions • Exposure / contamination	A	N	2	1	1	R	H
Lighting • Disturbance	A	L	2	1	1	R	H
Solid Waste • Exposure / contamination	N	-	-	-	-	-	H
Liquid Waste • Exposure / contamination	A	N	2	1	1	R	H
Potential Accidental Events • Potential injury • Exposure / contamination	A	L	2	1	1	R	H

Overall, Resulting Effect(s) of Project on the VEC	**Evaluation of Significance**
• The Project is not anticipated to have material, negative effects on any species, especially, at the population level.	• The proposed Project is not likely to result in significant adverse environmental effects on Marine / Migratory Birds

Nature / Direction:
A = Adverse
N = Neutral or No Effect
P = Positive

Magnitude:
N = Negligible or No Effect
L = Low
M = Medium
H = High

Geographic Extent:
1 = < 1 km^2
2 = 1-10 km^2
3 = 11-100 km^2
4 = 101-1,000 km^2
5 = 1,001-10,000 km^2
6 = >10,000 km^2

Duration:
1 = < 1 month
2 = 1-12 months
3 = 13-36 months
4 = 37-72 months
5 = > 72 months

Frequency:
1 = <11 events/year
2 = 11- 50 events/year
3 = 51-100 events/year
4 = 101-200 events/year
5 = >200 events/year
6 = Continuous

Reversibility:
R = Reversible
I = Irreversible

Certainty in Prediction:
L Low
M Moderate
H High

Project Activity and Potential Effect(s)	Environmental Effect Descriptors						
	Nature	**Magnitude**	**Extent**	**Duration**	**Frequency**	**Reversibility**	**Certainty**

NOTES

- In all cases, the above referenced effect descriptors refer to the resulting environmental effect to a particular environmental receptor, not to the Project activity or associated disturbance that creates the effect.

- The residual environmental effects predictions that are summarized above include integral consideration of the mitigation measures described in the preceding sections and in detail in Section 5.3

As described and summarized above, the proposed Project is not likely to result in significant adverse environmental effects on Marine / Migratory Birds.

5.7 Marine Mammals and Sea Turtles: Environmental Effects Assessment

Marine mammal (cetacean) species are known or considered likely to occur within the Study Area, include a number of mysticetes (baleen whales), odontocetes (toothed whales and porpoises) and pinnipeds (seals) as well as several sea turtle species. These differ considerably in their likelihood of presence and in the particular locations and habitat types that they utilize and the times at which they occur in or pass through the region. Given that a number of these species have been designated as species at risk under Canadian legislation or are otherwise considered to be of conservation concern, they are typically a key consideration in the Environmental Assessment review and eventual implementation of offshore seismic survey programs.

5.7.1 Potential Environmental Issues, Interactions and Existing Knowledge

Potential environmental interactions between offshore oil and gas exploration activities and marine mammals and sea turtles include (adapted from Amec 2014):

- Temporary hearing impairment or permanent injury or mortality from exposure to loud underwater noise after coming into close contact with a seismic sound source;
- Behavioural effects (avoidance) due to Project-related noise emissions or other disturbances, altering the presence, abundance and overall distribution of marine mammal and sea turtles and their movements, feeding and other activity;
- Interference with (and the masking of) sounds within the marine environment that originate from and/or are used by marine biota, such as in communication between individuals, the identification and detection of predators and prey, echolocation and other activities and requirements;
- The possible attraction of individual animals to offshore survey and supply vessels, resulting in increased potential for injury or mortality through collisions or other interactions; and
- Possible changes in the availability, distribution or quality of feed sources and/or habitats for marine mammals and sea turtles.

An overview of the potential interactions between each of the main Project components and activities and the various key indicators and parameters that have been identified for this VEC is presented in Table 5.7.

Table 5.7 Marine Mammals and Sea Turtles: Potential Project-VEC Interactions

Project Component / Activity	Key Indicators and Parameters				
	Presence and Abundance	Habitat Availability and Quality	Feeding (Availability and Quality)	Migration and Movements	Health (Individuals or Populations)
Presence of Vessels / Equipment	●	●	●	●	
Seismic Sound	●	●	●	●	●
Other Sound (vessels,	●		●	●	

Project Component / Activity	Key Indicators and Parameters				
	Presence and Abundance	Habitat Availability and Quality	Feeding (Availability and Quality)	Migration and Movements	Health (Individuals or Populations)
equipment)					
Seabed and Environmental Sampling Activities	●	●			●
Air Emissions					●
Lighting	●				
Solid Waste					
Liquid Waste			●		●
Potential Accidental Spills	●	●	●	●	●

A considerable amount of research has been conducted on the effects of offshore seismic surveys (of various types and intensities) on marine mammals, and to a lesser degree sea turtles. This has included scientific research, monitoring studies and anecdotal reports of observed reactions to such activities by various species. A summary overview of some existing and available information from the literature and other sources regarding these potential environmental interactions and effects is provided below. Table 5.8 provides a more detailed overview of this literature and associated sources / references.

- There is little indication or evidence that direct physical damage to marine mammals or sea turtles has occurred as a result of seismic air source array noise, particularly due to the avoidance behaviour exhibited by many species.

- A wide range of behavioural responses have been reported in the literature and through anecdotal reports. Research results and observations have not provided conclusive or consistent findings, however, and knowledge of the behavioural effects of seismic noise remains incomplete.

- For the most part, however, any such responses are expected to be localized (within one or perhaps up to several kilometres) and temporary, and of relatively low ecological significance, except possibly in instances where key habitats or life stages such as reproductive activity are significantly and repeatedly affected.

- The noise and other disturbances that are associated with marine vessel traffic may also cause behavioural responses in marine mammals, although this is again variable and likely reversible once the perturbation is removed.

Table 5.8 Potential Environmental Effects on Marine Mammals and Sea Turtles: Summary of Existing Knowledge

Potential Issue / Interaction	Overview of Relevant Studies
Physical and Behavioural Effects from Seismic and Vessel Noise	Anthropogenic noise in the marine environment has been shown to have a variety of effects on marine mammals and sea turtles, particularly in the case of relatively intense sounds at close ranges. These may be physical (injury or mortality) or and/or behavioural (avoidance or other changes in distribution or activities) in nature.

Potential Issue / Interaction	Overview of Relevant Studies
	Vessel traffic and associated noise can be a source of chronic stress for marine mammal populations (Rolland et al 2012; Rao et al 2012). The reactions of cetaceans to ships may be avoidance, approach, or indifference (Richardson et al 1995), as well as other behavioural effects such as changes in vocalizations (Clark et al 2009). Cetacean species are also susceptible to mortality or injury from vessel collisions (Williams and O'Hara 2010). Although permanent hearing damage can result in some instances (Nowacek et al 2007), hearing deterioration due to prolonged or repeated exposure to high levels of noise (also referred to as temporary threshold shift, or TTS) can also occur, the degree and duration of which is influenced by such factors as the individual or species involved and the magnitude and duration of exposure (Richardson et al 1995; Davis et al 1998). Several previous studies have investigated this phenomenon (e.g., Finneran et al 2000, 2002, 2010; Southall et al 2007; Lucke et al 2009; Gedamke et al 2011), although the noise levels that cause TTS for most marine biota are not known, including the sound levels required to cause injury as well as the specific distances within which these may be produced for particular noise levels and other conditions. Studies related to potential TTS resulting from offshore seismic surveys have cited distances from less than 100 m from the sound source (Ridgway et al 1997), to several hundred meters (as described in LGL Limited 2005) to one km or more (Madsen et al 2006; Gedamke et al 2011). Behavioural effects may also occur as a result of marine seismic survey activity and these have been documented in a variety of species and situations. Such interactions occur when animals are disturbed or otherwise affected by intense noise, including the possibility that the sounds emitted and/or used by these animals may be interfered with. Other, indirect effects may also occur when underwater noise results in changes in the location or abundance of food sources. Some of the behavioural effects that underwater noise sources have been observed to have on marine mammals include changes in vocalizations (Parks et al 2007; Holt et al 2009; Miller et al 2000, 2009; Di Iorio and Clark 2010; Risch et al 2012); respiration, swim speed, diving, and foraging behaviour (Stone and Tasker 2006); displacement and avoidance (Castellote et al 2012, Weir 2008); shifts in migration paths, stress and immune depression (Romano et al 2004; Rao et al 2012) and strandings (Gentry 2000; Malakoff 2002; Weilgart 2007). Some species utilize underwater sounds to communicate and for other uses and activities (LGL 2013). These sounds may be "masked" or interfered with by anthropogenic sounds in the marine environment, including seismic sound, particularly where these are at similar frequencies (Richardson et al 1995). Several recent studies have indicated that marine mammal communications can be affected by operating seismic source arrays (Gedamke 2011; Nieukirk et al 2012; Blackwell et al 2013), particularly low-frequency species such as baleen whales (Clark et al 2009). The behavioural responses of marine mammals to seismic sound have been shown to be highly variable between species and other factors and conditions (Weilgart 2007; Miller et al 2009), and generalizations about marine mammal behavioural reactions are therefore difficult to make as they can vary

Potential Issue / Interaction	Overview of Relevant Studies
	considerably based on such factors (Wood et al 2012). For example, some cetaceans have been known to utilize seismic surveys for foraging (e.g. bottlenose dolphins; Barry et al 2012), whereas others have been shown to avoid operating seismic source arrays, although these zones of influence are quite variable (as reviewed by LGL 2005). Some recent studies have, however, shown avoidance or other disturbances up to several hundred kilometres away from seismic airguns source arrays, and well after the survey is completed (Nieukirk et al 2004, 2012; Risch et al 2012; Castellote et al 2012). Wood et al (2012) for example, describe relatively high levels of behavioural reactions to seismic noise at relatively low intensity (e.g., 120−140 dB re: 1 µPa rms), although some species (such as minke whales) have been observed in close proximity (less than 100 m) to operating seismic source arrays (Boertmann and Mosbech 2012).The zones of influence for marine noise appear to be much larger for low frequency cetaceans compared to high frequency cetaceans (Laws 2012). Of particular concern is the potential for marine mammals disturbance associated with seismic surveys to interfere with species at risk and other rare species and small populations, particularly any associated disruption of animal movements, communication or other activities during key periods such as reproduction (Croll et al 2002; Beauchamp et al 2009). Seals have been observed react behaviourally to seismic surveys and other human-induced noise in the marine environment, although if it occurs any such disturbance is usually localized in extent and short-term in duration (Richardson et al 1995). Sea turtles have also been shown to exhibit short-term physical, physiological and behavioural effects as a result of noise-related disturbances (McCauley et al 2000). The loggerhead turtle's hearing range overlaps with the sound frequencies produced by seismic activities (Martin et al 2012), as does that of leatherback turtles (Dow Piniak et al 2012). Temporary hearing loss has been reported in some instances (Moein et al 1994), as has a strong initial avoidance response to seismic air-gun operations (O'Hara and Wilcox 1990; McCauley et al 2000). In recent research, Cerchio et al (2014) used marine autonomous recording units to track numbers of singing humpback whales. They determined that the number of singing whales was reduced considerably during times of seismic noise. It was suggested that seismic surveys could disrupt breeding behaviours of these animals. Robertson (2014) determined that response of bowhead whales to seismic activity was context dependent (i.e. dependent on the whale's circumstance and activity). This author also determined that bowhead whales spend less time at the surface, and are more difficult to observe and count when exposed to seismic activity. When accounting for these behavioural changes, it was suggested that seismic activity did not displace bowheads to the degree previously thought but rather primarily altered their dive behaviour. Pirotta et al (2014) used passive acoustic loggers to monitor vocalizations in harbour porpoises in an area where there had been no evidence of broad scale displacement of animals from seismic activity. The authors determined that such vocalizations declined by 15 percent in the seismic area and that the further animals were away from activity, the greater the likelihood of vocalizations. This paper also documents evidence of sub-lethal effects of seismic airguns on

Potential Issue / Interaction	Overview of Relevant Studies
	harbour porpoises and suggests that exposure to seismic activity could influence energy budgets through reduced foraging performance.

Again, this summary is intended to provide a brief overview of the known and likely environmental issues and interactions, as background and context for predicting Project effects and for identifying and proposing mitigation. More detailed reviews of such information are available through other sources, including the Eastern Newfoundland SEA (Amec 2014), as well as other sources.

5.7.2 Environmental Effects Assessment

The following sections provide an assessment and evaluation of the potential effects of the Project on Marine Mammals and Sea Turtles, with a particular focus on the seismic noise that will be released into the marine environment during periods of 2D or 3D survey activity. The effects assessment also considers other Project components, activities and disturbances which may interact with and affect this VEC, including the associated vessel traffic, other potential emissions to the marine and atmospheric environment during planned Project operations, and possible accidental events (such as a spill).

As with each of the other VECs in this assessment, mitigation measures to prevent or reduce adverse effects upon this VEC were identified and summarized in Section 5.3, and these are considered integrally within and throughout the environmental effects analysis that follows, as applicable.

5.7.2.1 Vessel and Equipment Use

As described earlier, the proposed exploration program will involve vessel traffic, including the use of seismic survey vessels and other sampling and support ships at locations within the Project Area for several months each year over multiple years.

The marine mammal and sea turtles species that occur within the Study Area during these times will not be disturbed by Project-related vessel activity due to its transitory nature and short-term presence at any one location, and because it is generally in keeping with the overall marine traffic that has occurred throughout the region for years. During seismic survey operations, due to the acoustic outputs of the seismic source arrays, vessel noise will not be a material or detectable contributor to any Project-related noise and its possible effects on marine biota.

Other possible environmental emissions from survey vessels and equipment, such deck drainage, liquid and solid wastes, air emissions from exhausts, and other possible sources of discharges will be managed through strict adherence to applicable regulations and standards (Chapter 2) and the various mitigation measures outlined previously, which will also serve to avoid or reduce any adverse effects to this VEC.

5.7.2.2 Seismic Sound Energy

The potential effects of the underwater noise that is associated with marine seismic surveys may be physical (injury or mortality) or behavioural (avoidance, other changes in distribution or activities) in nature. Temporary threshold shift (TTS) is hearing deterioration due to prolonged or repeated

exposure to high levels of noise and can last from minutes or hours to days, depending upon such factors as the receptor involved and the level and duration of noise exposure (Richardson et al 1995; Davis et al 1998). Permanent hearing impairment may also occur is some instances. Although a limited number of studies have investigated this issue, specific TTS thresholds for marine mammals and sea turtles are not currently known, including both the sound levels required to cause such injury as well as the distances at which these may be produced for air gun noise levels and oceanographic conditions. There is, however, limited potential for mortality of or serious injury to marine mammals or sea turtles as a result of exposure to the anticipated levels of seismic noise that will be generated and released into the marine environment as part of this Project. The avoidance behaviour that has been observed by many species during offshore seismic programs will further reduce the potential for physical effects to occur. The proposed survey activities will also be carried out in strict compliance with the operational procedures outlined in the *Statement of Canadian Practice with Respect to the Mitigation of Seismic Sound in the Marine Environment* (DFO 2007) and other mitigations summarized above.

Behavioural reactions to exposure to seismic noise have been widely documented in marine organisms (DFO 2004), including marine mammals and sea turtles (see previous section). The available research indicates that individual species vary in their sensitivity and reactions to seismic noise, with other factors such as time of year also appearing to influence these responses. Moreover, previous research and reported observations have not yielded conclusive, nor particularly consistent, results, making it somewhat difficult to state specifically and conclusively whether, how, to what degree and for how long individuals or species will react to underwater noise levels such as those that will be generated through this Project. It is however, anticipated – and for the purposes of this assessment, assumed - that any individuals that may come into close contact with sufficient underwater sound levels during the seismic program will exhibit some type of level of behavioural response to it, including displacement for a period of time from the immediate vicinity of the affected area. The predicted zone of influence of seismic sound in the marine environment (especially for marine biota as receptors) is typically defined by the area within which specific received sound levels are exceeded (LGL 2013). These thresholds can be established in terms of a maximum level of underwater sound to which cetaceans and reptiles should be exposed, which has been stated in some sources at between 160 to 190 db re 1 µPa (see LGL 2013), or as a minimum distance of separation, such as DFO (2007) which recommends a circle with a radius of at least 500 m as measured from the centre of the seismic air source array(s).

The localized and short-term nature of underwater disturbance at any one location and time during the seismic program considerably reduces the potential for adverse effects upon marine mammals and sea turtles (individuals or populations) to occur. With the seismic vessel moving continuously, the re-occurrence interval of firing the seismic source array within a one kilometre radius of a particular survey point in a 2,000-5,000 km^2 3D survey block would be greater than 24 hours, and could be greater than 48 hours based on an acquisition speed of 4.5 knots and 3-4 hour line turns, given that the lines are acquired in a widely separated “racetrack” type pattern. This minimizes the potential for localized and repeated environmental disturbances at a particular location, and affecting a particular environmental receptor. It is therefore very unlikely that any individuals will be displaced over extended areas or timeframes. Given that the likely zone of influence of the Project at any one time or location will represent a very small proportion of the feeding, breeding or migration area of any species, marine mammals and sea turtles will not be displaced from any key habitats or during important activities, or be otherwise affected in a manner that causes negative and detectable effects to overall populations in the region.

Underwater noise from seismic surveys could also adversely affect marine mammals and sea turtles indirectly, through potential changes in the presence, abundance or concentration of prey and potential displacement from key foraging areas. As described earlier, however, extensive and persistent changes to fish resources or other marine biota are not expected to occur as a result of the Project. Therefore, the availability, location or quality of food sources for marine mammals or sea turtles are not likely to be adversely affected as a result of this Project.

A summary of the predicted (residual) environmental effects of the Project on Marine Mammals and Sea Turtles is provided in Table 5.9 below.

Table 5.9 Marine Mammals and Sea Turtles: Residual Environmental Effects Assessment Summary

Project Activity and Potential Effect(s)	Environmental Effect Descriptors						
	Nature	**Magnitude**	**Extent**	**Duration**	**Frequency**	**Reversibility**	**Certainty**
Presence of Vessels / Equipment • Disturbance	A	L	3	2	1	R	H
Seismic Sound • Disturbance	A	L	3	2	1	R	H
Other Sound (Vessel, etc) • Disturbance	A	L	2	2	1	R	H
Seabed and Environmental Sampling Activities • Disturbance	A	L	1	1	1	R	H
Air Emissions • Exposure / contamination	A	N	3	2	1	R	H
Lighting • Disturbance	N	N	2	2	1	R	H
Solid Waste • Exposure / contamination	N	-	-	-	-	-	H
Liquid Waste • Exposure / contamination	A	N	2	2	1	R	H
Potential Accidental Events • Potential injury • Exposure / contamination	A	L	2	2	1	R	H
Overall, Resulting Effect(s) of Project on the VEC • The Project is not anticipated to have material, negative effects on any species, or especially, at the population level.				**Evaluation of Significance** • The Project is not likely to result in significant effects on Marine Mammals and Sea Turtles.			

Project Activity and Potential Effect(s)	Environmental Effect Descriptors						
	Nature	**Magnitude**	**Extent**	**Duration**	**Frequency**	**Reversibility**	**Certainty**

Nature / Direction:
A = Adverse
N = Neutral or No Effect
P = Positive

Magnitude:
N = Negligible or No Effect
L = Low
M = Medium
H = High

Geographic Extent:
1 = < 1 km^2
2 = 1-10 km^2
3 = 11-100 km^2
4 = 101-1,000 km^2
5 = 1,001-10,000 km^2
6 = >10,000 km^2

Duration:
1 = < 1 month
2 = 1-12 months
3 = 13-36 months
4 = 37-72 months
5 = > 72 months

Frequency:
1 = <11 events/year
2 = 11- 50 events/year
3 = 51-100 events/year
4 = 101-200 events/year
5 = >200 events/year
6 = Continuous

Reversibility:
R = Reversible
I = Irreversible

Certainty in Prediction:
L Low
M Moderate
H High

NOTES

- In all cases, the above referenced effect descriptors refer to the resulting environmental effect to a particular environmental receptor, not to the Project activity or associated disturbance that creates the effect.
- The residual environmental effects predictions that are summarized above include integral consideration of the mitigation measures described in the preceding sections and in detail in Section 5.3

As described above, the proposed Project is not likely to result in significant adverse environmental effects on Marine Mammals and Sea Turtles.

5.8 Species at Risk: Environmental Assessment Summary

A number of fish, bird, mammal and reptile species that are known or considered likely to occur within the Study Area have been designated as Species at Risk, and are therefore protected under applicable Canadian legislation.

The Canadian *Species at Risk Act* (*SARA*) provides for the protection of species at the national level to prevent extinction and extirpation, facilitate the recovery of endangered and threatened species, and to promote the management of other species to prevent them from becoming at risk in the future. Designations under the Act follow the recommendations and advice provided by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC).

There are currently a number of schedules associated with the *SARA*. Species that have formal protection are listed on Schedule 1, which includes the following potential designations:

- *Extirpated*: A species that no longer exists in the wild in Canada, but exists elsewhere;
- *Endangered*: A species that is facing imminent extirpation or extinction;
- *Threatened*: A species that is likely to become endangered if nothing is done to reverse the factors leading to its extirpation or extinction; and
- *Special Concern*: A species that may become threatened or endangered because of a combination of biological characteristics and identified threats.

Schedule 1 of *SARA* is the official federal list of species at risk in Canada. Once a species is listed, measures to protect and recover a listed species are established and implemented, including the development of a Recovery Strategy. Action Plans summarize the activities required to meet recovery strategy objectives and goals, and Management Plans set goals and objectives for maintaining sustainable population levels of one or more species that are particularly sensitive to environmental factors.

At the provincial level, the Newfoundland and Labrador *Endangered Species Act* (*NL ESA*) provides protection for indigenous species, sub-species and populations considered to be endangered, threatened, or vulnerable within the province. These potential designations under the legislation are defined as follows:

- *Endangered*: A species that is facing imminent extirpation or extinction;
- *Threatened*: A species that is likely to become endangered if nothing is done to reverse the factors leading to its extirpation or extinction; and
- *Vulnerable*: A species that has characteristics which make it particularly sensitive to human activities or natural events.

Designations are based on recommendations from COSEWIC and/or the provincial Species Status Advisory Committee (SSAC). Habitat that is important to the recovery and survival of endangered or

threatened species can also be designated as critical habitat or recovery habitat, and protected under the *NL ESA*.

Species at Risk have been identified, and their known or likely presence, abundance and geographic and temporal distribution are evaluated, as an integrated component of the description of the existing biophysical environment (Chapter 4). The potential effects of the Project on these species has also been integrally assessed and evaluated within the Marine Fish and Fish Habitat, Marine / Migratory Birds, and Marine Mammals and Sea Turtles VECs themselves.

As specified in the Scoping Document issued by the C-NLOPB, however, Species at Risk and potential effects on them are given special (and separate) attention and emphasis in the assessment, including in the identification and analysis of potential environmental effects and mitigation. Therefore, while the overall content and findings of each of the other biophysical VECs are applicable to the individual Species at Risk within them - and, for the purposes of efficiency, this information and analysis is not repeated in its entirely here – the following sections provide an overview and "species-specific" analysis and summary of the potential effects of the Project on each protected species.

5.8.1 Marine Fish Species at Risk

Four marine fish species that are known or likely to occur in the Study Area that have formal designation and protection under *SARA*, which comprise three species of wolffish (family *Anarhichadidae*) and white shark (*Carcharodon carcharias*). A single species also has provincial designation and protection under *NL ESA*, American eel (*Anguilla rostrata*). The main potential environmental interactions between the Project and these species are the same as those for the Marine Fish and Fish Habitat VEC as a whole as are the planned mitigation measures to avoid or reduce any such adverse interactions.

Further, information and analysis related to each of these species, and the potential for the Project to interact with, and affect, each of these Species at Risk is provided in the Table below:

Table 5.10 Marine Fish Species at Risk: Analysis of Potential Environmental Interactions and Effects

Species	*SARA*	*NL ESA*	Summary of Presence and Potential Interactions
Atlantic wolffish	Special Concern		• Spawns September and October • Pelagic larvae • Adults remain in Study Area • Abundant in Flemish Pass and continental slopes • Limited potential for interaction (mobile species, Project mitigations, no critical habitat)
Northern wolffish	Threatened		• Spawns September through November • Pelagic larvae • Remain in Study Area • Aggregated in Flemish Pass and northeast slopes • Limited potential for interaction (mobile species, Project mitigations, no critical habitat)
Spotted wolffish	Threatened		• Spawn June, July and August • Pelagic larvae • Remain in Study Area • Common on Flemish Cap, eastern Grand Banks and

Species	*SARA*	*NL ESA*	Summary of Presence and Potential Interactions
			Newfoundland Shelf • Limited potential for interaction (mobile species, Project mitigations, no critical habitat)
White shark	Endangered		• Timing and location of spawning is unknown • Pelagic species • May pass through Study Area (Oceach 2015) • Limited potential for interaction (mobile species, Project mitigations, no critical habitat)
American eel		Vulnerable	• Spawn in the Saragasso Sea • Pelagic species • May pass through Study Area during migrations to or from spawning areas • Limited potential for interaction (mobile species, Project mitigations, no critical habitat)

All of these species are highly mobile, and with the implementation of Project mitigation measures (such as the associated ramp-up / soft-start procedures outlined previously) individual species that may be present within the Project's zone of influence are likely to move out of the area if they are disturbed by the Project. The Project will also not affect any identified critical habitat for any such species, and will not affect the residences of other key habitats of any individual or populations.

5.8.2 Marine / Migratory Bird Species at Risk

The potential environmental interactions between the Project and any bird species at risk are the same as those for the Marine / Migratory Bird VEC as a whole, as are the planned and proposed mitigation measures to avoid or reduce any such adverse interactions. Additional species-specific information and analysis related to the potential for the Project to interact with and affect each of these Species at Risk is provided in the Table below.

Table 5.11 Marine / Migratory Birds Species at Risk: Analysis of Potential Environmental Interactions and Effects

Species	*SARA*	*NL ESA*	Summary of Presence and Potential Interactions
Ivory Gull	Endangered	Endangered	• Ivory Gulls breed in the far north. • Outside of the breeding season, they spend almost all of their time in the marine environment. • No critical habitat exists in the Project area. • Small numbers occur in the winter months within the Project area, where they are found most often among the pack ice. • Because they are typically found among pack ice and only in the winter months, interactions with Project activities are unlikely.
Barrow's Goldeneye	Special Concern	Vulnerable	• Present in the Study Area in small numbers and only in the winter, and are generally found in coastal waters only. • Interactions with Project activities are therefore very unlikely.
Harlequin Duck	Special Concern	Vulnerable	• Most common in the area outside of the Project activities (with the exception at Cape St. Mary's,

Species	*SARA*	*NL ESA*	Summary of Presence and Potential Interactions
			where they may occur year-round), and are associated with coastal environments. • They are therefore unlikely to interact with Project activities.

The Project will not affect critical habitat for any of these species, nor will it result in disturbance of coastline areas and any associated bird colonies given its offshore location.

5.8.3 Marine Mammal and Sea Turtle Species at Risk

A number of marine mammal and sea turtle species at risk are known to occur in the Study Area. Again, the main potential environmental interactions between the Project and these species are the same as those for the Marine Mammals and Sea Turtles VEC as a whole as are the planned mitigation measures to avoid or reduce any such adverse interactions.

Further, species-specific information and analysis related to the potential for the Project to interact with, and affect, each of these Species at Risk is provided in the Table below:

Table 5.12 Marine Mammal and Sea Turtle Species at Risk: Analysis of Potential Environmental Interactions and Effects

Species	*SARA*	*NL ESA*	Summary of Presence and Potential Interactions
Blue Whale - Atlantic Population	Endangered		• Blue whales occur singly or in pairs in coastal and pelagic waters, frequently at shelf edge where food production is high. • In the Study Area, blue whales are present in small numbers throughout the year, although they are most commonly observed in the winter and early spring, outside the schedule of Project activities. • Limited potential for interaction (mobile species, Project mitigations, no critical habitat).
Fin Whale - Atlantic Population	Special Concern		• Fin whales are generally found along the coastal shelf edge and offshore waters. • Their summer distribution is typically in areas with high prey concentration (e.g., the Grand Banks). • In the Study Area, they are present year-round but are likely most common in the summer months. • Limited potential for interaction (mobile species, Project mitigations, no critical habitat).
North Atlantic Right Whale	Endangered		• The North Atlantic right whale is usually found in waters 100 to 200 m deep, with surface temperatures between 8 and 15°C. • They aggregate in five seasonal habitat areas along the east coast of North America, all of which are outside of the Study Area. • In Canada, the lower Bay of Fundy and Roseway Basin on the Scotian Shelf (all of which are outside the Study Area) have been designated as critical habitat for the species. • North Atlantic right whales are likely to be extremely rare visitors to the Study Area, primarily in the summer months.

Species	*SARA*	*NL ESA*	Summary of Presence and Potential Interactions
			• Therefore, any interactions with Project activities are unlikely (also, mobile species, Project mitigations, no critical habitat).
Northern Bottlenose Whale - Scotian Shelf population	Endangered		• The northern bottlenose whale is a deep-diving species, typically found alone or in small groups of up to 20 individuals, in waters between 800 and 1,500 m deep. • The Scotian Shelf population is apparently non-migratory. • Critical habitat for this population has been identified along the Scotian Shelf, outside of the Study Area. • They have been observed at all times of year in the Study Area, although most sightings have been in the spring and summer. • It is unclear to which population individuals observed in the Study Area belong; however, of the two populations, the Davis Strait population is more mobile. • Limited potential for interaction (mobile species, Project mitigations, no critical habitat).
Sowerby's Beaked Whale	Special Concern		• A deep-water species found at continental edges and slopes in depths of 550 – 1,500 m or more, the Sowerby's beaked whale is seldom seen and its biology is poorly understood. • They are generally observed in groups of 3 to 10 individuals. • Seasonal movements of Sowerby's beaked whales are unknown. • Although almost all sightings have been in the summer, that may be due to a relative lack of search effort in other times of year, and they may be present year round in deep water habitats in the Study Area. • Limited potential for interaction (mobile species, Project mitigations, no critical habitat).
Beluga Whale - St. Lawrence Estuary population	Threatened		• Belugas are a coastal species, and tend to be concentrated in estuarine breeding range for most of the year, dispersing in the winter months. • Critical habitat for the population is in the St. Lawrence Estuary and lower reaches of the Saguenay River, outside of the Study Area. • Only a very small proportion of the population occurs in the Study Area; belugas seldom range far from the St. Lawrence estuary. • They are present in the Study Area only in small numbers, typically in the winter, and they are generally found in coastal waters. • Therefore, any interactions with Project activities are unlikely (also, mobile species, Project mitigations, no critical habitat.
Leatherback Sea Turtle	Endangered		• Typically found in coastal shelf waters with depths of < 200 m, with most of their time spent in the upper 12 m of the water column.

Species	*SARA*	*NL ESA*	Summary of Presence and Potential Interactions
			• Leatherback turtles occur in the Study Area mainly from April to December. • The existing Recovery Strategy for the species does not identify critical habitat. • The area south and east of the Burin Peninsula (including parts of Placentia Bay) is one of three high-use feeding areas that were identified in a recent tracking study. • Information from this DFO study is being used to inform the identification of critical habitat in a forthcoming amendment to the Recovery Strategy. • Limited potential for interaction (mobile species, Project mitigations, no critical habitat).

All of these species are highly mobile, and with the implementation of Project mitigation measures (such as the associated ramp-up / soft-start procedures outlined previously) individual species that may be present within the Project's zone of influence are likely to move out of the area if they are disturbed by the Project. The Project will also not occur within identified critical habitat for either of these species.

5.8.4 Summary of Environmental Assessment Results for Species at Risk

As a result of the above, and with the implementation of the various mitigations outlined in the preceding (VEC) sections, the proposed Project is not likely to result in significant adverse effects upon any Species at Risk, nor is it likely to contravene any of the associated provisions or prohibitions of *SARA.*

5.9 Protected and Sensitive Areas: Environmental Effects Assessment

Several areas within and adjacent to the Study Area have been designated as protected under provincial, federal and/or other legislation and processes, or have been identified as being otherwise special or sensitive due to their ecological and/or socio-cultural characteristics and importance.

5.9.1 Potential Environmental Issues and Interactions

Environmental interactions between petroleum activities and protected and sensitive areas may be both direct and indirect in nature and cause (Amec 2014). Conducting an activity directly within or near such an area may, for example, have adverse implications through the presence of vessels, equipment and personnel and any associated noise and other emissions and resulting disturbances. Any associated decrease in the real or perceived integrity of these sites in the short or long term may, in turn, affect their ecological and/or socio-cultural importance, value and (where applicable) the use and enjoyment of these areas. Biophysical effects resulting from offshore oil and gas or other human activities may also affect protected and sensitive areas by affecting marine fish, birds, mammals or other environmental components that are relevant to their designation and/or key and relevant characteristics.

An overview of the potential interactions between each of the planned Project components and activities and the various key indicators and parameters that have been identified for this VEC is presented in Table 5.13.

Table 5.13 Protected and Sensitive Areas: Potential Project-VEC Interactions

Project Component / Activity	Key Indicators and Parameters	
	Environmental Features and/or Processes	Human Use and/or Societal Value
Presence of Vessels / Equipment	●	●
Seismic Sound	●	●
Other Sound (vessels, equipment)	●	●
Seabed and Environmental Sampling Activities	●	●
Air Emissions	●	●
Lighting	●	●
Solid Waste	●	●
Liquid Waste	●	●
Potential Accidental Spills	●	●

5.9.2 Environmental Effects Assessment

A description (and mapping) of each of the marine and coastal areas within and adjacent to the Study Area that have been designated as protected or identified as otherwise special or sensitive was provided in Chapter 4. The following sections provide an assessment and evaluation of the potential effects of the Project on these Protected and Sensitive Areas. Again, the previously identified mitigation measures are identified and considered integrally within the effects analysis, as relevant.

Table 5.14 below provides a summary of the (minimum) distance between the edge of the proposed Project Area and the various relevant Protected and Sensitive Areas identified and mapped in Chapter 4. As indicated, the planned Project will occur in an offshore area which is many kilometres

from shore. Project activities will therefore not occur within, or otherwise interact directly with, any of the existing provincial or federal Parks, Ecological Reserves, Wildlife Reserves, Marine Protected Areas, Migratory Birds Sanctuaries, Important Birds Area or other locations that have been designated as protected on the Island of Newfoundland. The proposed Project and Study Areas do, however, overlap with a number of identified special or sensitive areas in the offshore environment, none of which are formally protected under legislation, and for which there are no associated prohibitions of marine activities such as that being proposed as part of this Project.

Table 5.14 Protected and Sensitive Areas: Summary of Minimum Distances from the Project Area

Protected / Sensitive Area	Minimum Distance from Project Area Boundary (km)
Fishery Closure Areas	
Orphan Knoll Seamount	Overlaps with Project Area
NAFO Coral Closures	Overlaps with Project Area
Newfoundland Seamounts	63
Funk Island Deep	149
3O Coral Closures	215
Hawke Channel	312
Fogo Seamount 1	318
Fogo Seamount 2	417
Ecologically and Biologically Significant Areas (EBSAs)	
Virgin Rocks	Overlaps with Project Area
Southeast Shoal and Tail of The Banks	Overlaps with Project Area
Lilly Canyon-Carson Canyon	Overlaps with Project Area
Northeast Shelf and Slope	Overlaps with Project Area
Orphan Spur	Overlaps with Project Area
Notre Dame Channel	174
Eastern Avalon Coast	181
Southwest Shelf Edge and Slope	191
Fogo Shelf	213
Smith Sound	259
Grey Islands	298
Labrador Slope	302
Placentia Bay Extension	311
Labrador Marginal Trough	376
Gilbert Bay	487
Laurentian Channel and Slope	494
St. Pierre Bank	496
Hamilton Inlet	534
Preliminary Representative Marine Area (RMA)	
South Grand Bank Area	Overlaps with Project Area
Virgin Rocks	13
Northwestern Conception Bay	199
Southern Coast of Burin Peninsula & Southwestern Placentia Bay	406
Marine Protected Areas / Areas of Interest	
Eastport – Duck Island Marine Protected Area	271

Protected / Sensitive Area	Minimum Distance from Project Area Boundary (km)
Eastport – Round Island Marine Protected Area	282
Laurentian Channel Area of Interest	505
Migratory Bird Sanctuary	
Terra Nova Migratory Bird Sanctuary	287
Parks and Ecological / Wildlife Reserves (Provincial and Federal)	
Baccalieu Island Ecological Reserve	209
Witless Bay Ecological Reserve	212
Marine Drive Provincial Park	212
La Manche Provincial Park	221
Dungeon Provincial Park	227
Funk Island Ecological Reserve	227
Chance Cove Provincial Park	234
Mistaken Point Ecological Reserve	247
Windmill Bight Provincial Park	257
Deadman's Bay Provincial Park	267
Terra Nova National Park	272
Bellevue Beach Provincial Park	284
Jack's Pond Provincial Park	298
Gooseberry Cove Provincial Park	313
Cape St. Mary's Ecological Reserve	320
Dildo Run Provincial Park	341
Frenchman's Cove Provincial Park	411
Lawn Islands Archipelago Provisional Ecological Reserve	431
Fortune Head Ecological Reserve	447

The Fisheries Closure Areas that overlap with the Study Area have been designated as such in order to help protect benthic areas from further disturbance from certain types of (bottom dragging) fishing activity. Most of the offshore survey activities that are planned to be undertaken as part of this Project will not result in any direct contact with the seabed, and will therefore not physically disturb benthic animals or their habitats. Seabed core, grab and seabed samples may also be acquired to determine seabed sediment characteristics, as well as other geochemical and environmental data acquisition using a towed seabed camera / video system, gravity or piston core, box corer or water sampler, these activities have a very short duration, and those which involve contact with the seabed will have a very small footprint. As referenced earlier, ExxonMobil will undertake representative seabed reconnaissance prior to core drilling or other intrusive seabed sampling work in areas that have been identified as having a high probability of occurrence of sensitive corals and sponges.

In terms of the various EBSAs and RMAs that overlap with the Project Area, the biophysical or socioeconomic environments within these areas will not be significantly affected by the Project. Again, most of the offshore survey activities that will be undertaken as part of this Project will not result in any direct contact with the seabed, and the nature, magnitude, location, frequency and duration of the planned exploration activities will mean that activity will occur at any one location for a very short period of time, and will be generally in keeping with (and will make a negligible contribution to) the marine activity (especially, vessel traffic) that has occurred throughout the region for years. As described for the various preceding biophysical VECs, the proposed Project is not expected to result

in any significant adverse effects upon marine fish, birds, mammals, sea turtles or their habitats. It will therefore not adversely affect the ecological features, processes and integrity of any marine or coastal areas, including the Protected and Sensitive Areas that are part of this VEC. The implementation of the various environmental protection measures and procedures outlined throughout this Environmental Assessment Report, including those which are designed to avoid or reduce Project-related discharges and/or disturbances and their associated environmental effects, will also serve to help address any direct or indirect potential effects on overlapping or adjacent Protected and Sensitive Areas.

A summary of the predicted (residual) environmental effects of the Project on Protected and Sensitive Areas is provided in Table 5.15 below.

Table 5.15 Protected and Sensitive Areas: Residual Environmental Effects Assessment Summary

Project Activity and Potential Effect(s)	Environmental Effect Descriptors						
	Nature	**Magnitude**	**Extent**	**Duration**	**Frequency**	**Reversibility**	**Certainty**
Presence of Vessels / Equipment • Disturbance	N	-	-	-	-	-	H
Seismic Sound • Disturbance	N	-	-	-	-	-	H
Other Sound (Vessel, etc) • Disturbance	N	-	-	-	-	-	H
Seabed and Environmental Sampling Activities • Exposure / contamination • Disturbance (vessel related and habitats)	N	-	-	-	-	-	H
Air Emissions • Exposure / contamination	N	-	-	-	-	-	H
Lighting • Disturbance	N	-	-	-	-	-	H
Solid Waste • Exposure / contamination	N	-	-	-	-	-	H
Liquid Waste • Exposure / contamination	N	-	-	-	-	-	H
Potential Accidental Events • Potential injury • Exposure / contamination	A	L	2	1	1	R	H
Overall, Resulting Effect(s) of Project on the VEC • The Project is not anticipated to have adverse				**Evaluation of Significance** • The proposed Project is not likely to result in			

Project Activity and Potential Effect(s)	Environmental Effect Descriptors						
	Nature	**Magnitude**	**Extent**	**Duration**	**Frequency**	**Reversibility**	**Certainty**
effects upon this VEC.				significant adverse environmental effects on this VEC			

Nature / Direction:	**Magnitude**:	**Geographic Extent**:	**Duration**:	**Frequency**:
A = Adverse	N = Negligible or No Effect	1 = < 1 km^2	1 = < 1 month	1 = <11 events/year
N = Neutral or No Effect	L = Low	2 = 1-10 km^2	2 = 1-12 months	2 = 11- 50 events/year
P = Positive	M = Medium	3 = 11-100 km^2	3 = 13-36 months	3 = 51-100 events/year
	H = High	4 = 101-1,000 km^2	4 = 37-72 months	4 = 101-200 events/year
		5 = 1,001-10,000 km^2	5 = > 72 months	5 = >200 events/year
		6 = >10,000 km^2		6 = Continuous
Reversibility:	**Certainty in Prediction:**			
R = Reversible	L Low			
I = Irreversible	M Moderate			
	H High			

NOTES

- In all cases, the above referenced effect descriptors refer to the resulting environmental effect to a particular environmental receptor, not to the Project activity or associated disturbance that creates the effect.
- The residual environmental effects predictions that are summarized above include integral consideration of the mitigation measures described in the preceding sections and in detail in Section 5.3

As described and summarized above, the proposed Project is not likely to result in significant adverse environmental effects on Protected and Sensitive Areas.

5.10 Marine Fisheries and Other Activities: Environmental Effects Assessment

Marine fisheries are an important and long-standing element of the socioeconomic environment of Newfoundland and Labrador, including many of the communities and regions that surround the Study Area. A number of other anthropogenic components and activities also occur throughout the Study Area, including various commercial and recreational pursuits.

5.10.1 Potential Environmental Issues, Interactions and Existing Knowledge

Possible interactions between offshore petroleum activities and other human activities may again be both direct and indirect in nature and cause, and include (adapted from Amec 2014):

- Potential damage to fishing gear, vessels, equipment or other components as a result of direct interactions with oil and gas related vessels, equipment, activities or their environmental discharges;

- Decreased access to preferred fishing grounds or other marine areas during offshore oil and gas activities, with possible resulting decreases in the success, efficiency, enjoyment or value of these pursuits;

- Indirect effects on fisheries or other uses of the marine environment due to possible biophysical effects on the presence, distribution, abundance or quality of marine fish or other resources or environmental features, resulting from planned activities or accidental events;

- Potential economic effects to individuals, businesses and communities as a result of the above; and

- Possible interference with governmental / industry fish survey activities, including direct disturbance and/or effects upon research results and associated management decisions.

An overview of the key potential interactions between each of the main Project components and activities and the various key indicators and parameters that have been identified for this VEC is presented in Table 5.16.

Table 5.16 Marine Fisheries and Other Activities: Potential Project-VEC Interactions

Project Component / Activity	Key Indicators and Parameters				
	Distribution and Intensity of Marine Activities	Effectiveness and Efficiency of Marine Activities (including catch rates)	Abundance, Location and Quality of Marine Resources	Quality and Value of Marine Activities (Economic)	Quality and Value of Marine Uses (Socio-cultural)
Presence of Vessels / Equipment	●	●	●	●	●
Seismic Sound		●	●	●	●
Other Sound (vessels, etc)			●		
Seabed and Environmental Sampling Activities	●				
Air Emissions					

Project Component / Activity	Key Indicators and Parameters				
	Distribution and Intensity of Marine Activities	Effectiveness and Efficiency of Marine Activities (including catch rates)	Abundance, Location and Quality of Marine Resources	Quality and Value of Marine Activities (Economic)	Quality and Value of Marine Uses (Socio-cultural)
Lighting			●		
Solid Waste			●		
Liquid Waste			●		
Potential Accidental Spills	●	●	●	●	●

5.10.2 Environmental Effects Assessment

The following sections provide an assessment and evaluation of the potential effects of the Project on Marine Fisheries and Other Activities. As with each of the other VECs, mitigation measures to prevent or reduce adverse effects upon these activities were identified and summarized at the onset of this Chapter, and these are considered integrally within and throughout the environmental effects analysis that follows, as applicable.

A description of commercial fisheries within the Study Area was provided in Chapter 4, based upon existing and available catch statistics and geospatial data provided by DFO and other information sources. As illustrated, a variety of fisheries occur within and throughout the Study Area at various times of the year, and the region is characterized by a complex and somewhat dynamic spatial and temporal mix of fishing and other marine pursuits, including with regard to the location, timing and intensity of specific activities, the particular marine resource (species) of interest, the equipment types used, and other factors.

The potential for the Project to interact with and affect marine fisheries and other commercial activities will depend upon the specific nature, location and timing of these activities, and the equipment or gear involved (such as the possible presence of fixed fishing gear (such as crab pots) along or near a survey line at the same time as planned Project activities). In general, however, the available data on fishing and other commercial and recreational pursuits occur throughout the planned Project timeframes (May-November). The planned timing of the offshore survey work that is being proposed as part of this Project will therefore inevitably overlap with periods of fishing and other offshore pursuits. This will require advanced planning and avoidance to minimize the potential for affecting both Project activities and fisheries, as well as on-going cooperation and communication between the survey vessel and other marine vessels to avoid potential interactions for safety and other reasons.

Detailed and specific operational plans for the proposed survey work - including for each of the potential nine years of activity - are not and cannot be available at this stage, since the specific location and other characteristics of a particular year's activities will depend on the previous year's survey and its findings, exploration interests and priorities, and other logistical considerations. At this stage it is therefore not possible to identify and specify particular locations and times at which Project activities will be undertaken or curtailed in order to avoid or reduce the potential for interactions with other marine users, and program planning will therefore continue to occur based on a variety of factors, primarily relying on industry communications and advice and applying the mitigations described herein. As is also a typical condition of Environmental Assessment approval for such marine exploration activities in the NL Offshore Area, ExxonMobil will submit annual Updates in

relation to this multi-year program which will describe the previous year's activities, recent and on-going stakeholder consultations, outline the proposed survey work for the coming year and evaluate the continued applicability and validity of the EA predictions and associated mitigations.

The mobile and transitory nature, spatial extent and timing of the planned offshore survey activities that will be associated with this Project will mean that activity will occur at any one location for a very short period of time. Typically, only small portions of some of the planned survey lines would pass near key active fishing areas at any one time, which would therefore result in minimal (and likely very brief) potential interaction or disturbance at any particular site and time. On-going coordination and effective and timely communication between offshore oil and gas operators and the fishing industry and other marine interests, through the various processes and forums described above and as outlined in the One Ocean *Protocol for Seismic Survey Programs in Newfoundland and Labrador,* has been and remains the best means for ensuring that such activities are carried out in a safe and environmentally responsible manner. These measures are aimed at avoiding or reducing adverse interactions between offshore geophysical programs and other users of the marine environment, and are widely used (and effective) in the Newfoundland and Labrador Offshore Area.

As outlined in detail in Section 5.3, this involves planned communications and coordination procedures involving the Proponent and relevant regulatory authorities, stakeholders and key ocean users throughout the operational life of the Project, including:

- On-going information gathering on key fishing areas and times and continued monitoring of fishing activity;
- The presence, active participation and advice of the FLO on board the seismic ship, and a shore-based SPOC.
- The issuance of Notices to Mariners and other notifications and direct industry communications throughout the periods of Project operations, and regular communication of planned survey activities with key industry representatives;
- The use of a standby or guard vessel to scout for hazards and for communicating with active fishers in the area (if any); and
- Establishment and implementation of a Fishing Gear Damage or Loss Compensation Program.

As noted above, the proposed survey activities will also be planned and implemented to avoid negative interactions with fisheries research surveys in the Study Area, through active and on-going communication and coordination with DFO and industry representatives.

The area of interest for the planned geophysical surveys is offshore, and the limited amount of vessel activity that will or may take place in coastal locations (such as crew changes or re-supply) will occur at existing and established commercial ports. The Project is therefore not expected to interact with, or otherwise adversely affect, other human activities that occur on land or near shore, including relevant recreational activities such as hunting, fishing and other pursuits.

Any Project-related biophysical effects to marine resources could potentially result in a subsequent change in the nature, quality and/or value of one or more of the marine activities that utilize or depend upon them (economic or otherwise). As described throughout this Chapter, the proposed Project is not expected to result in detectable (and certainly, not significant) adverse effects upon marine biota or their habitats. Although the underwater noise and other potential interactions that will be associated with the Project have the potential to interact with marine biota, these activities will be undertaken in strict compliance with relevant standards and guidelines that pertain to vessel traffic, waste management, and other potential environmental discharges and emissions. This includes the mitigation measures that are typically required and implemented for such programs in the NL Offshore Area as conditions of regulatory approvals and which have been identified by ExxonMobil in this Environmental Assessment. Any disturbance to marine biota will be localized and of very short-term duration at any one location.

It is therefore unlikely that any individuals will be displaced from key areas for extended periods, or be otherwise affected or disrupted in a manner that would then translate into effects on the overall availability or quality of a marine resource. As also discussed in Chapter 2, adequate and appropriate spill prevention and response measures will also be in place for the duration of Project operations.

A summary of the predicted (residual) environmental effects of the Project on Marine Fisheries and Other Activities is provided in Table 5.17 below.

Table 5.17 Marine Fisheries and Other Activities: Residual Environmental Effects Assessment Summary

Project Activity and Potential Effect(s)	Environmental Effect Descriptors						
	Nature	**Magnitude**	**Extent**	**Duration**	**Frequency**	**Reversibility**	**Certainty**
Presence of Vessels / Equipment • Disturbance	A	L	2	1	1	R	H
Seismic Sound • Disturbance	A	N	2	1	1	R	H
Other Sound (Vessel, etc) • Disturbance	A	N	2	1	1	R	H
Seabed and Environmental Sampling Activities • Disturbance	A	N	1	1	1	R	H
Air Emissions • Contamination	N	-	-	-	-	-	H
Lighting • Disturbance	N	-	-	-	-	-	H
Solid Waste • Contamination	N	-	-	-	-	-	H
Liquid Waste • Contamination	A	N	2	1	1	R	H
Potential Accidental Events • Potential injury • Contamination	A	L	2	1	1	R	H

Project Activity and Potential Effect(s)	Environmental Effect Descriptors						
	Nature	**Magnitude**	**Extent**	**Duration**	**Frequency**	**Reversibility**	**Certainty**
Overall, Resulting Effect(s) of Project on the VEC • The Project is not anticipated to affect the overall intensity, distribution (spatial or temporal) or value of marine fisheries or other marine activities in the Study Area.				**Evaluation of Significance** • The proposed Project is not likely to result in significant adverse environmental effects on Marine Fisheries and Other Activities.			

Nature / Direction:	**Magnitude**:	**Geographic Extent**:	**Duration**:	**Frequency**:
A = Adverse	N = Negligible or No Effect	1 = < 1 km^2	1 = < 1 month	1 = <11 events/year
N = Neutral or No Effect	L = Low	2 = 1-10 km^2	2 = 1-12 months	2 = 11- 50 events/year
P = Positive	M = Medium	3 = 11-100 km^2	3 = 13-36 months	3 = 51-100 events/year
	H = High	4 = 101-1,000 km^2	4 = 37-72 months	4 = 101-200 events/year
		5 = 1,001-10,000 km^2	5 = > 72 months	5 = >200 events/year
		6 = >10,000 km^2		6 = Continuous

Reversibility:	**Certainty in Prediction:**
R = Reversible	L Low
I = Irreversible	M Moderate
	H High

NOTES

- In all cases, the above referenced effect descriptors refer to the resulting environmental effect to a particular environmental receptor, not to the Project activity or associated disturbance that creates the effect.
- The residual environmental effects predictions that are summarized above include integral consideration of the mitigation measures described in the preceding sections and in detail in Section 5.3

As described above, the proposed Project is not likely to result in significant adverse environmental effects on Marine Fisheries and Other Activities.

5.11 Cumulative Environmental Effects

The environmental effects of individual projects and activities in the marine environment are not necessarily mutually exclusive of each other, but can accumulate and interact in environmental systems to result in cumulative environmental change. As specified in the C-NLOPB's March 2015 Scoping Document, the potential cumulative environmental effects of the Project in combination with those of other relevant projects and activities are also assessed and evaluated herein.

Past and on-going projects and activities within the Study Area and their environmental effects are reflected in the existing (baseline) environmental conditions for each VEC, as described in some detail in Chapter 4 of this Environmental Assessment Report. Marine biota and their habitats within the Study Area and in the larger Northwest Atlantic have been and are being affected by a variety of natural and anthropogenic factors and processes, including past and on-going fishing activity, offshore petroleum exploration and production, general vessel traffic and other human activities, as well as the effects of changing climatic conditions and other factors and processes. These have all collectively influenced the presence, distribution and abundance of species in particular areas, depths and times, as well as the overall size and health of marine fish, bird, mammal and sea turtle populations, as well as the environmental characteristics of particular areas and locations within and throughout the Study Area. Fisheries and other human activities in the marine environment may also be affected both individually and collectively by offshore oil and gas exploration and production activities, general marine traffic and other activities and associated disturbances, with these effects possibly accumulating or interacting on a regional scale to bring about cumulative environmental effects.

These previous, on-going, and future activities and processes will continue to affect the environmental conditions and characteristics of the Study Area, in combination with each other and with possible future oil and gas exploration and development projects in the region. The current and likely future condition of each VEC as a result of these natural and/or anthropogenic factors, and thus its overall sensitivity or resiliency to any further disturbance or change that might result from this Project, has been integrally considered throughout the environmental effects assessments described in the earlier sections of this Chapter.

As described in the preceding sections, offshore oil and gas exploration activities such as those being proposed as part of this Project may affect marine biota through direct and indirect influences. This includes possible injury, mortality or behavioural effects to fish, birds, mammals or turtles due to noise or other disturbances in the marine environment, possible contamination resulting from routine activities (discharges) or unplanned and accidental events (oil spills), and through the alteration of marine habitats.

In terms of other on-going and future projects and activities which may affect marine biota, the commercial fishing industry will continue to be a key influence, resulting in fish catches (mortality) and habitat disturbance through current and future fishing activities, practices and management processes. The rather dynamic nature of fishing activity throughout the region (in terms of fishing locations, seasons, gear types and key species) makes it difficult to predict specific areas and times from year to year for both domestic and foreign fleets, and thus, the potential for interactions between activities and their effects. The eastern portion of the NL Offshore Area is also subject to on-going and planned oil and gas development and exploration activities, including a number of proposed offshore exploration programs which were recently proposed and approved or which are being subject to Environmental Assessment review by the C-NLOPB as of the time of writing (Section 3.4.7). Offshore

petroleum exploration and development activities also have associated vessel traffic, and there are vessel movements associated with fishing vessels, cargo transport, and other marine activities that will continue to occur throughout the region. The widespread and migratory nature of many marine species and activities also increases the potential for these to be affected by multiple perturbations, and therefore, for cumulative environmental effects to occur.

Although the proposed Project that is the subject of this Environmental Assessment will have the potential to interact with marine biota within and adjacent to the proposed Project Area, as described earlier any potential effects upon marine fish, birds, mammals and sea turtles and their habitats (as well as any associated protected or identified environmentally sensitive areas) will therefore entail a very short-term, infrequent and relatively mild environmental disturbance at any one location and time. With the implementation of the various mitigation measures outlined in this Environmental Assessment, the Project will itself not likely result in significant adverse effects to any VEC. Indeed, the vessel presence, movements and other marine activities and potential disturbances that will be associated with the proposed Project would represent a very small fraction of the total marine activity in the Eastern NL Offshore Area. Its relatively localized and transient nature will reduce the potential for particular individuals, populations, areas or other environmental components to be affected through multiple interactions with this Project and other activities in the marine environment, and for any one environmental receptor to be affected simultaneously and repeatedly by multiple projects and activities. As part of the planning and implementation of its survey activities over the course of this Project, ExxonMobil will also continue to communicate and consult with relevant industry stakeholders. This will also include other oil and gas exploration companies operating in the area, to plan and coordinate activities to ensure appropriate spatial and temporal separation is maintained, for technical (data quality), safety and environmental reasons.

In terms of other marine activities (particularly, commercial fisheries), the often spatially extensive nature of seismic surveys, along with the somewhat widespread nature of some fishing activities (both geographically and seasonally), increases the potential for fishing enterprises and other pursuits to be affected by multiple projects and activities in a region. The potential for interference by offshore oil and gas activities can again be managed and mitigated through good communication and cooperation between industries. These include the various planning and mitigation measures and procedures outlined in this Environmental Assessment, through which the proposed Project will be planned and implemented so as to reduce the potential for adverse interactions with commercial and recreational human activity in the marine environment. Although an unlikely and relatively infrequent occurrence, any damage to gear, vessels or other marine assets would also be managed through applicable compensation policies and procedures.

The proposed Project is therefore not likely to result in significant adverse cumulative environmental effects in combination with other projects and activities that have been or will be carried out. Indeed, the relative contribution of this Project and its potential effects to any such overall effects on the environment of the Study Area will be very low, and will not likely be perceptible.

5.12 Environmental Monitoring and Follow-up

ExxonMobil is committed to obtaining all required permits, approvals and authorizations for the proposed Project, and the company and its contractors will comply with these and all relevant regulations and guidelines in planning and implementing the proposed marine exploration program that is the subject of this Environmental Assessment. This includes the various mitigations identified and committed to in the proceeding sections, the implementation and effectiveness of which will be directed, managed and tracked in accordance with ExxonMobil' s existing policies and procedures.

ExxonMobil will develop and implement an operational monitoring program for marine birds and mammals throughout the course of the Project. A qualified and experienced Environmental Observer will be onboard the seismic vessel(s) to record marine bird and marine mammal sightings during Project operations, which will be undertaken in accordance with applicable requirements and guidelines. Reports from these monitoring programs will be submitted to the relevant government authorities on a regular basis.

As part of the Environmental Assessment, ExxonMobil has also identified and committed to a number of measures and processes to avoid or reduce the potential for adverse interactions with, and effects upon, fisheries and other marine activities and users in the region. These include on-going communication and cooperation mechanisms throughout the operational life of this Project, which are intended to allow for continued discussion of Project related activities and any issues as they may arise during Project implementation, as well as to cooperatively and collaboratively plan and implement any required (adaptive) management measures throughout the life of the Project.

ExxonMobil will submit updates in relation to this multi-year program. These will describe the previous year's activities, recent and on-going consultation activities and their outcomes, as well as outlining the proposed survey work for the coming year and evaluating the continued applicability and validity of the EA predictions and associated mitigations.

6 ENVIRONMENTAL ASSESSMENT SUMMARY AND CONCLUSIONS

ExxonMobil is proposing to undertake offshore exploration activities over its recently acquired Exploration Licences and other areas of interest within the Eastern Newfoundland Offshore Area annually over the 2015-2024 period, generally within the May – November timeframe. This may include 2D and 3D seismic surveys, as well as wellsite geohazard, geochemical, geotechnical and environmental survey activities. No ExxonMobil proprietary 3D surveys are planned in 2015. After receiving several unsolicited multi-client speculative 3D seismic proposals for the EL 1135 area, ExxonMobil is working with a vendor on a 3D acquisition program for that area. If opportunity arises ExxonMobil would consider 2015 geochemical and/or related bathymetric surveys for Flemish Pass (EL 1135) and Carson Basin (EL 1136).

The Project requires authorizations from the C-NLOPB pursuant to the *Accord Acts*. This document provides an Environmental Assessment of the proposed marine exploration program in accordance with the requirements and processes of the Board and the Project-specific Scoping Document (Appendix A). This includes information and analysis related to each of the following:

- Project purpose, rationale and alternatives;
- Project description (equipment, activities);
- Existing environment (biophysical and socioeconomic);
- Environmental issues scoping and consultation activities;
- The predicted environmental effects of the Project on the identified VECs;
- Proposed mitigation measures to avoid / reduce any adverse effects;
- The significance of the Project's predicted (residual) environmental effects;
- Cumulative environmental effects; and
- Environmental monitoring and follow-up.

Each of the potential environmental issues and effects that could be associated with the proposed Project can be avoided or otherwise mitigated through the use of good planning and proven operational practices and procedures, supported by Project-specific and industry standard mitigations that are well established and outlined in relevant regulatory procedures and guidelines, and which have been identified by ExxonMobil as part of this Environmental Assessment.

Overall, the proposed Project will entail a very localized, short-term and transient disturbance in the marine environment at any one location and time throughout the operational life of the exploration program. It is therefore not anticipated to displace or otherwise affect marine fish, birds, mammals, turtles, fisheries or other marine activities in such a way that causes negative and detectable effects to populations, species at risk or human activities in the region.

The proposed Project is therefore not likely to result in significant adverse environmental effects.

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APPENDIX A

Table of Concordance with C-NLOPB Environmental Assessment Scoping Document

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Table of Concordance with C-NLOPB EA Scoping Document

EA Scoping Document Sections / Requirements	Where / How Addressed in the EA Report
Purpose	
This document provides scoping information for the Environmental Assessment (EA) of geophysical, geochemical, environmental, and geotechnical programs in the eastern Newfoundland offshore and all other related activities (the Project). ExxonMobil Ltd. Canada (ExxonMobil) is proposing to conduct a ship-borne geophysical program that includes two dimensional (2D), three dimensional (3D), wellsite geohazard, geochemical, geotechnical and environmental survey programs in one or more years within the 2015 to 2024 timeframe. The primary objectives of the Project are to: acquire data to image structural and stratigraphic trends; define and assess prospects for potential drilling and development; and assess overall hydrocarbon potential.	• Understood and acknowledged, and referenced throughout the EA Report.
Included in this document is a description of the scope of the project that will be assessed, the factors to be considered in the assessment, and the scope of those factors.	
This document has been developed by the Canada-Newfoundland and Labrador Offshore Petroleum Board (C-NLOPB) in consultation with federal and provincial fisheries and environmental departments	
Regulatory Considerations	
The Project will require authorizations pursuant to Section 138 (1) (b) of the *Canada-Newfoundland Atlantic Accord Implementation Act* and Section 134(1) (b) of the *Canada-Newfoundland and Labrador Atlantic Accord Implementation Newfoundland and Labrador Act* (Accord Acts).	• Understood and acknowledged, and referenced in Sections 1.3 and 3.1 of the EA Report
The C-NLOPB formally delegates the responsibility of an acceptable environmental assessment report and any supporting documents to ExxonMobil Canada Ltd., the project proponent.	
Scope of the Project	
The project to be assessed consists of the following components:	• The scope of the Project for EA purposes is as specified here, as referenced and described in Sections 1.1, 2.1 to 2.6, 3.1 and throughout the EA Report. • The EA has been carried out for each of the Project components and activities listed here.
The conduct of 2D, 3D, wellsite geohazard, geochemical, geotechnical and environmental survey program surveys between May 1 and November 30 in one or more years between 2015 and 2024 within the Project Area; and	
Operation of support craft associated with the above activities, including but not limited to support and guard/picket vessels, and helicopters.	
Factors to be Considered	
The EA shall include a consideration of the following factors:	
The purpose of the project;	• Section 2.1
The environmental effects of the Project, including those due to malfunctions or accidents that may occur in connection with the Project and any change to the Project that may be caused by the environment. Environmental effect is defined as: any change that the project may cause in the environment, including any such change on health and socio-economic conditions, on physical and cultural heritage, on the current use of lands and resources for traditional purposes by aboriginal persons, or on any structure, site or thing that is of historical, archaeological, paleontological or architectural significance; and any change to the project that may be caused by the environment, whether any such change occurs within or outside Canada;	• Chapters 3 and 5
Cumulative environmental effects of the Project that are likely to result from the project in combination with other projects or activities that have been or will be carried out;	• Sections 3.4.7 and 5.11
The significance of the environmental effects described in 4.2 and 4.3;	• Sections 3.4, 5.5, 5.6, 5.7, 5.8, 5.9, 5.10 and 6.0
Measures, including contingency and compensation measures as appropriate, that are technically and economically feasible and that would mitigate any significant adverse environmental effects of the project;	• Sections 2.7 and 5.3

EA Scoping Document Sections / Requirements	Where / How Addressed in the EA Report
The significance of adverse environmental effects following the employment of mitigative measures, including the feasibility of additional or augmented mitigative measures; and	• Sections 3.4, 5.5, 5.6, 5.7, 5.8, 5.9, 5.10 and 6.0 • The mitigation measures outlined and considered (integrally) throughout the environmental effects assessment will be implemented to avoid or reduce adverse environmental effects, and all are considered to be technically and economically feasible.
Report on consultations undertaken by ExxonMobil with interested other ocean users who may be affected by program activities and/or the general public respecting any of the matters described above.	• Section 3.2
Scope of the Factors to be Considered	
ExxonMobil will prepare and submit to the C-NLOPB an EA for the above-described physical activity, and as described in the "*Environmental Project Description Eastern Newfoundland Offshore Geophysical, Geochemical, Environmental and Geotechnical Programs 2015-2024"* (ExxonMobil Canada Ltd. February 2015). The EA will address the factors listed above; the issues identified in Section 5.2 (following), and document any issues and concerns that may be identified by the proponent through regulatory, stakeholder, and public consultation.	• Addressed throughout the EA Report
Program activities are proposed for the eastern Newfoundland offshore area, which has been studied in a number of recent EAs and the recently published *Eastern Newfoundland Strategic Environmental Assessment* (SEA) (August 2014). For the purposes of this assessment, the information provided in the *Eastern Newfoundland SEA* should support the EA to avoid unnecessary duplication of information. Appropriate references should be included in the EA.	• Relevant information from other EAs and SEAs has been incorporated into the EA Report, and referenced appropriately
It is recommended that the "valued ecosystem component" (VEC) approach be used to focus its analysis. A definition of each VEC (including components or subsets thereof) identified for the purposes of environmental assessment, and the rationale for its selection, shall be provided.	• The VEC approach has been used, as described in Section 3.3 and as illustrated throughout Chapter 5
The scope of the factors, to be considered in the EA, will include the components identified in Section 5.2 - Summary of Potential Issues, setting out the specific matters to be considered in assessing the environmental effects of the project and in developing environmental plans for The project, and the "Spatial Boundaries" identified below (Section 5.1). Considerations relating to definition of "significance" of environmental effects are provided in the following sections.	• These concepts and requirements are addressed throughout the EA Report
Discussion of the biological and physical environments should consider the data available from recent EAs and the recently completed *Eastern Newfoundland SEA* (August 2014) for the Project and Study Areas. Where data gaps exist, the EA should clearly identify the lack of data available.	• The information sources used are described and referenced throughout the EA Report. • In some cases, a lack of environmental baseline information for certain environmental components is referenced (e.g., in Fish and Fish Habitat). • Although there are examples of less than complete baseline information on some aspects of the environment, no data gaps have been identified which have prevented the assessment and evaluation of environmental effects and the identification and proposal of mitigation for this Project and its EA.

EA Scoping Document Sections / Requirements	Where / How Addressed in the EA Report
Boundaries The EA shall consider the potential effects of the proposed survey program within spatial and temporal boundaries that encompass the periods and areas during and within which the project may potentially interact with, and have an effect on, one or more VECs. These boundaries may vary with each VEC and the factors considered, and should reflect a consideration of: • the proposed schedule/timing of the seismic survey program; • the natural variation of a VEC or subset thereof; • the timing of sensitive life cycle phases in relation to the scheduling of seismic survey activities; • interrelationships/interactions between and within VECs; • the time required for recovery from an effect and/or return to a pre-effect condition, including the estimated proportion, level, or amount of recovery; and • the area within which a VEC functions and within which a project effect may be felt.	• The EA study areas (spatial and temporal) are clearly defined, including general and VEC-specific boundaries, and the rationale for them is described (see Sections 2.3, 3.4.2, and 5.2) • This includes consideration of each of the factors listed here, as referenced in Section 3.4.2
The proponent shall clearly define, and provide the rationale for the spatial and temporal boundaries that are used in its EA. The EA report shall clearly describe the spatial boundaries (*e.g*. Study Area, Project Area) and shall include figures, maps and the corner-point coordinates. Boundaries should be flexible and adaptive to enable adjustment or alteration based on field data. The Study Area will be described based on consideration of potential areas of effects as determined by the scientific literature, and project-environment interactions. A suggested categorization of spatial boundaries follows.	• The EA study areas (spatial and temporal) are clearly defined, including general and VEC-specific boundaries, and the rationale for them is described (see above). • The Project Area and Study Area are illustrated in Figures in Chapters 1 and 3, including corner point coordinates (Figure 2.1).
Spatial Boundaries	
<u>Project Area</u> The area in which seismic survey activities are to occur, including the area of the buffer zone normally defined for line changes.	• Each of these types of study areas are defined for each VEC (see Sections 3.4.2, and 5.2).
<u>Study Area</u> The area which could potentially be affected by project activities beyond the "Project Area".	
<u>Regional Area</u> The area extending beyond the "Study Area" boundary. The "Regional Area" boundary will also vary with the component being considered (e.g., boundaries suggested by bathymetric and/or oceanographic considerations).	
The EA Report shall also include a description of the first survey(s) proposed within the Project Area (e.g. 2015 3D seismic survey), including the size of the survey area and a description of the boundaries.	• Sections 2.4.1 and 2.6
Temporal Boundaries The temporal scope should describe the timing of project activities. Scheduling of project Activities should consider the timing of sensitive life cycle phases of the VECs in relation to physical activities.	• Temporal boundaries are defined, which include consideration of each of these factors (see Sections 3.4.2 and 5.2).
Summary of Potential Issues	
The EA shall contain descriptions and definitions of EA methodologies employed in the assessment of effects. Where information is summarized from existing reports, the sections referenced should be clearly indicated. The EA should be an assessment of environmental effects on selected VEC's related to the specific Project Area and the specific Project proposed, thereby providing a comprehensive assessment of potential environmental effects and Mitigation applicable to the Project (and VECs) being proposed and assessed. Effects of relevant Project activities on those VECs most likely to be in the defined Study Area shall be assessed. Discussion of cumulative effects within the Project Area and with other relevant marine projects shall be included. Issues to be considered in the EA shall include, but not be limited to, the following:	• Section 3.4 and Chapter 5
<u>Physical Environment</u>	
The recently published *Eastern Newfoundland SEA* (August 2014) provides information on the eastern Newfoundland offshore physical environment.	• Section 4.1

EA Scoping Document Sections / Requirements	Where / How Addressed in the EA Report
This SEA, as well as recent EAs in the area provides descriptions of the meteorological and oceanographic characteristics, including extreme conditions. Only new information for the Study Area that has become available since the publication of the above noted documents, and that is relevant to the consideration of environmental effects, should be provided in the EA.	
Biological Environment	
The recently published *Eastern Newfoundland SEA* (August 2014) provides information on the eastern Newfoundland offshore biological environment. This SEA, as well as recent EAs in the area, provides descriptions of: marine birds; fish and fish habitat; marine mammals and sea turtles; species at risk; sensitive areas; and human activities, including marine fisheries. Only relevant new information for the Study Area that has become available since the publication of the above noted documents should be provided in the EA, in particular species at risk, sensitive areas, and marine fisheries.	• Section 4.2
Marine and/or Migratory Birds • The EA shall provide only new or updated information, where applicable, to address any changes to the following:	
Noise disturbance from seismic equipment including both direct effects (physiological), or indirect effects (foraging behaviour, prey species, adult attendance at the nest);	• Sections 5.6 and 5.8
Physical displacement as a result of vessel presence (e.g. disruption of foraging activities);	• Sections 5.6 and 5.8
Attraction of, and increase in, predator species as a result of waste disposal practices (*i.e*., sanitary and food waste);	• Sections 5.6 and 5.8
Nocturnal disturbance from light (e.g. increased opportunities for predators, attraction of birds to vessel lighting and subsequent collision, disruption of incubation);	• Sections 5.6 and 5.8
Procedures for handling birds that may become stranded on survey vessels;	• Sections 5.6 and 5.8
Means by which bird mortalities associated with project operations may be documented and assessed;	• Sections 2.7, 5.6 and 5.8
Effects of hydrocarbon spills from accidental events, including fluid loss from streamers and operational discharges (e.g. deck drainage, gray water, black water);	• Sections 5.6 and 5.8
Means by which potentially significant adverse effects upon birds may be mitigated through design and/or operational procedures; and	• Sections 5.3, 5.6 and 5.8
Environmental effects due to the Project, including cumulative effects.	• Sections 5.6, 5.8 and 5.11
Marine Fish and Shellfish The EA shall provide only new or updated information, where applicable, to address any changes to the following:	
The means by which potentially significant adverse effects upon fish (including critical life stages) and commercial fisheries may be mitigated through design, scheduling, and/or operational procedures; and	• Sections 5.5 and 5.10
Environmental effects due to the Project, including cumulative effects.	• Sections 5.5, 5.8 and 5.11
Marine Mammals and Sea Turtles The EA shall provide only new or updated information, where applicable, to address any changes to the following:	
Disturbance to/displacement of marine mammals and sea turtles due to noise and the possibility of ship strikes;	• Sections 5.7 and 5.8
Means by which potentially significant adverse effects upon marine mammals and sea turtles (including critical life stages) may be mitigated through design, scheduling, and/or operational procedures; and	• Sections 5.3, 5.7 and 5.8
Environmental effects due to the Project, including cumulative effects.	• Sections 5.7, 5.8 and 5.11
Species at Risk (SAR) • The EA shall provide only new or updated information, where applicable, to address any changes to the following:	
Monitoring and mitigation, consistent with recovery strategies/action plans (endangered/threatened) and management plans (special concern);	• Sections 5.5 to 5.8
A summary statement stating whether project effects are expected to contravene the prohibitions of *Species at Risk Act* (*SARA*) (Sections 32(1), 33, 58(1));	• Section 5.8.4
Means by which adverse effects upon SAR and their critical habitat may be mitigated through design, scheduling, and/or operational procedures; and	• Section 5.3 and 5.8

EA Scoping Document Sections / Requirements	Where / How Addressed in the EA Report
Assessment of effects (adverse and significant) on Species at Risk SAR and critical habitat, including cumulative effects.	•
"Sensitive" Areas • The EA shall provide only new or updated information, where applicable, to address any changes to the following:	
Sensitive Areas in the Study Area deemed important or essential habitat to support any of the marine resources identified;	• Sections 4.2.4 and 5.9
Environmental effects due to the project, including cumulative effects, on those "Sensitive" Areas identified; and	• Section 5.9
Means by which adverse effects upon "Sensitive" Areas may be mitigated through design, scheduling and/or operational procedures.	• Section 5.3 and 5.9
Marine Use	
Noise/Acoustic Environment The EA shall provide only new or updated information, where applicable, to address any changes to the following:	
Disturbance/displacement of VECs and SAR associated with seismic survey activities;	• Sections 5.5 to 5.8
Means by which potentially significant effects may be mitigated through design, scheduling and/or operational procedures; and	• Sections 5.3, 5.5 and 5.8
Effects of seismic activities (direct and indirect) including cumulative effects, on the VECs and SAR identified within the EA. Critical life stages should be included.	• Sections 5.5 to 5.8
Presence of Seismic Survey Vessel(s) The EA shall provide only new or updated information, where applicable, to address any changes to the following:	
Description of project-related traffic, including routings, volumes, scheduling and vessel types;	• Section 2.4
Effects upon access to fishing grounds;	• Section 5.10
Effects upon general marine traffic/navigation, including fisheries research surveys, and mitigations to avoid research surveys;	• Section 5.10
Means by which potentially significant effects may be mitigated through design, scheduling and/or operational procedures; and	• Sections 5.3 and 5.10
Environmental effects assessment, including cumulative effects.	• Sections 5.1 to 5.11
Fisheries and Other Ocean Users The EA shall provide only new or updated information, where applicable, to address any changes to the following:	
An analysis of the effects of Project operations and accidental events upon fisheries and other ocean users. The analysis should include consideration of recent scientific literature on effects of survey activity on invertebrate species, including identified data gaps;	• Section 5.10
Qualification of any change or effect of the Project on existing commercial activities;	• Section 5.10
Fisheries liaison/interaction policies and procedures;	• Sections 5.3 and 5.10
Program(s) for compensation of affected parties, including fisheries interests, for accidental damage resulting from project activities;	• Sections 5.3 and 5.10
Means by which adverse effects upon commercial fisheries may be mitigated through design and/or operational procedures; and	• Sections 5.3 and 5.10
Environmental effects due to the Project, including cumulative effects.	• Sections 5.10 and 5.11
Accidental Events	
Discussion on the potential for spill events related to the use and maintenance of streamers.	• Sections 2.4 and 5.1 to 5.10
Environmental effects of any accidental events arising from streamers or accidental releases from the seismic and/or support vessels (e.g., loss of product from streamers). Cumulative effects in consideration of other oil pollution events (e.g., illegal bilge disposal) should be included.	• Sections 2.7.4, 5.1, 5.3, 5.5 to 5.10, 5.11
Mitigations to reduce or prevent such events from occurring.	• Sections 2.7 and 5.3
Contingency plans to be implemented in the event of an accidental release.	• Sections 2.7 and 5.3
Environmental Management	
The EA shall outline ExxonMobil Canada Ltd.'s environmental management system and its components, including, but not limited to:	
Pollution prevention policies and procedures;	• Sections 2.7 and 5.3
Fisheries liaison/interaction policies and procedures;	• Sections 2.7 and 5.3
Program(s) for compensation of affected parties, including fishery interests, for accidental damage resulting from project activities; and	• Sections 5.3 and 5.10

EA Scoping Document Sections / Requirements	Where / How Addressed in the EA Report
Emergency response plan(s).	• Sections 2.7 and 5.3
Biological and Follow-up Monitoring	
Discuss the need for and requirements of a follow-up program to verify the accuracy of the EA, to verify the effectiveness of any mitigation measures identified in the EA, or both. The discussion should also include any requirement for compensation monitoring (compensation is considered mitigation).	• Section 5.12
Details regarding the monitoring and observation procedures to be implemented regarding marine mammals, sea turtles and seabirds (observation protocols should be consistent with the C-NLOPB "*Geophysical, Geological, Environmental and Geotechnical Program Guidelines"* (January 2012).	• Sections 5.3 and 5.6
Significance of Adverse Environmental Effects	
The Proponent shall clearly describe the criteria by which it proposes to define the "significance" of any residual adverse environmental effects that are predicted by the EA. This definition should be consistent with the November 1994 CEAA reference guide "*Determining Whether a Project is Likely to Cause Significant Adverse Environmental Effects*", and be relevant to consideration of each VEC (including components or subsets thereof) that is identified. SARA species shall be assessed independent of non-SARA species. The effects assessment methodology should clearly describe how data gaps are considered in the determination of significance of effects.	• Sections 3.4.4 and 5.4 • The definition and determination of significance is consistent with the referenced guide. • Individual assessments and environmental effects conclusions are provided for each SARA listed species in Section 5.8. • Mitigation measures and significance definitions for SARA listed species are the same as for the Marine Fish and Fish Habitat, Marine / Migratory Birds and Marine Mammals and Sea Turtles VECs themselves. • No data gaps have been identified which have prevented the assessment and evaluation of environmental effects and the identification and proposal of mitigation for this Project and its EA, nor which would lead to a conclusion that the Project is likely to cause significant adverse environmental effects.
Cumulative Effects	
The assessment of cumulative environmental effects should be consistent with the principles described in the February 1999 CEAA "Cumulative Effects Assessment Practitioners' Guide" and in the November 2007 CEAA operational policy statement "Addressing Cumulative Environmental Effects under the Canadian Environmental Assessment Act". It should include a consideration of environmental effects that are likely to result from the proposed project in combination with other projects or activities that have been or will be carried out. These include, but are not limited to: proposed oil and gas activities under EA review (listed on the C-NLOPB Public registry at www.cnlopb.ca); other geophysical activities; fishing activities, including Aboriginal fisheries; and marine transportation. The C-NLOPB website lists all current and active offshore petroleum activity within the NL offshore area.	• Sections 3.4.7, 5.11 • The cumulative effects assessment approach and methods are consistent with the referenced guides • Each of the noted "other projects and activities" have been considered in the cumulative effects assessment.