9.0 EFFECTS OF THE ENVIRONMENT ON THE PROJECT

Section 19(1)(h) of CEAA, 2012 requires consideration of "any change to the designated project that may be caused by the environment". This section considers how local environmental conditions and natural hazards (*e.g.*, extreme weather) could adversely affect the Project and thus result in potential effects on the environment (*e.g.*, accidental events). Potential adverse effects of the environment on a project are typically a function of project design and environmental conditions that could affect the project. These effects are generally mitigated through engineering and environmental design criteria, industry standards, and environmental monitoring.

Aspects of the environment that could potentially affect the Project include:

- fog;
- sea ice and superstructure icing;
- seismic events and tsunamis;
- extreme weather conditions; and
- sediment and seafloor stability.

9.1 ENVIRONMENTAL CONSIDERATIONS

9.1.1 Fog

Fog, a major cause of low visibility at sea, is reported on the Scotian Shelf approximately 35% of days annually, resulting in a visibility less than 1 km approximately 13% annually (refer to Table 5.1.16). Reduced visibility due to fog is more common in the summer and least common in the fall.

Sea fog or advection fog forms when warm, moist air moves over colder seawater and as the air cools below its saturation point, excess moisture condenses to form fog. Sea fog can cover large areas and persist for long periods as long as a continuous supply of warm moist air is available (DFO 2012c). Sea smoke or evaporation fog forms when cold air moves over warmer seawater (DFO 2012c).

Foggy conditions, resulting in poor visibility, can hinder PSV and helicopter transportation, potentially resulting in delay of supply and personnel movement to and from the MODU, although it is unlikely to result in work stoppage. Based on the consideration of historical visibility data from the Sable Island Weather Station (refer to Table 5.1.16), and implementation of standard operating procedures for safe PSV and helicopter operations, fog is not likely to result in a significant adverse effect of the environment on the Project.

9.1.2 Extreme Weather Conditions

Average wind speeds on the Scotian Shelf range from 4.9 m/s to 8.8 m/s (17.5 km/hour to 31.5 km/hour) in September and January, respectively, with sustained wind speeds of 36.1 m/s (130 km/hour) during severe storm events (Stantec 2013). As indicated in Section 5.1.2.3, wind in the Project Area is predominantly from the northwest during the winter and from the southwest during spring and summer. Maximum wind speeds range from 20.4 m/s (73 km/hour) in May to 29.8 m/s (107 km/hour) In December.

Further environmental information on general and extreme climate and weather data used for the purposes of this analysis are included in Section 5.1.2 of the EIS. Extreme weather that could potentially occur in the Project Area and require consideration for Project planning includes lightning and tropical and extra tropical cyclones. Winds and storm surges generated as a consequence of tropical and extra-tropical cyclones are addressed here; lightning is discussed in Section 9.1.3.

A total of 22 tropical cyclones have passed through the Scotian Shelf and Slope from 2003 to 2014, with 13 passing through or within close proximity to the Project Area. Tropical cyclones that traveled through the Scotian Shelf and Slope have been most prevalent in September, followed by July, October, August, June and November, in decreasing monthly frequency respectively. More detailed information on tropical and extra-tropical cyclones that can affect the Project Area is presented in Section 5.1.2.4.

With respect to wave conditions, on the basis of the MSC50 wave data from 1954 to 2013 and a grid point within the Project Area (refer to Section 5.1.3.3), the maximum hourly significant wave height is highest in January at 13.6 m. The most frequent direction in January for these waves is towards the east.

High wind and wave conditions could delay loading and offloading of cargo to the MODU. In the unlikely event of a spill, it could also potentially affect spill response operations, including the availability and effectiveness of response methods. Consideration has been given to limitations and delays due to weather and sea state in the estimation of the maximum timeline for response to accidental events detailed in Section 8.3.3.

Extreme wind and wave conditions could result in accidental spills, suspension or delay of Project activities, evacuation of the MODU, and in extreme cases, such as the 1982 sinking of the *Ocean Ranger* offshore Newfoundland, loss of life. During a fierce winter storm, the ingress of sea water into the ballast room of the *Ocean Ranger* platform ultimately led to the evacuation and sinking of the rig and the loss of all 84 crew members. The *Ocean Ranger* tragedy resulted in significant improvements for the Canadian offshore petroleum industry, including the establishment of the offshore petroleum boards in Newfoundland and Labrador and in Nova Scotia, and more rigorous requirements around safety training, equipment and inspection (Stantec 2014a).

The local metocean conditions will be a primary consideration when planning drilling activities, supporting logistics (helicopter travel and movement of supplies and personnel), and in the unlikely event of an incident where emergency response or spill response is required.

Mitigation to reduce risks associated with operating in extreme weather is discussed in Section 9.2.

9.1.3 Lightning

Lightning can pose a safety risk to personnel as well as potentially affect electronic systems. However, both the MODU and PSVs will have lightning protection systems to ground lightning electrical charges and to transfer the energy to the sea water where it would dissipate. Lightning is therefore not likely to affect Project equipment. Safe work practices will be implemented to reduce exposure of personnel to lightning risk (*e.g.*, restriction of access to external areas on the MODU or PSV during thunder and lightning events).

9.1.4 Sea Ice and Superstructure Icing

Sea ice (including icebergs) is very rare in the Nova Scotia offshore environment (Worcester and Parker 2010; Environment Canada 2012b). Sea ice is therefore not considered a factor affecting Project operations. Further information on which this assumption is based, as well as figures depicting the maximum extent of median sea ice coverage from 1981–2010 and the maximum sea ice coverage, are shown in Section 5.1.3.5.

Although ice is not considered an important factor affecting Project operations, vessels operating in late fall and winter are likely to experience some degree of icing. Accumulation of ice on the MODU or vessels, sometimes referred to as "superstructure icing", can result from freshwater moisture such as fog, freezing rain, drizzle and wet snow, or from salt water associated with freezing spray or wave wash. Superstructure icing is possible when air temperatures are -2.2˚C or less and winds are more than 31 km/hour (DFO 2012c).

Freezing spray is the most common cause of icing and occurs when the air temperature falls below the freezing temperature of sea water and when sea surface temperatures drop below 6°C (DFO 2012c). Freezing spray is more frequent and severe in coastal waters off eastern Canada. Ice accretion rates from freezing spray can exceed 2 cm/hour and ice build-up of over 25 cm is not uncommon (DFO 2012c).

The rate of ice accumulation also depends on individual vessel characteristics. Smaller vessels are most at risk from spray icing as they are exposed to more spray and lose stability more rapidly than larger vessels (DFO 2012c). The accumulation of ice on a ship's superstructure can raise the centre of gravity, lower vessel speed and cause difficulty in maneuvering. It can also create problems with cargo handling equipment (DFO 2012c). Superstructure icing can cause delays because operations are slowed or suspended to remove or avoid ice accumulations.

Section 9.3 discusses mitigation to reduce effects of sea ice and superstructure icing on PSVs and the MODU.

9.1.5 Seismic Events and Tsunamis

The Scotian Shelf is an area of known seismic activity with recorded earthquakes and fault zones occurring on the Shelf. While the area is seismically active (Figure 9.1.1), events tend to be of a low magnitude (Table 9.1.1). Given the short duration of exploration activities the probability of a major seismic event occurring during an exploration drilling program is low. There have been five earthquakes recorded from 1985 to present in the Project Area, with the strongest occurring in 2005 at a magnitude of 2.9 ML (local magnitude on the Richter scale).

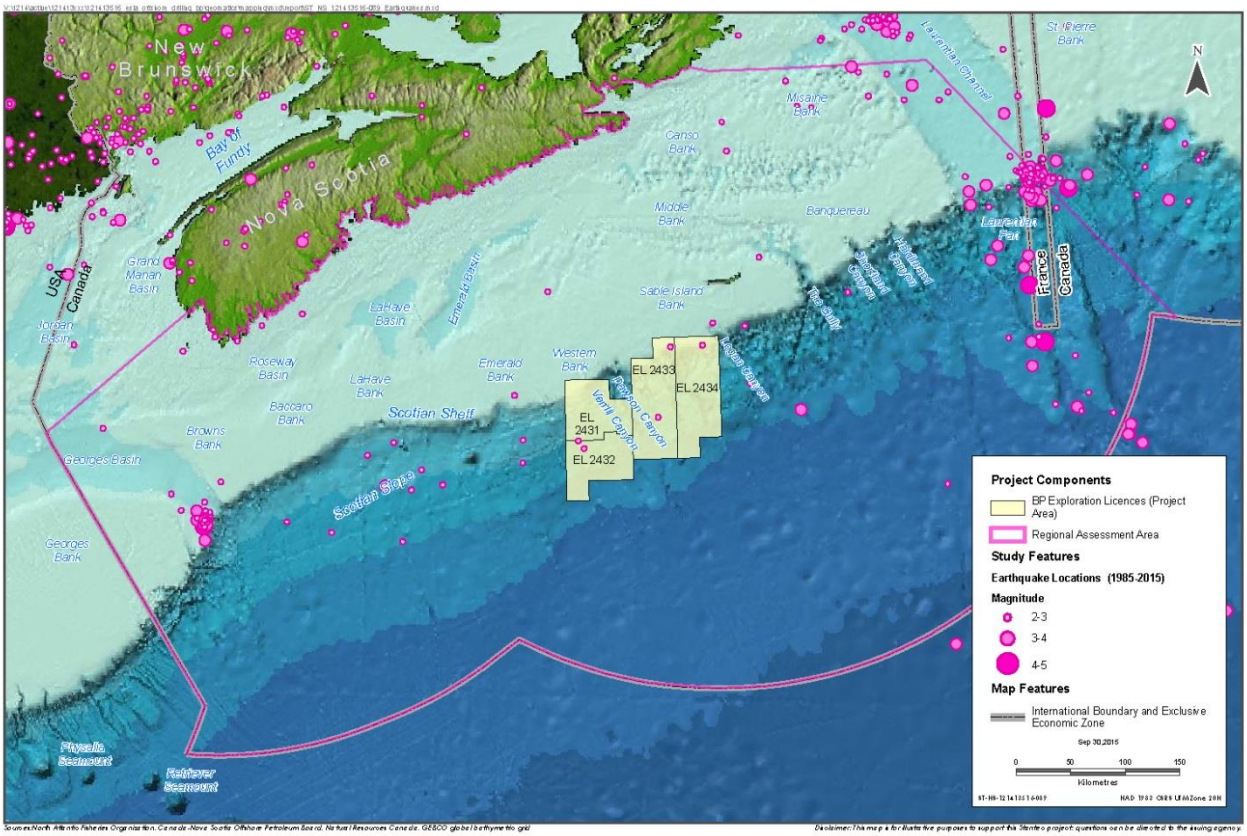

Figure 9.1.1 Earthquakes in or near Nova Scotia, Canada 1977–2015

Table 9.1.1 Earthquakes Recorded within the Project Area, 1985 to 2015

Date	Time (UTC)	Latitude	Longitude	Depth	Magnitude
6/30/2007	03:49:29	42.838000	-60.700000	18.0g	2.8MN
3/14/2007	09:23:18	42.656000	-61.603000	18.0g	2.4MN
10/7/2006	08:45:57	42.592000	-61.540000	18.0g	2.3ML
10/25/2005	23:53:02	43.422000	-60.179000	18.0g	2.9ML
6/19/2002	09:02:40	43.417000	-60.540000	18.0g	2.3ML
g = default depth (18 km) fixed by Geological Survey of Canada seismologist MN = Nuttli magnitude (developed to measure seisms of Eastern Canada) ML = Local magnitude (associated with the Richter scale)					

Source: Earthquakes Canada 2015

Tsunamis are long, surface gravity waves with amplitudes usually less than 2 m in height in the open ocean and are produced by earthquakes, volcanic island explosions and submarine landslides (as well as explosions or the impact of cosmic bodies such as meteorites). Tsunamis can travel at speeds of approximately 750 km/hour in the open ocean (4,500 m deep), slowing down (approximately 350 km/hour in 1,000 m water depth) and gaining wave height as it travels into shallower water (NOAA 2009). In 1929, an earthquake on the Laurentian Slope (approximately 250 km south of the Island of Newfoundland) triggered an underwater landslide that generated a tsunami and impacted Newfoundland's Burin Peninsula causing loss of life (NRCan 2011).

There is a low likelihood of tsunamis occurring on the Scotian Slope, and, given the relatively short period of the exploration drilling program, it is unlikely that a tsunami would occur during the life of the Project. Furthermore, the small wave height in the open ocean and long period of the waves for a tsunami are not anticipated to pose a serious risk to offshore drilling operations.

9.1.6 Sediment and Seafloor Instability and Other Geohazards

Sediment scour, liquefaction of sediments from seismic events, and slope failure on the seafloor are geohazards that could adversely affect exploration drilling activities (Stantec 2014b). Canyons in and around the Project Area (*e.g.*, Dawson and Verrill Canyons) represent possible areas of slope instability as they create steep banks, and provide avenues for sediment transport between the Shelf and the Slope into the deep ocean (Stantec 2013a).

Potential seabed geohazards in the Project Area include local fluid expulsion features, seabed faults, steep slopes related to massive canyons and localized slope failures, and variable soil properties at or near the seabed. Subsurface features may include shallow gas pockets, gas hydrates, and buried faults. Avoidance of geohazards associated with sediment and seafloor instability is critical to the success of drilling programs and to reduce the risk of accidental events.

9.2 MITIGATION

The primary means of mitigating adverse effects of the environment on the Project is through detailed engineering and use of environmental design criteria, compliance with industry codes of practice, and avoidance of environmental hazards where possible.

Fog, Extreme Weather Conditions and Superstructure Icing

The implementation of standard operating procedures, such as reducing vessel or helicopter speed and/or adjusting flight altitude, using appropriate sound and/or light signals, and relying on radar and navigation equipment as appropriate, will help PSVs and helicopters to navigate safely during foggy conditions.

To maintain navigational safety at all times during the Project, obstruction lights, navigation lights and foghorns will be kept in working condition on board the MODU and PSVs. Radio communication systems will be in place and in working order for contacting other marine vessels as necessary. The MODU will be equipped with local communication equipment to enable radio communication between the PSVs and the MODU's bridge. Communication channels will also be put in place for internet access, and enable communication between the MODU and shore.

Safe work practices will be implemented to reduce exposure of personnel to lightning risk (*e.g.*, restriction of access to external areas on the MODU or PSV during thunder and lightning events).

The MODU selected for this Project will be an all-weather drillship or semi-submersible that is specifically designed to operate in harsh, deepwater environments, including during inclement weather. For example, a semi-submersible MODU would be designed to optimize stability in rough sea conditions. This type of MODU has a large deck box that contains the quarters, support system and drilling package that is supported by large columns on a hull consisting of two pontoon structures. In active drilling operations, the pontoons are ballasted down below the sea surface to provide stability. While drilling, the bottom of the deck box is elevated about 13 m above sea level. The design of semi-submersible MODUs provides the advantage of being able to submerge the hull with only limited free surface area in contact with the sea, thus reducing the effect of waves and wind and making these MODUs stable for drilling operations in rough sea conditions. Modern drill ships and rigs have the capability to disconnect the riser from the well in very short periods to reduce the risk of damage to the well, riser and the MODU during extreme weather events.

Once the MODU has been identified, it will be subject to a BP internal rig intake process. The rig intake process provides a means to identify and effectively manage risks for rig start-ups and verify that contracted rigs conform to specified BP practices and industry standards.

Pursuant to the Accord Acts and the requirements of an OA, a Certificate of Fitness for the drilling vessel will be required which will be issued by a recognized Certifying Authority prior to approval for use. BP will obtain a Certificate of Fitness from an independent third party Certifying

Authority for the MODU prior to the commencement of drilling operations in accordance with the *Nova Scotia Offshore Certificate of Fitness Regulations*. The Certifying Authority reviews installations to confirm they are fit for purpose, function as intended, can be operated safely without polluting the environment, and meet the requirements of the regulations. The regulations require that all offshore installations are designed, constructed, transported and installed or established in accordance with Parts I to III of the *Nova Scotia Offshore Petroleum Installations Regulations*, which stipulate that every installation and every component of an installation shall be designed in accordance with good engineering practice, taking into account:

- the nature of activities on and around the installation;
- the type and magnitude of functional loads, environmental loads (*i.e.*, a load imposed by waves, currents, tides, wind, ice, sea ice, snow, an earthquake or any other naturally occurring phenomenon, or by any combination of those phenomena), and foreseeable accidental loads;
- operating ambient temperatures;
- corrosion conditions that may be encountered during the construction, operation and maintenance of the installation;
- the avoidance of damage to any part of the installation that may lead to the progressive collapse of the whole installation; and
- soil conditions.

Part II of the *Nova Scotia Offshore Petroleum Installations Regulations* also requires that the design of an installation be based on analyses, model tests and/or simulations to determine the behaviour of the installation, and of the soils that support the installation or anchoring systems, under all foreseeable transportation, installation and operating conditions. The Certificate of Fitness will therefore provide third party verification that the MODU has been properly designed to operate safely within the wide range of environmental conditions known to occur in the Project Area.

The PSVs selected for this Project will similarly be equipped for safe all-weather operations, including stability in rough sea conditions and inclement weather. In addition, measures to reduce superstructure icing hazards on PSVs will be implemented as necessary and may include (DFO 2012c):

- reducing vessel speed in heavy seas;
- placing gear below deck and covering deck machinery, if possible;
- moving objects that may prevent water drainage from the deck;
- making the ship as watertight as possible; and
- manual removal of ice if required under severe icing conditions.

PSVs will undergo BP's internal verification process as well as additional external inspections/audits inclusive of the CNSOPB pre-authorization inspection process in preparation for the Project.

Icing conditions and accumulation rates on PSVs, helicopters, and the MODU will be monitored during fall and winter operations, particularly when gale-force winds may be combined with air temperatures below -2°C (DFO 2012c). In addition, the observation, forecasting and reporting of physical environment data will be conducted in accordance with the *Offshore Physical Environment Guidelines* (NEB *et al.* 2008) with the intention of promoting the safe and prudent conduct of routine operations and emergency response.

Marine weather observations, forecast bulletins and warnings are issued for Canadian marine areas by Environment Canada through the MSC, Weatheradio and regional Storm Prediction Centres. Observations and forecast bulletins are updated hourly and are available on MSC's Automated Telephone Answering Device and Weatheradio, which continuously broadcasts weather reports over VHF or FM radio. The Atlantic Storm Prediction Centre in Dartmouth, NS provides year-round marine weather and wave height information, consisting of a weather watch, warning and amendment service, for an area including Halifax Harbour and waters off the coast of Nova Scotia out to approximately 250 nautical miles offshore (DFO 2015q). The frequency of these marine forecasts is indicated in Table 9.2.1.

Table 9.2.1 Marine Forecast Schedule

Forecast Name	Details	Issue Time (ADT/AST)
Technical Marine Synopsis	Provides the positions and trends of the main weather systems for the forecast period covering Days 1 and 2.	03:00, 10:00, 15:30, 20:00
Marine Forecast	Provides information on: synoptic warnings, wind, visibility, precipitation and freezing spray. It may include air temperature as appropriate. Valid for Days 1 and 2.	03:00, 10:00, 15:30, 20:00
Extended Marine Forecast	Meant for longer-range planning purposes, it provides an extended marine wind outlook for Days 3, 4, and 5.	03:00, 15:30
Wave Height Forecast	Provides information on significant wave heights for Days 1 and 2.	05:00, 17:00
Marine Weather Statement	Issued when deemed necessary, it provides additional information on potentially high impact marine conditions.	As needed

Source: DFO 2015q

BP and contractors working on the Project will regularly monitor weather forecasts to forewarn PSVs, helicopters and the MODU of inclement weather or heavy fog before it poses a risk to their activities and operations. Extreme weather conditions that are outside the operating limits of PSVs or helicopters will be avoided if possible. Captains/Pilots will have the authority and obligation to suspend or modify operations in case of adverse weather or poor visibility that compromises the safety of PSV, helicopter, or MODU operations.

Geohazard Identification

Prior to any drilling activity, BP will conduct a comprehensive regional geohazard baseline review (GBR), followed by detailed geohazard assessments for each proposed wellsite to identify potential geohazards that may affect drilling operations. The GBR and detailed wellsite assessments will be based primarily on reprocessed 3D WATS seismic data acquired by BP in 2014. Existing regional data, such as geotechnical cores and offset wells, will be incorporated where available. The geohazard assessments will focus on identifying potential drilling hazards at the seabed and subsurface to a depth that is defined by the limit of the first pressure containment casing string (generally from seabed to 1,000 m to 1,200 m below mudline). This work will be conducted by a BP geohazards specialist following internal guidelines that either meet or exceed local regulatory requirements.

The GBR will be completed first and will focus on reprocessed 3D seismic WATS data acquired by BP in 2014 over an approximate 7000 km^2 area that covers water depths between about 1500 m and 3730 m. The WATS data was reprocessed in 2015 to demonstrate that the data can meet sampling rate and frequency required for regional geohazard baseline reviews.

After the GBR, the WATS data will be further reprocessed to increase the sampling rate and frequency requirements for detailed wellsite assessments. This data will be used to assess potential geohazards at potential well locations. After the proposed wellsites have been located to minimize potential geohazards, BP will conduct an imagery based seabed survey in the vicinity of wellsites to ground-truth the findings of the GBR. This includes confirming the absence of shipwrecks, debris on the seafloor, unexploded ordnance and sensitive environmental features, such as habitat-forming corals or species at risk. The survey will be carried out prior to drilling. If any environmental or anthropogenic sensitivities are identified during the survey, BP will move the wellsite to avoid affecting them if it is feasible to do so. If it is not feasible, BP will consult with the CNSOPB to determine an appropriate course of action. Additional information about how the specific well locations will be determined in consideration of survey data is provided in Section 2.2.

9.3 RESIDUAL EFFECTS SUMMARY

The key environmental factors that may affect the Project include reduced visibility, high winds and waves, and geohazards. However, engineering design, operational procedures, geohazard assessments, and other mitigation measures discussed above will reduce the potential adverse effects on, and risks to, the Project. Potential effects from sea ice, seismic activity and tsunamis are unlikely given their low probabilities of occurrence, the distance offshore and water depths at which Project activities and components will be located, the limited duration of offshore activities (*i.e.*, approximately 120 days to drill each individual well (up to seven) between 2018 and 2022), and the absence of fixed offshore infrastructure for the Project. Extreme weather conditions and superstructure icing are also unlikely to adversely affect the Project given that the MODU will be designed for harsh weather conditions, meteorological conditions will be

monitored, and stop-work procedures would be implemented should conditions become unsafe.

A **significant adverse residual effect** of the environment on the Project is defined as one that results in one or more of the following:

- damage to the Project infrastructure resulting in harm to Project workers or the public; and
- damage to the Project infrastructure such that the well had to be temporarily abandoned in order to conduct repairs and/or damage resulting in repairs that cannot be technically or economically implemented.

In consideration of the above significance criteria, implementation of appropriate engineering, environmental design standards, and operational procedures; adherence to the *Offshore Physical Environment Guidelines*; and application of the assessment methods described in Section 6.2.3.9, the adverse residual effects of the physical environment on the Project are predicted to be not significant.

10.0 CUMULATIVE EFFECTS

In addition to assessing Project-specific environmental effects, section 19(1)(a) of CEAA, 2012 requires that the EA of a designated project consider "any cumulative environmental effects that are likely to result from the designated project in combination with other physical activities that have been or will be carried out".

This chapter of the EIS identifies past, present, and certain or reasonably foreseeable future physical activities (*i.e.*, projects or activities) with residual environmental effects that could interact cumulatively with the residual environmental effects of the Project, and assesses the significance of the associated potential cumulative environmental effects on the affected VCs.

10.1 CUMULATIVE ENVIRONMENTAL EFFECTS ASSESSMENT SCOPE AND METHODS

The CEA Agency's (2013b) Operational Policy Statement (OPS), *Assessing Cumulative Environmental Effects Under the Canadian Environmental Assessment Act, 2012* was taken into consideration during development of the cumulative environmental effects assessment (CEA) scope and methods for this EIS. This CEA builds on one conducted for the Shelburne Basin Venture Exploration Drilling Project (Stantec 2014a) which assessed cumulative effects within a similar RAA.

10.1.1 Scoping the Assessment

Scoping the assessment of cumulative environmental effects involves selecting the VCs on which to focus the assessment; defining the spatial and temporal boundaries of the assessment; identifying other past, present, and future (*i.e.*, certain or reasonably foreseeable) physical activities in the RAA where residual environmental effects have potential to overlap spatially and temporally with those of the Project; and establishing criteria for determining the significance of residual cumulative environmental effects.

10.1.1.1 Valued Components

The assessment of cumulative environmental effects considers all six of the VCs for which Project-related environmental effects were assessed, as residual environmental effects were predicted for each VC (refer to Section 7). These six VCs are:

- Fish and Fish Habitat;
- Marine Mammals and Sea Turtles;
- Migratory Birds;
- Special Areas;

- Commercial Fisheries; and
- Current Aboriginal Use of Lands and Resources for Traditional Purposes.

10.1.1.2 Spatial and Temporal Boundaries

The OPS (CEA Agency 2013b) requires determination of spatial and temporal boundaries for the assessment of cumulative environmental effects. In particular, the OPS suggests that spatial boundaries encompass potential environmental effects on the selected VC of the designated project in combination with other physical activities that have been or will be carried out. Temporal boundaries should take into account future physical activities that are certain or reasonably foreseeable, and the degree to which potential environmental effects related to these physical activities will overlap those predicted from the designated project.

The specific spatial and temporal boundaries that are presented for each VC in the respective VC analysis chapter in Section 7 have also been applied to the assessment of cumulative environmental effects for each VC in Section 10.2, including the Project Area, LAA and RAA as illustrated on Figure 10.1.1. The definition of the RAA is particularly relevant with respect to the assessment of cumulative environmental effects and is therefore repeated here for ease of reference. The RAA is larger than the spatial boundaries for Project-related effects in order to encompass the other physical activities outside of the Project Area and LAA that have potential to interact cumulatively with the Project (refer to Section 10.1.1.3).

Regional Assessment Area (RAA): The RAA is the area within which residual environmental effects from Project activities and components may interact cumulatively with the residual environmental effects of other past, present, and future (*i.e.*, certain or reasonably foreseeable) physical activities and to provide regional context for the assessment. The RAA is restricted to the 200 nautical mile limit of Canada's EEZ, including offshore marine waters of the Scotian Shelf and Slope within Canadian jurisdiction. The western extent of the RAA encompasses the Georges Bank Oil and Gas Moratorium Area and terminates at the international maritime boundary between Canada and the United States. The RAA is consistent for all VCs and is depicted on Figure 10.1.1.

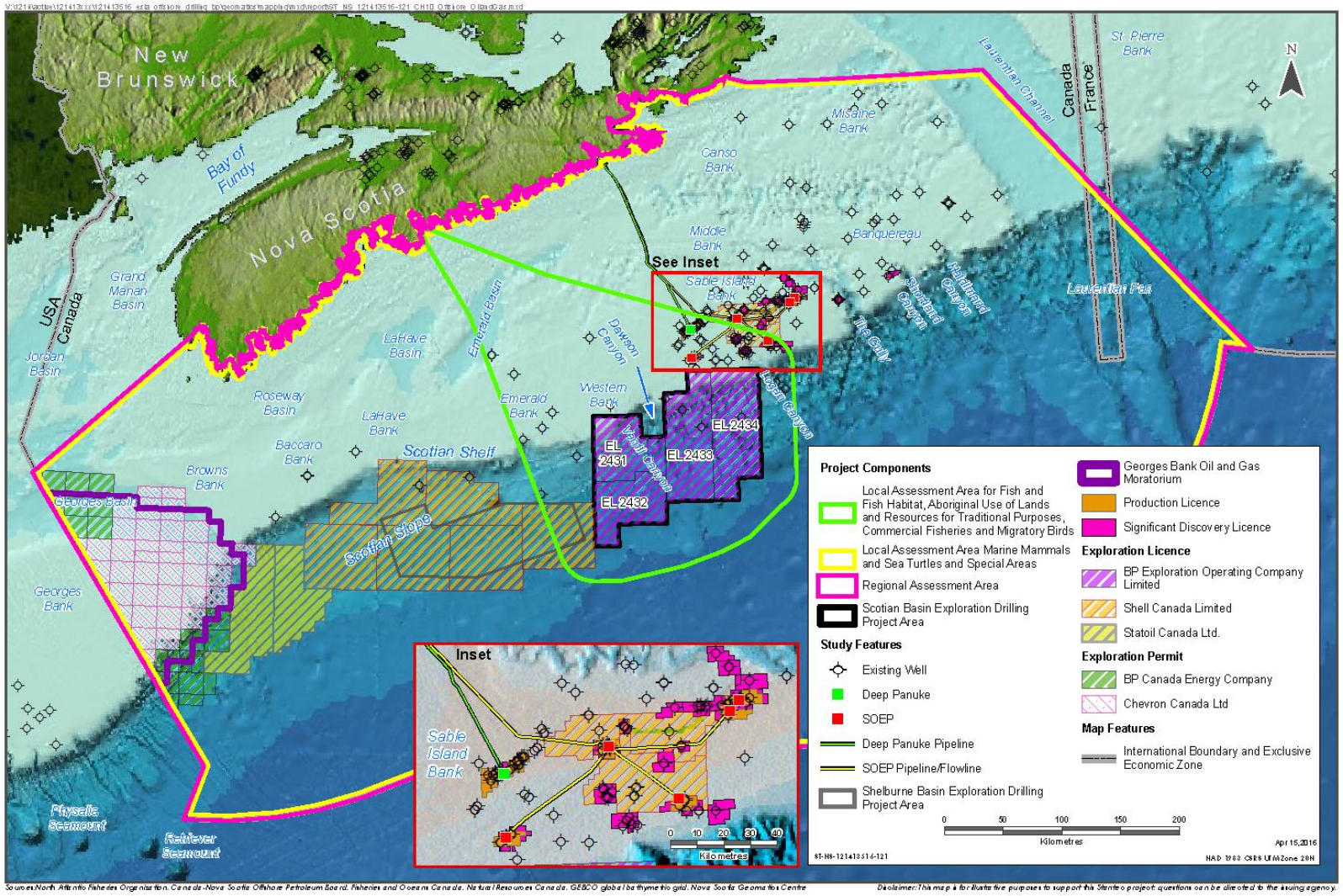

Figure 10.1.1 Other Physical Projects (Oil and Gas) Relative to the Project Area, LAA and RAA

10.1.1.3 Other Physical Activities

In accordance with the OPS (CEA Agency 2013a), the cumulative environmental effects assessment includes consideration of other physical activities that have been, are being, and will be carried out in the RAA. With respect to future physical activities that will be carried out, the assessment considers (CEA Agency 2013a):

- future physical activities that are certain (*i.e.*, the physical activity will proceed or there is a high probability that the physical activity will proceed – *e.g.*, the proponent has received the necessary authorizations or is in the process of obtaining those authorizations); and

- future physical activities that are reasonably foreseeable (*i.e.*, the physical activity is expected to proceed – *e.g.*, the proponent has publicly disclosed its intention to seek the necessary EA or other authorizations to proceed).

The following list identifies the past, present, and future (*i.e.*, certain or reasonably foreseeable) physical activities within the RAA that have potential to cause residual environmental effects that overlap spatially and temporally with the residual environmental effects of the Project.

- Offshore gas development projects on the Scotian Shelf (*i.e.*, SOEP and Deep Panuke);
- Offshore petroleum exploration projects (*e.g.*, Shelburne Basin Venture Exploration Drilling Project);
- Commercial, Aboriginal and recreational fisheries; and
- Other ocean uses, such as shipping, scientific research, and military activities.

The Cohasset-Panuke Project, Canada's first offshore oil project, operated from 1992 to 1999 on the Scotian Shelf in the vicinity of the current Deep Panuke Project (Production Licences 2901 and 2902). Decommissioning and environmental follow-up work was completed in 2009. Regulatory approval was granted to leave flowlines and subsea materials in place and a subsea survey inspection confirmed that the flowlines have become covered through self-burial. No significant adverse environmental effects (including socio-economic effects) were predicted to occur as a result of the decommissioning (CNSOPB 2004b). Given the lack of spatial and temporal overlap of residual effects with the Scotian Basin Exploration Drilling Project, the Cohasset-Panuke Project is not considered in this cumulative effects assessment.

BP's Tangier 3D Seismic Survey was conducted in 2014, with the survey area overlapping the current Project Area. However, this activity (and any other past seismic survey) is not included in this cumulative effects assessment since residual effects from seismic surveys are temporary and do not generally last beyond cessation of the survey. Therefore, while there would be some spatial overlap of residual effects with the current drilling Project, there is no temporal overlap of residual effects that would necessitate consideration in the cumulative effects assessment.

In recent years, the CNSOPB has issued an annual Call for Bids, which is a formal announcement that an exploration licence (EL) is available to be awarded through a competitive bidding

process. Industry can submit work expenditure bids in a competitive bidding process, with the winner awarded the rights to the exploration licence. In advance of the Call for Bids, the CNSOPB prepares a Strategic Environmental Assessment (SEA) to inform the Call for Bids process in terms of potential environmental sensitivities and special mitigation measures (including avoidance) that may need to be taken into consideration. Shell and BP were awarded exploration rights through this process for the Shelburne Basin Venture and Scotian Basin Exploration Drilling Projects, respectively. The most recent Call for Bids closed in November 2015, with two ELs awarded to Statoil Canada Ltd. These ELs, located on the Scotian Slope between Shell's ELs and the Georges Bank Moratorium Area (refer to Figure 5.3.2), are active for a nine year term effective January 2016.

Although Statoil has not yet filed any applications for authorizations, its work expenditure bid of $82 million on the two ELs is a good indicator that future exploration activities (*e.g.*, seismic and exploration drilling) are likely to occur in the next nine years. Exploration activities proposed by Statoil would, however, require project-specific environmental assessment and authorization from the CNSOPB. Given the uncertainty of project-specific details at this time and relative distance to the Scotian Basin Exploration Drilling Project Area (225 km), Statoil exploration activities are not specifically considered in this CEA. However, exploration drilling activities described for the Shelburne Basin Venture Exploration Project (and resulting effects) are expected to be similar to drilling activities which might be proposed by Statoil.

The physical activities listed above are included in the scope of the cumulative environmental effects assessment, as applicable, with respect to each VC (*i.e.*, where there is potential for a residual environmental effect of the Project to interact cumulatively with a residual environmental effect of another physical activity on the VC; refer to Section 10.1.2.2).

10.1.2 Cumulative Environmental Effects Assessment Method

The CEA is carried out in three stages: (1) establishing context for the cumulative effects; (2) determining if Project-specific environmental effects interact in space and time with the environmental effects of other physical activities; and (3) assessing the cumulative environmental effects and the Project's contribution to them.

10.1.2.1 Establishing Context for Cumulative Environmental Effects

Existing environmental conditions for the marine physical environment, marine biological environment, and socio-economic environment in the RAA have been, and continue to be, shaped by the cumulative environmental effects of historical physical activities previously carried out in the RAA and ongoing physical activities currently being carried out in the RAA. Likewise, future physical activities in the RAA will influence future environmental conditions in the RAA. Section 5 describes existing conditions in the RAA to characterize the setting for the Project, support an understanding of the receiving environment, and provide sufficient context to enable an understanding of how current environmental conditions might be affected by the Project in combination with other past, present, and future physical activities within the RAA.

It is assumed that the existing status or baseline conditions of each VC reflect the influence of other past and present physical activities within the RAA. Section 10.2.1 provides a brief overview of how the environmental effects of various physical activities in the RAA have affected, are affecting, or are anticipated to affect each VC, independently of the residual environmental effects that will be contributed by the Project. This information establishes context to support the assessment of cumulative environmental effects.

10.1.2.2 Determination of Potential Cumulative Interactions

The following two considerations with respect to each VC are used as criteria to determine whether the Project has potential to interact with another physical activity to contribute to cumulative environmental effects:

1. Whether the Project could result in a demonstrable or measurable residual environmental effect on the VC; and
2. Whether the residual environmental effect of the Project is likely to act in a cumulative fashion with the residual environmental effect of another past, present, or future physical activity (*e.g.*, whether the residual environmental effects of the Project and the other physical activity are likely to overlap spatially and temporally).

An assessment of cumulative environmental effects is not warranted for any given VC unless both of the above criteria are satisfied.

10.1.2.3 Assessment of Cumulative Environmental Effects

When the two criteria in Section 10.1.2.2 above are met for a VC, the assessment of cumulative environmental effects considers how the residual environmental effects of the Project may contribute to changes to the VC from the residual environmental effects of other past, present, or future physical activities.

The potential for residual environmental effects from the Project to cause a change in cumulative environmental effects that could affect the quality or sustainability of the VC is evaluated. The evaluation considers the context for cumulative environmental effects in the RAA, the nature and extent of the potential cumulative interactions, and the planned implementation of mitigation.

Residual cumulative environmental effects are characterized through application of the specific analysis criteria (*i.e.*, magnitude, geographic extent, duration, frequency, reversibility, and context) defined for each VC in its respective VC analysis chapter in Section 7. The significance of potential cumulative environmental effects is then determined based on the same VC-specific thresholds used for the assessment of Project-related environmental effects in Section 7.

Following the determination of significance, follow-up and monitoring programs are recommended, where necessary, to verify cumulative environmental effects predictions or to assess the effectiveness of proposed mitigation measures.

10.2 CUMULATIVE ENVIRONMENTAL EFFECTS ASSESSMENT

10.2.1 Context for Cumulative Environmental Effects

This section provides a brief overview of how the residual environmental effects associated with other past, present, and future physical activities in the RAA have affected, are affecting, or are anticipated to affect each VC prior to any residual environmental effects that will be contributed by the Project.

10.2.1.1 Potential Residual Effects of Offshore Gas Development Projects in the RAA

Various offshore oil and gas activities have occurred in the RAA, including production of offshore oil and gas resources since 1992 (refer to Section 5.3.2.1). ExxonMobil's SOEP and Encana's Deep Panuke are the only offshore oil and gas projects presently operating in the RAA. SOEP has been producing natural gas since 1999 and was projected to have a total project life expectancy of approximately 25 years. ExxonMobil recently announced that they may begin plugging wells in 2017 and has commenced decommissioning studies (NEB 2015; Chronicle-Herald 2015).

Deep Panuke began producing natural gas in 2013 and at that time was anticipated to continue for a mean production life of 13 years (CNSOPB n.d. (a)). However, Encana recently decreased their reserve estimate and announced they were moving to a seasonal production, producing gas only in winter months when local prices are higher (NEB 2015). These ongoing offshore gas development projects comprise similar physical activities and components to the Project being assessed (albeit on a larger spatial and temporal scale) and are subject to the same overall regulatory framework established by the Accord Acts and regulations.

These ongoing offshore gas development projects have resulted or potentially will result in localized residual environmental effects. In particular, they have potential to cause a Change in Risk of Mortality and Physical Injury as well as a Change in Habitat Quality and Use affecting fish and fish habitat, marine mammals, sea turtles, and marine birds; a Change in Habitat Quality for Special Areas; a Change in Availability of Fisheries Resources affecting commercial fisheries; and a Change in Traditional Use affecting Aboriginal fisheries (refer to Table 10.2.1). These potential residual effects are localized in proximity to offshore gas development project activities and components. The nearest production platforms for SOEP and Deep Panuke are located approximately 11 km and 35 km from the LAA, respectively.

Table 10.2.1 Potential Residual Effects Associated with Offshore Gas Development Projects

Activities and Components Associated with Offshore Gas Development Projects	VCs Affected	Residual Environmental Effects	Explanation of Residual Environmental Effects
Presence and Operation of Offshore Gas Production Platforms and subsea pipelines	Fish and Fish Habitat	Change in Habitat Quality and Use	• Based on EA predictions for SOEP and Deep Panuke (MacLaren Plansearch 1996; Encana 2002; Encana 2006) the sound pressures levels (SPLs) generated by the production platforms operating in support of those offshore gas development projects are assumed to be considerably less than those generated by Project-related exploration drilling activities. Of more relevance would be the reef and refuge effect caused by the platforms and subsea pipelines attracting fish to an area that is protected from no fishing (safety [exclusion] zone), creating a localized Change in Habitat Quality and Use for fish.
	Marine Mammals and Sea Turtles	Change in Habitat Quality and Use	• The SPLs generated by the production platforms and pipelines, as well as the reef and refuge effect realized by prey species could potentially cause a low magnitude and localized Change in Habitat Quality and Use for marine mammals and sea turtles.
	Migratory Birds	Change in Risk of Mortality or Physical Injury	• Nocturnally migrating birds may be attracted and/or disoriented by artificial night lighting on the SOEP and Deep Panuke platforms, thereby increasing their risk of injury or mortality. However, EEM data for these Projects indicate a very minor effect on migratory birds (ExxonMobil 2012; McGregor Geoscience Limited 2013).
	Special Areas	Change in Habitat Quality	• SOEP is located approximately 5 km from Sable Island and 36 km from the Gully. Deep Panuke is approximately 47 km from Sable Island and 114 km from the Gully. Neither development would likely be visible or audible from these Special Areas. Both Encana and SOEP have codes of practice to reduce effects on these Special Areas.
	Commercial Fisheries	Change in Availability of Fisheries Resources	• SOEP and Deep Panuke are situated in NAFO Division 4W. • Offshore gas development projects have localized effects on access to fisheries resources for commercial and Aboriginal fishers due to the establishment of 500-m radius safety (exclusion) zones around their production platforms. Commercial and Aboriginal
	Current Aboriginal Use of Lands and	Change in	

Table 10.2.1 Potential Residual Effects Associated with Offshore Gas Development Projects

Activities and Components Associated with Offshore Gas Development Projects	VCs Affected	Residual Environmental Effects	Explanation of Residual Environmental Effects
	Resources for Traditional Purposes	Traditional Use	fishing activity has been, and will continue to be, excluded within these safety (exclusion) zones for the duration of gas production from SOEP and Deep Panuke. • Offshore gas development projects also cause environmental effects on fish and fish habitat due to the generation of underwater sound and water quality effects associated with discharges. However, these environmental effects on fish and fish habitat are generally not expected to be of sufficient magnitude, duration, or extent to affect catch rates or otherwise cause a Change in Availability of Fisheries Resources for commercial fisheries or Change in Traditional Use for Aboriginal fisheries.
PSV Operations	Fish and Fish Habitat	Change in Habitat Quality and Use	• Based on EA predictions for SOEP and Deep Panuke (MacLaren Plansearch 1996; Encana 2002; Encana 2006) SPLs generated by the PSVs operating in support of those offshore gas development projects are assumed to be similar to or less than those generated by Project PSVs (*e.g.*, 189 dB re 1 µPa @ 1 m). These SPLs are high enough to cause a localized temporary Change in Habitat Quality and Use for fish within a limited area (refer to Section 7.1.1.2 for a summary of thresholds for physical and behavioural effects on fish).
	Marine Mammals and Sea Turtles	Change in Habitat Quality and Use Change in Risk of Mortality or Physical Injury	• The SPLs are high enough to cause a localized temporary Change in Habitat Quality and Use for marine mammals and sea turtles. • The transiting of PSVs may also cause a Change in Risk of Mortality or Physical Injury for marine mammals and sea turtles due to potential vessel strikes.
	Migratory Birds	Change in Risk of Mortality or Physical Injury	• Nocturnally migrating birds may be attracted and/or disoriented by artificial night lighting on the SOEP and Deep Panuke PSVs, thereby increasing their risk of injury or mortality. • As indicated in Section 7, the oil and gas industry has adopted PSV and helicopter traffic restrictions around Sable Island which includes maintaining a 2 km buffer from Sable Island, except in the

Table 10.2.1 Potential Residual Effects Associated with Offshore Gas Development Projects

Activities and Components Associated with Offshore Gas Development Projects	VCs Affected	Residual Environmental Effects	Explanation of Residual Environmental Effects
			case of an emergency, to reduce the potential effects on migratory birds.
Operational Discharges	Fish and Fish Habitat Marine Mammals and Sea Turtles Migratory Birds	Change in Habitat Quality and Use	• Discharges from the SOEP and Deep Panuke production platforms and PSVs (*e.g.*, produced water, grey and black water, ballast water, bilge water, and deck drainage deck drainage) are discharged in accordance with the OWTG and MARPOL and are therefore unlikely to cause a Change in Risk of Mortality or Physical Injury for marine species. • Discharges may cause a Change in Habitat Quality and Use for fish, marine mammals, sea turtles, and migratory birds within a localized area around the PSVs and SOEP and Deep Panuke production platforms. EEM programs conducted for both projects have indicated localized minor effects on habitat quality (ExxonMobil 2012; McGregor Geoscience Limited 2013).
	Special Areas	Change in Habitat Quality	• Air quality monitoring results at the Sable Island monitoring station did not indicate adverse effects on air quality from the offshore oil and gas industry (Environment Canada 2012a, 2013a). • Sable Island provides a platform for beach surveys to monitor oil pollution in Scotian Shelf waters, with surveys dating back to the 1970s. A recent analysis of survey data indicates a declining trend in the oiling rate of beached birds on Sable Island with little indication of local oil pollution from offshore oil and gas projects (Lucas *et al.* 2012).
Helicopter Transportation	Marine Mammals and Sea Turtles	Change in Habitat Quality and Use	• There is potential for helicopter traffic to elicit diving behaviour in marine mammals in response to physical presence or sound, although these behaviours will be temporary.
	Migratory Birds	Change in Risk of Mortality or Physical Injury	• Helicopter traffic may cause a localized Change in Risk of Mortality or Physical Injury for marine birds, due to potential bird strikes, as well as a Change in Habitat Quality and Use for migratory birds in

Table 10.2.1 Potential Residual Effects Associated with Offshore Gas Development Projects

Activities and Components Associated with Offshore Gas Development Projects	VCs Affected	Residual Environmental Effects	Explanation of Residual Environmental Effects
		Change in Habitat Quality and Use	proximity to the helicopter due to atmospheric sound emissions. • Although there is a helicopter landing pad and refuelling facility on Sable Island, it is only used occasionally by the offshore energy industry (Freedman 2014). As indicated in Section 7, the oil and gas industry has adopted PSV and helicopter traffic restrictions around Sable Island which includes maintaining a 2 km buffer from Sable Island, except in the case of an emergency, to reduce the potential effects on migratory birds on Sable Island.
	Special Areas	Change in Habitat Quality	
Decommissioning	Fish and Fish Habitat Marine Mammals and Sea Turtles Migratory Birds	Change in Habitat Quality and Use Change in Risk of Mortality or Physical Injury	• Effects of future decommissioning will be similar to those generated by current operational activities, including lighting effects, ongoing vessel and helicopter traffic, underwater sound, and marine discharges. Depending on the nature of decommissioning activities proposed for SOEP and Deep Panuke (currently not known) and extent of removal of infrastructure on the seafloor, there may be more or less localized benthic disturbance. Effects are predicted to be localized although the duration and reversibility of effects will depend on specific decommissioning plans for these Projects.
	Special Areas	Change in Habitat Quality	
	Commercial Fisheries	Change in Availability of Fisheries Resources	
	Current Aboriginal Use of Lands and Resources for Traditional Purposes	Change in Traditional Use	

10.2.1.2 Potential Residual Effects of the Shelburne Basin Venture Exploration Drilling Project

Shell commenced drilling their initial well (Cheshire) of the Shelburne Basin Venture Exploration Drilling Project on October 23, 2015. A second well (Monterey Jack) is planned to follow within the same drilling campaign with drilling predicted to continue through 2016. Depending on the results of these initial wells, Shell may drill up to five additional wells before 2019. Exploration drilling will be conducted using the Stena drillship *IceMax*. Proposed project components and activities are very similar to those proposed for the current Project. The Shelburne Basin Exploration Drilling Project Area is located directly adjacent (approximately 8 km distance) to the Scotian Basin Exploration Drilling Project Area.

Table 10.2.2 Potential Residual Effects Associated with the Shelburne Basin Venture Exploration Drilling Project

Activities and Components Associated with Shelburne Basin Venture Exploration Drilling	VCs Affected	Residual Environmental Effects	Explanation of Residual Environmental Effects
Presence and Operation of MODU (including safety [exclusion] zone, underwater sound, and lights)	Fish and Fish Habitat	Change in Habitat Quality and Use Change in Risk or Mortality or Physical Injury	• The presence and operation of the MODU could potentially result in a Change in Habitat Quality and Use and a Change in Risk of Mortality or Physical Injury for marine fish, due to the generation of temporary, localized underwater sound during MODU operations, subsequently affecting the quality of the underwater acoustic environment within the Project Area.
	Marine Mammals and Sea Turtles	Change in Habitat Quality and Use Change in Risk of Mortality or Physical Injury	• Sound pressure levels generated by the MODU are predicted to result in a Change in Habitat Quality and Use and a Change in Risk of Mortality or Physical Injury to marine mammals and sea turtles through behavioural responses, including localized avoidance and displacement.
	Migratory Birds	Change in Habitat Quality and Use Change in Risk of Mortality or Physical Injury	• The presence and operation of the MODU is predicted to result in a Change in Habitat Quality for migratory birds due to the generation of drilling sound, lights, and flares. • Sound from the MODU may result in sensory disturbance of migratory birds locally, potentially leading to behavioral responses such as temporary habitat avoidance or changes in activity state. • Change in Risk of Mortality or Physical Injury may occur due to attraction of migratory birds to the MODU.
	Special Areas	Change in Habitat Quality and Use	• Within a localized area, the Scotian Slope EBSA could potentially experience a Change in Habitat Quality and Use from the presence and operation of the MODU and subsequent underwater sound emissions and lights.
	Commercial Fisheries	Change in Availability of Fisheries Resources	• A safety (exclusion) zone will be established around the MODU resulting in a fisheries exclusion of approximately 0.8 km^2 for a maximum of 130 days per well. • Underwater sound emissions will also be generated as a result of the presence of the MODU and its operations during drilling, testing
	Current Aboriginal Use	Change in	

Table 10.2.2 Potential Residual Effects Associated with the Shelburne Basin Venture Exploration Drilling Project

Activities and Components Associated with Shelburne Basin Venture Exploration Drilling	VCs Affected	Residual Environmental Effects	Explanation of Residual Environmental Effects
	of Lands and Resources for Traditional Purposes	Traditional Use	and abandonment, which may cause fisheries species to temporarily avoid the immediate area surrounding the MODU, particularly during start-up of drilling.
Discharges of Drill Mud and Cuttings	Fish and Fish Habitat	Change in Habitat Quality and Use Change in Risk of Mortality or Physical Injury	• The discharge of drill muds and cuttings is expected to result in a localized and temporary Change in Habitat Quality and Use and a Change in Risk of Mortality or Physical Injury for marine fish. • Thicknesses of cuttings piles greater than 10 mm were predicted to extend up to 155 m, with a maximum footprint of 1.89 ha per well. Thicknesses at or above 100 mm will be confined to a distance of 30 m from the wellhead, with a maximum footprint of 0.26 ha per well (Stantec 2014a) (thicknesses of approximately 10 mm or more, can potentially result in changes to the composition of the benthic macro fauna community (See Section 7.1.2)). • Habitat altered by the deposition of drill muds and cuttings will become available for use as fish habitat immediately following the completion of drilling operations, and is expected to be recolonized by benthic communities within approximately one to five years.
	Marine Mammals and Sea Turtles Migratory Birds Special Areas	Change in Habitat Quality and Use	• The discharge of mud and cuttings will be in accordance with the OWTG and OCSG. However, discharges of mud and cuttings will result in localized increases in TSS in the water column, temporarily affecting water quality in a portion of the Shelburne Project Area, potentially resulting in species avoidance.
	Commercial Fisheries	Change in Availability of Fisheries Resources	• The discharge of drill muds and cuttings may interact with fisheries species within a localized area as a result of sedimentation and localized changes in water quality, thereby affecting availability of fisheries resources and/or a change in traditional use for Aboriginal fisheries.

Table 10.2.2 Potential Residual Effects Associated with the Shelburne Basin Venture Exploration Drilling Project

Activities and Components Associated with Shelburne Basin Venture Exploration Drilling	VCs Affected	Residual Environmental Effects	Explanation of Residual Environmental Effects
	Current Aboriginal Use of Lands and Resources for Traditional Purposes	Change in Traditional Use	
Other Discharges and Emissions (including drilling and testing emissions)	Fish and Fish Habitat	Change in Habitat Quality and Use	• Routine discharges will be in accordance with OWTG and MARPOL requirements and will be non-bio-accumulating, and non-toxic, resulting in localized and temporary effects in water quality. However, Changes in Habitat Quality and Use by fish and marine species is predicted to be not significant with adherence to standard practices and guidelines.
	Marine Mammals and Sea Turtles		
	Migratory Birds	Change in Habitat Quality and Use Change in Risk of Mortality or Physical Injury	• The routine discharge of waste and emissions could possibly result in a Change in Habitat Quality and Use and a Change in Risk of Mortality or Physical Injury for migratory birds. Discharges from the MODU will be in accordance with OWTG and MARPOL requirements. • Discharges of sanitary and domestic waste may attract migratory birds and/or prey to the MODU, but non-hazardous waste will be macerated to maximum particle size (6 mm) and treated on board prior to disposal. • Gray water discharge may attract gulls and other species to the vicinity of the MODU, which may slightly increase the Risk of Mortality or Physical Injury of migratory bird species, particularly if they interact with a flare or become stranded on the MODU.
	Special Areas	Change in Habitat Quality and Use	• Discharges and emissions will be emitted into the Scotian Slope EBSA on a regular basis during the duration of the drilling program. However, it is predicted to result in a low magnitude Change in Habitat Quality and Use of the EBSA within the Shelburne Project Area.

Table 10.2.2 Potential Residual Effects Associated with the Shelburne Basin Venture Exploration Drilling Project

Activities and Components Associated with Shelburne Basin Venture Exploration Drilling	VCs Affected	Residual Environmental Effects	Explanation of Residual Environmental Effects
	Commercial Fisheries	Change in Availability of Fisheries Resources	• Other discharges and emissions (including drilling and testing emissions) will result in temporary and localized effects on water quality around the wellsite in the Shelburne Project Area. • Discharges will be in accordance with the OWTG and are predicted to not adversely affect fish species in the Project Area or the LAA.
	Current Aboriginal Use of Lands and Resources for Traditional Purposes	Change in Traditional Use	
VSP	Fish and Fish Habitat	Change in Habitat Quality and Use Change in Risk of Mortality or Physical Injury	• VSP surveys could result in a Change in Habitat Quality and Use and a Change in Risk of Mortality or Physical Injury for marine fish (particularly fish eggs and larvae in close proximity to the air-gun array) due to predicted underwater sound emissions.
	Marine Mammals and Sea Turtles	Change in Habitat Quality and Use Change in Risk of Mortality or Physical Injury	• Sound pressure levels from VSP are expected to result in a Change in Habitat Quality and Use and a Change in Risk of Mortality or Physical Injury to marine mammals and sea turtles. • This effect is predicted to be temporary (surveys are expected to take up to one day per well), and limited in geographic extent (horizontal distances for SPLs of ≤ 200 dB RMS re 1 µPa were predicted to extend up to 78 m from the wellsite during VSP surveys) (Stantec 2014a).
	Migratory Birds	Change in Habitat Quality and Use Change in Risk of Mortality or Physical Injury	• Although migratory birds diving in close proximity to loud underwater sounds have the potential to be injured, VSP operations are not anticipated to have a measurable adverse effect on migratory bird mortality risk, given the short duration migratory birds spend underwater during foraging dives, and the short temporal scale of the VSP operations. • VSP operations could potentially result in a Change in Habitat Quality and Use for migratory birds. This change is predicted to be short-term (the VSP will take approximately one day per well), and

Table 10.2.2 Potential Residual Effects Associated with the Shelburne Basin Venture Exploration Drilling Project

Activities and Components Associated with Shelburne Basin Venture Exploration Drilling	VCs Affected	Residual Environmental Effects	Explanation of Residual Environmental Effects
			reversible with no predicted lasting effects once VSP surveys are complete. • Although migratory birds diving in close proximity to loud underwater sounds have the potential to be injured, VSP operations are not anticipated to have a measurable adverse effect on migratory underwater during foraging dives, and the short temporal scale of the VSP operations.
	Special Areas	Change in Habitat Quality and Use	• VSP surveys could potentially result in a Change in Habitat Quality and Use, largely for marine mammals and sea turtles in the portion of the Scotian Slope EBSA that falls within the Shelburne LAA. • This change in habitat use would be short-term (the VSP will take approximately one day per well), and reversible, with no predicted lasting effects once VSP operations are complete.
	Commercial Fisheries	Change in Availability of Fisheries Resources	• The Shelburne Basin Venture Exploration Drilling EIS predicted that horizontal distances for SPLs of ≤ 160 dB RMS re 1 µPa could extend up to 26 km from the wellsite during VSP surveys (Stantec 2014a). • As noted in Section 7.1.4, startle and alarm responses in fish have been observed at SPLs as low as 156–161 dB re 1 µPa, as such, behavioral responses in fish could occur up to approximately 26 km from the VSP sound source, thereby potentially resulting in a Change in Availability of Fisheries Resources and a Change in Traditional Use. • There are no important spawning areas or unique fishing grounds within 26 km of the Shelburne Project Area.
	Current Aboriginal Use of Lands and Resources for Traditional Purposes	Change in Traditional Use	

Table 10.2.2 Potential Residual Effects Associated with the Shelburne Basin Venture Exploration Drilling Project

Activities and Components Associated with Shelburne Basin Venture Exploration Drilling	VCs Affected	Residual Environmental Effects	Explanation of Residual Environmental Effects
Helicopter Transportation	Marine Mammals and Sea Turtles	Change in Habitat Quality and Use	• Helicopter traffic may cause a Change in Habitat Quality and Use for marine mammals and sea turtles as it may elicit diving behavior as a response mechanism to the physical presence or atmospheric sound created by helicopter traffic. However, these behaviors are predicted to be temporary in nature as any effects from the presence of helicopters will be brief in both space and time.
	Migratory Birds	Change in Habitat Quality and Use Change in Risk of Mortality or Physical Injury	• Helicopter traffic may cause a localized Change in Habitat Quality and Use and a Change in Risk of Mortality or Physical Injury for migratory birds, due to potential bird strikes, and atmospheric sound emissions. • To reduce the potential effects on migratory birds, Shell will implement PSV and helicopter traffic restrictions around Sable Island, including maintaining a 2 km buffer from Sable Island, except in the case of an emergency.
	Special Areas	Change in Habitat Quality and Use	• Special Areas could potentially experience effects from the presence and operation of helicopter transportation for the Shelburne Basin Venture Exploration Drilling project. • Helicopter transportation is predicted to have any no substantial interaction with Special Areas, as operators will adhere to the standard code of practice and restrictions for offshore helicopter transportation.
PSV Operations	Fish and Fish Habitat	Change in Habitat Quality and Use	• Operation of PSVs could result in short-term, localized Change in Habitat Quality and Use for marine fish, due to increased vessel traffic within the Project Area and LAA, and subsequent increased underwater sound emissions.
	Marine Mammals and Sea Turtles	Change in Habitat Quality and Use Change in Risk of	• Underwater sounds associated with PSV traffic could result in a Change in Habitat Quality and Use by marine mammals and sea turtles as predicted levels of SPLs generated by the PSV are high

Table 10.2.2 Potential Residual Effects Associated with the Shelburne Basin Venture Exploration Drilling Project

Activities and Components Associated with Shelburne Basin Venture Exploration Drilling	VCs Affected	Residual Environmental Effects	Explanation of Residual Environmental Effects
		Mortality or Physical Injury	enough to cause changes in swimming, foraging, or vocal behaviours. • The presence and operation of PSVs will also result in an increase in marine traffic within the LAA, potentially resulting in a Change in Risk of Mortality or Physical Injury due to potential for vessel collisions with marine mammals and sea turtles. • Shell is implementing mitigation measures to reduce adverse effects including a limitation on PSV transit speed and avoidance of the Roseway Basin, the Gully, and Shortland and Haldimand Canyons.
	Migratory Birds	Change in Habitat Quality and Use Change in Risk of Mortality or Physical Injury	• PSV activities could potentially result in a Change in Habitat Quality and Use with regard to migratory birds, as the presence of an approaching PSV may alert birds and flush some species from the area. However, PSVs will not come in close proximity to any critical habitat for migratory birds (*i.e.*, Piping Plover or Roseate Tern), or IBAs. • In addition, increased artificial lighting during transiting and operations of the PSVs may present a mortality risk to migratory birds.
	Special Areas	Change in Habitat Quality and Use	• The distance of the Shelburne Project Area (which is approximately 8 km west of the Scotian Basin Project Area) from other Special Areas as well as adherence to standard avoidance mitigation practices will reduce the likelihood of any interaction with Special Areas.
	Commercial Fisheries	Change in Availability of Fisheries Resources	• Environmental effects on fish attributable to PSV traffic and operations would represent a small incremental increase over similar effects currently associated with existing high levels of marine traffic and shipping activity throughout the RAA.

Table 10.2.2 Potential Residual Effects Associated with the Shelburne Basin Venture Exploration Drilling Project

Activities and Components Associated with Shelburne Basin Venture Exploration Drilling	VCs Affected	Residual Environmental Effects	Explanation of Residual Environmental Effects
	Current Aboriginal Use of Lands and Resources for Traditional Purposes	Change in Traditional Use	• PSVs will use existing shipping routes when travelling between the MODU and the supply base in Halifax Harbour, and will adhere to standard navigation procedures, thereby avoiding potential conflicts with commercial, Aboriginal FSC or communal commercial fisheries.
Well Abandonment	Fish and Fish Habitat	Change in Habitat Quality and Use	• Well abandonment could potentially result in a Change in Habitat Quality and Use for marine fish. • Due to the localized nature of well abandonment, it is expected that fish would avoid the immediate area where the mechanical separation activities are taking place. If the wellhead is kept in place, it is expected to be colonized by benthic epifauna.
	Marine Mammals and Sea Turtles	Change in Habitat Quality and Use	• The mechanical separation of the wellhead from the seabed will not produce excess sound or discharge; however, it is likely that marine mammals and sea turtles may temporarily avoid the immediate area during this undertaking.
	Special Areas	Change in Habitat Quality and Use	• Well abandonment is expected to occur via mechanical separation and will have little interaction with the Scotian Slope EBSA outside the immediate vicinity of the wellhead. • This activity will not produce excess sound or discharge, and blasting will not be required. As a result, the residual environmental effects of well abandonment on Special Areas are predicted to be not significant.
	Commercial Fisheries	Change in Availability of Fisheries Resources	• Abandonment of wells could potentially interact with commercial or Aboriginal fishing activity in the Project Area, either through a change in fish habitat or temporary underwater sounds.

Table 10.2.2 Potential Residual Effects Associated with the Shelburne Basin Venture Exploration Drilling Project

Activities and Components Associated with Shelburne Basin Venture Exploration Drilling	VCs Affected	Residual Environmental Effects	Explanation of Residual Environmental Effects
	Current Aboriginal Use of Lands and Resources for Traditional Purposes	Change in Traditional Use	• Wells will be abandoned in accordance with CNSOPB requirements and will take approximately 7–10 days. • If wellheads are kept in place, they will be mapped on marine charts and are not expected to affect fisheries activities.

10.2.1.3 Potential Residual Effects of Fisheries in the RAA

Fishing is the main socio-economic activity regularly occurring in the RAA potentially affecting all of the selected VCs. As summarized in Sections 5.3.3 and 5.3.4, a diverse range of species is targeted by fisheries in the RAA, including groundfish (*e.g.*, cod, haddock, pollock, flatfishes), small pelagic fishes (*e.g.*, herring, mackerel), large pelagic fishes (*e.g.*, tuna, sharks, swordfish) and invertebrates (*e.g.*, lobster, crab, shrimp, scallop). The different types of gear employed in fisheries in the RAA include otter trawl, seine, longline, gillnet, handline, dredge, weir, traps and pots, and harpoon (Burbridge 2011).

Past and present fishing activities in the RAA have potential to cause a Change in Habitat Quality and Use, and Change in Risk of Mortality or Physical Injury affecting fish and fish habitat, marine mammals and sea turtles, and migratory birds; a Change in Habitat Quality and Use affecting Special Areas; a Change in Availability of Fisheries Resources affecting other commercial fishers; and a Change in Traditional Use affecting other Aboriginal fishers (refer to Table 10.2.3). These potential residual effects are localized in proximity to activities and components associated with fisheries.

Table 10.2.3 Potential Residual Effects Associated with Fisheries

Activities and Components Associated with Fisheries	VCs Affected	Residual Environmental Effects	Explanation of Residual Environmental Effects
Use of Mobile Bottom-Contact Fishing Gear	Fish and Fish Habitat	Change in Risk of Mortality or Physical Injury Change in Habitat Quality and Use	• Commercial, recreational, and Aboriginal fisheries within the RAA cause a direct Change in Risk of Mortality or Physical Injury for targeted fish species as well as any non-targeted fish species that may be taken as bycatch. The use of mobile bottom-contact fishing gear that is dragged along the seafloor (*e.g.*, trawlers) for certain commercial groundfish fisheries can remove plants, corals, and sessile food items; overturn rocks; level rock outcrops; crush, bury, or expose benthic organisms; and re-suspend sediments, thereby causing a Change in Habitat Quality and Use and Change in Risk of Mortality or Physical Injury for marine benthos.
	Special Areas	Change in Habitat Quality and Use	• Certain Special Areas are subject to fishing closures or gear restrictions (refer to Table 5.2.18), including the Haddock Box and Emerald Basin and Sambro Bank Sponge Conservation Areas. The Haddock Box is closed to commercial groundfish fisheries and the Emerald Bank and Sambro Bank Sponge Conservation Areas are closed to bottom-contact fishing gear. • Given that the Scotian Slope EBSA is not currently subject to any fishing closures or gear restrictions, the use of mobile bottom-contact fishing gear has potential to cause a Change in Habitat Quality and Use in that Special Area, which is partially located within the Project Area.
Use of Gillnet, Trawl, Seines, Longline Gear	Fish and Fish Habitat Marine Mammals and Sea Turtles Migratory Birds	Change in Risk of Mortality or Physical Injury	• Marine fish can experience a Change in Risk of Mortality or Physical Injury as they are targeted for fisheries, or caught as bycatch. • Entanglement in fishing gear is one of the primary threats for marine mammals in Atlantic Canada waters, including the endangered North Atlantic right whale and leatherback sea turtle (DFO 2014c, 2015o), resulting in a Change in Risk of Mortality or Physical Injury. • Migratory birds, particularly seabirds, can become entangled in fishing gear and potentially drown, thereby resulting in a Change in Risk of Mortality or Physical Injury.

Table 10.2.3 Potential Residual Effects Associated with Fisheries

Activities and Components Associated with Fisheries	VCs Affected	Residual Environmental Effects	Explanation of Residual Environmental Effects
Vessel Operations	Fish and Fish Habitat Marine Mammals and Sea Turtles Migratory Birds	Change in Risk of Mortality or Physical Injury Change in Habitat Quality and Use	• Fishing vessels may cause a localized Change in Habitat Quality and Use for fish, marine mammals, and sea turtles through the generation of underwater sound from engines and propellers during transiting. • Although SPLs produced during the transiting of fishing vessels are below the thresholds for physical injury to marine species, SPLs of other third party physical activities that may be carried out by fishing vessels (*e.g.*, depth sounding, bottom profiling, and side scan sonar) are high enough to cause injury or mortality to fish at close ranges. • The transiting of fishing vessels may cause a Change in Risk of Mortality or Physical Injury for marine mammals and sea turtles due to potential vessel strikes. • Atmospheric or underwater sound associated with fisheries vessels has potential to cause a localized Change in Habitat Quality and Use that could result in sensory disturbance of migratory birds. Any vessels that employ artificial night lighting may also attract and/or disorient nocturnally migrating birds and cause an associated Change in Risk of Mortality or Physical Injury.
	Special Areas	Change in Habitat Quality and Use	• Fishing vessels may be present in certain Special Areas (including the Scotian Slope EBSA, Haddock Box, and Emerald Basin and Sambro Bank Sponge Conservation Areas), thereby potentially causing a localized Change in Habitat Quality and Use in Special Areas through the generation of underwater sound levels from engines and propellers during transiting, as well as from other physical activities that may be carried out by fishing vessels (*e.g.*, depth sounding, bottom profiling, and side scan sonar).
Operational Discharges	Fish and Fish Habitat Marine Mammals and Sea Turtles Marine Birds Special Areas	Change in Habitat Quality and Use	• Discharges from fishing vessels (*e.g.*, grey and black water, ballast water, bilge water, and deck drainage) will be discharged in accordance with MARPOL and are therefore unlikely to cause a Change in Risk of Mortality or Physical Injury for marine species. • Discharges may cause a Change in Habitat Quality and Use for fish, marine mammals, sea turtles, and migratory birds within a localized area around fishing

Table 10.2.3 Potential Residual Effects Associated with Fisheries

Activities and Components Associated with Fisheries	VCs Affected	Residual Environmental Effects	Explanation of Residual Environmental Effects
			vessels. • Depending on the location of the fishing vessel at the time that the discharge is made, this Change in Habitat Quality and Use has potential to occur in a Special Area.
Fishing Activity	Commercial Fisheries	Change in Availability of Fisheries Resources	• Fisheries can occur in any NAFO Division and Unit Area in the RAA and have potential to cause a Change in Availability of Fisheries Resources for competing commercial fisheries in the RAA or Change in Traditional Use for Aboriginal fisheries in the RAA (*e.g.*, through displacement of competitors from their preferred fishing grounds). • If fisheries resources are not harvested sustainably, the residual environmental effects of present fishing activity in the RAA could cause a Change in Availability of Fisheries Resources and Change in Traditional Use for future commercial and Aboriginal fishers due to decreased catch rate as well as resource depletion. • Fisheries also cause localized environmental effects on fish and fish habitat due to the generation of underwater sound and water quality effects associated with discharges. However, these environmental effects on fish and fish habitat are generally not expected to be of sufficient magnitude, duration, or extent to affect catch rate or otherwise cause a Change in Availability of Fisheries Resources for commercial fisheries or Change in Traditional Use Aboriginal fisheries.
	Current Aboriginal Use of Lands and Resources for Traditional Purposes	Change in Traditional Use	

10.2.1.4 Potential Residual Effects of Other Ocean Users in the RAA

As summarized in Section 5.3.2, various other ocean users have been, and continue to be, active throughout the RAA, including shipping, scientific research, and military activities. The past and present activities of other ocean users in the RAA have potential to cause a Change in Habitat Quality and Change in Risk of Mortality or Physical Injury affecting fish and fish habitat, marine mammals and sea turtles, and migratory birds; a Change in Habitat Quality and Use affecting Special Areas; a Change in Availability of Fisheries Resources affecting commercial fishers; and a Change in Traditional Use affecting Aboriginal fishers (refer to Table 10.2.4). These potential residual effects are localized in proximity to activities and components associated with other ocean users.

Table 10.2.4 Potential Residual Effects Associated with Other Ocean Users

Activities and Components Associated with Other Ocean Users	VCs Affected	Residual Environmental Effects	Explanation of Residual Environmental Effects
Vessel Operations	Fish and Fish Habitat Marine Mammals and Sea Turtles Migratory Birds	Change in Risk of Mortality or Physical Injury Change in Habitat Quality and Use	• Other ocean users in the RAA can cause a Change in Risk of Mortality or Physical Injury and a Change in Habitat Quality and Use for fish, marine mammals, and sea turtles through the generation of underwater sound. • Although the SPLs produced by the types of vessels most commonly used by other ocean users are generally below the thresholds for physical injury to marine species, the SPLs of other physical activities that may be carried out by these ocean users (*e.g.*, naval sonar) are high enough to cause injury or mortality to some marine species in certain circumstances. • Atmospheric and/or underwater sound associated with other ocean users' vessels have potential to cause a localized Change in Habitat Quality and Use that could result in sensory disturbance of migratory birds. Vessels that employ artificial night lighting may also attract and/or disorient nocturnally migrating birds and cause an associated Change in Risk of Mortality or Physical Injury. • The transiting of vessels by other ocean users can cause a Change in Risk of Mortality or Physical Injury for marine mammals and sea turtles due to potential vessel strikes.
	Special Areas	Change in Habitat Quality and Use	• The vessels of other ocean users can cause a Change in Habitat Quality and Use in Special Areas, including the Scotian Slope EBSA and Haddock Box due to the generation of underwater sound emissions.
	Commercial Fisheries	Change in Availability of Fisheries Resources	• Other ocean users can occur in any NAFO Division and Unit Area in the RAA and have potential to cause a Change in Availability of Fisheries Resources for commercial fisheries and a Change in Traditional Use for Aboriginal fisheries through temporary displacement of commercial and Aboriginal fishing activity (due to vessel presence) or damage to fishing gear. • Other ocean users also cause localized environmental effects on fish and fish habitat due to the generation of underwater sound and water quality effects associated with discharges. However, these environmental effects on fish and fish habitat are generally not expected to be of sufficient magnitude, duration, or extent to affect catch rate or otherwise cause a Change in Availability of
	Current Aboriginal Use of Lands and Resources for Traditional Purposes	Change in Traditional Use	

Table 10.2.4 Potential Residual Effects Associated with Other Ocean Users

Activities and Components Associated with Other Ocean Users	VCs Affected	Residual Environmental Effects	Explanation of Residual Environmental Effects
			Fisheries Resources for commercial fisheries or a Change in Traditional Use for Aboriginal fisheries.
Helicopter Transportation	Marine Mammals and Sea Turtles	Change in Habitat Quality and Use	• There is potential for helicopter traffic to elicit diving behaviour in marine mammals in response to physical presence or sound, although these behaviours will be temporary. Helicopter traffic associated with other ocean users (where applicable) may therefore result in a temporary Change in Habitat Quality and Use for marine mammals.
	Marine Birds	Change in Risk of Mortality or Physical Injury Change in Habitat Quality and Use	• Helicopter traffic may also cause a Change in Risk of Mortality or Physical Injury for migratory birds, due to potential bird strikes, as well as a Change in Habitat Quality and Use for migratory birds due to atmospheric sound emissions.
	Special Areas	Change in Habitat Quality and Use	• Helicopter traffic could potentially cause a Change in Habitat Quality and Use for Special Areas such as Sable Island National Park Reserve.
Operational Discharges	Fish and Fish Habitat Marine Mammals and Sea Turtles Marine Birds Special Areas	Change in Habitat Quality and Use	• Discharges from the vessels of other ocean users (*e.g.*, grey and black water, ballast water, bilge water, and deck drainage) will be discharged in accordance with MARPOL and are therefore unlikely to cause a Change in Risk of Mortality or Physical Injury for marine species. • Discharges may cause a Change in Habitat Quality and Use for fish, marine mammals, sea turtles, and marine birds within a localized area around the vessels of other ocean users. • Depending on the location of the vessel at the time that the discharge is made, this Change in Habitat Quality and Use has potential to occur in a Special Area.

10.2.2 Potential Cumulative Interactions between the Project and Past/Present/Future Activities

The residual environmental effects of the Project on each VC (*i.e.*, Fish and Fish Habitat, Marine Mammals and Sea Turtles, Migratory Birds, Special Areas, Commercial Fisheries, and Current Aboriginal Use of Lands and Resources for Traditional Purposes) could overlap temporally with the residual environmental effects of each of the past, present, and future physical activities identified in Section 10.1.1.3.

The residual environmental effects of routine Project activities on each VC will be spatially limited to the Project Area and LAA. An assessment of cumulative interactions as a result of accidental events is presented in Section 10.2.9. Key spatial considerations for the cumulative effects assessment focusing on routine Project activities are provided in the following:

- With the exception of PSV transit, the residual environmental effects of the Project will not overlap spatially with the residual environmental effects of offshore gas development projects on any VC as the nearest production platforms for SOEP and Deep Panuke are located approximately 11 km and 35 km from the LAA, respectively. The supply base for the Project is at the same location in Halifax Harbour as is being used for SOEP and Deep Panuke; therefore, there could be a cumulative increase in vessel traffic as the PSVs approach Halifax Harbour. However, the incremental addition of PSVs from the Project would result in a low increase in risk of adverse effects to the following VCs: Marine Mammals and Sea Turtles, Migratory Birds, Special Areas, Commercial Fisheries, and Current Aboriginal Use of Lands and Resources for Traditional Purposes.

  Although there is little spatial overlap between the residual environmental effects of the Project and the residual environmental effects of offshore gas development projects (limited to nearshore PSV traffic), certain VCs may nonetheless be affected by sequential exposure to the residual environmental effects of the Project, SOEP, and Deep Panuke. The life cycles of several species of fish, marine mammals, sea turtles, and migratory birds include long-distance movement within the RAA (refer to Section 5.2), and there is potential for individuals of these species to be affected by the combined residual environmental effects of the Project and offshore gas development projects (*i.e.*, the same individuals may be exposed to the residual environmental effects of multiple physical activities during the course of their migrations within the RAA). Similarly, because the customary or traditional fishing grounds of any given commercial or Aboriginal fisher may encompass a broad area or include multiple areas, there is potential for some fishers to be adversely affected by the combined residual environmental effects of the Project and fisheries and other ocean users (*i.e.*, the same fishers may be exposed to the residual environmental effects of multiple physical activities during the course of their harvesting activities within the RAA).

- The residual environmental effects of the Project could potentially overlap spatially and/or temporally with the residual environmental effects of the Shelburne Basin Venture Exploration Drilling Project on every VC. The Scotian Basin Exploration Drilling Project Area is directly

adjacent (approximately 8 km at the closest point) to the Shelburne Basin Venture Exploration Drilling Project Area; the LAAs for the two projects overlap offshore as well as nearshore in terms of PSV transit to the supply base in Halifax Harbour. Both projects are predicted to have similar types and magnitudes of environmental effects.

- The residual environmental effects of the Project could overlap spatially with the residual environmental effects of fisheries (commercial and Aboriginal) and other ocean users on every VC. In particular, both the Project and vessels associated with fisheries and other ocean user activities would have routine discharges to the marine environment. With respect to the Project's drilling discharges, the majority of Project-related discharges of drill muds and cuttings is expected to remain confined to an area within 563 m of the release site (refer to Appendix C) and it is anticipated that any potential smothering of marine benthos will be primarily limited to within 116 m (based on an average burial depth of 9.6 mm, cited in Neff *et al.* 2004). Sediment dispersion and deposition resulting from discharges of drill muds and cuttings of 0.1 mm thickness are predicted to extend up to 1,367 m from the release site and may therefore affect benthic species, as well as water and sediment quality, to varying degrees, for fish, marine mammals, sea turtles, and marine birds within that radius. Drill muds and cuttings will be discharged within the Project Area, which overlaps with the Scotian Slope EBSA.

- The life cycles of several species of fish, marine mammals, sea turtles, and migratory birds include long-distance movement within the RAA (refer to Section 5.2), and there is potential for individuals of these species to be affected by the combined residual environmental effects of the Project and fisheries and other ocean users (*i.e.*, the same individuals may be exposed to the residual environmental effects of multiple physical activities during the course of their migrations within the RAA). Similarly, because the customary or traditional fishing grounds of any given commercial or Aboriginal fisher may encompass a broad area or include multiple areas, there is potential for some fishers to be adversely affected by the combined residual environmental effects of the Project and fisheries and other ocean users (*i.e.*, the same fishers may be exposed to the residual environmental effects of multiple physical activities during the course of their harvesting activities within the RAA).

Table 10.2.5 applies the criteria from Section 10.1.2.2 to determine whether further assessment of cumulative environmental effects is warranted for each VC, and indicates where the residual effects of the Project may overlap and interact cumulatively with the environmental effects of other third party physical activities in the RAA. The potential cumulative environmental effects identified in Table 10.2.5 are assessed in Section 10.2.3.

Table 10.2.5 Cumulative Interactions between the Residual Effects of the Project and the Residual Effects of Other Physical Activities on Each VC

Environmental Effect	Potential Cumulative Environmental Effects*			
	Offshore Gas Development Projects	Shelburne Basin Exploration Drilling Project	Fisheries	Other Ocean Users
Fish and Fish Habitat				
Change in Risk of Mortality or Physical Injury	-	✓	✓	✓
Change in Habitat Quality and Use	✓	✓	✓	✓
Marine Mammals and Sea Turtles				
Change in Risk of Mortality or Physical Injury	✓	✓	✓	✓
Change in Habitat Quality and Use	✓	✓	✓	✓
Migratory Birds				
Change in Risk of Mortality or Physical Injury	✓	✓	✓	✓
Change in Habitat Quality and Use	✓	✓	✓	✓
Special Areas				
Change in Habitat Quality and Use	-	✓	✓	✓
Commercial Fisheries				
Change in Availability of Fisheries Resources	✓	✓	✓	✓
Current Aboriginal Use of Lands and Resources for Traditional Purposes				
Change in Traditional Use	✓	✓	✓	✓

Note:

* The "✓" indicates that both of the following criteria are satisfied and that further assessment of potential cumulative environmental effects is warranted:

1) The Project could result in a demonstrable or measurable residual environmental effect on the VC.
2) The residual environmental effect of the Project is likely to act in a cumulative fashion with the residual environmental effect of the other physical activity (*i.e.*, the residual environmental effects of the Project and the other physical activity are likely to overlap).

The "**-**"indicates that the above criteria are not satisfied and that no further assessment of potential cumulative environmental effects is warranted. Where applicable, an explanation is provided in the right-most column of the table.

As indicated in Table 10.2.5, there are no predicted interactions between residual effects of the Project and residual effects of offshore gas development projects that would be expected to result in a cumulative Change in Risk of Mortality or Physical Injury for Fish and Fish Habitat or a Change in Habitat Quality and Use for Special Areas.

The nearest production platforms for SOEP and Deep Panuke are located approximately 35 and 11 km from the Project Area, respectively. The underwater SPLs produced by offshore gas development projects are at levels that would not cause a Change in Risk of Mortality or Physical Injury for fish or their eggs/larvae. Additionally, discharges from the Project and offshore gas development projects will comply with the requirements of OWTG and MARPOL, and will rapidly become highly diluted in the open ocean at levels that are unlikely to cause mortality to fish species.

With respect to a cumulative effect on Special Areas, Project activities and components could result in residual environmental effects on the Scotian Slope EBSA (which is partially located with the Project Area), the Haddock Box and Emerald Basin and Sambro Bank Sponge Conservation Areas (areas crossed by the LAA portion surrounding the PSV route to Halifax Harbour), as well as potentially the Gully and Shortland Canyon (elevated underwater sound levels predicted in winter conditions). The results of EEM studies completed to date for SOEP and Deep Panuke have not identified any apparent residual environmental effects on habitat quality and use in the Haddock Box, Sable Island National Park Reserve, the Scotian Slope EBSA, or any other designated Special Area (ExxonMobil 2012; McGregor Geoscience Limited 2013). The potential Change in Risk of Mortality or Physical Injury for migratory birds nesting in the Sable Island National Park Reserve and associated Sable Island IBA (due to potential attraction to SOEP platforms and subsequent collision or stranding) is considered in the context of the Migratory Birds (Section 10.2.5).

10.2.3 Assessment of Cumulative Environmental Effects on Fish and Fish Habitat

This section assesses the potential cumulative Change in Habitat Quality and Use and the potential cumulative Change in Risk of Mortality or Physical Injury for Fish and Fish Habitat that may be caused by the residual environmental effects of the Project in combination with the residual environmental effects of other past, present, and future physical activities in the RAA.

10.2.3.1 Cumulative Change in Risk of Mortality or Physical Injury

Some of the underwater sound emissions generated by the Shelburne Basin Venture Exploration Drilling Project, fisheries, and other ocean users during vessel transiting and other activities (*e.g.*, depth sounding, bottom profiling, naval or side scan sonar, airgun arrays) generate SPLs that may be harmful to fish at close ranges (refer to Table 5.1.15 in Section 5.1.3.6). SPLs generated by VSP operations, which may be conducted for the Shelburne Basin Venture Exploration Drilling Project as well as this Project, will generate sound levels that may result in physical damage to fish at very close proximity to the sound source. However, the possibility of cumulative interaction is uncertain, though unlikely, given the infrequent nature and short duration (*e.g.*, approximately one day per well) of VSP operations, and which may not be completed for each well for either drilling project.

With respect to other third party physical activities in the RAA that generate underwater SPLs that may cause a Change in Risk of Mortality or Physical Injury, it is expected that the presence

of an approaching vessel or drilling activity will locally displace some species from the area around operating VSP, seismic, sounding, profiling, or sonar sound sources before they are exposed to high SPLs in close proximity to those sound sources, and that most species will respond behaviourally to avoid underwater sound at lower levels than those at which injury or mortality might occur. The implementation of ramp-up procedures of the VSP source array in accordance with the SOCP will mitigate potential underwater sound effects on fish, marine mammals, sea turtles, and diving birds in close proximity to Project and non-Project seismic sources.

The SPLs produced by BP's and Shell's proposed VSP operations are each high enough to cause a potential cumulative Change in Risk of Mortality or Physical Injury to fish eggs/larvae within a few metres of the respective seismic source, although this would be expected to be in the range of natural variability (not affecting population viability). Fish eggs/larvae are immotile and are therefore more susceptible to harm in close proximity to these sound sources than other life stages of fish; however, the sound sources themselves are far enough apart that, even if there was some temporal overlap of activities, there will be no spatial overlap (based on predicted propagation of underwater sound levels) of residual environmental effects on fish eggs/larvae. The establishment of a 500-m radius safety (exclusion) zone around the MODU within which non-Project activities are excluded, will further reduce potential cumulative interactions between underwater sound emissions from Project-related VSP operations and from other third party physical activities generating high SPLs in the RAA, as well as prevent the spatial overlap of residual environmental effects on fish eggs/larvae.

The deposition of Project-related drill muds and cuttings may smother marine benthos within a 116 m radius of the wellhead. Sediment (drill waste) dispersion modelling conducted for the Shelburne Basin Venture Exploration Drilling Project predicted a 155 m radius for benthic smothering. These affected areas from both drilling projects will not likely overlap spatially, but could result in additive effects for benthic species on the Scotian Slope, thereby potentially contributing to a cumulative Change in Risk of Mortality or Physical Injury.

The Change in Risk of Mortality or Physical Injury predicted for the Project could also combine with the harmful effects that groundfishing can have on benthic organisms, resulting in adverse cumulative effects. However, the Project Area is not subject to a high level of groundfishing pressure and groundfishing is unlikely to take place in proximity to the MODU during Project activities. Potential cumulative environmental interactions between the Project and groundfisheries will be further limited by the presence of the 500-m radius safety (exclusion) zone excluding other third party physical activities, as well as the highly localized nature of the deposition of drilling muds and cuttings around the wellsite. The residual effects of Project-related drill muds and cuttings discharged inside the safety (exclusion) zone are unlikely to contribute to the residual effects of groundfishing outside of the safety (exclusion) zone.

A cumulative Change in Risk of Mortality or Physical Injury associated with underwater sound is also considered unlikely to occur as a result of the varying spatial and temporal scale of VSP operations. The cumulative Change in Risk of Mortality or Physical Injury associated with the

deposition of Project-related drill muds and cuttings is predicted to be primarily limited to the wellsite and Project Area and to be short-term in duration.

The residual cumulative Change in Risk of Mortality or Physical Injury for Fish and Fish Habitat is generally predicted to be adverse, low in magnitude, occur within the LAA, sporadic to regular in frequency, medium-term in duration, and reversible. With the application of proposed Project-related mitigation and environmental protection measures, the residual cumulative environmental effect of a Change in Risk of Mortality or Physical Injury for Fish and Fish Habitat is predicted to be not significant. This conclusion has been determined with a high level of confidence based on an understanding of the general environmental effects of exploration drilling and other physical activities in the RAA, as well as the effectiveness of standard mitigation measures.

10.2.3.2 Cumulative Change in Habitat Quality and Use

Although routine discharges and underwater sound emissions from the Project are not likely to be detected outside the LAA, for species whose ranges cover a large extent of the RAA, individuals may be exposed to discharges from one or more physical activities, as well as various sources of underwater sound, throughout their life cycle. The Project will introduce an additional source of discharges and underwater sound that these individuals have potential to encounter. Fish and other marine wildlife may temporarily avoid localized areas subject to degraded water quality and/or underwater sound. The cumulative environmental effects of the Project in combination with other physical activities may therefore include a temporary reduction in the amount of habitat available within the RAA (*i.e.*, due to temporary avoidance of multiple areas at once). This cumulative Change in Habitat Quality and Use has potential to disrupt reproductive, foraging and feeding, and/or migratory behaviour if the availability of important habitat areas, including designated Special Areas (*e.g.*, Haddock Box), is affected; however, this is not expected to occur for the reasons provided below.

It is anticipated that routine discharges from the Project and from other third party physical activities will be in compliance with the requirements of OWTG and/or MARPOL (as applicable), at levels that are intended to be prevent damage of the marine environment, including fish and fish habitats.

Routine discharges are predicted to disperse quickly, causing only localized effects in water quality around the source. Given that the concentrations of individual discharges are expected to be rapidly diluted in the open ocean, and given the distances between the Project and other third party physical activities occurring in the offshore (including the exclusion of fisheries and other users within a 500-m radius safety (exclusion) zone surrounding the MODU), Project-related discharges are unlikely to mix or combine with discharges from other physical activities from third parties. Routine discharges from the Project and other third party physical activities are therefore not expected cause a substantial cumulative Change in Habitat Quality and Use.

Although drill waste dispersion modelling results indicate that dispersed sediment from Project-related discharge of drill muds and cuttings may extend up to a maximum distance of 1,367 m from the release site (at a deposition thickness of 0.1 mm), the thickness of sediment discharge which could potentially result in benthic smothering is predicted to be confined to an area within 116 m of the release site (refer to Appendix C). This spatial extent is well within the 500-m radius safety (exclusion) zone around the MODU within which other third party physical activities are excluded, thereby limiting potential cumulative interactions between Project-related drill muds and cuttings discharged inside the safety (exclusion) zone and discharges from other third party physical activities outside the safety (exclusion) zone. It is expected that Project-related discharges of drill muds and cuttings will be at such low water column concentrations outside of the 500-m radius safety (exclusion) zone that any potential cumulative Change in Habitat Quality and Use caused by interaction with the discharges of other physical activities would be negligible. These modelling results are similar to that predicted for the Shelburne Basin Exploration Drilling Project in which the maximum extent of measureable discharge was predicted to be 1,380 m from the wellhead with the majority of discharges expected to be observed within 100 m of the wellhead. Assuming a threshold of 10 mm for mortality due to smothering, a radius of 155 m was predicted to occur for each well drilled for the Shelburne Basin Exploration Drilling Project. Both the Scotian Basin and Shelburne Basin exploration drilling projects involved drilling up to seven wells over their respective EL period, depending on initial well results. Cumulatively, this could result in patchy distributions of drill waste discharges on the sea floor on the Scotian Slope within the respective project areas. However, any cumulative alteration would be negligible and temporary.

It is similarly expected that any potential cumulative Change in Habitat Quality and Use caused by interaction between Project-related drill waste discharges and the sediments temporarily resuspended during groundfishing activity outside of the 500-m radius safety (exclusion) zone would be negligible based on the limited sedimentation expected beyond the safety (exclusion) zone.

The presence of Project and non-Project vessels in any particular area is generally anticipated to be medium-term and transient in nature, thus limiting water quality and sound effects (and associated cumulative Changes in Habitat Quality and Use) at any given location, including designated Special Areas and other areas of importance for reproduction, feeding, and migration of fish. Although PSVs, fishing vessels, and the vessels of other ocean users may be present in designated Special Areas, they are subject to special restrictions where necessary to protect sensitive marine species and habitats.

Underwater sound emissions produced during operation of the Project MODU, Shell's MODU and the production platforms for SOEP and Deep Panuke will be longer lasting and generated from a stationary source for the duration of Project exploration drilling activities at each well (*i.e.*, 120-130 days) and gas production activities at each SOEP and Deep Panuke platform (*i.e.*, several years), respectively. Although fish are not expected to approach close enough to these offshore facilities to be exposed to sound levels capable of causing auditory injury, the sound emissions may cause behavioural responses such as temporary habitat avoidance or changes in activity

state. Given their distances from the Project Area (which is located approximately 11 km and 35 km from the nearest SOEP and Deep Panuke platforms, respectively), Browns Bank, the Georges Bank Oil and Gas Moratorium Area, the Georges Bank Fishery Closure (5Z), and the Emerald/Western Bank Haddock Nursery Closure (Haddock Box), sound emissions from the SOEP and Deep Panuke gas production platforms are not anticipated to interact cumulatively with the sound emissions from the Project to result in a cumulative Change in Habitat Quality and Use in designated Special Areas of importance for fish spawning.

In consideration of the above, cumulative water quality and sound effects are considered unlikely to disrupt the use of important habitat areas by fish. The localized areas potentially affected by the Project and other physical activities represent a relatively small proportion of the total amount of habitat available within the RAA and would not interact in such a way that causes any potential cumulative Change in Habitat Quality and Use for fish.

The residual cumulative Change in Habitat Quality and Use for Fish and Fish Habitat is generally predicted to be adverse, low to moderate in magnitude, occur within the LAA, sporadic to regular in frequency, short to medium-term in duration, and reversible. The cumulative Change in Habitat Quality and Use associated with the deposition of Project-related drill muds and cuttings is predicted to be primarily limited to the wellsite and Project Area. With the application of proposed Project-related mitigation and environmental protection measures such as compliance with the OWTG, the residual cumulative environmental effect of a Change in Habitat Quality and Use for Fish and Fish Habitat is predicted to be not significant. This conclusion has been determined with a high level of confidence based on an understanding of the general environmental effects of exploration drilling and other physical activities in the RAA, as well as the effectiveness of standard mitigation measures.

10.2.3.3 Summary of Cumulative Environmental Effects on Fish and Fish Habitat

Cumulative environmental effects on fish and fish habitat are predicted to be adverse, low to moderate in magnitude, occurring within the LAA, sporadic to regular in frequency, short to medium-term in duration, and reversible. With the application of proposed Project-related mitigation and environmental protection measures, the residual cumulative environmental effects on Fish and Fish Habitat are predicted to be not significant. Therefore, no additional mitigation measures beyond those in place to mitigate the Project's direct effects are needed to address potential cumulative effects.

10.2.4 Assessment of Cumulative Environmental Effects on Marine Mammals and Sea Turtles

This section assesses the potential cumulative Change in Habitat Quality and Use and the potential cumulative Change in Risk of Mortality or Physical Injury for Marine Mammals and Sea Turtles that may be caused by the residual environmental effects of the Project in combination with the residual environmental effects of other past, present, and future physical activities in the RAA.

10.2.4.1 Cumulative Change in Risk of Mortality or Physical Injury

Underwater sound emissions from Project-related VSP operations will contribute to the underwater sound emissions of other third party physical activities generating high SPLs in the RAA to potentially result in a cumulative Change in Risk of Mortality or Physical Injury.

There will also be a cumulative Change in Risk of Mortality or Physical Injury for marine mammals and sea turtles due to increased potential for strikes with vessels conducting various physical activities within the RAA (including Project activities). Marine mammals and sea turtles are also at risk of mortality due to entanglement in fishing gear. Project activities, offshore gas development projects, Shell's Shelburne Basin Venture Exploration Drilling Project, and the activities of fisheries and other ocean users all have potential to occur in different parts of the RAA at the same time, thereby cumulatively increasing Risk of Mortality or Physical Injury.

With the exception of the discussion of cumulative environmental effects on fish eggs/larvae and benthic organisms, the analysis of cumulative environmental effects from underwater sound and operational discharges provided in Section 10.2.3 is also applicable for Marine Mammals and Sea Turtles.

The operation of the Project MODU and PSVs will represent only a small incremental increase over existing levels of marine traffic in the RAA, including likely marine traffic associated with the Shelburne Basin Venture Exploration Drilling Project and will therefore only cause a small increase in the cumulative Change in Risk of Mortality or Physical Injury for marine mammals and sea turtles. Project PSVs will reduce the risk of collision with marine mammals and sea turtles by limiting their maximum speed to 22 km/h (12 knots), avoiding known important areas for marine mammals (*e.g.*, Roseway Basin, the Gully, and Shortland and Haldimand Canyons) except as needed in the case of an emergency. In general, the presence of Project and non-Project vessels in any given area is anticipated to be short-term and transient in nature, thereby limiting opportunities for vessel strikes.

The residual cumulative Change in Risk of Mortality or Physical Injury for Marine Mammals and Sea Turtles is predicted to be adverse, low in magnitude, occur within the LAA, sporadic to regular in frequency, medium-term in duration, and reversible. With the application of proposed Project-related mitigation and environmental protection measures, the residual cumulative environmental effect of a Change in Risk of Mortality or Physical Injury for Marine Mammals and Sea Turtles is predicted to be not significant. This conclusion has been determined with a high level of confidence based on an understanding of the general environmental effects of exploration drilling and other physical activities in the RAA, as well as the effectiveness of standard mitigation measures.

10.2.4.2 Cumulative Change in Habitat Quality and Use

Similar to the cumulative interactions discussed above for Fish and Fish Habitat, water quality and sound effects from the Project and other third party physical activities may temporarily

reduce habitat availability within the RAA (*i.e.*, due to the potential for temporary avoidance of multiple areas at once). Although this cumulative Change in Habitat Quality and Use has potential to disrupt reproductive, foraging and feeding, and/or migratory behaviour of marine mammals and sea turtles if the availability of important habitat areas, including designated Special Areas, is affected, the likelihood of this cumulative interaction is considered low given the distances over which Project and non-Project activities are taking place, as well as the localized nature of potential residual Project effects.

Underwater sound generated by various Project activities will contribute to the underwater sound produced by other physical activities in the RAA. The resultant cumulative increase in ambient underwater sound levels may adversely affect marine mammals through the masking of biologically significant sounds as well as avoidance behaviours. The presence and sound of helicopter traffic also has potential to elicit temporary diving responses in marine mammals; thus the presence and sound of Project-related helicopter traffic may potentially trigger additional diving responses in individual marine mammals already exposed to the presence and sound of helicopter traffic from offshore gas development projects, Shell's Shelburne Basin Venture Exploration Drilling Project, and other ocean users (where applicable).

Much of the analysis of cumulative environmental effects from underwater sound and operational discharges provided in Section 10.2.3.2 for Fish and Fish Habitat is also applicable for Marine Mammals and Sea Turtles.

With respect to behavioural responses in marine mammals and sea turtles (*i.e.*, masking and avoidance behaviour), Project-related SPLs are predicted to be above thresholds associated with behavioural effects for cetaceans (refer to Section 7.3.8 and Appendix H). Under certain environmental conditions (winter), SPLs from the MODU is predicted to be above 120 db re 1 µPa RMS SPL at distances of more than a 150 km radius from the MODU. This continuous sound could interact cumulatively with transient and intermittent sound from Project and non-Project vessels (including Shelburne Basin Venture Exploration Drilling Project MODU and vessels) within this radius potentially contributing to a cumulative Change in Habitat Quality and Use. Project PSVs will avoid critical habitat for the northern bottlenose whale (the Gully, and Shortland and Haldimand canyons) and the North Atlantic right whale (Roseway Basin).

With respect to behavioural effects on marine mammals due to helicopter presence and sound, the standard protocol for oil and gas operators working offshore Nova Scotia is for helicopters to avoid flying over Sable Island, except in the case of an emergency. This mitigation will limit potential cumulative interactions between helicopter traffic from the Project, SOEP, Deep Panuke, and Shelburne Project Area, and Sable Island seal populations. Project helicopters will also avoid flying over Roseway Basin, except in the case of an emergency. In general, the residual environmental effects of helicopter traffic from the Project will be so spatially and temporally limited that potential cumulative interactions with the residual environmental effects of other helicopter traffic in the RAA will be minimal and are not anticipated to result in a substantial cumulative Change in Habitat Quality and Use for marine mammals.

The residual cumulative Change in Habitat Quality and Use for Marine Mammals and Sea Turtles is predicted to be adverse, low to moderate in magnitude, restricted to the Project Area or RAA, sporadic to regular in frequency, short to medium-term in duration, and reversible. With the application of proposed Project-related mitigation and environmental protection measures, the residual cumulative environmental effect of a Change in Habitat Quality and Use for Marine Mammals and Sea Turtles is predicted to be not significant. This conclusion has been determined with a moderate level of confidence based on a limited understanding of the effects of introduced underwater sound on sea turtles and marine mammals (particularly with respect to species-specific behavioural effects), but a reasonable understanding of the general effects of exploration drilling and VSP on marine mammals and the effectiveness of mitigation measures, including those discussed in Section 7.3.8.2. There are also inherent uncertainties in the acoustic model, as well as scientific disagreement about the appropriateness of the various effects thresholds for marine mammals and sea turtles related to underwater sound.

10.2.4.3 Summary of Cumulative Environmental Effects on Marine Mammals and Sea Turtles

Cumulative environmental effects on Marine Mammals and Sea Turtles are predicted to be adverse, low to moderate in magnitude, occur within the RAA, sporadic to regular in frequency, medium-term in duration, and reversible. With the application of proposed Project-related mitigation and environmental protection measures, the residual cumulative environmental effects on Marine Mammals and Sea Turtles are predicted to be not significant. Therefore, no additional mitigation measures beyond those in place to mitigate the Project's direct effects are needed to address potential cumulative effects. Marine mammal and sea turtle observation programs implemented by offshore oil and gas operators and seismic survey operators on the Scotian Shelf and Slope, as well as BP's proposed acoustic monitoring program will help to further the understanding of species presence and behaviour on the Scotian Shelf and Slope and potential cumulative environmental effects on Marine Mammals and Sea Turtles.

10.2.5 Assessment of Cumulative Environmental Effects on Migratory Birds

This section assesses the potential cumulative Change in Habitat Quality and Use and the potential cumulative Change in Risk of Mortality or Physical Injury for Migratory Birds that may be caused by the residual environmental effects of the Project in combination with the residual environmental effects of other past, present, and future physical activities in the RAA.

10.2.5.1 Change in Risk of Mortality or Physical Injury

As discussed in Sections 10.2.3 and 10.2.4, underwater sound emissions from Project-related VSP operations will contribute to the underwater sound emissions of other third party physical activities generating high SPLs in the RAA to potentially result in a cumulative Change in Risk of Mortality or Physical Injury. The analysis provided in Section 10.2.3 regarding underwater sound emissions from Project-related VSP operations in combination with the underwater sound emissions of other physical activities generating high SPLs in the RAA could be relevant for diving

marine birds. However, based on current scientific knowledge regarding the effects of underwater sound on birds (refer to Section 7.1), diving marine birds appear to be less sensitive to underwater sound emissions than fish, marine mammals, or sea turtles. Migratory birds are therefore assumed to be less susceptible to a potential cumulative Change in Risk of Mortality or Physical Injury from underwater sound than fish or marine mammals and sea turtles.

Migratory birds are vulnerable to potential injury or mortality when exposed to hydrocarbon contamination. Crude and heavy fuel oil, lubricants, and diesels accounted for most of the contamination found on the corpses of the more than 2800 oiled birds that were recovered during beached bird surveys conducted on Sable Island between 1993 and 2002. These fatalities were primarily attributable to unlawful ship-source pollution from large vessels (Stantec 2014b). Thus, non-routine discharges from the Project and various other physical activities in the RAA could contribute to a cumulative Change in Risk of Mortality or Physical Injury for migratory birds. However, routine discharges are expected to comply with government standards and requirements, and residual hydrocarbons in discharges released in accordance with the OWTG and/or MARPOL (as applicable) are generally not associated with the formation of a slick (potentially affecting marine birds) and are therefore unlikely to cause a measurable cumulative Change in Risk of Mortality or Physical Injury to marine birds.

Although rare, it is possible for helicopter traffic from the Project, offshore gas development and exploration projects, and other ocean users (where applicable) to strike flying birds. Thus, the Project may contribute to a cumulative Change in Risk of Mortality or Physical Injury due to potential collisions with migratory birds.

The standard protocol for oil and gas operators working offshore Nova Scotia is for helicopters to avoid flying over Sable Island, except in the case of an emergency; this will mitigate potential disturbance of the Sable Island National Park Reserve (and associated Sable Island IBA) and birds nesting on Sable Island. Helicopters transiting to and from the MODU will fly at altitudes greater than 300 m and at a lateral distance of 2 km away from active colonies when possible, thereby reducing the risk of collisions with migratory birds. In general, the residual environmental effects of helicopter traffic from the Project will be so spatially and temporally limited that potential cumulative interactions with the residual environmental effects of other helicopter traffic in the RAA will be minimal and are not expected to result in a substantial Change in Risk of Mortality or Physical Injury for migratory birds.

Artificial night lighting associated with the Project will contribute to the total amount of night lighting from various sources in the RAA, including lighting on the PSVs and platforms for offshore gas development projects, the Shelburne Basin Venture Exploration Drilling Project, fishing vessels, and the vessels of other ocean users. Each of these sources of artificial night lighting can attract and/or disorient migratory birds, thereby resulting in a cumulative Change in Risk of Mortality or Physical Injury due to potential stranding and increased opportunities for predation, collisions, exposure to vessel based threats, and emissions. Limited flaring by the MODU during Project activities (*e.g.*, testing) may similarly attract migratory birds and result in increased mortality due to the lighting-related hazards identified above as well as the risk of incineration.

Project-related flaring will contribute to the bird mortality risk already associated with gas flaring from offshore gas development projects.

Routine checks for stranded birds on the MODU and PSVs and appropriate procedures for release (*i.e.*, the protocol outlined in *The Leach's Storm Petrel: General Information and Handling Instructions* (Williams and Chardine 1999)) will be implemented to mitigate the environmental effects of Project-related artificial night lighting and flaring on birds. Lighting on Project infrastructure will be reduced, to the extent possible without compromising worker safety. Flaring will only be undertaken during the Project as necessary to characterize the well potential and maintain safe operations, and will be carried out in accordance with CNSOPB *Drilling and Production Guidelines*. Project lighting and flaring will represent only a small increase over existing levels of lighting and flaring in the RAA, will be temporary and localized, and will occur at sufficient distance from other light sources (*i.e.*, at least 500 m from fishing vessels and the vessels of other ocean users) and flaring sources (*i.e.*, approximately 11 km and 35 km from SOEP and Deep Panuke, respectively). Residual lighting and flaring effects of the Project are therefore not anticipated to contribute to those of other third party physical activities within the RAA in such a way that causes a substantive cumulative increase in mortality or injury affecting migratory birds.

The residual cumulative Change in Risk of Mortality or Physical Injury for Migratory Birds is predicted to be adverse, low to moderate in magnitude, occur within the LAA, sporadic (VSP operations) to continuous (artificial night lighting) in frequency, medium-term in duration, and reversible. With the application of proposed Project-related mitigation and environmental protection measures, the residual cumulative environmental effect of a Change in Risk of Mortality or Injury for Migratory Birds is predicted to be not significant. This conclusion has been determined with a high level of confidence based on an understanding of the general environmental effects of exploration drilling and other third party physical activities in the RAA, as well as the effectiveness of standard mitigation measures.

10.2.5.2 Change in Habitat Quality and Use

For migratory birds whose ranges cover a large extent of the RAA, individuals may be exposed to various sources of liquid emissions and atmospheric sound (*i.e.*, offshore gas development projects, the Shelburne Basin Venture Exploration Drilling Project, fisheries, and other ocean users) throughout their life cycle, thereby potentially resulting in a cumulative Change in Habitat Quality and Use, when combined with discharges and atmospheric sound generated by the Project. Section 10.2.3 discusses potential cumulative interactions with respect to marine discharges.

Sound emissions generated from other third party physical activities may locally displace migratory birds for short durations. The cumulative environmental effects of the Project in combination with other third party physical activities will therefore include a temporary reduction in the amount of migratory bird habitat available within the RAA (*i.e.*, due to temporary avoidance of multiple areas at once). This cumulative Change in Habitat Quality and

Use has potential to disrupt reproductive, foraging and feeding, and/or migratory behaviour if the availability of important habitat areas, including designated Special Areas, is affected. Such a potential cumulative effect is considered unlikely, however, given the mitigation measures that will be taken for the Project to avoid important areas.

The presence of Project and non-Project vessels in a particular area is generally anticipated to be short-term and transient in nature, thus limiting associated atmospheric sound effects at any given location, including Sable Island National Park Reserve and other areas of importance for reproduction, foraging and feeding, and/or migration of birds.

Atmospheric sound emissions produced during operation of the Project MODU and the production platforms for SOEP and Deep Panuke will be generated from a stationary source for the duration of Project exploration drilling activities at each well (*i.e.*, 120 days) and gas production activities at each SOEP and Deep Panuke platform (*i.e.*, several years), respectively. Sound emissions may cause behavioural responses such as temporary habitat avoidance or changes in activity state (*e.g.*, feeding, resting or travelling). However, the affected areas represent a very small portion of the total amount of bird habitat available in the RAA and are not known to contain any uniquely important habitat for migratory birds.

The standard protocol for oil and gas operators working offshore Nova Scotia is for helicopters to avoid flying over Sable Island, except in the case of an emergency, which will mitigate potential disturbance of the Sable Island National Park Reserve (and associated Sable Island IBA) and birds nesting on Sable Island. Helicopters transiting to and from the MODU will fly at altitudes greater than 300 m and at a lateral distance of 2 km over active colonies when possible, thereby reducing disturbance to migratory birds. In general, the residual environmental effects of helicopter traffic from the Project will be so spatially and temporally limited that potential cumulative interactions with the residual environmental effects of other helicopter traffic in the RAA will be minimal and are not expected to result in a substantial Change in Habitat Quality and Use for migratory birds.

In consideration of the above, cumulative atmospheric sound effects are considered unlikely to substantially disrupt the use of important habitat areas by migratory birds. The localized areas potentially affected by the Project and other third party physical activities in such a way that causes a cumulative Change in Habitat Quality and Use for migratory birds will represent a relatively small proportion of the total amount of habitat available within the RAA.

The residual cumulative Change in Habitat Quality and Use for Migratory Birds is predicted to be adverse, low to moderate in magnitude, occur within the LAA, sporadic to regular in frequency, short to medium-term in duration, and reversible. With the application of proposed Project-related mitigation and environmental protection measures, the residual cumulative environmental effect of a Change in Habitat Quality and Use for Migratory Birds is predicted to be not significant. This conclusion has been determined with a high level of confidence based on an understanding of the general environmental effects of exploration drilling and other third party physical activities in the RAA, as well as the effectiveness of standard mitigation measures.

10.2.5.3 Summary of Cumulative Environmental Effects on Migratory Birds

Cumulative environmental effects on Migratory Birds is predicted to be adverse, low to moderate in magnitude, occur within the LAA, sporadic (VSP operations) to continuous (artificial night lighting) in frequency, medium-term in duration, and reversible. With the application of proposed Project-related mitigation and environmental protection measures, the residual cumulative environmental effects on Migratory Birds are predicted to be not significant. Therefore, no additional mitigation measures beyond those in place to mitigate the Project's direct effects are needed to address potential cumulative effects. Migratory bird monitoring programs implemented by offshore oil and gas operators on the Scotian Shelf and Slope as well as BP's proposed migratory bird monitoring program will help to advance an understanding of species use and distribution as well as potential cumulative effects.

10.2.6 Assessment of Cumulative Environmental Effects on Special Areas

This section assesses the potential cumulative Change in Habitat Quality in Special Areas that may be caused by the residual environmental effects of the Project in combination with the residual environmental effects of other past, present, and future physical activities in the RAA.

10.2.6.1 Change in Habitat Quality

The Scotian Slope EBSA and the Haddock Box are the only Special Areas located within the Project Area. Given the distance of the Project Area from other Special Areas (Table 5.2.17), potential cumulative interactions associated with the presence and operation of the MODU, including discharge of drill muds and cuttings as well as other discharges and emissions, VSP surveys, and well abandonment activities, would be limited, for the most part, to localized areas of the Scotian Slope EBSA and to a lesser extent, the Haddock Box. No Project well locations will be located within the Haddock Box. Cumulative environmental effects from these activities would be localized and not extend to distances that may interact with other Special Areas, except where modelling in winter conditions has predicted underwater sound levels above 120 db RMS re 1 µPa in the Gully and Shortland Canyon (refer to Section 7.5.8.3 and Appendix H). PSV transiting has potential to cumulatively interact with other third party physical activities in the Haddock Box and Emerald Basin and Sambro Bank Sponge Conservation Areas.

Many of the mechanisms for cumulative environmental effects on Fish and Fish Habitat, Marine Mammals and Sea Turtles, and Migratory Birds are also applicable to Special Areas.

- Marine discharges from the Project as well as from other third party physical activities could result in localized areas of water quality reduction throughout the RAA. Fish, marine mammals, sea turtles, and migratory birds may temporarily avoid or be attracted to these areas. This cumulative environmental effect has potential to occur to localized areas of the Scotian Slope EBSA and to a lesser extent, the Haddock Box, (although no drilling will occur here), and in the Sambro Bank and Emerald Basin Sponge Conservation Areas which could be crossed by PSV traffic.

- The dispersion of Project-related discharges of drill muds and cuttings up to 1,367 m (0.1 mm thickness of benthic deposition) from each wellsite could contribute to the residual environmental effects of fishing activity in the RAA, including the resuspension of sediments during groundfishing with mobile bottom contact fishing gear, in such a way that causes a cumulative Change in Habitat Quality for benthic organisms within that 1,367 m radius. This cumulative environmental effect has potential to occur within localized areas of the Scotian Slope EBSA, in which the Project Area is located.
- Underwater sound generated by various Project activities and components will contribute to the underwater sound produced by other physical activities in the RAA. Fish, marine mammals, and sea turtles may temporarily avoid localized areas subject to underwater sound. A cumulative increase in ambient underwater sound level may adversely affect marine mammals causing temporary avoidance. This cumulative environmental effect has potential to occur in the Scotian Slope EBSA, where the Project Area is located, and in the Haddock Box and Emerald Basin Sponge Conservation Area, which are crossed by the PSV route portion of the LAA. Based on acoustic modelling conducted for the Project (refer to Appendix H), it is possible that SPLs of 120 dB RMS re 1 µPA could be exceeded in winter conditions at distances reaching as far as the Gully and Shortland Canyon, both of which comprise SARA designated critical habitat for the northern bottlenose whale. This sound threshold has been cited as potentially resulting in behavioral effects on cetaceans and pinnipeds for continuous sounds (*e.g.*, shipping and drilling), although it is noted that there is scientific disagreement and debate concerning the validity of establishing a single threshold (refer to Section 7.3 for more discussion). As noted in Section 7.3.8, the potential magnitude of a response is expected to vary depending on a number of factors, such as the intensity of underwater sound, degree of overlap in frequency between a sound and marine mammal species' hearing sensitivity, as well as the animal's activity state at the time of exposure. Odontocete (*e.g.*, northern bottlenose whale) communication frequency ranges from 2 to over 100 kHz (Au and Hastings 2008), which would only partially be overlapped by the low frequency range of drilling sounds (10 Hz to 10 kHz), suggesting that effects of masking may be of lesser concern than for baleen whales, though recent studies suggest odontocetes may still react to low levels of the high frequency components of vessel sound (*e.g.*, Dyndo *et al.* 2015; Veirs *et al.* 2016).

- As noted in Section 7.3.8.3, Lee *et al.* (2005) reported that northern bottlenose whales in the Gully were not displaced by received sound levels of 145 dB re 1 µPa RMS SPL generated by a seismic survey >20 km away that had been operating for a number of weeks.
- The presence and sound of Project-related helicopter traffic may trigger additional diving responses in individual marine mammals already exposed to the presence and sound of helicopter traffic from offshore gas development projects, the Shelburne Basin Venture Exploration Drilling Project, and other ocean users (where applicable). This cumulative environmental effect has potential to occur in localized areas of the Scotian Slope EBSA.
- Atmospheric sound generated by various Project activities and components will contribute to the atmospheric sound produced by other third party physical activities in the RAA. The

sound emissions from these activities may physically displace migratory birds for short durations. This cumulative Change in Habitat Quality has potential to occur in the Scotian Slope EBSA, which is a feeding/overwintering area for migratory birds.

Given the importance of the Haddock Box and the Sambro Bank and Emerald Basin Sponge Conservation Areas for fish and fish habitat, as well as the importance of the Scotian Slope EBSA for fish, marine mammals, sea turtles, and migratory birds, much of the analysis of cumulative environmental effects provided for fish, marine mammals, sea turtles, and migratory birds in Sections 10.2.3, 10.2.4, and 10.2.5 is also applicable for Special Areas.

The cumulative Change in Habitat Quality associated with the deposition of Project-related drill muds and cuttings is predicted to be primarily limited to the wellsite and Project Area (with potential to extend into the LAA if a drill site is located within 1,367 m of the Project Area boundary) and to be long-term in duration.

The residual cumulative Change in Habitat Quality of Special Areas is predicted to be adverse, low to moderate in magnitude, occur within the LAA, sporadic to regular in frequency, short to medium-term in duration, and reversible. With the application of proposed Project-related mitigation and environmental protection measures, the residual cumulative environmental effects of a Change in Habitat Quality of Special Areas, is predicted to be not significant. This conclusion has been determined with a high level of confidence based on an understanding of the general environmental effects of exploration drilling and other physical activities in the RAA, as well as the effectiveness of standard mitigation measures.

10.2.6.2 Summary of Cumulative Environmental Effects on Special Areas

Cumulative environmental effects on Special Areas are predicted to be adverse, low to moderate in magnitude, occur within the LAA, sporadic to regular in frequency, short to medium-term in duration, and reversible. With the application of proposed Project-related mitigation and environmental protection measures, the residual cumulative environmental effects on Special Areas are predicted to be not significant. Therefore, , no additional mitigation measures beyond those in place to mitigate the Project's direct effects are needed to address potential cumulative effects, assuming other ocean users also respect industry standard protection measures in place for Special Areas (*e.g.*, no bottom contact fishing in Sambro Bank and Emerald Basin Sponge Conservation Areas; buffer zone around Sable Island; and restricted activities within the Gully).

10.2.7 Assessment of Cumulative Environmental Effects on Commercial Fisheries

This section assesses the potential cumulative Change in Availability of Fisheries Resources for Commercial Fisheries that may be caused by the residual environmental effects of the Project in combination with the residual environmental effects of other past, present, and future physical activities in the RAA.

10.2.7.1 Change in Availability of Fisheries Resources

A 500-m radius safety (exclusion) zone will be established around the MODU, in accordance with the *Nova Scotia Offshore Petroleum Drilling and Production Regulations*, within which fisheries activities will be excluded while the MODU is in operation. This will amount to the localized exclusion of fisheries within an area of approximately 0.8 km^2 for up to 120 days for each of the wells to be drilled in the Project Area. More specifically, the safety (exclusion) zone to be established for the Project will occupy 0.0003% of the total available area in NAFO Division 4W. The safety (exclusion) zones associated with offshore gas development projects and the Shelburne Basin Venture Exploration Drilling Project will increase the cumulative area that will be temporarily unavailable to fishers at any given time during Project activities. For a fisher licensed to fish in NAFO Division 4W, this is predicted to result in the temporary loss of a negligible percentage of the approximately 237,763 km^2 of total available area. No substantial Change in Availability of Fisheries Resources for fishers is anticipated to result from the cumulative interaction of the various safety (exclusion) zones associated with the Project, SOEP, Deep Panuke, and the Shelburne Basin Venture Exploration Drilling Project. Alternative fishing locations are anticipated to be available nearby as these safety (exclusion) zones are relatively small and occupy a negligible amount of the total harvestable grounds in the RAA.

In addition to the safety (exclusion) zones associated with offshore oil and gas exploration and development, the presence of PSVs, competing fishing vessels, and the marine traffic associated with other ocean users are other sources of potential conflict with fishing vessels within the RAA that could cause a Change in Availability of Fisheries Resources for fishers. Project PSVs are not expected to contribute to space-use conflicts with fishing vessels, as Project PSVs will use existing shipping routes when travelling between the MODU and the supply base in Halifax Harbour, and Project-related PSV traffic will represent a minor component of total marine traffic in the RAA, occupy a negligible proportion of the total available fishing area in the RAA, and be short-term and transient in nature.

Fishers may adversely affect one another through direct competition over productive fishing grounds in such a way that causes a Change in Availability of Fisheries Resources. Any fishers that experience a change in access to their customary fishing areas as a result of the Project in combination with other physical activities in the RAA may be required to temporarily relocate their fishing effort. This could put additional pressure on nearby fishing areas, and fishers may be adversely affected by the resultant competition for remaining fishing areas in the LAA and RAA, thereby causing a cumulative Change in Availability of Fisheries Resources. The level of fishing effort within and surrounding the Project Area is relatively low. The LAA does not include any unique fishing grounds or concentrated fishing effort that occurs exclusively within the LAA, nor is it likely to represent a substantial portion of a customary fishing area for a fisher. The potential for temporary loss of access to preferred fishing grounds as a result of the Project is therefore anticipated to be negligible and is unlikely to have any discernable effect on the overall distribution of fishing effort within the RAA.

All of the physical activities within the RAA have some potential to inadvertently result in damage to fishing gear. The Project contributes to a potential cumulative Change in Availability of Fisheries Resources within the RAA due to potential sequential incidents of gear loss or damage. Project-related damage to fishing gear, if any, will be compensated in accordance with the *Compensation Guidelines with Respect to Damages Relating to Offshore Petroleum Activity* (C-NLOPB and CNSOPB 2002).

Standard practices for communication among marine users, including the issuance of Notices to Mariners and Notices to Shipping (as appropriate), is expected to mitigate potential conflicts with fisheries as well as other ocean users.

The residual cumulative Change in Availability of Fisheries Resources for Commercial Fisheries is predicted to be adverse, negligible in magnitude, occur within the LAA, continuous in frequency, medium-term in duration, and reversible. With the application of proposed Project-related mitigation and environmental protection measures, the residual cumulative environmental effect of a Change in Availability of Fisheries Resources for Commercial Fisheries is predicted to be not significant. This conclusion has been determined with a high level of confidence based on an understanding of the general environmental effects of exploration drilling and other physical activities in the RAA, as well as the effectiveness of standard mitigation measures.

10.2.7.2 Summary of Cumulative Environmental Effects on Commercial Fisheries

Cumulative environmental effects on Commercial Fisheries are predicted to be adverse, negligible in magnitude, occur within the LAA, continuous in frequency, medium-term in duration, and reversible. With the application of proposed Project-related mitigation and environmental protection measures, the residual cumulative environmental effects on Commercial Fisheries are predicted to be not significant. With the application of standard practices for communication among marine users, including fisheries communication plans implemented by other offshore oil and gas operators on the Scotian Shelf and Slope, it is concluded therefore that no additional mitigation measures beyond those in place to mitigate the Project's direct effects are needed to address potential cumulative effects.

10.2.8 Assessment of Cumulative Environmental Effects on Current Aboriginal Use of Lands and Resources for Traditional Purposes

This section assesses the potential cumulative Change in Traditional Use with respect to the Current Aboriginal Use of Lands and Resources for Traditional Purposes that may be caused by the residual environmental effects of the Project in combination with the residual environmental effects of other past, present, and future physical activities in the RAA.

10.2.8.1 Change in Traditional Use

Similar to the cumulative effects assessed for Commercial Fisheries, the following cumulative environmental effect mechanisms are also applicable with respect to the Current Aboriginal Use of Lands and Resources for Traditional Purposes, specifically Aboriginal communal commercial fisheries and FSC fisheries:

- temporary displacement of Aboriginal fishers from their traditional fishing grounds due to establishment of 500-m radius safety (exclusion) zones around the Project MODU, offshore gas production platforms for SOEP and Deep Panuke, and the MODU for the Shelburne Basin Venture Exploration Drilling Project;
- space-use conflicts between Aboriginal fishing vessels and vessels associated with various other physical activities;
- increased competition with other displaced fishers over remaining fishing areas; and
- risk of incidents of gear loss or damage caused by the Project in combination with other physical activities in the RAA.

The analysis of cumulative environmental effects provided in Sections 10.2.7 relating to commercial fisheries is also directly applicable for Aboriginal fishers. That section should be referred to for the assessment of potential cumulative effects related to a Change in Traditional Use. The analysis of cumulative effects provided in Section 10.2.3 regarding Fish and Fish Habitat and in Section 10.2.6 regarding Special Areas should also be referenced given that these VCs were identified by Aboriginal groups as important considerations with respect to traditional use.

The residual cumulative Change in Traditional Use with respect to Current Aboriginal Use of Lands and Resources for Traditional Purposes is predicted to be adverse, negligible in magnitude, occur within the LAA, continuous in frequency, medium-term in duration, and reversible. With the application of proposed Project-related mitigation and environmental protection measures, the residual cumulative environmental effect of a Change in Traditional Use with respect to the Current Aboriginal Use of Lands and Resources for Traditional Purposes is predicted to be not significant. As described in Sections 10.2.3, 10.2.6, and 10.2.7, cumulative effects for Fish and Fish Habitat, Special Areas, and Commercial Fisheries, respectively and are also predicted to be not significant, further supporting this conclusion. This conclusion has been determined with a high level of confidence based on an understanding of the general environmental effects of exploration drilling and other third party physical activities in the RAA, as well as the effectiveness of standard mitigation measures.

10.2.8.2 Summary of Cumulative Environmental Effects on Current Aboriginal Use of Lands and Resources for Traditional Purposes

Cumulative environmental effects on Current Aboriginal Use of Lands and Resources for Traditional Purposes is predicted to be adverse, negligible in magnitude, occur within the LAA, continuous in frequency, medium-term in duration, and reversible. With the application of

proposed Project-related mitigation and environmental protection measures, the residual cumulative environmental effects on Current Aboriginal Use of Lands and Resources for Traditional Purposes are predicted to be not significant. With the application of standard practices for communication among marine users, and ongoing Aboriginal engagement efforts from other offshore oil and gas operators on the Scotian Shelf and Slope, it is concluded therefore that no additional mitigation measures beyond those in place to mitigate the Project's direct effects are needed to address potential cumulative effects.

10.2.9 Accidental Events

According to the CEA Agency's OPS, *Assessing Cumulative Environmental Effects Under the Canadian Environmental Assessment Act, 2012*, "the environmental effects of accidents and malfunctions must be considered in the assessment of cumulative environmental effects if they are likely to result from the designated project in combination with other third party physical activities that have been or will be carried out" (CEA Agency 2013a).

The potential environmental effects of various Project-related malfunction and accidental event scenarios are assessed in Section 8. All of these scenarios are considered very unlikely to occur. Of the identified scenarios, the most likely accidental events which could occur are small batch spills from the MODU (*i.e.*, spills less than 10 bbl). Based on Canadian offshore data, the return period for a spill of less than 10 bbl is 41 years (ERC 2014; Appendix F of Stantec 2014a). Spill prevention and response procedures will be in place to reduce the risk of all spills, including small spills, and associated environmental effects (refer to Section 8 for additional information). Other operators will implement spill prevention and response measures. For example, as noted in the Shelburne Basin Venture Exploration Drilling Project EIS (Stantec 2014a), Shell will implement best management practices and spill prevention measures to reduce the risk of all spills and associated environmental effects. Given the low likelihood of a spill event occurring for even one physical activity in the RAA, the likelihood of spills occurring from multiple physical activities in such a way that residual environmental effects have potential to overlap spatially or temporally is even more remote.

Although a small batch spill could cause residual adverse environmental effects to various VCs (refer to Section 8.5), it would be unlikely to interact with the residual environmental effects of discharges from offshore gas development projects, the Shelburne Basin Venture Exploration Drilling Project, fisheries, or other ocean users in such a way that causes a cumulative environmental effect.

The exclusion of fisheries and other ocean users within a 500-m radius safety (exclusion) zone surrounding the MODU will prevent undiluted small batch spills from combining with undiluted discharges from other physical activities. The concentrations of discharges from other physical activities are expected to be rapidly diluted in the open ocean prior to any mixing thus avoiding cumulative environmental effects.

In the event of a spill, BP's spill response procedures will be implemented immediately upon identification of the spill with the intention of limiting the spatial extent of the spill (*i.e.*, containing, controlling and cleaning up spills as close to the spill site as possible), thus further limiting potential cumulative interactions between small batch spills and the discharges of other third party physical activities outside of the 500-m radius safety (exclusion) zone. The potential contribution of the residual environmental effects of a small batch spill to the residual environmental effects of another physical activity in the RAA is not considered a likely scenario and is therefore not assessed further.

10.3 FOLLOW-UP AND MONITORING

Given the nature of the Project (*e.g.,* exploration drilling), follow-up and monitoring requirements are limited (refer to Section 13). However, various monitoring programs are/will be undertaken in support of other third party physical activities in the RAA that are regulated by the CNSOPB (*i.e.*, Deep Panuke, SOEP, Shelburne Basin Venture Exploration Drilling Project). Encana and ExxonMobil also have obligations to conduct EEM for their offshore gas development projects (*i.e.*, SOEP and Deep Panuke, respectively), in accordance with an EEM process framework developed jointly in 2005 between the CNSOPB, the CEA Agency, DFO, and Environment Canada (CNSOPB n.d. (b)). Depending on the nature of their activities, fisheries and other ocean users may be subject to various monitoring requirements mandated by DFO, Transport Canada, and/or Environment Canada. Monitoring activities associated with the Project and other physical activities will support the development and implementation of adaptive management measures if previously unanticipated adverse environmental effects are identified, thereby reducing the overall potential for cumulative environmental effects.

BP will communicate with fishers and other ocean users before, during, and after drilling programs, and details of safety (exclusion) zones will be published in Notices to Shipping and/or Notices to Mariners, as appropriate. This will allow fishers and other ocean users to plan accordingly and mitigate potential space-use conflicts or environmental effects.

11.0 SUMMARY OF ENVIRONMENTAL EFFECTS

11.1 CHANGES TO THE PHYSICAL ENVIRONMENT

This section summarizes the changes that may be caused by the Project on the components of the environment listed in sections 5(1)(a) and (b) of CEAA, 2012, including those that are directly linked or necessarily incidental to federal decisions that would allow the Project to proceed (refer to Table 11.1.1). Conclusions in this section are summarized from the detailed analyses in Sections 7 through 9 and are categorized as follows:

- Changes to components of the environment within federal jurisdiction;
- Changes to the environment that would occur on federal or transboundary lands; and
- Changes to the environment that are directly linked or necessarily incidental to federal decisions.

An analysis regarding the potential changes to the environment summarized in Table 11.1.1 is provided in Sections 11.1.1 to 11.1.3 below.

Table 11.1.1 Summary of Changes to the Environment

Topic	Changes
Changes to Components of the Environment within Federal Jurisdiction	
Fish and Fish Habitat	• Change in Risk of Mortality or Physical Injury • Change in Habitat Quality and Use
Marine Mammals and Sea Turtles	• Change in Risk of Mortality or Physical Injury • Change in Habitat Quality and Use
Migratory Birds	• Change in Risk of Mortality or Physical Injury • Change in Habitat Quality and Use
Changes to the Environment that Would Occur on Federal or Transboundary Lands	
Special Areas	• Change in Habitat Quality
Commercial Fisheries	• Change in Availability of Fisheries Resources
Current Aboriginal Use of Lands and Resources for Traditional Purposes	• Change in Traditional Use
Changes to the Environment that are Directly Linked or Necessarily Incidental to Federal Decisions	
Accord Acts Authorizations (Operations Authorization and Well Approval under the Accord Acts and *Nova Scotia Offshore Petroleum Drilling and Production Regulations*)	• Operations Authorizations and Well Approvals under the Accord Acts sanction offshore exploration drilling projects in their entirety. Therefore, the changes to the environment associated with Project activities and components are directly linked or necessarily incidental to these authorizations.
Authorization under section 35(2)(b) of the *Fisheries Act* (if applicable)	• Change in Risk of Mortality or Physical Injury and/or Change in Habitat Quality and Use that constitutes serious harm to fish that are part of or support a commercial, recreational, or Aboriginal fishery.

11.1.1 Changes to Components of the Environment within Federal Jurisdiction

Section 5(1)(a) of CEAA, 2012 requires consideration of changes that may be caused to the following components of the environment that are within federal jurisdiction (*i.e.*, within the legislative authority of Parliament): fish and fish habitat, as defined in section 2(1) of the *Fisheries Act;* aquatic species, as defined in section 2(1) of SARA; and migratory birds, as defined in section 2(1) of the MBCA.

Changes affecting fish and fish habitat, marine mammals and sea turtles, and migratory birds are summarized below. Greater detail is provided in Section 7.2 (Fish and Fish Habitat), Section 7.3 (Marine Mammals and Sea Turtles), and Section 7.4 (Migratory Birds).

11.1.1.1 Fish and Fish Habitat

Marine benthic, demersal, and pelagic fish species (including SAR and SOCC) and habitat are present in and around the Project Area, LAA, and RAA. Potential environmental effects of the Project on fish and fish habitat include the following:

- Change in Risk of Mortality or Physical Injury; and
- Change in Habitat Quality and Use.

Fish habitat includes all aspects of the physical marine environment (including the benthic environment and water quality), and considers spawning, rearing, nursery, food supply, overwintering, migration corridors, and any other area on which fish depend directly or indirectly in order to carry out their life processes.

Fish within the LAA may be subject to increased risk of mortality or physical injury due to underwater sound emissions during certain Project activities (*i.e.*, MODU operation and VSP surveys) and the smothering of marine benthos during the deposition of routine discharges of drill muds and cuttings. Underwater sound emissions from MODU operation, VSP surveys, PSV operations, and well abandonment may also temporarily degrade the quality of fish habitat and result in sensory disturbance that may trigger behavioural responses in fish within the LAA. The localized, temporary reduction of water and sediment quality as a result of routine operational discharges and emissions, including the discharge of drill muds and cuttings as well as drilling and testing emissions, may similarly affect habitat quality and use for fish within the LAA. Marine plants are not located in the Project Area (given water depth) and routine Project activities are not predicted to interact with marine plants which occur in the nearshore. Accidental events (*e.g.*, spills), although unlikely to occur, could alter fish habitat and/or result in species mortality or injury within the affected area. Depending on the type and location of the spill, these effects could potentially be realized beyond the LAA into the RAA, including the nearshore environment.

Habitat altered by the deposition of drill muds and cuttings will become available for use as fish habitat immediately following the completion of drilling operations and is expected to be recolonized by benthic communities in less than five years.

As summarized in Section 7.2.9, in consideration of the extent of the interactions and the planned implementation of known and proven mitigation, the residual environmental effects of routine Project activities and components on Fish and Fish Habitat are predicted to be not significant. With the development and implementation of proposed well control, spill response, contingency, and emergency response plans (refer to Section 8.3), accidental events are unlikely to result in significant residual adverse environmental effects on Fish and Fish Habitat.

11.1.1.2 Marine Mammals and Sea Turtles

Several species of baleen whales (mysticetes), toothed whales (odontocetes), seals (phocids), and sea turtles (including SAR and SOCC) are present in and around the Project Area, LAA, and RAA. Potential environmental effects of the Project on marine mammals and sea turtles include the following:

- Change in Risk of Mortality or Physical Injury; and
- Change in Habitat Quality and Use.

Marine mammal and sea turtles within the LAA may be subject to increased risk of mortality or physical injury due to auditory damage from underwater sound emissions during certain Project activities (*i.e.*, MODU operation and VSP surveys) and collisions with transiting PSVs. Underwater sound emissions from MODU operation, VSP surveys, and PSV operations may temporarily degrade the quality of marine mammal and sea turtle habitat and result in sensory disturbance that triggers behavioural responses in marine mammals and sea turtles within the LAA. Sensory disturbance associated with well abandonment and the localized degradation of water quality as a result of routine operational discharges and emissions, including the discharge of drill muds and cuttings as well as drilling and testing emissions, may similarly affect habitat quality and use for marine mammals and sea turtles within the LAA. There is also potential for helicopter transportation to affect habitat quality and use for marine mammals by eliciting temporary diving behaviour. Accidental events (*e.g.*, spills), although unlikely to occur, could alter marine mammal and sea turtle habitat and/or result in species mortality or injury within the affected area, which could extend beyond the LAA into the RAA.

As summarized in Section 7.3.9, with the application of proposed mitigation and environmental protection measures, the residual environmental effects of routine Project activities and components on Marine Mammals and Sea Turtles are predicted to be not significant. A significant adverse residual environmental effect is predicted for marine mammals and sea turtles in event of a well blowout in recognition of the risk of interaction with breeding seals on Sable Island and marine mammal and sea turtle species at risk inhabiting the affected area. However, with the implementation of proposed well control, spill response, contingency, and

emergency response plans (refer to Section 8.3), significant residual adverse environmental effects on Marine Mammals and Sea Turtles are unlikely to occur.

11.1.1.3 Migratory Birds

Several species of pelagic (*i.e.*, offshore) and neritic (*i.e.*, inshore) seabirds, waterfowl, shorebirds, and migratory land birds are present in and around the Project Area, LAA, and RAA. Potential environmental effects of the Project on migratory birds include the following:

- Change in Risk of Mortality or Physical Injury; and
- Change in Habitat Quality and Use.

Migratory birds within the LAA may be subject to increased risk of mortality or physical injury due to underwater sound emissions; collisions with the MODU, helicopters, and PSVs; harm from flaring from well test on the MODU; and exposure to other MODU or vessel-based threats. The presence of potential marine bird attractants (*e.g.*, Project-related lights, flares, sanitary wastes) may affect habitat quality and use in such a way that further increases risk of mortality or physical injury. Underwater sound emissions from MODU operation and VSP surveys may temporarily degrade the quality of migratory bird habitat and result in sensory disturbance that may trigger behavioural responses in migratory birds within the LAA. The localized degradation of water quality as a result of routine operational discharges and emissions, including the discharge of drill muds and cuttings as well as drilling and testing emissions, may similarly affect habitat quality and use for migratory birds within the LAA, as could atmospheric sound, artificial night lighting, and other sensory disturbance associated with MODU operation, helicopter transportation, and PSV operations. Accidental events (*e.g.*, spills), although unlikely to occur, could alter migratory bird habitat and/or result in species mortality or injury within the affected area, which could extend beyond the LAA into the RAA.

As summarized in Section 7.4.9, with the application of proposed mitigation and environmental protection measures, the residual environmental effects on Migratory Birds are predicted to be not significant. Under certain circumstances (refer to Section 8.5.3), some accidental event scenarios could potentially result in a significant adverse effect on Migratory Birds. However, with the implementation of proposed well control, spill response, contingency, and emergency response plans (refer to Section 8.3), significant residual adverse environmental effects on Migratory Birds are unlikely to occur.

11.1.2 Changes to the Environment that Would Occur on Federal or Transboundary Lands

Section 5(1)(b) of CEAA, 2012 requires consideration of changes that may be caused to the environment that would occur on federal lands, in another province, or outside of Canada. Project activities and components described within the scope of this EIS have the potential to result in changes to the environment that would occur on federal lands, including federal submerged lands and the federal waters and airspace above those lands. In particular, the PSV

route enters Canada's territorial sea and internal waters (Halifax Harbour). The Project Area is located within Canada's EEZ on the Southwest Scotian Slope portion of Canada's continental shelf. The helicopter route occurs in the airspace above these areas. All of these areas constitute federal lands as defined under section 2(1) of CEAA, 2012. Since the scope of the Project does not include any land-based activities or components, changes to the environment from routine Project activities are not anticipated to occur on terrestrial lands belonging to Her Majesty in right of Canada, or reserves, surrendered lands, or other lands that are set apart for the use and benefit of a band and are subject to the *Indian Act*.

A major accidental event (*e.g.*, subsea blowout) could result in transboundary effects outside of Nova Scotian or Canadian offshore areas if left unmitigated (refer to Section 8.4.7.3 and Appendix H). However, with the development and implementation of proposed well control, spill response, contingency, and emergency response plans (refer to Section 8.3), a major accidental event is extremely unlikely to occur and would not be left unmitigated. The Project is therefore not anticipated to result in any changes to the environment that would occur outside of the Nova Scotian or Canadian offshore area.

Changes to Fish and Fish Habitat, Marine Mammals and Sea Turtles, and Migratory Birds will also occur on federal submerged lands and in federal waters; these components have been addressed in Section 11.1.1. Therefore, this section focuses on Special Areas, Commercial Fisheries, and Current Aboriginal Use of Lands and Resources for Traditional Purposes (*i.e.*, Aboriginal fisheries) with greater detail provided in Section 7.5 (Special Areas), Section 7.6 (Commercial Fisheries), and Current Aboriginal Use of Lands and Resources for Traditional Purposes (Section 7.7).

11.1.2.1 Special Areas

The Project Area overlaps spatially with a portion of the Scotian Slope EBSA and a very small portion of the Haddock Box (153 ha of the Haddock Box occurs within the Project Area). The Haddock Box and the Emerald Basin Sponge Conservation Area are within the LAA portion surrounding the PSV route to Halifax Harbour; several other Special Areas are located within the RAA (see Section 5.2.8). The potential environmental effect of the Project on Special Areas is a Change in Habitat Quality. However, given the localized effects of routine Project activities and the distance of the Special Areas from the Project, the Scotian Slope Shelf Break EBSA has the most potential to interact with routine Project activities.

Underwater sound from MODU operation, VSP surveys, PSV operations, and well abandonment may temporarily reduce the quality of habitat in the portions of the Scotian Slope EBSA and the Haddock Box encompassed by the LAA and result in localized sensory disturbance that may trigger behavioural responses in marine species within these areas. Under certain conditions (*e.g.*, winter), continuous sounds from the MODU during drilling may increase ambient noise levels as far afield as the Gully MPA and the Shortland Canyon (both of which are designated critical habitat for the Northern bottlenose whale), potentially resulting in a Change in Habitat Quality of these areas.

The presence of artificial night lighting and other attractants associated with MODU operation, and the localized reduction of water and sediment quality as a result of routine operational discharges and emissions, including the discharge of drill muds and cuttings as well as drilling and testing emissions, may similarly cause localized and temporary effects on habitat quality within the Scotian Slope EBSA. The deposition of drill muds and cuttings may smother marine benthos and cause changes to the composition of the benthic macrofauna community within a highly localized area of the Scotian Slope EBSA. Accidental events (*e.g.*, spills), although unlikely to occur, could temporarily affect habitat in Special Areas within the affected area, which could extend beyond the LAA into the RAA.

As summarized in Section 7.5.9, in consideration of the extent of the interactions and the planned implementation of known and proven mitigation, residual environmental effects on Special Areas are predicted to be not significant. If left unmitigated, and under certain metocean conditions, a major accidental event (*e.g.*, subsea blowout) could potentially result in a significant adverse effect on Special Areas, particularly with regard to the Gully MPA and Sable Island National Park Reserve (refer to Section 8.5.4). However, with the implementation of proposed well control, spill response, contingency, and emergency response plans (refer to Section 8.3), significant residual adverse environmental effects on Special Areas are unlikely to occur.

11.1.2.2 Commercial Fisheries

Commercial fisheries are present in and around the Project Area, LAA, and RAA. The potential environmental effect of the Project on commercial fisheries is a Change in Availability of Fisheries Resources.

The establishment of a 500-m radius safety (exclusion) zone around the MODU may affect the availability of fisheries resources for commercial fishers by excluding commercial fishing activities within that radius. There is also potential for gear loss or damage to affect the availability of fisheries resources. Underwater sound emissions from MODU operation and VSP surveys may affect the availability of fisheries resources for commercial fishers if associated sensory disturbance within the LAA results in behavioural responses in commercially-fished species (*e.g.*, avoidance). However, given the small extent of the affected area, the temporary nature of the activities, the availability of other similar fishing areas, and the Notices to Shipping and Notices to Mariners that BP will provide regarding its operations, the potential for effects is considered low.

The reduction of water and sediment quality as a result of routine operational discharges and emissions, including the discharge of drill muds and cuttings as well as drilling and testing emissions, is unlikely to affect resource availability for commercial fishers given the temporary and localized nature of the potential effects around the wellsite. In addition, the potential smothering of marine benthos within a highly localized area of the Project Area/LAA, including benthic prey species for commercially fished species, as a result of the deposition of drill muds and cuttings is unlikely to affect the availability of fisheries resources for commercial fishers. Accidental events (*e.g.*, spills), although unlikely to occur, could damage fishing gear, result in

the imposition of fisheries closures due to contamination of fish species commonly harvested for human consumption through CRA fisheries, alter fish habitat, and/or result in species mortality or injury for commercially important species within the affected area, which could extend beyond the LAA into the RAA.

As summarized in Section 7.6.9, in consideration of the extent of the potential interactions and the planned implementation of known and proven mitigation, residual environmental effects on Commercial Fisheries are predicted to be not significant. However, under certain circumstances, some accidental event scenarios could potentially result in a significant adverse effect on Commercial Fisheries (refer to Section 8.5.5). With the implementation of proposed well control, spill response, contingency, and emergency response plans (refer to Section 8.3), significant residual adverse environmental effects on Commercial Fisheries are unlikely to occur.

11.1.2.3 Current Aboriginal Use of Lands and Resources for Traditional Purpose

Aboriginal communal commercial fisheries are present in and around the Project Area, LAA, and RAA. The potential environmental effect of the Project on Aboriginal communal commercial and FSC fisheries is a Change in Traditional Use. All of the mechanisms for a potential Change in Availability of Fisheries Resources for commercial fisheries, as well as the mitigation measures to reduce this environmental effect on commercial fisheries (refer to Section 11.1.3.2), are also applicable with respect to a potential Change in Traditional Use for Aboriginal communal commercial fisheries and FSC fisheries.

As summarized in Section 7.7.9, in consideration of the extent of the interactions and the planned implementation of known and proven mitigation, residual environmental effects on the Current Aboriginal Use of Land and Resources for Traditional Purposes are predicted to be not significant. Under certain circumstances some accidental event scenarios could potentially result in a significant adverse effect on Current Aboriginal Use of Land and Resources for Traditional Purposes (refer to Section 8.5.6). However, with the development and implementation of proposed well control, spill response, contingency, and emergency response plans (refer to Section 8.3), significant residual adverse environmental effects on the Current Aboriginal Use of Lands and Resources for Traditional Purposes are unlikely to occur.

With respect to Aboriginal peoples, the potential effects of any change that may be caused to the environment on health and socio-economic conditions; physical and cultural heritage; the current Aboriginal use of lands and resources for traditional purposes; or any structure, site or thing that is of historical, archaeological, paleontological, or archaeological significance are summarized in Section 11.2.1 of this EIS, in accordance with section 5(1)(c) of CEAA, 2012.

11.1.3 Changes to the Environment that are Directly Linked or Necessarily Incidental to Federal Decisions

Section 5(2)(a) of CEAA, 2012 requires consideration of additional changes that may be caused to the environment and that are directly linked or necessarily incidental to a federal authority's

exercise of a power or performance of a duty or function that would permit the carrying out, in whole or in part, of the designated project. The primary regulatory approvals necessary to conduct an offshore drilling program are an Operations Authorization (Drilling) and a Well Approval (Approval to Drill a Well) pursuant to the Accord Acts and their regulations. A *Fisheries Act* authorization is not expected to be required in support of the Project, as Project activities and components are not predicted to result in "serious harm to fish" (*i.e.*, the death of fish or any permanent alteration to, or destruction of, fish habitat) for species that are part of or support a CRA fishery. Although drilling discharges will result in localized alteration of benthic habitat, these effects will not be permanent and are not anticipated to affect CRA species. In advance of drilling, seabed surveys at the proposed wellsites will be conducted to confirm the absence of habitat-forming coral and unique benthic habitat at the chosen drilling locations.

This section focuses on changes to the environment other than those referred to under section 5(1)(a) and (b) of CEAA, 2012, which are considered in Sections 11.1.1 or 11.1.2 of this EIS.

11.1.3.1 Atmospheric Environment

Project activities and components authorized by the CNSOPB under these regulatory approvals may cause changes to the environment as outlined above in Section 11.1.1 and 11.2.2. Project activities and components could also result in a change to the atmospheric environment through the release of air emissions and generation of sound emissions associated with operation of the MODU, PSVs, and helicopters.

Project discharges and emissions will be in compliance with the requirements of MARPOL and/or the OWTG, at levels that are intended to be protective of the environment. As noted in Section 6, all nearshore and offshore Project-related vessel operations will take place in Canada's portion of the North American Emission Control Area (ECA), which was established under amendments to the *Dangerous Chemicals Regulations* pursuant to the *Canada Shipping Act* that were adopted in 2013 under Annex VI to MARPOL. New standards have been implemented for the ECA that are designed to progressively reduce allowable emissions of key air pollutants by ships such that, by 2020, emissions of sulphur oxide will be reduced by 96% and nitrogen oxides by 80% (Transport Canada 2013). As noted in Section 2.8.1, the Project is predicted to emit approximately 295.8 tonnes of CO_2 per day, which represents approximately 0.59% of Nova Scotia's average daily emission of CO_2. Atmospheric sound is assessed with respect to the Migratory Birds VC and residual environmental effects are predicted to be not significant (refer to Section 7.4). Underwater sound is assessed with respect to Fish and Fish Habitat (refer to Section 7.2), Marine Mammals and Sea Turtles (refer to Section 7.3) and Migratory Birds (refer to Section 7.4) and residual environmental effects for all VCs are predicted to be not significant.

11.1.3.2 Terrestrial Environment

As per the EIS Guidelines, the EIS must identify any changes related to the terrestrial environment including:

- landscape disturbance;
- migratory bird habitat, including losses, structural changes, fragmentation of habitat and wetlands used by migratory birds;
- critical habitat for federally listed species at risk; and
- key habitat for species important to Aboriginal current use of resources.

Routine Project activities and components are not predicted to interact with the terrestrial environment, including migratory bird habitat, critical habitat for SAR, or key habitat for species important to Aboriginal current use of resources.

The loading and refueling of PSVs in Halifax Harbour will occur at existing industrial facilities and not result in any landscape disturbance, or changes to migratory bird habitat, or critical habitat for SAR, or habitat for species important to Aboriginal current use of resources. Nearshore approaches to the harbor contain migratory bird habitat including habitat for the endangered Piping Plover on the western shore of McNabs Island. Halifax Harbour and its approaches are also within the distribution range of Barrow's Goldeneye (*Bucephala islandica*), and Harlequin Duck (*Histrionicus histrionicus*), both of which are listed as Special Concern on Schedule 1 of SARA (Environment Canada 2015). Section 5.2.7.3 describes areas of significance for migratory birds. PSVs will enter and leave Halifax Harbour using established shipping lanes. Incremental atmospheric sound emitted from the PSVs would be minor and not expected to adversely affect migratory birds (including species at risk) nesting or foraging nearby.

Routine Project activities (including PSV operations) are not predicted to interact with the terrestrial environment and therefore will not affect key habitat for species important to Aboriginal current use of resources.

In the unlikely event of a major accidental event (*e.g.*, subsea blowout), there could potentially be some interaction with the shoreline environment thereby potentially resulting in any or all of the changes to the terrestrial environment listed in the EIS Guidelines and referred above (refer to Section 8.4 and Appendix H). However, with the development and implementation of proposed well control, spill response, contingency, and emergency response plans (refer to Section 8.3), a major accidental event is extremely unlikely to occur and would not be left unmitigated. The Project is therefore not likely to result in any changes to the terrestrial environment.

11.2 EFFECTS OF CHANGES TO THE ENVIRONMENT

This section summarizes the effects of changes that may be caused by the Project on the components of the environment listed in section 5(1)(c) and 5(2)(b) of CEAA, 2012, including those that are directly linked or necessarily incidental to federal decisions that would allow the Project to proceed. Conclusions in this section are summarized from the detailed analyses in Sections 7 through 9 and are categorized as follows:

- effects of changes to the environment occurring in Canada of changes to the environment on Aboriginal people; and
- effects of changes to the environment that are directly linked or necessarily incidental to federal decisions.

11.2.1 Effects of Changes to the Environment on Aboriginal People

Effects of changes to the environment on Aboriginal People as outlined in the EIS Guidelines are presented in Section 7.7 Aboriginal Use of Lands and Resources for Traditional Purposes. This section of the EIS summarizes the effects of changes to the environment on Aboriginal people caused by the Project in accordance with section 5(1)(c) of CEAA, 2012. In particular, changes to the following environmental components are summarized:

- health and socio-economic conditions;
- the current Aboriginal use of lands and resources for traditional purposes; and
- physical and cultural heritage and any structure, site or thing that is of historical, archaeological, paleontological or architectural significance.

Given its distance offshore, the Project is unlikely to affect any receptors that would be sensitive to atmospheric air or sound emissions from Project activities and components or accidental events. As stated in Section 2.8.1, Project-related air emissions for criteria air contaminants will remain well below the regulatory thresholds for human health effects. Emissions and discharges from routine drilling operations will meet OWTG and will not result in contamination of sediments or marine fish tissues such that consumption of fish species would result in adverse health effects. Thus, the Project is not expected to result in significant residual adverse environmental effects on the health of Aboriginal or non-Aboriginal people.

Accidental events (*e.g.*, spills), although unlikely to occur, could result in contamination of fish species commonly harvested for human consumption through communal commercial or CRA fisheries. However, fisheries closures would be imposed in the event of such an incident, thereby preventing human exposure to contaminated food sources. Similarly, the imposition of an exclusion zone around the affected area(s) would prevent human contact with spilled oil.

The TUS was conducted to characterize traditional use of marine waters in and around the Project Area and to identify potential interactions, issues and concerns with respect to effects on the current Aboriginal use of resources for traditional purposes. The TUS identifies several communal commercial fisheries that are active in and around the Project Area. Based on interviews conducted as of April 2016, the TUS reports that there are no known FSC fisheries currently occurring in the Project Area. Lobster, clams and scallop are fished within the LAA, and several finfish and invertebrate species are fished within the RAA for FSC purposes (MGS and UINR 2016). However, the TUS also acknowledges that this does not imply that FSC fisheries are not occurring in the Project Area or that the Project Area may not be accessed for future FSC fisheries needs. A precautionary approach is therefore taken, assuming that FSC fisheries could potentially occur in the Project Area and LAA, as well as the RAA. BP also acknowledges that species fished for FSC purposes could be harvested outside the RAA but could potentially temporarily interact with the Project during migration activities through the Project Area or LAA.

As described in Section 7.7, the Project may interact with Aboriginal communal commercial and FSC fisheries, potentially resulting in a Change in Traditional Use. The mechanisms for this potential environmental effect on Aboriginal fisheries are similar to those considered with respect to a Change in Availability of Fisheries Resources for commercial fisheries in Section 11.1.2.3. Information regarding traditional Aboriginal fisheries and traditional resource use has been gathered through engagement with Aboriginal groups (refer to Section 4), including the preparation of a TUS (refer to Appendix B). In consideration of the extent of the interactions and the planned implementation of known and proven mitigation (refer to Section 7.7), Project activities and components are not predicted to result in a loss of access to lands and resources for traditional purposes (beyond the 500-m radius safety [exclusion] zone established temporarily around the MODU), a change in availability of fisheries resources, or serious harm to fish that are part of or support a CRA fishery. Residual environmental effects on Current Aboriginal Use of Lands and Resources for Traditional Purposes are therefore predicted to be not significant.

Under certain circumstances, some accidental event scenarios could potentially result in a significant adverse effect on Aboriginal fisheries. However, with the development and implementation of proposed well control, spill response, contingency, and emergency response plans (refer to Section 8.3), significant residual adverse environmental effects on the Current Aboriginal Use of Lands and Resources for Traditional Purposes are unlikely to occur.

Project activities and components are not anticipated to result in any changes to the environment that would have an effect on Aboriginal or non-Aboriginal physical and cultural heritage areas, sites, structures, or other resources (or access to or availability of those areas, sites, structures, or resources). Given the distance offshore, heritage areas sites, structures, or other such resources are not anticipated to be present in the Project Area. BP will conduct an imagery based seabed survey in the vicinity of wellsites to ground-truth the findings of the GBR. This includes confirming the absence of shipwrecks, debris on the seafloor, unexploded ordnance and sensitive environmental features, such as habitat-forming corals or species at risk. The survey will be carried out prior to drilling. If any environmental or anthropogenic sensitives are identified during the survey, BP will move the wellsite to avoid affecting them if it is feasible to

do so. If it is not feasible, BP will consult with the CNSOPB to determine an appropriate course of action.

In the unlikely event of a spill, a temporary exclusion zone may be placed around the affected area which could affect access to heritage sites or resources. No cultural heritage areas, sites, structures, or other such resources have been identified in or around the Project Area during the public, stakeholder, or Aboriginal engagement activities completed to date (refer to Sections 3 and 4).

11.2.2 Effects of Changes to the Environment that are Directly Linked or Necessarily Incidental to Federal Decisions

Section 5(2)(b) of CEAA, 2012 requires consideration of the effects of changes to the environment that are directly linked or necessarily incidental to a federal authority's exercise of a power or performance of a duty or function that would permit the carrying out, in whole or in part, of the designated project, if any of the following are affected:

- health and socio-economic conditions; and
- physical and cultural heritage and any structure, site or thing that is of historical, archaeological, paleontological or architectural significance.

Table 11.2.1 summarizes the changes to the environment that are linked to federal decisions on the Project which are required under the Accord Acts and the *Fisheries Act*.

Table 11.2.1 Summary of Changes to the Environment that are Potentially Contingent on Federal Decisions

Federal Decision	Changes (Potential Environmental Effects)	Affected VCs
Accord Acts Authorizations (Operations Authorization and Well Approval under the Accord Acts and *Nova Scotia Offshore Petroleum Drilling and Production Regulations*)	Change in Risk of Mortality or Physical Injury	• Fish and Fish Habitat • Marine Mammals and Sea Turtles • Migratory Birds
	Change in Habitat Quality and Use	• Fish and Fish Habitat • Marine Mammals and Sea Turtles • Migratory Birds
	Change in Habitat Quality	• Special Areas
	Change in Availability of Fisheries Resources	• Commercial Fisheries
	Change in Traditional Use	• Current Aboriginal Use of Lands and Resources for Traditional Purposes
Fisheries Act Authorization (Authorization for Serious Harm to Fish under section 35(2)(b) of the *Fisheries Act*)	Change in Risk of Mortality or Physical Injury	• Fish and Fish Habitat
	Change in Habitat Quality and Use	• Fish and Fish Habitat

Operations Authorizations and Well Approvals under the Accord Acts sanction offshore exploration drilling projects in their entirety. Therefore, Project activities and components are directly linked or necessarily incidental to these authorizations.

For the same reasons as explained above with respect to the effects of changes to the environment on Aboriginal people (refer to Section 11.2.1), Project activities and components are not expected to result in changes to the environment that would have an effect on health conditions; physical and cultural heritage; or any structure, site or thing that is of historical, archaeological, paleontological or architectural significance for Aboriginal or non-Aboriginal people. However, effects on socio-economic conditions may occur from the following potential changes to the environment:

- Change in Risk of Mortality or Physical Injury for fish;
- Change in Habitat Quality and Use for fish;
- Change in Availability of Fisheries Resources (for commercial and Aboriginal fisheries); and
- Change in Traditional Use for Aboriginal fisheries.

Given that these potential changes to the environment are temporary and localized around the MODU and PSVs, and that other suitable fish habitat and fishing areas are readily available throughout the RAA, these potential changes to the environment are not anticipated to substantially affect socio-economic conditions for commercial or Aboriginal fishers (refer to Sections 7.6 and 7.7).

In consideration of the extent of the interactions and the planned implementation of known and proven mitigation, as described in Sections 7.2, 7.6, and 7.7, residual environmental effects from routine activities on Fish and Fish Habitat, and associated residual environmental effects on socio-economic conditions pertaining to Commercial Fisheries and Current Aboriginal Use of Lands and Resources for Traditional Purposes, are predicted to be not significant.

11.3 SUMMARY OF CHANGES MADE TO THE PROJECT SINCE ORIGINALLY PROPOSED

The Project, as proposed, demonstrates adherence to standard industry and regulatory policies, procedures and best management practices. Through the environmental assessment process, including engagement with public and regulatory stakeholders, and Aboriginal persons, environmental management planning for the Project has generally informed the Project and confirmed the applicability of standard mitigation measures that have been accepted previously for similar offshore exploration drilling projects in the same regional area. A specific example of where engagement resulted in changes to the Project was input provided by government technical experts on the spill dispersion modelling approach. This improved the accuracy of spill modelling results and effects predictions which will also improve emergency response and incident management planning for the Project.

11.4 SUMMARY

The Project has the potential to result in residual adverse environmental effects in relation to the following considerations:

- changes to components of the environment within federal jurisdiction;
- changes to the environment that would occur on federal or transboundary lands;
- changes to the environment that are directly linked or necessarily incidental to federal decisions;
- effects of changes to the environment occurring in Canada of changes to the environment on Aboriginal people; and
- effects of changes to the environment that are directly linked or necessarily incidental to federal decisions.

The residual environmental effects of routine Project activities and components on Fish and Fish Habitat, Marine Mammals and Sea Turtles, Migratory Birds, Special Areas, Commercial Fisheries, and Current Aboriginal Use of Lands and Resources for Traditional Purposes are predicted to be not significant.

In the unlikely event of a Project-related accidental event resulting in the large-scale release of oil (*e.g.*, blowout), effects to Marine Mammals and Sea Turtles, Migratory Birds, Special Areas, Commercial Fisheries, and Current Aboriginal Land and Resource Use for Traditional Purposes have potential to be significant if the spill trajectory overlaps spatially and temporally with sensitive receptors. However, with the implementation of proposed well control, spill response, contingency, and emergency response plans (refer to Section 8.3), significant residual adverse environmental effects are unlikely to occur.

12.0 ENVIRONMENTAL MANAGEMENT AND MONITORING

12.1 ENVIRONMENTAL MANAGEMENT PLANS

As detailed in Section 1.3.1 of this EIS, BP's operating management system includes requirements and guidance for the identification and management of environmental and social impacts. BP's ability to be a safe and responsible operator depends, in part, on the capability and performance of contractors and suppliers. Contractors and subcontractors shall be required to demonstrate conformance with the requirements that have been established, including HSSE standards and performance requirements. Bridging documents are necessary in some cases to define how BP's safety management systems and those of BP's contractors will align to manage risk on a site.

BP will develop environmental management plans to verify that appropriate measures and controls are in place in order to reduce the potential for environmental effects as well as provide clearly defined action plans and emergency response procedures to protect human and environmental health and safety. As part of the CNSOPB authorization process for exploration drilling (refer to Section 1.5.1), BP will submit the following plans to the CNSOPB for review and approval:

- an Environmental Protection Plan (EPP);
- a Safety Plan;
- an Incident Management Plan (IMP);
- a Spill Response Plan (SRP); and
- a Canada-Nova Scotia Benefits Plan.

An EPP will be prepared in accordance with the Environmental Protection Plan Guidelines (C-NLOB *et al.* 2011b) and will serve as a summary and reference document that describes project-specific environment-related processes and documents. The EPP is used as a means to implement and track compliance with applicable regulatory requirements as well as commitments made during the EA process and subsequent approval process with the CNSOPB.

The Safety Plan, to be prepared in accordance with the Safety Plan Guidelines (C-NLOPB *et al.* 2011a), will present BP's plan for managing safety and risk during the proposed Project, and describe responsibilities and expectations for employees as well as contractors. The Safety Plan will describe processes associated with hazard identification and risk management, training and competency of personnel, incident reporting and investigation, and compliance and performance monitoring. The Safety Plan will also describe facilities and equipment critical to safety and describe the system in place for inspection, testing and maintenance.

As described in Section 8.3, an IMP and associated contingency plans will be prepared to define the response to incidents. The IMP will be a comprehensive document including practices

and procedures for responding to an emergency event. The IMP will include, or reference, a number of specific contingency plans for responding to specific emergency events. The IMP and supporting specific contingency plans, including the SRP will be aligned with applicable regulations, industry practice and BP standards and will include response strategies, arrangements and procedures. These plans will be submitted to CNSOPB prior to the start of any drilling activity as part of the OA process. The SRP will be finalized in consultation with applicable regulatory authorities.

In accordance with s. 45 of the Accord Act and the Canada-Nova Scotia Benefits Plan Guidelines (CNSOPB 2011b), a Canada-Nova Scotia Benefits Plan will be prepared which will document BP's commitment to providing industrial benefits and employment opportunities on a full and fair basis for residents of Canada, and in particular, Nova Scotia, that arise from Project activities.

12.2 FOLLOW-UP AND MONITORING

Under CEAA, 2012, a follow-up program is defined as a program for "verifying the accuracy of the environmental assessment of a designated project" and "determining the effectiveness of any mitigation measures." In most cases, the effects of routine exploration drilling activities and effectiveness of mitigation measures are well-understood (refer to Section 7). Where the level of confidence in effects prediction is not high or an interest has been expressed by regulatory, public or Aboriginal stakeholders for additional information, follow-up and monitoring has been proposed.

In particular, BP is proposing to implement the following monitoring programs to address uncertainty and/or confirm effects predictions related to effects on the marine benthos (refer to Section 7.2 Fish and Fish Habitat), marine mammals and sea turtles (refer to Section 7.3), migratory birds (refer to Section 7.4), and Special Areas (refer to Section 7.5). The implementation schedule and program details will be developed in consultation with the appropriate regulatory agencies, including CNSOPB, DFO and Canadian Wildlife Service (CWS) as applicable. In some cases, as noted below, relevant information from other recent monitoring programs will be factored into the design of BP's monitoring program.

Table 12.2.1 Summary of Follow-up and Monitoring Programs for the Scotian Basin Exploration Drilling Project

Follow-up or Monitoring Program	Objective	Applicable VC(s)	Proposed Intervention/Adaptive Management	Schedule	Reporting
Sediment Survey	BP will conduct a visual (using a remote operated vehicle [ROV]) survey of the seafloor to assess the extent of sediment dispersion.	Fish and Fish Habitat	Survey is for data gathering purposes.	Drilling and Post-Drilling	BP will report observations of sedimentation noting radial extent from drill site. Reports will be provided to the CNSOPB within 90 days of well abandonment of the initial well.
Acoustic Monitoring Survey	BP will assess in consultation with the appropriate authorities the potential for undertaking an acoustic monitoring program during the first phase of the drilling program to collect field measurements to verify predicted underwater sound levels. The objectives of such a program will be identified in collaboration with DFO and the CNSOPB and in consideration of lessons learned from the underwater sound monitoring program that will be undertaken by Shell as part of the Shelburne Basin Venture Exploration Drilling Project.	Fish and Fish Habitat Marine Mammals and Sea Turtles Special Areas	Survey is for data gathering purposes.	Drilling	BP will report monitoring results to DFO and CNSOPB within 30 days of data collection.
Marine Mammal and Sea Turtle Monitoring Program	Monitor and report on sightings of marine mammals and sea turtles during VSP surveys. Monitoring will include visual observations and use of passive acoustic monitoring (PAM) to inform decisions related to mitigation actions required during VSP operations when baleen whales, sea turtles, or any marine mammal listed on Schedule 1 of SARA are detected within a minimum 650-m predetermined exclusion zone.	Marine Mammals and Sea Turtles	Shutdown or delay of VSP operations when baleen whales, sea turtles, or any marine mammal listed on Schedule 1 of SARA are detected within a minimum 650-m predetermined exclusion zone	VSP Survey	In the event that a vessel collision with a marine mammal or sea turtle occurs, BP will contact the Marine Animal Response Society or the Canadian Coast Guard to relay incident information. Following the program, copies of the marine mammal and sea turtle observer reports will be provided to DFO and the CNSOPB. Following the program, recorded PAM data will be provided to DFO so that this information can be used to help inform understanding of marine mammals in the area.
Migratory Bird Mortality Monitoring	Carry out routine checks for stranded birds or bird mortality on the MODU and PSVs and compliance with the requirements for documenting and reporting any stranded birds (or bird mortalities) to the CWS during the drilling program.	Migratory Birds	Survey is for data gathering purposes.	Mobilization to Well Abandonment	If a Species at Risk (SAR) is found alive (stranded) or dead on the MODU or PSV, a report will be sent to CWS within 24 hours of identification. Reporting of live migratory seabirds captured and released will be recorded in accordance with a Migratory Bird Permit issued by CWS. A bird monitoring report will be submitted to the CNSOPB within 90 days of well abandonment.

For a complete list of mitigation, monitoring and reporting commitments to be fulfilled, including physical environment monitoring and ongoing consultation and engagement with commercial and Aboriginal fishers, refer to Table 13.2.1.

BP will submit a report to the CNSOPB documenting the implementation schedule (prior to drilling) and the outcome of follow-up and monitoring programs (post-abandonment) of each well, along with any additional conditions of approval, as applicable. The implementation schedule and results will be made available online for public information.

In addition to monitoring and reporting associated with mitigative commitments presented in this EIS, BP will be responsible for reporting to the CNSOPB in accordance with the *Drilling and Production Regulations and Data Acquisition and Reporting Regulations*. The Drilling and Production Guidelines (C-NLOPB and CNSOPB 2011) and Data Acquisition and Reporting Guidelines (CNSOPB 2011c) describe the extensive testing, measurement, monitoring and reporting requirements to be conducted during an exploratory well drilling program. Incidents will be reported in accordance with the *Incident Reporting and Investigation Guidelines* (C-NLOPB and CNSOPB 2012). Examples of CNSOPB reporting requirements for exploration drilling include (but are not limited to):

- Survey Plan to confirm the location of the well on the seafloor;
- daily Drilling Report summarizing drilling and related operations, including completion, workover, well intervention, or any other well operation;
- daily site-specific meteorological forecast and report of ice conditions;
- monthly Compliance Monitoring and Reporting for Waste Discharges, where specific qualitative or quantitative discharge limits are identified in the Environmental Protection Plan;
- annual Chemical Selection Report that outlines each chemical used in the past year, including the hazard rating, quantity used, and its ultimate fate;
- annual Safety Report including a summary of lost or restricted workday injuries, minor injuries and safety-related incidents and near-misses that have occurred during the preceding year; and efforts undertaken to improve safety;
- Well Operations Report (within 30 days after the end of a well operation) that includes details on the well operations such as any problems encountered during well operation, the completion fluid properties, engineering data, impact of the well operation on the performance of the well, and rig release date;
- Well Termination Report (within 30 days of well termination date);
- annual Work Plan Report which includes an understanding of what activities occurred in the previous year, what activities are planned for each upcoming year and how the progress

compares with the initial Work Plan submitted to the CNSOPB at the beginning of the licence term;

- Environmental Report within 90 days of the rig release date for each exploration well including a physical environment report and summary of environmental protection matters; and

- Investigation Report submitted no later than 21 days following the incident or near-miss identifying root causes, casual factors and corrective actions.

13.0 CONCLUSIONS

BP is proposing to conduct an exploration drilling program on ELs 2431, 2432, 2433, and 2434. The Scotian Basin Exploration Drilling Project may involve the drilling, testing and abandonment of up to seven wells between 2018 and 2022. This document has been prepared to meet the requirements of an EIS pursuant to CEAA, 2012 as specified by Project-specific EIS Guidelines (CEA Agency 2015a, refer to Appendix A) as well as EA requirements of the CNSOPB pursuant to the Accord Acts.

13.1 SUMMARY OF POTENTIAL EFFECTS

The assessment methods used in the preparation of this EIS included an evaluation of the potential environmental effects for each valued component (VC) that may arise during routine operations and potential accidental events which may occur as part of the Project. The assessment methods also included an evaluation of potential cumulative effects to consider whether there is potential for the residual environmental effects of the Project to interact cumulatively with the residual environmental effects of other past, present, or future (*i.e.*, certain or reasonably foreseeable) physical activities in the vicinity of the Project.

In support of the EA process, supporting studies were undertaken including a traditional use study (Appendix B), drill waste dispersion modelling (Appendix C), acoustic modelling (Appendix D), and oil spill fate and trajectory modelling (Appendix H).

The scope of the Project evaluated as part of this EIS was selected to align with the EIS Guidelines. Routine and accidental events were assessed against a number of VCs, specifically Fish and Fish Habitat, Marine Mammals and Sea Turtles, Migratory Birds, Special Areas, Commercial Fisheries and Current Aboriginal Use of Lands and Resources for Traditional Purposes. The selected VCs encompassed candidate VCs listed in the EIS Guidelines not included as VCs in their own right. For example, Species at Risk and Species of Conservation Concern were considered as part of Fish and Fish Habitat VC, the Marine Mammals and Sea Turtles VC, and the Migratory Birds VC rather than as a stand-alone VC to eliminate repetition throughout the EIS and Marine Plants were addressed, as relevant, in the Fish and Fish Habitat VC.

Routine operations represent physical activities that would occur throughout the life of the Project and include the presence and operation of the MODU (including light and underwater sound emissions), waste management (including discharge of drill muds and cuttings and other discharges and emissions), VSP, supply and servicing operations (helicopter transportation and PSV operations) and well abandonment. These activities reflect the scope of the Project as outlined in the EIS Guidelines and represent physical activities that would occur throughout the life of the Project forming the basis of the effects assessment.

Accidental events that could potentially occur during exploration drilling and could potentially result in adverse environmental effects were identified and evaluated. Potential accidental events that were identified include small spills which could occur during operations and maintenance activity, small to medium size batch spills which could occur on the MODU and PSVs and a subsea blowout. Accidental events which could give rise to a spill are unlikely and the probability of a large oil spill occurring during an exploration drilling project is very low (refer to Appendix H). However, as discussed in Section 8.5, significant adverse residual environmental effects could potentially occur to Marine Mammals and Sea Turtles, Migratory Birds, Special Areas, Commercial Fisheries, and Current Aboriginal Use of Lands and Resources for Traditional Purposes in the unlikely event of a large accidental spill which could occur as a result of a blowout.

The key environmental factors that may affect the Project include reduced visibility, high winds and waves, and geohazards (such as shallow gas pocket or abnormal pressure zones). However, engineering design, operational procedures, geohazard assessments, and other mitigation measures will reduce the potential adverse effects on, and risks to, the Project. The MODU will be designed for harsh weather conditions. Adverse residual effects of the physical environment on the Project are predicted to be not significant.

Potential interactions between the VCs and Project activities included in the scope of the EIS, which formed the basis for the effects analysis are presented in Table 13.1.1. Proposed mitigation measures are presented in Table 13.2.1 and an overview of the effects analysis is presented in Table 13.3.1.

Table 13.1.1 Potential Project-VC Interactions and Effects

Project Activities and Components	Fish and Fish Habitat		Marine Mammals and Sea Turtles		Migratory Birds		Special Areas	Commercial Fisheries	Current Aboriginal Use of Lands and Resources for Traditional Purposes*
	Change in Risk of Mortality or Physical Injury	Change in Habitat Quality and Use	Change in Risk of Mortality or Physical Injury	Change in Habitat Quality and Use	Change in Risk of Mortality or Physical Injury	Change in Habitat Quality and Use	Change in Habitat Quality	Change in Availability of Fisheries Resources	Change in Traditional Use
Routine Activities									
Presence and Operation of MODU (including well drilling and testing operations and associated lights, safety [exclusion] zone and underwater sound)	✓	✓	✓	✓	✓	✓	✓	✓	✓
Waste Management (including discharge of drill muds and cuttings and other drilling and testing emissions)	✓	✓		✓	✓	✓	✓	✓	✓
Vertical Seismic Profiling	✓	✓	✓	✓	✓	✓	✓	✓	✓

Table 13.1.1 Potential Project-VC Interactions and Effects

Project Activities and Components	Fish and Fish Habitat		Marine Mammals and Sea Turtles		Migratory Birds		Special Areas	Commercial Fisheries	Current Aboriginal Use of Lands and Resources for Traditional Purposes*
	Change in Risk of Mortality or Physical Injury	Change in Habitat Quality and Use	Change in Risk of Mortality or Physical Injury	Change in Habitat Quality and Use	Change in Risk of Mortality or Physical Injury	Change in Habitat Quality and Use	Change in Habitat Quality	Change in Availability of Fisheries Resources	Change in Traditional Use
Supply and Servicing Operations (including helicopter transportation and PSV operations)		✓	✓	✓	✓	✓	✓	✓	✓
Well Abandonment		✓		✓			✓	✓	✓
Accidental Events									
Small Diesel Batch Spill from the MODU (10 bbl)	✓	✓	✓	✓	✓	✓	✓	✓	✓

Table 13.1.1 Potential Project-VC Interactions and Effects

Project Activities and Components	Fish and Fish Habitat		Marine Mammals and Sea Turtles		Migratory Birds		Special Areas	Commercial Fisheries	Current Aboriginal Use of Lands and Resources for Traditional Purposes*
	Change in Risk of Mortality or Physical Injury	Change in Habitat Quality and Use	Change in Risk of Mortality or Physical Injury	Change in Habitat Quality and Use	Change in Risk of Mortality or Physical Injury	Change in Habitat Quality and Use	Change in Habitat Quality	Change in Availability of Fisheries Resources	Change in Traditional Use
Medium Diesel Batch Spill from the MODU (100 bbl)	✓	✓	✓	✓	✓	✓	✓	✓	✓
PSV Diesel Spill	✓	✓	✓	✓	✓	✓	✓	✓	✓
Well Blowout	✓	✓	✓	✓	✓	✓	✓	✓	✓
SBM Spill (surface release [60 m^3 or 337 bbl] and subsea release [573 m^3 or 3,604 bbl])	✓	✓	✓	✓	✓	✓	✓	✓	✓

* Considers Aboriginal and Treaty Rights

13.2 SUMMARY OF MITIGATION, MONITORING AND FOLLOW-UP COMMITMENTS

Mitigation is proposed to reduce or eliminate adverse environmental effects. Most potential environmental effects will be addressed by general design mitigation and best management practices, and by VC-specific mitigation. A summary of mitigation, monitoring and follow-up commitments is provided in Table 13.2.1.

Table 13.2.1 Summary of Commitments

No.	Proponent Commitments	EIS Section Reference
General		
1	Contractors and subcontractors shall be required to demonstrate conformance with the requirements that have been established, including HSSE standards and performance requirements.	12.1
2	As part of the CNSOPB authorization process for exploration drilling, BP will submit the following plans to the CNSOPB for review and approval: • an Environmental Protection Plan (EPP); • a Safety Plan; • an Incident Management Plan; • a Spill Response Plan; and • a Canada-Nova Scotia Benefits Plan.	12.1
3	BP will obtain a Certificate of Fitness from an independent third party Certifying Authority for the MODU prior to commencement of drilling operations in accordance with the *Nova Scotia Offshore Certificate of Fitness Regulations*.	9.2
4	The observation, forecasting and reporting of physical environment data will be conducted in accordance with the *Offshore Physical Environment Guidelines* (NEB *et al.* 2008).	9.2
5	BP and contractors working on the Project will regularly monitor weather forecasts to forewarn PSVs, helicopters and the MODU of inclement weather or heavy fog before it poses a risk to their activities and operations. Extreme weather conditions that are outside the operating limits of PSVs or helicopters will be avoided if possible. Captains/Pilots will have the authority and obligation to suspend or modify operations in case of adverse weather or poor visibility that compromises the safety of PSV, helicopter, or MODU operations.	9.2
6	Icing conditions and accumulation rates on PSVs, helicopters, and the MODU will be monitored during fall and winter operations, particularly when gale-force winds may be combined with air temperatures below -2°C (DFO 2012c).	9.2
7	Safe work practices will be implemented to reduce exposure of personnel to lightning risk (*e.g.*, restriction of access to external areas on the MODU or PSV during thunder and lightning events).	9.2
8	Prior to any drilling activity, BP will conduct a comprehensive regional geohazard baseline review (GBR), followed by detailed geohazard assessments for each proposed wellsite.	2.2, 9.2
9	The well design and location for the proposed wells have not yet been finalized. Once confirmed, these details for the wells will be provided for review and approval to the CNSOPB as part of the OA and ADW for each well submitted in association with the Project.	2.3.2

Table 13.2.1 Summary of Commitments

No.	Proponent Commitments	EIS Section Reference
10	Prior to installation on the well, the BOP stack will be pressure tested on the MODU deck, and then again following installation on the well to test the wellhead connection with the BOP.	2.5
11	BP will continue to engage commercial and Aboriginal fishers to share Project details as applicable and facilitate coordination of information sharing. A Fisheries Communication Plan will be used to facilitate coordinated communication with fishers.	3.4, 4.5, 7.6, 7.7
12	BP will provide details of the safety (exclusion) zone to the Marine Communication and Traffic Services for broadcasting and publishing in the Notices to Shipping and Notices to Mariners. Details of the safety (exclusion) zone will also be communicated during ongoing consultations with commercial fishers.	7.6, 7.7
13	Project-related damage to fishing gear, if any, will be compensated in accordance with the Compensation Guidelines with Respect to Damages Relating to Offshore Petroleum Activity (C-NLOPB and CNSOPB 2002).	7.6, 7.7, 8.5.5.2, 8.5.6.2
Presence and Operation of MODU		
14	To maintain navigational safety at all times during the Project, obstruction lights, navigation lights and foghorns will be kept in working condition on board the MODU and PSVs. Radio communication systems will be in place and in working order for contacting other marine vessels as necessary.	2.4, 7.6, 7.7, 9.2
15	The MODU will be equipped with local communication equipment to enable radio communication between the PSVs and the MODU's bridge. Communication channels will also be put in place for internet access, and enable communication between the MODU and shore.	2.4
16	In accordance with the Nova Scotia Offshore Drilling and Production Regulations, a safety (exclusion) zone (estimated to be a 500-m wide radius) will be established around the MODU within which non-Project related vessels are prohibited.	2.4.1, 8.1.3.1
17	BP will conduct an imagery based seabed survey in the vicinity of wellsites to ground-truth the findings of the GBR. This includes confirming the absence of shipwrecks, debris on the seafloor, unexploded ordnance and sensitive environmental features, such as habitat-forming corals or species at risk. The survey will be carried out prior to drilling. If any environmental or anthropogenic sensitivities are identified during the survey, BP will move the wellsite to avoid affecting them if it is feasible to do so. If it is not feasible, BP will consult with the CNSOPB to determine an appropriate course of action.	2.2, 7.2, 7.5, 9.2, 11.2
18	No Project well locations will be located within the Haddock Box.	7.2, 7.5
19	Lighting will be reduced to the extent that worker safety and safe operations is not compromised. Reduction of light may include avoiding use of unnecessary lighting, shading, and directing lights towards the deck.	7.2, 7.4
20	PSV and MODU contractors will have a Maintenance Management System designed to ensure that the vessels and MODU, and all equipment, are well maintained and operated efficiently.	7.3

Table 13.2.1 Summary of Commitments

No.	Proponent Commitments	EIS Section Reference
21	Routine checks for stranded birds will be conducted on the MODU and PSVs and appropriate procedures for release will be implemented. If stranded birds are found during routine inspections, they will be handled using the protocol outlined in *The Leach's Storm Petrel: General Information and Handling Instructions* (Williams and Chardine 1999), including obtaining the associated permit from CWS. Activities will comply with the requirements for documenting and reporting any stranded birds (or bird mortalities) to CWS during the drilling program.	7.4
Waste Management		
22	Air emissions from the Project will adhere to applicable regulations and standards including the Nova Scotia *Air Quality Regulations* under the Nova Scotia *Environment Act,* the National Ambient Air Quality Objectives (SO_2, NO_2, total suspended PM, and CO) and the Canadian Ambient Air Quality Standards (fine PM).	2.8
23	Ultra-low sulphur diesel (ULSD) fuel will be used for the Project wherever practicable and available.	2.8.1
24	Offshore waste discharges and emissions associated with the Project (*i.e.*, operational discharges and emissions from the MODU and PSVs) will be managed in accordance with relevant regulations and municipal bylaws as applicable, including the OWTG and International Convention for the Prevention of Pollution from Ships (MARPOL), of which Canada has incorporated provisions under various sections of the *Canada Shipping Act*. Waste discharges not meeting legal requirements will not be discharged to the ocean and will be brought to shore for disposal.	2.8, 7.2, 7.3, 7.4, 7.5
25	Selection of drilling chemicals will be in accordance with the OCSG which provides a framework for chemical selection to reduce potential for environmental effects. During planning of drilling activities, where feasible, lower toxicity drilling muds and biodegradable and environmentally friendly additives within muds and cements will be preferentially used. Where feasible the chemical components of the drilling fluids will be those that have been rated as being least hazardous under the OCNS scheme and as PLONOR by OSPAR.	2.8, 7.2, 7.3, 7.4, 7.5
26	Discharges of SBM mud and cuttings will be managed in accordance with the OWTG. SBM cuttings will only be discharged once the performance targets in OWTG of 6.9 g/100 g retained "synthetic on cuttings" on wet solids can be satisfied. The concentration of SBM on cuttings will be monitored on the MODU for compliance with the OWTG. In accordance with OWTG, no excess or spent SBM will be discharged to the sea. Spent or excess SBM that cannot be re-used during drilling operations will be brought back to shore for disposal.	2.8, 7.2, 7.3, 7.4, 7.5
27	Excess cement may be discharged to the seabed during the initial phases of the well, which will be drilled without a riser. Once the riser has been installed, all cement waste will be returned to the MODU. Cement waste will then be transported to shore for disposal in an approved facility.	2.8, 7.2, 7.3, 7.4, 7.5
28	Small amounts of produced water may be flared. If volumes of produced water are large, some produced water may be brought onto the MODU for treatment so that it can be discharged in line with the OWTG.	2.8, 7.2, 7.3, 7.4, 7.5
29	Deck drainage and bilge water will be discharged according to the OWTG which state that deck drainage and bilge water can only be discharged if the residual oil concentration of the water does not exceed 15 mg/L.	2.8, 7.2, 7.3, 7.4, 7.5

Table 13.2.1 Summary of Commitments

No.	Proponent Commitments	EIS Section Reference
30	Ballast water will be discharged according to IMO *Ballast Water Management Regulations* and Transport Canada's *Ballast Water Control and Management Regulations.* The MODU will carry out ballast tank flushing prior to arriving in Canadian waters.	2.8, 7.2, 7.3, 7.4, 7.5
31	Sewage will be macerated prior to discharge. In line with the OWTG and International Convention for the Prevention of Pollution from Ships (MARPOL) requirements, sewage will be macerated so that particles are less than 6 mm in size prior to discharge.	2.8, 7.2, 7.3, 7.4, 7.5
32	Cooling water will be discharged in line with the OWTG which states that any biocides used in cooling water are selected in line with a chemical management system developed in line with the OCSG.	2.8, 7.2, 7.3, 7.4, 7.5
33	BOP fluids and any other discharges from the subsea control equipment will be discharged according to OWTG and OCSG.	2.8, 7.2, 7.3, 7.4, 7.5
34	Any hydrocarbons, such as gas, oil or formation water that are brought to surface as part of well test activity will be flared to enable their safe disposal. All flaring will be via one of two horizontal burner booms, to either a high efficiency burner head for liquids, or simple open ended gas flare tips for gases to minimize fall out of uncombusted hydrocarbons. Flaring will be optimized to the amount necessary to characterize the well potential and as necessary for the safety of the operation.	2.8, 7.2, 7.3, 7.4, 7.5
35	Liquid wastes, not approved for discharge in OWTG such as waste chemicals, cooking oils or lubricating oils, will be transported onshore for transfer to an approved disposal facility.	2.8, 7.2, 7.3, 7.4, 7.5
36	All waste generated offshore on the MODU and PSVs will be handled and disposed of in accordance with relevant regulations and municipal bylaws. Waste management plans and procedures will be developed and implemented to prevent unauthorized waste discharges and transfers.	2.8, 7.2, 7.3, 7.4, 7.5
37	Putrescible solid waste, specifically food waste generated offshore on the MODU and PSVs, will be disposed of according to OWTG and MARPOL requirements. In particular, food waste will be macerated so that particles are less than 6 mm in diameter and then discharged. There will be no discharge of macerated food waste within 3 nm from land.	2.8, 7.2, 7.3, 7.4, 7.5
38	Biomedical waste will be collected onboard by the doctor and stored in special containers before being sent to land for incineration.	2.8
39	Transfer of hazardous wastes will be conducted according to the *Transportation of Dangerous Goods Act.* Any applicable approvals for the transportation, handling and temporary storage, of these hazardous wastes will be obtained as required.	2.8, 7.2, 7.3, 7.4, 7.5
40	Information on the releases, wastes and discharges will be reported as part of a regular environmental reporting program in accordance with regulatory requirements as described in the OWTG.	2.8
Vertical Seismic Profiling		
41	VSP activity will be planned and conducted in consideration of the Statement of *Canadian Practice with respect to the Mitigation of Seismic Sound in the Marine Environment* (SOCP, DFO 2007b).	2.4.3.2, 7.2, 7.3, 7.5
42	BP will use the minimum amount of energy necessary to achieve operational objectives; reduce the energy at frequencies above those necessary for the purpose of the survey; and will reduce the proportion of energy that propagates horizontally.	7.2

Table 13.2.1 Summary of Commitments

No.	Proponent Commitments	EIS Section Reference
43	BP will consult with DFO regarding relevant findings from the 2014 CSAS review (DFO 2015a), including additional recommended mitigation that would be appropriate for implementation during VSP prior to Project commencement.	7.3
44	Marine Mammal Observers (MMOs) will be used to monitor and report on marine mammal and sea turtle sightings during VSP surveys to enable shutdown or delay actions to be implemented in the presence of a marine mammal or sea turtle species listed on Schedule 1 of SARA, as well as all other baleen whales and sea turtles (see also Section 7.3.10).	7.3
45	A ramp-up procedure (*i.e.*, gradually increasing seismic source elements over a period of approximately 30 minutes until the operating level is achieved) will be implemented before any VSP activity begins.	7.2, 7.3, 7.4
46	Shutdown procedures (*i.e.,* shutdown of source array) will be implemented if a marine mammal or sea turtle species listed on Schedule 1 of SARA, as well as all other baleen whales (*i.e*., mysticetes) and sea turtles are observed within 650 m of the wellsite.	7.3
47	Passive acoustic monitoring (PAM) will be used to detect vocalizing marine mammals during conditions of low visibility (*e.g*., fog and darkness). The technical specifications and operational deployment configuration of the PAM system will be optimized within the bounds of operational and safety constraints in order to maximize the likelihood of detecting cetacean species anticipated being in the area.	7.3
Supply and Servicing Operations		
48	Helicopters transiting to and from the MODU will fly at altitudes greater than 300 m (with the exception of approach and landing activities) and at a lateral distance of 2 km around active bird colonies when possible. Helicopters will avoid flying over Sable Island (a 2 km buffer will be recognized) except as needed in the case of an emergency.	2.4, 7.3, 7.4, 7.5
49	To reduce the risk of marine mammal vessel strikes, Project PSVs will avoid currently-identified critical habitat for the North Atlantic right whale (Roseway Basin) and northern bottlenose whale (the Gully, and Shortland and Haldimand canyons), during transiting activities within the LAA and outside the Project Area, except as needed in the case of an emergency.	7.3, 7.5
50	PSVs travelling from mainland Nova Scotia will follow established shipping lanes in proximity to shore. During transit to/from the Project Area, PSVs will travel at vessel speeds not exceeding 22 km/hour (12 knots) except as needed in the case of an emergency	7.3, 7.4, 7.6, 7.7
51	In order to reduce the potential for vessel collisions during transiting activities outside the Project Area, vessels will reduce speed in the event that a marine mammal or sea turtle is noted in proximity to the vessel.	7.3
52	In the event that a vessel collision with a marine mammal or sea turtle occurs, BP will contact the Marine Animal Response Society or the Canadian Coast Guard to relay incident information.	7.3
53	PSVs will maintain a 2 km avoidance buffer around Sable Island and associated bird colonies in that area except in the case of an emergency.	7.4
54	Should critical habitat be formally designated for leatherback sea turtle or other SAR within the RAA over the term of the exploration licences, BP will comply with applicable restrictions or mitigations developed for the marine shipping industry to reduce the risks of vessel strikes in these areas.	7.3

Table 13.2.1 Summary of Commitments

No.	Proponent Commitments	EIS Section Reference
55	Lighting on PSVs will be reduced to the extent that worker safety and safe operations is not compromised. Reduction of light may include avoiding use of unnecessary lighting, shading, and directing lights towards the deck.	7.4
56	The PSVs selected for this Project will be equipped for safe all-weather operations, including stability in rough sea conditions and inclement weather. In addition, measures to reduce superstructure icing hazards on PSVs will be implemented as necessary and may include (DFO 2012c): • reducing vessel speed in heavy seas; • placing gear below deck and covering deck machinery, if possible; • moving objects that may prevent water drainage from the deck; • making the ship as watertight as possible; and • manual removal of ice if required under severe icing conditions.	9.2
57	A PSV will remain on standby at the MODU at all times in the event that operational assistance or emergency response support is required.	2.3.3
58	PSVs will undergo BP's internal verification process as well as additional external inspections/audits inclusive of the CNSOPB pre-authorization inspection process in preparation for the Project.	2.4.5.1, 9.2
Well Abandonment		
59	A seabed survey will be conducted at the end of the drilling program using an ROV to survey the seabed for debris.	2.4
60	Once wells have been drilled to TD and well evaluation programs completed (if applicable), the well will be plugged and abandoned in line with applicable BP practices and CNSOPB requirements. The final well abandonment program has not yet been finalized; however, these details will be confirmed to the CNSOPB as planning for the Project continues.	2.4, 7.1, 7.2, 7.3, 7.5, 7.6, 7.7
Accidental Events		
61	Procedures will be put in place to ensure that hoses are inspected and operated correctly to minimize the risk of an unintended release. The vessels, MODU and supply base will be equipped with primary spill contingency equipment to deal with spills in the unlikely event that they occur.	2.4
62	BP will implement multiple preventative and response barriers to manage risk of incidents occurring and mitigate potential consequences. The Project will operate under an Incident Management Plan (IMP) which will include a number of specific contingency plans for responding to specific emergency events, including potential spill or well control events. The IMP and supporting specific contingency plans, such as a Spill Response Plan (SRP), will be submitted to the CNSOPB prior to the start of any drilling activity as part of the OA process. The SRP will set out tactical response methods, procedures and strategies for safely responding to different spill scenarios. Tactical response methods that will be considered following a spill incident include: offshore containment and recovery; surveillance and tracking; dispersant application; in-situ burning; shoreline protection; shoreline clean up; and oiled wildlife response.	8.5.1, 8.5.2, 8.5.3, 8.5.4, 8.5.5, 8.5.6
63	BP will undertake a NEBA as part of the OA process with the CNSOPB to evaluate the risks and benefits of dispersing oil into the water column, and will obtain regulatory approval for any use of dispersants as required.	8.5.1, 8.5.2, 8.5.3, 8.5.4

Table 13.2.1 Summary of Commitments

No.	Proponent Commitments	EIS Section Reference
64	In the event that oil does reach the shoreline, a shoreline clean-up and remediation team will be mobilized to the affected areas. A SCAT survey will be conducted to inform shoreline clean-up and remediation as applicable. BP will also engage specialized expertise to deflect oil from sensitive areas, and recover and rehabilitate wildlife species as needed.	8.5.3
65	BP will include procedures for informing fishers of an accidental event and appropriate response within the Fisheries Communication Plan. Emphasis is on timely communication, thereby providing fishers with the opportunity to haul out gear from affected areas, reducing potential for fouling of fishing gear.	8.5.5, 8.5.6
66	In the unlikely event of a spill, specific monitoring (*e.g.*, environmental effects monitoring) and follow up programs may be required and will be developed in consultation with applicable regulatory agencies.	8.5.5, 8.5.6
67	Incidents will be reported in accordance with the Incident Reporting and Investigation Guidelines (C-NLOPB and CNSOPB 2012). BP will submit a report to the CNSOPB documenting the implementation schedule (prior to drilling) and the outcome of follow-up and monitoring programs (post-abandonment) of each well, along with any additional conditions of approval, as applicable. The implementation schedule and results will be made available online for public information.	8.3
Follow-up and Monitoring		
68	BP will submit a report to the CNSOPB documenting the implementation schedule (prior to drilling) and the outcome of follow-up and monitoring programs (post-abandonment) of each well, along with any additional conditions of approval, as applicable. The implementation schedule and results will be made available online for public information.	12.2
69	BP will conduct a visual survey of the seafloor during and after drilling activities to verify drill waste dispersion modelling predictions.	7.2
70	BP will assess in consultation with the appropriate authorities the potential for undertaking an acoustic monitoring program during the drilling program to collect field measurements of underwater sound in order to verify predicted underwater sound levels. The objectives of such a program will be identified in collaboration with DFO and the CNSOPB and in consideration of lessons learned from the underwater sound monitoring program to be undertaken by Shell as part of the Shelburne Basin Venture Exploration Drilling Project in 2016.	7.2, 7.3, 7.5

13.3 RESIDUAL ENVIRONMENTAL EFFECTS

Section 7 of this EIS presents the residual environmental effects for routine operations for each VC. Table 13.3.1 summarizes the residual effect findings for each VC and indicates the significance of these effects. Section 8 of this EIS presents the residual environmental effects for accidental events for each VC. Table 13.3.2 summarizes the residual effect findings for each VC and indicates the significance of these effects. Where an effect is predicted to be significant (refer to Section 7 for significance criteria for each VC), the likelihood of that effect occurring is also presented.

Table 13.3.1 Summary of Residual Effects for Routine Operations

Valued Component	Area of Federal Jurisdiction (CEAA, 2012 s.5 "environmental effect")	Potential Effect	Project Activity	Mitigation Reference (refer to Table 13.2.1)	Residual Effect Characterization					Other Criteria Used to Determine Significance (Ecological/ Socio-economic Context)	Significance of Residual Effect	Likelihood of Significant Effect
					Magnitude	Extent	Duration	Frequency	Reversibility			
Fish and Fish Habitat	s. 5(1)(a)(i)	Change in Risk of Mortality or Physical Injury	Presence and Operation of MODU (including well drilling and testing operations and associated lights, safety zone and underwater sound)	see Section 7.2.8.2 and Table 13.2.1	L	PA	MT	C	R	D	N	N/A
			Waste Management (including discharge of drill muds and cuttings and other drilling and testing emissions)		L	PA	MT	R	R	D	N	N/A
			Vertical Seismic Profiling		L	LAA	ST	IR	R	D	N	N/A
		Change in Habitat Quality and Use	Presence and Operation of MODU (including well drilling and testing operations and associated lights, safety zone and underwater sound)		L	LAA	MT	C	R	D	N	N/A
			Waste Management (including discharge of drill muds and cuttings and other drilling and testing emissions)		L	PA	MT	R	R	D	N	N/A
			Vertical Seismic Profiling		L	LAA	ST	IR	R	D	N	N/A
			Supply and Servicing Operations (including helicopter transportation and PSV operations)		L	LAA	MT	R	R	D	N	N/A
			Well Abandonment		L	PA	ST	IR	R	D	N	N/A
Marine Mammals and Sea Turtles	s. 5(1)(a)(ii)	Change in Risk of Mortality or Physical Injury	Presence and Operation of MODU (including lights, safety zone and underwater sound)	see Section 7.3.8.2 and Table 13.2.1	L	PA	MT	C	R	D	N	N/A
			Vertical Seismic Profiling		L	PA	ST	IR	R	D	N	N/A
			Supply and Servicing (PSV Operations)		L	LAA	MT	R	R	D	N	N/A
		Change in Habitat Quality and Use	Presence and Operation of MODU (including well drilling and testing operations and associated lights, safety zone and underwater sound)		M	RAA	MT	C	R	D	N	N/A
			Waste Management (including discharge of drill muds and cuttings and other drilling and testing emissions)		L	PA	MT	IR	R	D	N	N/A
			Vertical Seismic Profiling		L	PA	ST	IR	R	D	N	N/A
			Supply and Servicing (including helicopter transportation and PSV operations)		L	LAA	MT	R	R	D	N	N/A
			Well Abandonment		L	PA	ST	IR	R	D	N	N/A

Table 13.3.1 Summary of Residual Effects for Routine Operations

Valued Component	Area of Federal Jurisdiction (CEAA, 2012 s.5 "environmental effect")	Potential Effect	Project Activity	Mitigation Reference (refer to Table 13.2.1)	Residual Effect Characterization					Other Criteria Used to Determine Significance (Ecological/ Socio-economic Context)	Significance of Residual Effect	Likelihood of Significant Effect
					Magnitude	Extent	Duration	Frequency	Reversibility			
Migratory Birds	s. 5(1)(a)(iii)	Change in Risk of Mortality or Physical Injury	Presence and Operation of MODU (including drilling and testing operations and associated lights, safety zone and underwater sound)	see Section 7.4.8.2 and Table 13.2.1	L-M	PA	MT	C	R	U	N	N/A
			Waste Management (including discharge of drill muds and cuttings and other drilling and testing emissions)		N	PA	MT	R	R	U	N	N/A
			Vertical Seismic Profiling		N	PA	ST	IR	R	U	N	N/A
			Supply and Servicing (including helicopter transportation and PSV operations)		L	LAA	MT	R	R	U-D	N	N/A
		Change in Habitat Quality and Use	Presence and Operation of MODU (including drilling and testing operations and associated lights, safety zone and underwater sound)		L	PA	MT	C	R	U	N	N/A
			Waste Management (including discharge of drill muds and cuttings and other drilling and testing emissions)		N	PA	MT	R	R	U	N	N/A
			Vertical Seismic Profiling		L	PA	ST	IR	R	U	N	N/A
			Supply and Servicing Operations (including helicopter transportation PSV operations)		N-L	LAA	MT	R	R	U-D	N	N/A
Special Areas	s. 5(1)(b)(i)	Change in Habitat Quality	Presence and Operation of MODU (including drilling and testing operations and associated lights, safety zone and underwater sound)	see Section 7.5.8.2 and Table 13.2.1	L-M	LAA	ST-MT	C	R	D	N	N/A
			Waste Management (including discharge of drill muds and cuttings and other drilling and testing emissions)		L	PA	MT	R	R	U	N	N/A
			Vertical Seismic Profiling		L	LAA	ST	IR	R	D	N	N/A
			Supply and Servicing Operations (including helicopter transportation and PSV operations)		L	LAA	MT	R	R	D	N	N/A
			Well Abandonment		L	PA	ST	IR	R	U	N	N/A

Table 13.3.1 Summary of Residual Effects for Routine Operations

Valued Component	Area of Federal Jurisdiction (CEAA, 2012 s.5 "environmental effect")	Potential Effect	Project Activity	Mitigation Reference (refer to Table 13.2.1)	Residual Effect Characterization					Other Criteria Used to Determine Significance (Ecological/ Socio-economic Context)	Significance of Residual Effect	Likelihood of Significant Effect
					Magnitude	Extent	Duration	Frequency	Reversibility			
Commercial Fisheries	s. 5(2)(b)(i)	Change in Availability of Fisheries Resources	Presence and Operation of MODU (including well drilling and testing operations and associate lights, safety zone and underwater sound)	see Section 7.6.8.2 and Table 13.2.1	L	LAA	MT	C	R	U	N	N/A
			Waste Management (including discharge of drill muds and cuttings and other drilling and testing emissions)		L	PA	MT	R	R	U	N	N/A
			Vertical Seismic Profiling		L	LAA	ST	IR	R	U	N	N/A
			Supply and Servicing Operations (including helicopter transportation and PSV operation)		L	LAA	MT	R	R	U	N	N/A
			Well Abandonment		L	PA	ST	IR	R	U	N	N/A
Current Aboriginal Use of Lands and Resources for Traditional Purposes	s.5(1)(c)(i) s.5(1)(c)(iii)	Change in Traditional Use	Presence and Operation of MODU (including well drilling and testing operations and associate lights, safety zone and underwater sound)	see Section 7.7.8.2 and Table 13.2.1	L	LAA	MT	C	R	U	N	N/A
			Waste Management		L	PA	MT	R	R	U	N	N/A
			Vertical Seismic Profiling		L	LAA	ST	IR	R	U	N	N/A
			Supply and Servicing Operations (including helicopter transportation and PSV operations)		L	LAA	MT	R	R	U	N	N/A
			Well Abandonment		L	PA	ST	IR	R	U	N	N/A

Key/Note:
VC specific definitions included for each VC in Section 7.

Environmental Effects under CEAA, 2012:
5(1)
(a) a change that may be caused to the following components of the environment that are within the legislative authority of Parliament:
- (i) fish as defined in section 2 of the *Fisheries Act* and fish habitat as defined in subsection 34(1) of that Act,
- (ii) aquatic species as defined in subsection 2(1) of the *Species at Risk Act*,
- (iii) migratory birds as defined in subsection 2(1) of the *Migratory Birds Convention Act*, 1994, and
- (iv) any other component of the environment that is set out in Schedule 2 of [CEAA, 2012];

(b) a change that may be caused to the environment that would occur
- (i) on federal lands,
- (ii) in a province other than the one in which the act or thing is done or where the physical activity, the designated project or the project is being carried out, or
- (iii) outside Canada; and

(c) with respect to Aboriginal peoples, an effect occurring in Canada of any change that may be caused to the environment on
- (i) health and socio-economic conditions,
- (ii) physical and cultural heritage,
- (iii) the current use of lands and resources for traditional purposes, or

Magnitude:
N: Negligible
L: Low
M: Moderate
H: High

Geographic Extent:
PA: Project Area
LAA: Local Assessment Area
RAA: Regional Assessment Area

Duration:
ST: Short-term
MT: Medium-term
LT: Long-term

Frequency:
S: Single event
IR: Irregular event
R: Regular event
C: Continuous

Reversibility:
R: Reversible
I: Irreversible

Ecological/Socio-Economic Context:
D: Disturbed
U: Undisturbed

Significance:
S: Significant
N: Not Significant

Likelihood:
U: Unlikely
L: Likely
N/A: Not applicable

Table 13.3.1 Summary of Residual Effects for Routine Operations

Valued Component	Area of Federal Jurisdiction (CEAA, 2012 s.5 "environmental effect")	Potential Effect	Project Activity	Mitigation Reference (refer to Table 13.2.1)	Residual Effect Characterization					Other Criteria Used to Determine Significance (Ecological/ Socio-economic Context)	Significance of Residual Effect	Likelihood of Significant Effect
					Magnitude	Extent	Duration	Frequency	Reversibility			
(iv) any structure, site or thing that is of historical, archaeological, paleontological or architectural significance. Certain additional environmental effects must be considered under section 5(2) of CEAA, 2012 where the carrying out of the physical activity, the designated project, or the project requires a federal authority to exercise a power or perform a duty or function conferred on it under any Act of Parliament other than CEAA, 2012. 5(2) (a) a change, other than those referred to in paragraphs (1)(a) and (b), that may be caused to the environment and that is directly linked or necessarily incidental to a federal authority's exercise of a power or performance of a duty or function that would permit the carrying out, in whole or in part, of the physical activity, the designated project or the project; and (b) an effect, other than those referred to in paragraph (1)(c), of any change referred to in paragraph (a) on (i) health and socio-economic conditions, (ii) physical and cultural heritage, or (iii) any structure, site or thing that is of historical, archaeological, paleontological or architectural significance.												

Table 13.3.2 Summary of Residual Effects for Accident Events

Valued Component	Area of Federal Jurisdiction (CEAA, 2012 s.5 "environmental effect")	Potential Effect	Accidental Event Scenario	Mitigation Reference (refer to Table 13.2.1)	Residual Effect Characterization					Other Criteria Used to Determine Significance (Ecological/ Socio-economic Context)	Significance of Residual Effect	Likelihood of Significant Effect
					Magnitude	Extent	Duration	Frequency	Reversibility			
Fish and Fish Habitat	s. 5(1)(a)(i)	Change in Risk of Mortality or Physical Injury / Change in Habitat Quality and Use	10 bbl Diesel Spill	see Section 8.5.1.2 and Table 13.2.1	L	LAA	ST	S	R	U	N	N/A
			100 bbl Diesel Spill		M	RAA	ST	S	R	U	N	N/A
			PSV Diesel Spill		M	RAA	ST-MT	S	R	U	N	N/A
			Well Blowout		M	RAA*	ST-MT	S	R	U	N	N/A
			SBM Spill		L	LAA	ST	S	R	U	N	N/A
Marine Mammals and Sea Turtles	s. 5(1)(a)(ii)	Change in Risk of Mortality or Physical Injury / Change in Habitat Quality and Use	10 bbl Diesel Spill	see Section 8.5.2.2 and Table 13.2.1	L	LAA	ST	S	R	U	N	N/A
			100 bbl Diesel Spill		M	LAA	ST	S	R	U	N	N/A
			PSV Diesel Spill		M	LAA	ST-MT	S	R	U	N	N/A
			Well Blowout		H	RAA*	ST-MT	S	R	U	S	U
			SBM Spill		L	LAA	ST	S	R	U	N	N/A
Migratory Birds	s. 5(1)(a)(iii)	Change in Risk of Mortality or Physical Injury / Change in Habitat Quality and Use	10 bbl Diesel Spill	see Section 8.5.3.2 and Table 13.2.1	L	LAA	ST	S	R	U	N	N/A
			100 bbl Diesel Spill		M	RAA	ST	S	R	U	S	U
			PSV Diesel Spill		M	RAA	ST-MT	S	R	U	S	U
			Well Blowout		H	RAA*	ST-MT	S	R	U	S	U
			SBM Spill		L	LAA	ST	S	R	U	N	N/A
Special Areas	s. 5(1)(b)(i)	Change in Habitat Quality	10 bbl Diesel Spill	see Section 8.5.4.2 and Table 13.2.1	L	LAA	ST	S	R	U	N	N/A
			100 bbl Diesel Spill		M	LAA	ST	S	R	U	N	N/A
			PSV Diesel Spill		L-M	LAA	ST-MT	S	R	U	N	N/A
			Well Blowout		H	RAA*	ST-MT	S	R	U	S	L
			SBM Spill		L	LAA	ST	S	R	U	N	N/A
Commercial Fisheries	s. 5(2)(b)(i)	Change in Availability of Fisheries Resources	10 bbl Diesel Spill	see Section 8.5.5.2 and Table 13.2.1	L	LAA	ST	S	R	U	N	N/A
			100 bbl Diesel Spill		M	RAA	MT	S	R	U	S	L
			PSV Diesel Spill		H	RAA	MT	S	R	U	S	L
			Well Blowout		H	RAA*	LT	S	R	U	S	L
			SBM Spill		L	LAA	ST	S	R	U	N	N/A
Aboriginal Use of Lands and Resources for Traditional Purposes	s.5(1)(c)(i) s.5(1)(c)(iii)	Change in Traditional Use	10 bbl Diesel Spill	see Section 8.5.6.2 and Table 13.2.1	L	LAA	ST	S	R	U	N	N/A
			100 bbl Diesel Spill		M	RAA	MT	S	R	U	S	L
			PSV Diesel Spill		H	RAA	MT	S	R	U	S	L
			Well Blowout		H	RAA*	LT	S	R	U	S	L
			SBM Spill		L	LAA	ST	S	R	U	N	N/A

Note:
See Table 13.3.1 for key.
In certain scenarios, effects may extend beyond the RAA as indicated by an "".

Table 13.3.3 summarizes the significance of residual effects identified above in Tables 13.3.1 and 13.3.2 for each VC for routine operations, cumulative effects and accidental events, and, where applicable, the likelihood of significant residual adverse environmental effects occurring.

Table 13.3.3 Summary of Residual Environmental Effects for Routine Operations, Accidental Events and Cumulative Effects

VC	Routine Operations	Accidental Effects		Cumulative Effects
	Significance of Residual Environmental Effect	Significance of Residual Environmental Effect	Likelihood of Significant Effect	Significance of Residual Environmental Effect
Fish and Fish Habitat	N	N	N/A	N
Mammals and Sea Turtles	N	S	L	N
Marine Birds	N	S	L	N
Special Areas	N	S	L	N
Commercial Fisheries	N	S	L	N
Current Aboriginal Use of Land and Resources for Traditional Purposes	N	S	L	N

Key:
N = Not significant residual environmental effect (adverse)
S = Significant residual environmental effect (adverse)
L = Low likelihood
N/A = Not Applicable

Mitigation is proposed to reduce or eliminate adverse environmental effects (Table 13.2.1). Mitigation measures have been proposed to address potential Project and cumulative effects and address all components of the Project scope. They include both general Project mitigation measures and best management practices as well as VC-specific mitigation measures. With the implementation of these proposed mitigation measures, residual adverse environmental effects of routine Project activities and components are predicted to be not significant for all VCs.

In the highly unlikely event of a Project-related accidental event resulting in the large-scale release of oil, effects to Marine Mammals and Sea Turtles, Migratory Birds, Special Areas, Commercial Fisheries, and Current Aboriginal Land and Resource Use for Traditional Purposes have potential to be significant if the spill trajectory overlaps spatially and temporally with sensitive receptors. However, with the implementation of proposed well control, spill response, contingency, and emergency response plans significant residual adverse environmental effects are unlikely to occur.

In summary, the Project is not likely to result in significant residual adverse environmental effects, including cumulative environmental effects, provided that the proposed mitigation is implemented.

BP recognizes the challenge of managing and meeting growing worldwide demand for energy while addressing climate change and other environmental and social issues. The proposed Project will contribute to energy diversification and is expected to generate industrial, employment, and social benefits. The Project is also expected to contribute to technological and scientific knowledge sharing in Canada and Nova Scotia, advancing the understanding of deepwater drilling operations offshore Nova Scotia.

14.0 REFERENCES

AANDC [Aboriginal Affairs and Northern Development Canada]. 2011. Aboriginal Consultation and Accommodation-Updated Guidelines for Federal Officials to Fulfill the Duty to Consult. March 2011. Available from: http://www.ainc-inac.gc.ca/eng/1100100014664.

AANDC [Aboriginal Affairs and Northern Development Canada]. 2013. Peace and Friendship Treaties (1725-1779). Available from: http://www.aadncaandc.gc.ca/eng/1360937048903/1360937104633

AANDC [Aboriginal Affairs and Northern Development Canada]. 2015. Aboriginal Peoples and Communities. First Nation Profiles. Available from: http://pse5-esd5.ainc-inac.gc.ca/fnp/Main/Search/SearchFN.aspx?lang=eng

Abbriano, R.M., Carranza, M.M., Hogle, S.L., Levin, R.A., Netburn, A.N., Seto, K.L., Snyder S.M., and Franks, P.J.S. 2011. Deepwater Horizon oil spill: A review of the planktonic response. Oceanography, 24(3): 294-301.

Abegweit First Nation. 2015. Abegweit First Nation. Available from: http://www.abegweit.ca/about/about.php

ACCDC [Atlantic Canada Conservation Data Center]. 2011. Species Ranks. Obtained from the ACCDC, April 2011.

Ackleh, A.S., Loup, G.E., Loup, J.W., Ma, B., Newcomb, J.J., Pal, N., Sidorovskaia, N.A., and Tiemann, C. 2012. Assessing the Deepwater Horizon oil spill impact on marine mammal population through acoustics: endangered sperm whales. J. Acoust. Soc. Am., 131: 2306-2314.

ACZISC [Atlantic Coastal Zone Information Steering Committee]. 2011. State of the Scotian Shelf Report: The Scotian Shelf in Context. Prepared by the ACZISC: Oceans and Coastal Management Division, Bedford Institute of Oceanography, Fisheries and Oceans Canada. Available from: http://coinatlantic.ca/docs/scotian-shelf-in-context.pdf.

Albers, P.H., and Loughlin, T.R. 2003. Effects of PAHs on marine birds, mammals, and reptiles. In: Douben, P.E.T., editor. PAHs: An Ecotoxicological Perspective. John Wiley and Sons, London. pp 243-261.

Allard, K., Hanson, A., and Mahoney, M. 2014. Summary: Important Marine Habitat Areas for Migratory Birds in Eastern Canada. Technical Report Series No. 530, Canadian Wildlife Service, Sackville, New Brunswick.

APC [Atlantic Policy Congress of First Nations Chiefs Secretariat]. 2014. Executive Director Report 2014–2015. Available from: http://www.apcfnc.ca/images/uploads/APC_Annual_Report_-_Final_2014-15-W6.pdf.

ASM [American Society for Microbiology]. 2011. A Report from the American Academy of Microbiology: Microbes and Oil Spills, FAQ. 16pp.

Assembly of Nova Scotia Mi'kmaq Chiefs. 2007. Mi'kmaq Ecological Knowledge Study Protocol, 1st Edition. Produced by Mi'kmaq Rights Initiative. Available from: http://www.aboriginalsustainabilitynetwork.org/wp-content/uploads/2009/01/mikmaq-ecological-knowldege-study-protocol.pdf.

Atlantic Leatherback Turtle Recovery Team. 2006. Recovery Strategy for Leatherback Turtle (Dermochelys coriacea) in Atlantic Canada. Species at Risk Act Recovery Strategy Series. Fisheries and Oceans Canada, Ottawa, vi + 45pp.

Au, W.W.L., and Hastings, M.C. 2008. Principles of marine bioacoustics. Spring Science, LCC.

Bain, D.E., and Williams, R. 2006. Long-range effects of airgun noise on marine mammals: responses as a function of received sound level and distance. Paper SC/58/E35 presented to the IWC Scient. Commit., IWC Annu. Meet., 1-13 June, St. Kitts.

Bakke, T., Green, A.M.V., and Iversen, P.E. 2011. Offshore environmental monitoring in Norway: Regulations, results and developments (Chapter 25). In: Lee, K., Neff, J., editors. Produced Water, Springer, NY.

Bakke, T., Green, N.W., Næs, K., and Pedersen, A. 1986. Drill cuttings on the sea bed: phase 1 and 2. Field experiments on benthic recolonization and chemical changes in response to various types and amounts of cuttings. In: SFT/Statfjord Unit Joint Research Project Symposium, 24-26 February 2006, Trondheim, Norway.

Bakke, T., Klungsøyr, J., and Sanni, S. 2013. Environmental impacts of produced water and drilling waste discharges from the Norwegian offshore petroleum industry. Mar. Environ. Res., 92: 154-169.

Beauchamp, J., Bouchard, H., de Margerie, P., Otis, N., and Savaria, J.Y., 2009. Recovery Strategy for the Blue Whale Balaenoptera musculus (Northwest Atlantic Population) in Canada [Final]. Species at Risk Act Recovery Strategy Series. Fisheries and Oceans Canada, Ottawa. 62pp.

Bédard, J. 1985. Evolution and characteristics of the Atlantic Alcidae. Pages 1-53 in D. N. Nettleship and T. R. Birkhead (eds.). The Atlantic Alcidae: the evolution, distribution, and biology of the auks inhabiting the Atlantic Ocean and adjacent water areas. Academic Press, N.Y.

Belanger, M., Tan, L., Askin, N., and Wittnich, C. 2010. Chronological effects of the Deepwater Horizon Gulf of Mexico oil spill on regional seabird casualties. J. Mar. Anim. Ecol., 3: 10-14.

BEPCo. Canada Company. 2004. Environmental Assessment Report-Exploration Drilling on EL2407. Prepared by Jacques Whitford Ltd. in association with S.L. Ross Environmental Research Ltd. and Coastal Oceans Associates Ltd.

Berg, R. 2015. National Hurricane Centre Tropical Cyclone Report – Hurricane Arthur 1-5 July 2014. AL012014. 43 p. Available from: http://www.nhc.noaa.gov/data/tcr/AL012014_Arthur.pdf.

Best, B. 2009. Atlantic Cod in Canada [presentation]. DFO. Economic Analysis and Statistics.

BIO [Bedford Institute of Oceanography]. 2013a. Smooth Skate (Malacoraja senta). Bedford Institute of Oceanography-Research. Fisheries and Oceans Canada. Available from: http://www.bio.gc.ca/science/research-recherche/fisheries-pecheries/rays-raies/atlantic-atlantique/malacoraja-senta-eng.php.

BIO [Bedford Institute of Oceanography]. 2013b. Scotian Slope/Rise Monitoring Program. [updated 26 Mar 2013; cited 10 Dec 2013]. Available from: http://www.bio.gc.ca/science/monitoring-monitorage/azomp-pmzao/slope-pente/slope-pente-eng.php.

Blackwell S.B., Nations C.S., McDonald T.L., Greene C.R. Jr., Thode A.M., Guerra M., *et al.* Effects of airgun sounds on bowhead whale calling rates in the Alaskan Beaufort Sea. Mar Mamm Sci. 2013;29(4): E342–E365.

Blake, E. 2015. National Hurricane Centre Tropical Cyclone Report – Hurricane Bertha 1-6 August 2014. AL032014. 16 p. Available from: http://www.nhc.noaa.gov/data/tcr/AL032014_Bertha.pdf.

Boersma, P.D., Parrish, J.K., and Kettle, A.B. 1995. Common murre abundance, phenology, and productivity on the Barren Islands, Alaska: The Exxon Valdez oil spill and long-term environmental change. In: Wells, P.G., Butler, J.N., Hughes, J.S., editors. Exxon Valdez Oil Spill: Fate and Effects in Alaskan Waters. ASTM STP 1219. American Society for Testing and Materials, Philadelphia, PA. 965 pp: 820-853.

Booman, C., Dalen, J., Leivestad, H., Levsen, A., van der Meeren, T., and og Toklum, K. 1996. Effekter av luftkanonskyting på egg, larver og yngel. Undersøkelser ved Havforskningsinstituttet og Zoologisk Laboratorium, UiB. (Engelsk sammendrag og figurtekster). Havforskningsinstituttet, Bergen. *Fisken og Havet,* nr. 3 (1996). 83 s.

Bossart, G.D., Lutcavage, M., Mealey, B., and Lutz, P. 1995. The dermatopathologic effects of oil on loggerhead sea turtles (*Caretta caretta*). In: Frink, L., Ball-Weir, and K., Smith, C. (eds.).

Wildlife and Oil Spills: Response, Research, and Contingency Plan. Tri-State Bird Rescue and Research, DE. 182 pp: 180-181.

Boudreau, P.R., Gordon, D.C., Harding, G.C., Loder, J.W., Black, J., Bowen, W.D., Campana, S., Crandford, P.J., Drinkwater, K.F., and van Eeckhaute, L. 1999. The possible environmental impacts of petroleum exploration activities on the Georges Bank ecosystem. DFO Can. Stock Assess. Sec. Res. Doc 98/170.

Boudreau, S.A. 2013. Primary and Secondary Producers: State of the Scotian Shelf Report. Can. Tech. Rep. Fish. Aquat. Sci. 3074.

Bourne, W.R.P. 1979. Birds and gas flares. Mar. Pollut. Bull., 10: 124-125.

Bowen, W.D., den Heyer, C., McMillan, J.I., and Hammill, M.O. 2011. Pup Production of Scotian Shelf Grey Seal Halichoerus grypus Colonies in 2010. DFO. Can. Sci. Advis. Sec. Res. Doc. 2011/066: vi + 25pp.

Boyne, A.W., and Amirault, D.L. 1999. Habitat characteristics of piping plover nesting beaches in Nova Scotia, New Brunswick and Prince Edward Island. In: Higgins, K.F., Brashier, M.R., and Kruse, C.D. (eds.). Proceedings, Piping Plovers and Least Terns of the Great Plains and Nearby. Brookings: South Dakota State University. 132 pp.

BP. 2003. Environmental Assessment of Exploration Drilling of the Cabot Licence EL 2403 Final Report (BP December 2003).

BP. 2010. Deepwater Horizon Accident Investigation Report. Available from: http://www.bp.com/content/dam/bp/pdf/sustainability/issue-reports/Deepwater_Horizon_Accident_Investigation_Report.pdf.

BP. 2014a. Sustainability Report: Building a stronger, safer BP. Available from: http://www.bp.com/content/dam/bp/pdf/sustainability/group-reports/Sustainability_Report_2014.pdf.

BP. 2014b. BP Oil Spill Dispersant Use Manual.

BP. 2015. Energy Outlook 2035 – Regional Insights: North America. Available from: http://www.bp.com/content/dam/bp/pdf/energy-economics/energy-outlook-2015/Energy-Outlook-2035-Focus-on-North-America.pdf
http://www.bp.com/en/global/corporate/abouSustainability.

BRAHSS [Behavioural Response of Australian Humpback whales to Seismic Surveys]. 2015. Website. Available at: http://www.brahss.org.au/.

Breeze, H., Fenton, D., Rutherford, R.J., and Silva, M.A. 2002. The Scotian Shelf: An Ecological Overview for Ocean Planning. DFO Ca. Tech. Rep. Fish. Aquat. Sci. 2393.

Brickman, D., and Drozdowski, A. 2012. Canadian Technical Report of Hydrography and Ocean Sciences: Atlas of Model Currents and Variability in Maritime Canadian Waters. vi+ 64pp.

Brodie, P.F. 2000. Halifax Harbour and Marine Mammals: Life in the Shipping Lanes. Preserving the Environment of Halifax Harbour. [Workshop #1]. Halifax Regional Municipality and Fisheries and Oceans Canada.

Brown, D.P. 2015a. National Hurricane Centre Tropical Cyclone Report – Hurricane Gonzalo 12-19 October 2014. AL082014. 30 p. Available from: http://www.nhc.noaa.gov/data/tcr/AL082014_Gonzalo.pdf.

Brown, D.P. 2015b. National Hurricane Centre Tropical Cyclone Report – Hurricane Cristobal 23-29 August 2014. AL042014. 14 p. Available from: http://www.nhc.noaa.gov/data/tcr/AL042014_Cristobal.pdf.

Brown, M.W., Fenton, D., Smedbol, K., Merriman, C., Robichaud-Leblanc, K., and Conway, J.D. 2009. Recovery Strategy for the North Atlantic Right Whale (Eubalaena glacialis) in Atlantic Canadian Waters [Final]. Species at Risk Act Recovery Strategy Series. Fisheries and Oceans Canada. vi + 66p.

Brown, R.G.B. 1986. Revised Atlas of Eastern Canadian Seabirds. Bedford Institute of Oceanography, Dartmouth, NS, and Canadian Wildlife Service, Ottawa, ON.

Bruinzeel, L.W., and van Belle, J. 2010. Additional Research on the Impact of Conventional Illumination of Offshore Platforms in the North Sea on Migratory Bird Populations. A&W-rapport 1439. Altenburg & Wymenga Ecologisch Onderzoek, Feanwalden.

Bruinzeel, L.W., van Belle, J., and Davids, L. 2009. The Impact of Conventional Illumination of Offshore Platforms in the North Sea on Migratory Bird Populations. A&W-rapport 1227. Altenburg & Wymenga Ecologisch Onderzoek, Feanwalden.

Bruneau, B., and Grégoire, F. 2011. Spatial distribution study of Atlantic mackerel (Scomber scombrus) and Capelin (Mallotus villosus) abundance data from winter groundfish surveys in NAFO Divisions 4VW using generalized additive models. Can. Tech. Rep. Fish. Aquat. Sci. 2930: vi + 21 pp.

Bundy, A., Themelis, D., Sperl, J., and den Heyer, N. 2014. Inshore Scotian Shelf Ecosystem Overview Report: Status and Trends. DFO Can. Sci. Advis. Sec. Res. Doc. 2014/065. xii + 213 p. Available from: http://www.dfo-mpo.gc.ca/csas-sccs/publications/resdocs-docrech/2014/2014_065-eng.pdf.

Burbridge, C. 2011. State of the Scotian Shelf Report: Marine Habitats and Communities. Prepared for the Atlantic Coastal Zone Information Steering Committee [ACZISC]. 31 pp. Available from: http://coinatlantic.ca/docs/marine-habitats-and-communities.pdf.

Burger, A.E. 1993. Estimating the mortality of seabirds following oil spills: effects of spill volume. Mar. Pollut. Bull., 26: 140-143.

Burrows, W. R., and Kochtubajda, B. 2010. A Decade of Cloud-to-Ground Lightning in Canada: 1999–2008. Part 1: Flash Density and Occurrence. Atmosphere-Ocean 48 (3) 2010, 177–194. Available from: http://www.vaisala.com/Vaisala%20Documents/Scientific%20papers/8.Burrows,%20Kochtubajda.pdf.

Butler, R.G., Harfenist, A., Leighton, F.A., and Peakall, D.B. 1988. Impact of sublethal oil and emulsion exposure on the reproductive success of Leach's storm-petrels: short and long-term effects. J. Appl. Ecol., 25: 125-143.

Campana, S.E., Gibson, A.J.F., Fowler, M., Dorey, A., and Joyce, W. 2013. Population Dynamics of Northwest Atlantic porbeagle (Lamna nasus), with an Assessment of Status and Projections for Recovery. Fisheries and Oceans Canada. Can. Sci. Advis. Sec. Res. Doc. 2012/096. iv + 84pp.

Campana, S.E., Joyce, W., and Marks, L. 2003. Status of the Porbeagle Shark (Lamna nasus) Population in the Northwest Atlantic in the Context of Species at Risk. DFO Can. Sci. Advis. Sec. Res. Doc. 2003/007.

Campbell, J.S., and Simms, J.M. 2009. Status Report on Coral and Sponge Conservation in Canada. Fisheries and Oceans Canada: vii + 87pp.

Canadian Coast Guard. 2006. Visitors Guide to Sable Island, Nova Scotia. Fisheries and Oceans Canada and Canadian Coast Guard, Maritimes Region. Prepared by Gerry Forbes. [updated 2006 June 8; cited 2012 June 26]. Available from: http://www.ccg-gcc.gc.ca/folios/00018/docs/sable-island-visitors-guide-eng.pdf.

Cargnelli, L.M., Griesbach, S.J., Berrien, P.L., Morse, W.W., Johnson, D.L., and Morse, W.W. 1999a. Haddock, Melanogrammus aeglefinus, life history and habitat characteristics. National Marine Fisheries Service, NOAA Technical Memorandum, NMFS-NE-128: 31pp.

Cargnelli, L.M., Griesbach, S.J., Packer, D.B., Berrien, P.L., Johnson, D.L., and Morse, W.W. 1999b. Pollock, Pollachius virens, life history and habitat characteristics. National Marine Fisheries Service. NOAA Technical Memorandum, NMFS-NE-13: 30pp.

Carls, M. G., Holland, L., Larsen, M., Collier, T. K., Scholz, N. L., and Incardona, J. P. 2008. Fish embryos are damaged by dissolved PAHs, not oil particles. Aquatic Toxicology 88(2): 121-127.

Carls, M.G., Rice, S.D., and Hose, J.E. 1999. Sensitivity of fish embryos to weathered crude oil: Part 1. Low-level exposure during incubation causes malformations, genetic damage, and mortality in larval Pacific herring (Clupea pallasi). Environ. Toxicol. Chem. 18: 481-493.

Carscadden, J. E., Frank, K, T., and Miller, D. S. 1989. Capelin (Mallotus villosus) spawning on the southeast shoal: influence of physical factors past and present. Can. J Fish. Aquat. SCI. 46. 1743-1754.

Carscadden, J. E., Nakashima, B. S., and Frank, K. T. 1997. Effects of fish length and temperature on the timing of peak spawning in capelin (Mallotus villosus). Canadian Journal of Fisheries and Aquatic Sciences, 54: 781–787.

Carscadden, J.E, Montevecchi, W.A., Davoren, G.K., and Nakashima, B.S. 2002. Trophich relationships among capelin (Mallotus villosus) and seabirds in a changing ecosystem. ICES Journal of Marine Science, 59:1027-1033.

Carter, J.A., and D.H. Steele. 1982. Stomach contents of immature lobsters (Homarus americanus) from Placentia Bay, Newfoundland. Can. J. Zool. 60: 337-347.

Casper, B.M., Matthews, F.M., Halvorsen, M.B., Carlson, T.J., and Popper, A.N. 2011. Recovery from exposure to pile driving signals by Chinook salmon. J. Acoust. Soc. Am. 129(4): 2436.

CBCL Limited. 2009. Our Coast: The 2009 State of Nova Scotia's Coast Technical Report. Available from: http://novascotia.ca/coast/documents/report/Coastal-Tech-Report-Nov-09.pdf.

CEA Agency [Canadian Environmental Assessment Agency]. 1994. A Reference Guide for the Canadian Environmental Assessment Act: Determining Whether A Project is Likely to Cause Significant Adverse Environmental Effects. Available from: http://www.ceaa-acee.gc.ca/Content/D/2/1/D213D286-2512-47F4-B9C3 08B5C01E5005/Determining_Whether_a_Project_is_Likely_to_Cause_Significant_Adverse_ Environmental_Effects.pdf.

CEA Agency [Canadian Environmental Assessment Agency]. 2013a. Operational Policy Statement: Assessing Cumulative Environmental Effects under the Canadian Environmental Assessment Act, 2012. [updated May 2013; cited Feb 2014]. Available from: https://www.ceaa-acee.gc.ca/Content/1/D/A/1DA9E048-4B72-49FA-B585-B340E81DD6AE/CEA_OPS_May_2013-eng.pdf.

CEA Agency [Canadian Environmental Assessment Agency]. 2013b. Operational Policy Statement: Addressing "Purpose of" and "Alternative Means" under the Canadian Environmental Assessment Act, 2012. Available from: https://www.ceaa-acee.gc.ca/default.asp?lang=En&n=1B095C22-1.

CEA Agency [Canadian Environmental Assessment Agency]. 2013c. Reference Guide: Considering Aboriginal Traditional Knowledge in Environmental Assessments Conducted Under the Canadian Environmental Assessment Act, 2012. Available from: http://www.ceaa-acee.gc.ca/Content/C/3/C/C3C7E0D3-8DB1-47D0-AFC2-A8D4D1EFAAB3/ATK_Reference_Guide-eng.pdf.

CEA Agency [Canadian Environmental Assessment Agency]. 2015a. Guidelines for the Preparation of an Environmental Impact Statement Pursuant to the Canadian Environmental Assessment Act, 2012, Scotian Basin Venture Exploration Drilling Project, BP Canada Energy Group ULC. Final version issued November 4, 2015. Available from: http://www.ceaa-acee.gc.ca/050/documents-eng.cfm?evaluation=80109.

CEA Agency [Canadian Environmental Assessment Agency]. 2015b. Operational Policy Statement. Determining Whether a Designated Project is Likely to Cause Significant Environmental Effects under the Canadian Environmental Assesment Act, 2012. November 2015. Available from: http://www.ceaa-acee.gc.ca/default.asp?lang=En&n=363DF0E1-1.

CEA Agency [Canadian Environmental Assessment Agency]. 2015c. Technical Guidance for Assessing Physical and Cultural Heritage or any Structure, Site or Thing that is of Historical, Archaeological, Paleontological or Architectural Significance under the Canadian Environmental Assessment Act, 2012. Available from: http://www.ceaa-acee.gc.ca/default.asp?lang=en&n=536A4CFE-1.

CEA Agency [Canadian Environmental Assessment Agency]. 2015d. Shelburne Basin Venture Exploration Drilling Environmental Assessment Report. June 2015.

Chapman, C.J., and Hawkins, A.D. 1969. The Importance of Sound in Fish Behaviour in Relation to Capture by Trawls. FAO Fish. Rep. 62: 717-729.

Chapman, H., Purnell, K., and Law, R.J. 2007. The use of chemical dispersants to combat oil spills at sea: A review of practice and research needs in Europe. Marine Pollution Bulletin 54(4): 827-838.

Chardine, J.W. 1995. The distribution and abundance of aquatic birds in Canada in relation to the threat of oil pollution. In: Frink, L., Ball-Weir, K., and Smith, C., (eds.). Wildlife and Oil Spills: Response, Research, and Contingency Plan. Tri-State Bird Rescue and Research, DE. pp. 23-36.

Choi, J.S., Zisserson, B.M., and Cameron, B.J. 2012. Assessment of Scotian Shelf Snow Crab in 2011. DFO Can. Sci. Advis. Sec. Res. Doc. 2012/024. iv + 95 p.

Chronicle Herald. 2014. Shell hires drill ship for 2015 exploration off Nova Scotia. May 26, 2014. Available at: http://thechronicleherald.ca/business/1210189-shell-hires-drill-ship-for-2015-exploration-off-nova-scotia.

Chronicle Herald. 2015. Sable may start shutting down in 2017. Available from: http://thechronicleherald.ca/business/1295318-sable-may-start-shutting-down-in-2017

Clark, C.W. 1990. Acoustic behavior of mysticete whales. In: Thomas, J., and Kastelein, R., (eds.). Sensory Abilities of Cetaceans. Plenum Press. pp. 571-583.

Clark, C.W., Ellison, W.T., Southall, B.L., Hatch, L., Van Parijs, S.M., Frankel, A., and Ponirakis, D. 2009. Acoustic masking in marine ecosystems: intuitions, analysis, and implication. Mar. Ecol. Prog. Ser. 395: 201-222. Available from: http://dx.doi.org/10.3354/meps08402.

Clark, R.B. 1984. Impact of oil pollution on seabirds. Environ. Pollut., 33: 1-22.

C-NLOPB [Canada-Newfoundland and Labrador Offshore Petroleum Board], CNSOPB [Canada-Nova Scotia Offshore Petroleum Board], and NEB [National Energy Board]. 2011a. *Safety Plan Guidelines.* Government of Canada. Available from: http://www.cnsopb.ns.ca/sites/default/files/pdfs/NEB_DM_PROD_500568_Safety_Plan_Guidelines_Drilling_Production_Regulation.pdf.

C-NLOPB [Canada-Newfoundland and Labrador Offshore Petroleum Board], CNSOPB [Canada-Nova Scotia Offshore Petroleum Board], and NEB [National Energy Board].2011b. *Environmental Protection Plan Guidelines.* Government of Canada. Available from: http://www.cnlopb.ca/pdfs/guidelines/env_pp_guide.pdf.

C-NLOPB [Canadian-Newfoundland and Labrador Offshore Petroleum Board] and CNSOPB [Canada-Nova Scotia Offshore Petroleum Board]. 2011. Drilling and Production Guidelines. Available from: http://www.cnlopb.ca/pdfs/guidelines/drill_prod_guide.pdf.

C-NLOPB [Canadian-Newfoundland and Labrador Offshore Petroleum Board] and CNSOPB [Canada-Nova Scotia Offshore Petroleum Board]. 2012. Incident Reporting and Investigation Guidelines. Available from: http://www.cnsopb.ns.ca/sites/default/files/pdfs/c-nlopb_cnsopb_incident_reporting_and_investigation_guidelines_november_30_2012_finalized_version.pdf.

C-NLOPB, [Canadian-Newfoundland and Labrador Offshore Petroleum Board] and CNSOPB [Canada-Nova Scotia Offshore Petroleum Board]. 2002. Compensation Guidelines Respecting Damages Relating to Offshore Petroleum Activity. Available from: http://cnsopb.ns.ca/sites/default/files/pdfs/CompGuidelines.pdf.

CNSOPB [Canada-Nova Scotia Offshore Petroleum Board]. 2004b. Application to Amend the Cohasset Development Plan Decision Report. Available from: http://www.cnsopb.ns.ca/pdfs/Cohasset%20Panuke%20Application%20to%20Amed%20Decision%20Report_2005.pdf.

CNSOPB [Canada-Nova Scotia Offshore Petroleum Board]. 2011b. Canada-Nova Scotia Benefits Plan Guidelines. Available from: http://www.cnsopb.ns.ca/pdfs/2011_06_Benefits%20Guidelines.pdf.

CNSOPB [Canada-Nova Scotia Offshore Petroleum Board]. 2016. Incident Bulletin March 7, 2016. Available from: http://www.cnsopb.ns.ca/media/incident-bulletins

CNSOPB [Canada-Nova Scotia Offshore Petroleum Resources Board]. 2004a. Offshore Spills to be Reviewed. Available from: http://www.cnsopb.ns.ca/pdfs/news_sept_09_04.pdf.

CNSOPB [Canada-Nova Scotia Offshore Petroleum Resources Board]. n.d.(a). Offshore Activity: Offshore Projects. Available from: http://www.cnsopb.ns.ca/offshore-activity/offshore-projects.

CNSOPB [Canada-Nova Scotia Offshore Petroleum Resources Board]. n.d.(b). Environment: Environmental Effects Monitoring. Available from: http://www.cnsopb.ns.ca/environment/environmental-effects-monitoring

CNSOPB [Canada-Nova Scotia Offshore Petroleum Resources Board].n.d.(c).Typical Deep Water Well Emergency Response Activity. Available from: http://www.cnsopb.ns.ca/sites/default/files/pdfs/cnsopbcappingstack.pdf.

CNSOPB [Canadian Nova Scotia Offshore Petroleum Board]. 2011a. A Synopsis of Nova Scotia's Offshore Oil and Gas Environmental Effects Monitoring Programs: Summary Report. Available from: http://www.cnsopb.ns.ca/pdfs/EEM_Summary_Report.pdf.

CNSOPB [Canadian Nova Scotia Offshore Petroleum Board]. 2011c. Data Acquisition and Reporting Guidelines. Available from: http://www.cnsopb.ns.ca/sites/default/files/pdfs/Data_Acquisition_and_Reporting_Guidelines_Oct2011.pdf.

CNSOPB [Canadian Nova Scotia Offshore Petroleum Board]. 2012. Marine Protected Area: The Gully. Available from: http://cnsopb.ns.ca/marine_protected_area.pdf.

CNSOPB [Canadian Nova Scotia Offshore Petroleum Board]. 2013. Geoscience: Regional Geology. Available from: http://cnsopb.ns.ca/geoscience/geoscience-overview/regional-geology.

Cochonat, P., Masson, D., Armigliato, A., Bornhold, B., Camerlenghi, A., Cagatay, N., Favali, P., Kvalstad, T., Kopf, A., and Lykousis, V. 2007. History, monitoring and prediction of geohazards. In: Cochonat, P., Dürr, S., Gunn, V., Herzig, P., Mevel, C., Mienert, J., Schneider, R., Weaver, P.P.E., and Winkler, A., (eds.). The Deep-Sea Frontier: Science Challenges for a Sustainable Future. 52 pp: 9-15.

Cogswell, A.T., Kenchington, E.L.R., Lirette, C.G., MacIsaac, K., Best, M.M., Beazley, L.I., and Vickers, J. 2009. The Current State of Knowledge Concerning the Distribution of Coral in the Maritime Provinces. Can. Tech. Rep. Fish. Aquat. Sci. 2855: v + 66 p.

Colavecchia, M.V., Backus, S.M., Hodson, P.V., and Parrott, J.L. 2004. Toxicity of oil sands to early life stages of fathead minnows (*Pimephales promelas*). Environ. Toxicol. Chem., 23: 1709-1718.

Cook, A. M., Zisserson, B.M., Cameron, B.J. and Choi, J.S. 2014. Assessment of Scotian Shelf Snow Crab in 2013. DFO Can. Sci. Advis. Sec. Res. Doc. 2014/052. vi + 101 p. Available online at: http://www.dfo-mpo.gc.ca/csas-sccs/publications/resdocs-docrech/2014/2014_052-eng.pdf.

Cornell Lab of Ornithology. 2014. eBird. Available from: http://ebird.org/ebird/map/.

COSEWIC [Committee on the Status of Endangered Wildlife in Canada]. 2002a. COSEWIC Assessment and Update Status Report on the Northern Bottlenose Whale *Hyperoodon* ampullatus (Scotian Shelf population) in Canada. Committee on the Status of Endangered Wildlife in Canada. [cited 2012 July 3] Available from: http://www.sararegistry.gc.ca/default_e.cfm.

COSEWIC [Committee on the Status of Endangered Wildlife in Canada]. 2002b. COSEWIC Assessment and Update Status Report on the Blue Whale *Balaenoptera musculus* in Canada. Committee on the Status of Endangered Wildlife in Canada. Ottawa. vi + 32pp. Available from: http://www.sararegistry.gc.ca/default_e.cfm.

COSEWIC [Committee on the Status of Endangered Wildlife in Canada]. 2003. COSEWIC assessment and status report on the cusk *Brosme Brosme* in Canada. Committee on the Status of Endangered Wildlife in Canada. Ottawa. vi + 30 pp.

COSEWIC [Committee on the Status of Endangered Wildlife in Canada]. 2004. COSEWIC Assessment and Status Report on the Striped Bass *Morone saxatilis* in Canada.

COSEWIC [Committee on the Status of Endangered Wildlife in Canada]. 2006a. COSEWIC Assessment and Status Report on the Blue Shark *Prionace glauca* (Atlantic and Pacific populations) in Canada. Committee on the Status of Endangered Wildelife in Canada. Ottawa. vii + 46pp. Available from: http://www/sararegostru/gc/ca/default_e.cfm.

COSEWIC [Committee on the Status of Endangered Wildlife in Canada]. 2006b. COSEWIC Assessment and Status Report on the White Shark *Carcharodon carcharias* (Atlantic and Pacific populations) in Canada. Committee on the Status of Endangered Wildlife in Canada. Ottawa. vii + 31pp. Available from: http://www.sararegistry.gc.ca/default_e.cfm.

COSEWIC [Committee on the Status of Endangered Wildlife in Canada]. 2006c. COSEWIC Assessment and Update Status Report on the Harbour Porpoise *Phocoena phocoena* (Northwest Atlantic population) in Canada. Committee on the Status of Endangered Wildlife in Canada. Ottawa. vii + 32pp. Available from: http://www.sararegistry.gc.ca/default_e.cfm.

COSEWIC [Committee on the Status of Endangered Wildlife in Canada]. 2006d. COSEWIC Assessment and Update Status Report on the Sowerby's Beaked Whale *Mesoplodon*

bidens in Canada. Committee on the Status of Endangered Wildlife in Canada. Ottawa. vi + 20pp. Available from: http://www.sararegistry.gc.ca/default_e.cfm.

COSEWIC [Committee on the Status of Endangered Wildlife in Canada]. 2006e. COSEWIC Assessment and Update Status Report on the Ivory Gull *Pagophila eburnean* in Canada. Ottawa. vi + 42 pp. Available from: http://www.sararegistry.gc.ca/default_e.cfm.

COSEWIC [Committee on the Status of Endangered Wildlife in Canada]. 2006f. COSEWIC Assessment and Update Status Report on the Shortfin Mako (Atlantic population) *Isurus oxyrinchus* in Canada. Committee on the Status of Endangered Wildlife in Canada. Ottawa. vi + 24 pp. Available from: http://www.sararegistry.gc.ca/default_e.cfm.

COSEWIC [Committee on the Status of Endangered Wildlife in Canada]. 2007a. COSEWIC Assessment and Status Report on the Roughhead Grenadier *Macrourus berglax* in Canada. Committee on the Status of Endangered Wildlife in Canada. Ottawa. vii + 40pp. Available from: http://www.sararegistry.gc.ca/default_e.cfm.

COSEWIC [Committee on the Status of Endangered Wildlife in Canada]. 2007b. COSEWIC Assessment and Status Report on the Red Knot *Calidris canutus* in Canada. Committee on the Status of Endangered Wildlife in Canada, Ottawa, ON. vii + 58 pp. Available from: http://www.sararegistry.gc.ca/default_e.cfm.

COSEWIC [Committee on the Status of Endangered Wildlife in Canada]. 2007c. COSEWIC assessment and update status report on the Peregrine Falcon (*Falco peregrinus anatum/tundrius*) in Canada. Committee on the Status of Endangered Wildlife in Canada. Ottawa. vii + 45 pp. Available from: http://www.sararegistry.gc.ca/status/status_e.cfm.

COSEWIC [Committee on the Status of Endangered Wildlife in Canada]. 2008a. COSEWIC Assessment and Status Report on the Roundnose Grenadier *Coryphaenoides rupestris* in Canada. Committee on the Status of Endangered Wildlife in Canada. Ottawa. vii + 42pp. Available from: http://www.sararegistry.gc.ca/default_e.cfm.

COSEWIC [Committee on the Status of Endangered Wildlife in Canada]. 2008b. COSEWIC Assessment and Update Status Report on the Killer Whale *Orcinus orca* (Southern Resident population, Northern Resident population, West Coast Transient population, Offshore population and Northwest Atlantic / Eastern Arctic population) in Canada. Committee on the Status of Endangered Wildlife in Canada. Ottawa. vii + 65pp. Available from: http://www.sararegistry.gc.ca/default_e.cfm.

COSEWIC [Committee on the Status of Endangered Wildlife in Canada]. 2009a. COSEWIC Assessment and Status Report on the Savannah Sparrow *princeps* subspecies *Passerculus sandwichensis* in Canada. Committee on the Status of Endangered Wildlife in Canada. Ottawa. vi + 21 pp. Available from: http://sararegistry.gc.ca/default_e.cfm.

COSEWIC [Committee on the Status of Endangered Wildlife in Canada]. 2009b. COSEWIC Assessment and Status Report on the American Plaice *Hippoglossoides platessoides* (Maritime population, Newfoundland and Labrador population and Arctic population) in Canada. Committee on the Status of Endangered Wildlife in Canada. Ottawa. x + 74pp. Available from: http://www.sararegistry.gc.ca/default_e.cfm.

COSEWIC [Committee on the Status of Endangered Wildlife in Canada]. 2009c. COSEWIC Assessment and Status Report on the Basking Shark *Ceorhinus maximus* (Atlantic population) in Canada. Committee on the Status of Endangered Wildlife in Canada. Ottawa, ON. Vii + 48 pp. Available from: http://www.sararegistry.gc.ca/default_e.cfm.

COSEWIC [Committee on the Status of Endangered Wildlife in Canada]. 2009d. COSEWIC Assessment and Update Status Report on the Roseate Tern *Sterna dougallii* in Canada. Committee on the Status of Endangered Wildlife in Canada, Ottawa, ON. vii + 48 pp. Available from: http://www.sararegistry.gc.ca/default_e.cfm.

COSEWIC [Committee on the Status of Endangered Wildlife in Canada]. 2010a. COSEWIC Assessment and Status Report on the Atlantic Salmon *Salmo salar* (Nunavik population, Labrador population, Northeast Newfoundland population, South Newfoundland population, Southwest Newfoundland population, Northwest Newfoundland population, Quebec Eastern North Shore population, Quebec Western North Shore population, Anticosti Island population, Inner St. Lawrence population, Lake Ontario population, Gaspé-Southern Gulf of St. Lawrence population, Eastern Cape Breton population, Nova Scotia Southern Upland population, Inner Bay of Fundy population, Outer Bay of Fundy population) in Canada. Committee on the Status of Endangered Wildlife in Canada. Ottawa. xlvii + 136pp. Available from: http://www.sararegistry.gc.ca/default_e.cfm.

COSEWIC [Committee on the Status of Endangered Wildlife in Canada]. 2010b. COSEWIC Assessment and Status Report on the Spiny Dogfish *Squalus acanthias* (Atlantic population) in Canada. Committee on the Status of Endangered Wildlife in Canada. Ottawa. vii + 50pp. Available from: http://www.sararegistry.gc.ca/default_e.cfm.

COSEWIC [Committee on the Status of Endangered Wildlife in Canada]. 2010c. COSEWIC Assessment and Status Report on the Deepwater Redfish/ Acadian Redfish Complex *Sebates mentella* and *Sebates faciatus*, in Canada. Committee on the Status of Endangered Wildlife in Canada. Ottawa. x + 80pp. Available from: http://www.sararegistry.gc.ca/default_e.cfm.

COSEWIC [Committee on the Status of Endangered Wildlife in Canada]. 2010d. COSEWIC Assessment and Status Report on the Atlantic Cod *Gadus morhua* in Canada. Committee on the Status of Endangered Wildlife in Canada. Ottawa. x + 105pp. Available from: http://www.sararegistry.gc.ca/default_e.cfm.

COSEWIC [Committee on the Status of Endangered Wildlife in Canada]. 2010e. COSEWIC Assessment and Status Report on the Loggerhead Sea Turtle *Caretta caretta* in Canada. Committee on the Status of Endangered Wildlife in Canada. Ottawa. viii+ 75pp. Available from: http://www.sararegistry.gc.ca/default_e.cfm.

COSEWIC [Committee on the Status of Endangered Wildlife in Canada]. 2011a. COSEWIC Assessment and Status Report on the Atlantic Bluefin Tuna Thunnus thynnus in Canada. Committee on the Status of Endangered Wildlife in Canada. Ottawa. xiii +30 pp. Available from: http://www.sararegistry.gc.ca/default_e.cfm.

COSEWIC [Committee on the Status of Endangered Wildlife in Canada]. 2011b. COSEWIC Assessment and Status Report on the Atlantic Sturgeon *Acipenser oxyinchus* in Canada. Committee on the Status of Endangered Wildlife in Canada. Ottawa. xiii +50pp. Available from: http://www.sararegistry.gc.ca/default_e.cfm.

COSEWIC [Committee on the Status of Endangered Wildlife in Canada]. 2011c. COSEWIC Assessment and Status Report on the Northern Bottlenose Whale in Canada. Committee on the Status of Endangered Wildlife in Canada. Ottawa. xiii +31pp. Available from: http://www.sararegistry.gc.ca/default_e.cfm.

COSEWIC [Committee on the Status of Endangered Wildlife in Canada]. 2012a. COSEWIC Assessment and Status Report on the Thorny Skate *Amblyraja radiata* in Canada. Committee on the Status of Endangered Wildlife in Canada. Ottawa. ix + 75pp. Available from: http://www.sararegistry.gc.ca/default_e.cfm.

COSEWIC [Committee on the Status of Endangered Wildlife in Canada]. 2012b. COSEWIC Assessment and Status Report on the Atlantic Wolffish *Anarhichas lupus* in Canada. Committee on the Status of Endangered Wildlife in Canada. Ottawa. ix + 56pp. Available from: http://www.sararegistry.gc.ca/default_e.cfm.

COSEWIC [Committee on the Status of Endangered Wildlife in Canada]. 2012c. COSEWIC Assessment and Status Report on the American Eel *Anguilla rostrata* in Canada. Committee on the Status of Endangered Wildlife in Canada. Ottawa. xii + 109pp. Available from: http://www.sararegistry.gc.ca/default_e.cfm.

COSEWIC [Committee on the Status of Endangered Wildlife in Canada]. 2012d. COSEWIC Assessment and Status Report on the Northern Wolffish *Anarhichas denticulatus* in Canada. Committee on the Status of Endangered Wildlife in Canada. Ottawa. x + 41pp. Available from: http://www.sararegistry.gc.ca/default_e.cfm.

COSEWIC [Committee on the Status of Endangered Wildlife in Canada]. 2012e. COSEWIC Assessment and Status Report on the Spotted Wolffish *Anarhichas minor* in Canada. Committee on the Status of Endangered Wildlife in Canada. Ottawa. x + 44pp. Available from: http://www.sararegistry.gc.ca/default_e.cfm.

COSEWIC [Committee on the Status of Endangered Wildlife in Canada]. 2012f. COSEWIC Assessment and Status Report on the Leatherback Sea Turtle *Dermochelys coriacea* in Canada. Committee on the Status of Endangered Wildlife in Canada. Ottawa. xv + 58pp. Available from: http://www.sararegistry.gc.ca/default_e.cfm.

COSEWIC [Committee on the Status of Endangered Wildlife in Canada]. 2012g. COSEWIC assessment and status report on the Smooth Skate *Malacoraja senta* in Canada. Committee on the Status of Endangered Wildlife in Canada. Ottawa. xix + 77 pp. Available from: http://www.registrelep-sararegistry.gc.ca/virtual_sara/files/cosewic/sr_raie_queue_velours_smooth_skate_1012_e.pdf.

COSEWIC [Committee on the Status of Endangered Wildlife in Canada]. 2013. COSEWIC assessment and status report on the White Hake Urophycis tenuis in Canada. Committee on the Status of Endangered Wildlife in Canada. Ottawa. xiii + 45 pp. Available from: www.registrelep-sararegistry.gc.ca/default_e.cfm.

COSEWIC [Committee on the Status of Endangered Wildlife in Canada]. 2014a. COSEWIC Species Database: Red-Necked Phalarope. Available from: http://www.cosewic.gc.ca/eng/sct1/searchdetail_e.cfm?id=1278&StartRow=151&boxStatus=2,3,4,5,7&boxTaxonomic=All&location=All&change=All&board=All&commonName=&scienceName=&returnFlag=0&Page=16 [accessed: Sept. 24, 2015].

COSEWIC [Committee on the Status of Endangered Wildlife in Canada]. 2014b. COSEWIC assessment and status report on the Porbeagle *Lamna nasus* in Canada. Committee on the Status of Endangered Wildlife in Canada. Ottawa. xi + 40 pp. (www.registrelepsararegistry.gc.ca/default_e.cfm).

Couillard, C.M.A. 2002. Microscale test to measure petroleum oil toxicity to mummichog embryos. Environ. Toxicol., 17: 195-202.

Cranford, P.J., and Gordon, Jr., D.C. 1992. The influence of dilute clay suspensions on sea scallop (Placopecten magellanicus) feeding activity and tissue growth. Neth. J. Sea Res., 30: 107-120.

Cranford, P.J., Gordon, Jr., D.C., Lee, K., Armsworthy, S.L., and Tremblay, G.H. 1999. Chronic toxicity and physical disturbance effects of water-and oil-based drilling fluids and some major constituents on adult sea scallops (Placopecten magellanicus). Mar. Environ. Res., 48: 225-256.

Cripps, G.C., and Shears, J. 1997. The fate in the marine environment of a minor diesel fuel spill from an Antarctic research station. Environ. Monit. Assess., 46(3): 221-232.

Curran, K. and Azetsu-Scott, K. 2013. Ocean Acidification. In: State of the Scotian Shelf Report. MacLean, M., Breeze, H., Walmsley, J., and Corkum, J. (eds.). Can. Tech. Rep. Fish. Aquat. Sci. 3074.

CWS [Canadian Wildlife Serivce]. 2013b. Unpublished data. Report of Harlequin Surveys in Eastern Canada in 2013.

CWS [Canadian Wildlife Service]. 2013a. Monitoring Terns in Nova Scotia: Census Techniques, Population Trends, and Colony Dynamics. Draft technical report obtained from CWS December 2013.

Dahlheim, M.E., and Ljungblad, D.K. 1990. Preliminary hearing study on gray whales 12 (Eschrichtius robustus) in the field. In: Thomas, J., and Kastelein, R., (eds.). 13 Sensory Abilities of Cetaceans. New York: Plenum Press. pp. 335-346.

Dahlheim, M.E., and Matkin, C.O. 1994. Assessment of injuries to Prince William Sound killer whales. In: Loughlin, T.R. (ed.). Marine Mammals and the Exxon Valdez. Academic Press, San Diego, CA. 395 pp: 163-171.

Dalen, J., Ona, E., Vold Soldal, A. and og Sætre, R. 1996. Seismiske undersøkeleser til havs: En vurdering av konsekvenser for fisk og fiskerier. Fisken og Havet, nr. 9 – 1996. 26 s.

Daling, P. S., Aamo, O. M., Lewis, A., and Strøm-Kristiansen, T. 1997. SINTEF/UK Oil-weathering model: Predicting oil's properties at sea. International Oil Spill Conference Proceedings., 1997(1): 297-307.

Daling, P.S., P.J. Brandvik, D. MacKay and O. Johansen. 1990. Characterization of crude oils for environmental purposes. Proceedings of the 13th AMOP Technical Seminar. Environment Canada, pp. 119-138.

Day, R.H., Murphy, S.M., Wiens, J.A., Hayward, G.D., Harner, E.J., and Smith, L.N. 1997. Effects of the Exxon Valdez oil spill on habitat use by birds in Prince William Sound, Alaska. Ecol. Appl., 7: 593-613.

De Robertis, A., and Handegard, N.O. 2013. Fish avoidance of research vessels and the efficacy of noise-reduced vessels: A review. ICES J. Mar. Sci/J. Conseil. 70(1): 34-45.

DeRuiter, S.L. and Doukara, K.L., 2012. Loggerhead turtles dive in response to airgun sound exposure. Endangered Species Research, 16(1), pp.55-63.

DeRuiter, S.L., Tyack, P.L., Lin, Y.-T., Newhall, A.E., Lynch, J.F., and Miller, P.J.O. 2006. Modeling acoustic propagation of airgun array pulses recorded on tagged sperm whales (Physeter macrocephalus). J. Acoust. Soc. Am., 120(6): 4100-4114.

Desharnais, F., and Collison, N.E.B. 2001. Background Noise Levels in the Area of the Gully, Laurentian Channel and Sable Bank. Prepared for Fisheries and Oceans Canada, Oceans and Coastal Management Division, by Defense Research Establishment Atlantic, April 2001. (DREA ECR 2001-028).

DFO [Fisheries and Oceans Canada]. 1996. By the Sea. A Guide to the Coastal Zone of Atlantic Canada. Available from: http://www.dfo-mpo.gc.ca/Library/350058.pdf.

DFO [Fisheries and Oceans Canada]. 1997. DFO Stock Status Report B3-06. Scotian Shelf Capelin. 3 pp.

DFO [Fisheries and Oceans Canada]. 2001. Update on the Status of Redfish Stocks in the Northwest Atlantic: Redfish in Units 1 and 2 and Division 3O. DFO Science Stock Status Report. B4-03 (2001).

DFO [Fisheries and Oceans Canada]. 2004. Review of Scientific Information on Impacts of Seismic Sound on Fish, Invertebrates, Marine Turtles and Marine Mammals. Habitat Status Report 2004/002, September 2004.

DFO [Fisheries and Oceans Canada]. 2005a. The Scotian Shelf: An Atlas of Human Activities. [cited 6 Dec 2013]. Published by the Oceans and Coastal Management Division, Oceans and Habitat Branch, Dartmouth NS. Available [archived] from: http://www.inter.dfo-mpo.gc.ca/Maritimes/Oceans/OCMD/Atlas/Human-Use-Atlas.

DFO [Fisheries and Oceans Canada]. 2005b. Framework for Classification and Characterization of Scotia-Fundy Benthic Habitats. DFO Can. Sci. Advis. Sec. Sci. Advis. Rep. 2005/071.

DFO [Fisheries and Oceans Canada]. 2006. Coral Conservation Plan: Maritimes Region (2006-2010). Oceans and Coastal Management Report 2006-01. Prepared by: ESSIM Planning Office, Oceans and Coastal Management Division, Oceans and Habitat Branch, Maritimes Region. Fisheries and Oceans Canada, Bedford Institute of Oceanography. Available from: http://www.mar.dfo-mpo.gc.ca/folios/00260/docs/322312.pdf.

DFO [Fisheries and Oceans Canada]. 2007a. Assessment of Spiny Dogfish in Atlantic Canada. DFO Can. Sci. Advis. Sec. Sci. Advis. Rep. 2007/046.

DFO [Fisheries and Oceans Canada]. 2007b. Statement of Canadian Practice with respect to the Mitigation of Seismic Sound in the Marine Environment. http://www.dfo-mpo.gc.ca/oceans/management-gestion/integratedmanagement-gestionintegree/seismic-sismique/statement-enonce-eng.asp.

DFO [Fisheries and Oceans Canada]. 2008a. Marine Protected Area: The Gully. [cited 2012 July 3]. Available from: http://www.dfo-mpo.gc.ca/oceans/marineareas-zonesmarines/mpa-zpm/atlantic-atlantique/factsheets-feuillets/gully-eng.htm.

DFO [Fisheries and Oceans Canada]. 2008b. Recovery Potential Assessment for Cusk (Brosme brosme). DFO Can. Sci. Advis. Sec. Sci. Advis. Rep. 2008/024. Available online: http://www.dfo-mpo.gc.ca/csas/Csas/Publications/SAR-AS/2008/SAR-AS2008_024_E.pdf.

DFO [Fisheries and Oceans Canada]. 2008c. Aboriginal Fisheries Strategy. [cited 2012 July 24]. Available from: http://www.dfo-mpo.gc.ca/fm-gp/aboriginal-autochtones/afs-srapa-eng.htm.

DFO [Fisheries and Oceans Canada]. 2009a. Contaminant Monitoring in the Gully Marine Protected Area. DFO Can. Sci. Advis. Sec. Sci. Advis. Rep. 2009/002. 15pp. Available from: http://www.dfo-mpo.gc.ca/CSAS/Csas/Publications/SAR-AS/2009/2009_002_e.pdf.

DFO [Fisheries and Oceans Canada]. 2009b. Aquatic Species at Risk-The Spotted Wolffish. Available from: http://www.dfo-mpo.gc.ca/species-especes/species-especes/spottedwolf-louptachete-eng.htm.

DFO [Fisheries and Oceans Canada]. 2009c. Does eelgrass (Zostera marina) meet the criteria as ecologically significant species? DFO Can. Sci. Advis. Sec. Sci. Advis. Rep. 2009/018.

DFO [Fisheries and Oceans Canada]. 2009d. Policy for Managing the Impacts of Fishing on Sensitive Benthic Areas. Available from: http://www.dfo-mpo.gc.ca/fm-gp/peches-fisheries/fish-ren-peche/sff-cpd/benthi-eng.htm.

DFO [Fisheries and Oceans Canada]. 2009e. Marine Protected Areas on the Eastern Scotian Shelf: Selecting the Next Area of Interest [Consultation booklet]. DFO/2009-1625. Available from: http://www.inter.dfo-mpo.gc.ca/folios/00263/docs/AOI_Consultation_Booklet_FINAL.pdf

DFO [Fisheries and Oceans Canada]. 2009f. Underwater World: Atlantic Halibut-Estuary and Gulf of St. Lawrence (Canadian East Coast). Available from: http://www.dfo-mpo.gc.ca/science/publications/uww-msm/articles/atlantichalibut-fletanatlantique-eng.html.

DFO [Fisheries and Oceans Canada]. 2009g. Proceedings of a Workshop on Canadian Science and Management Strategies for Atlantic Hagfish. DFO Can. Sci. Advis. Sec. Proceed. Ser. 2009/009. Available online : http://www.dfo-mpo.gc.ca/CSAS/Csas/Publications/Pro-CR/2009/2009_009_e.pdf.

DFO [Fisheries and Oceans Canada]. 2009h. Underwater World: Yellowtail Flounder, Western North Atlantic Ocean. Available from: http://www.dfo-mpo.gc.ca/science/publications/uww-msm/articles/yellowtailflounder-limandeaqueuejaune-eng.html.

DFO [Fisheries and Oceans Canada]. 2009i. Underwater World: Short-Finned Squid, North American Atlantic coast. Available from: http://www.dfo-

mpo.gc.ca/Science/publications/uww-msm/articles/shortfinnedsquid-calmaranageoirescourtes-eng.html.

DFO [Fisheries and Oceans Canada]. 2009j. Recovery Strategy for the Northern Bottlenose Whale (Hyperoodon ampullatus), Scotian Shelf population, in Atlantic Canadian Waters [Proposed]. Species at Risk Act Recovery Strategy Series. Fisheries and Oceans Canada. vi + 60p.

DFO [Fisheries and Oceans Canada]. 2010a. Aquatic Species -Details for Monkfish. Available from: http://www.dfo-mpo.gc.ca/species-especes/aquatic-aquatique/monkfish-baudroie-amerique-eng.htm.

DFO [Fisheries and Oceans Canada]. 2010b. Recovery Strategy for the Northern Bottlenose Whale, Scotian Shelf population, in Atlantic Canadian Waters. *Species at Risk Act* Recovery Strategy Series. Fisheries and Oceans Canada. vi + 61p.

DFO [Fisheries and Oceans Canada]. 2011a. The Marine Environment and Fisheries of Georges Bank, Nova Scotia: Consideration of the Potential Interactions Associated with Offshore Petroleum Activities. DFO Can. Tech. Rep. Fish. Aquat. Sci. 2945: xxxv + 492pp. Available from: http://www.dfo-mpo.gc.ca/Library/344232.pdf.

DFO [Fisheries and Oceans Canada]. 2011b. Using Satellite Tracking Data to Define Important Habitat for Leatherback Turtles in Atlantic Canada. DFO Can. Sci. Advis. Sec. Sci. Advis. Rep. 2012/036. Available from: http://www.dfo-mpo.gc.ca/csas-sccs/Publications/SAR-AS/2012/2012_036-eng.pdf.

DFO [Fisheries and Oceans Canada]. 2011c. Recovery Potential Assessment for Northern Bottlenose Whales (Hyperoodon ampullatus) in Canada. DFO Can. Sci. Advis. Sec. Sci. Advis. Rep. 2011/031. Available from: http://www.dfo-mpo.gc.ca/Csas-sccs/publications/sar-as/2011/2011_031-eng.pdf.

DFO [Fisheries and Oceans Canada]. 2012a. Archived – Evaluation of the Atlantic Integrated Commercial Fisheries Initiative (AICFI). Available from: http://www.dfo-mpo.gc.ca/ae-ve/evaluations/10-11/6b118-eng.htm.

DFO [Fisheries and Oceans Canada]. 2012b. Atlantic Integrated Commercial Fisheries Initiative. http://www.dfo-mpo.gc.ca/fm-gp/aboriginal-autochtones/aicfi-ipcia/index-eng.htm.

DFO [Fisheries and Oceans Canada]. 2012c. Ice Navigation in Canadian Waters. Icebreaking Program, Navigational Services Directorate, Fisheries and Oceans Canada, Canadian Coast Guard, Ottawa, ON. Available from: http://www.ccg-gcc.gc.ca/folios/00913/docs/ice-navigation-dans-les-galces-eng.pdf.

DFO [Fisheries and Oceans Canada]. 2013a. Recent Oceanographic Conditions over the Scotian Slope/Rise. Atlantic Zone Off-Shelf Monitoring Program. Available from:

http://www.bio.gc.ca/science/monitoring-monitorage/azomp-pmzao/slope-pente/conditions-eng.php.

DFO [Fisheries and Oceans Canada]. 2013b. The Scotian Shelf in Context. In: State of the Scotian Shelf Report. MacLean, M., Breeze, H., Walmsley, J. and Corkum, J. (eds.). Can. Tech. Rep. Fish. Aquat. Sci. 3074: pp. 5-46.

DFO [Fisheries and Oceans Canada]. 2013c. Report on the Progress of Recovery Strategy Implementation for the Leatherback Sea Turtle (Dermochelys coriacea) in Canada for the Period 2007-2012. Species at Risk Act Recovery Strategy Report Series. Fisheries and Oceans Canada, Ottawa.

DFO [Fisheries and Oceans Canada]. 2013d. Habitat Closures will Protect Globally-Unique Sponge Grounds. Backgrounder. Available from: http://www.dfo-mpo.gc.ca/media/back-fiche/2013/hq-ac22a-eng.htm.

DFO [Fisheries and Oceans Canada]. 2013e. Satellite Tagging Uncovers Surprising Birthing Ground of Porbeagle Sharks. Available from: http://www.dfo-mpo.gc.ca/science/publications/article/2011/01-24-11-eng.html.

DFO [Fisheries and Oceans Canada]. 2013f. Aquatic Species at Risk-Cusk. Available from: http://www.dfo-mpo.gc.ca/species-especes/species-especes/cusk-brosme-eng.htm.

DFO [Fisheries and Oceans Canada]. 2013g. Recent Oceanographic Conditions Over the Scotian Slope/Rise. Atlantic Zone Off-Shelf Monitoring Program. Available from: http://www.bio.gc.ca/science/monitoring-monitorage/azomp-pmzao/slope-pente/conditions-eng.php.

DFO [Fisheries and Oceans Canada]. 2013h. Aquatic Species at Risk-Atlantic Cod (Newfoundland and Labrador population). Available from: http://www.dfo-mpo.gc.ca/species-especes/species-especes/atlanticcod-morue_nl-tnl-eng.htm.

DFO [Fisheries and Oceans Canada]. 2013i. Aquatic Species at Risk-American Plaice (Maritime population) Available from: http://www.dfo-mpo.gc.ca/species-especes/species-especes/american-plaice-plie-eng.htm.

DFO [Fisheries and Oceans Canada]. 2013j. Aquatic Species at Risk-American Eel. Available from: http://www.dfo-mpo.gc.ca/species-especes/species-especes/eel-anguille-eng.htm.

DFO [Fisheries and Oceans Canada]. 2013k. Aquatic Species at Risk-Acadian Redfish (Atlantic population). Available from: http://www.dfo-mpo.gc.ca/species-especes/species-especes/acadia-redfish-sebaste-acadie-eng.html#information.

DFO [Fisheries and Oceans Canada]. 2013l. Underwater World: White Hake (Western Atlantic Ocean population). Available from: http://www.dfo-mpo.gc.ca/science/publications/uww-msm/articles/whitehake-merlucheblanche-eng.html.

DFO [Fisheries and Oceans Canada]. 2013m. Underwater World: North American lobster (Northwest Atlantic population). Available from: http://www.dfo-mpo.gc.ca/science/publications/uww-msm/articles/americanlobster-homarddamerique-eng.html.

DFO [Fisheries and Oceans Canada]. 2013n. Managed Fisheries-Jonah Crab. Available from: http://www.bio.gc.ca/science/research-recherche/fisheries-pecheries/managed-gere/jonah-nordique-eng.php.

DFO [Fisheries and Oceans Canada]. 2013o. Search Aquatic Species at Risk: Aquatic Species at Risk in Canadian Waters. Available from: http://www.dfo-mpo.gc.ca/species-especes/listing-eng.htm.

DFO [Fisheries and Oceans Canada]. 2013p. Facts on Canadian Fisheries: Haddock. Available from: http://www.dfo-mpo.gc.ca/fm-gp/sustainable-durable/fisheries-peches/haddock-aiglefin-eng.htm.

DFO [Fisheries and Oceans Canada]. 2013q. Underwater World: Sandlance. Available from: http://www.dfo-mpo.gc.ca/science/publications/uww-msm/articles/sandlance-lancon-eng.htm.

DFO [Fisheries and Oceans Canada]. 2013r. 2012 Assessment of 4VWX Silver Hake. DFO Can. Sci. Advis. Sec. Sci. Advis. Rep. 2013/018. Available from: http://www.dfo-mpo.gc.ca/csas-sccs/Publications/SAR-AS/2013/2013_018-eng.pdf.

DFO [Fisheries and Oceans Canada]. 2013s. Underwater World: The Witch Flounder. Available from: http://www.dfo-mpo.gc.ca/science/publications/uww-msm/articles/witchflounder-pliegrise-eng.htm.

DFO [Fisheries and Oceans Canada]. 2013t. Facts on Canadian Fisheries: Shrimp. Available from: http://www.dfo-mpo.gc.ca/fm-gp/sustainable-durable/fisheries-peches/shrimp-crevette-eng.htm.

DFO [Fisheries and Oceans Canada]. 2013u. Ocean and Ecosystem Science Seminar Series. [cited 2013 Dec 10]. Available from: http://www2.mar.dfo-mpo.gc.ca/bin/cgi/ocean/biosem/biosem.pl?startdate=01-12-2010&language=English.

DFO [Fisheries and Oceans Canada]. 2013v. Assessment of Lobster (Homarus americanus) in Lobster Fishing Area (LFA) 34. DFO Can. Sci. Advis. Sec. Sci. Advis. Rep. 2013/024.

Available from: http://publications.gc.ca/collections/collection_2013/mpo-dfo/Fs70-6-2013-024-eng.pdf.

DFO [Fisheries and Oceans Canada]. 2013w. 2011 Value of Atlantic Coast Commercial Landings, by Region. Preliminary data.

DFO [Fisheries and Oceans Canada]. 2013x. Facts on Canadian Fisheries: Lobster. [cited 2013 Dec 17]. Available from: http://www.dfo-mpo.gc.ca/fm-gp/sustainable-durable/fisheries-peches/lobster-homard-eng.htm.

DFO [Fisheries and Oceans Canada]. 2013y. Fisheries Productivity Investment Policy: A Proponent's Guide to Offsetting. Available from: http://www.dfo-mpo.gc.ca/pnw-ppe/offsetting-guide-compensation/index-eng.html.

DFO [Fisheries and Oceans Canada]. 2013z. Fisheries Protection Policy Statement. Available from: http://www.dfo-mpo.gc.ca/pnw-ppe/pol/index-eng.html.

DFO [Fisheries and Oceans Canada]. 2014a. Frequently Asked Questions – Regulations. Available from: http://www.dfo-mpo.gc.ca/acts-lois/faq-eng.htm.

DFO [Fisheries and Oceans Canada]. 2014b. Offshore Ecologically and Biologically Significant Areas in the Scotian Shelf Bioregion. DFO Can. Sci. Advis. Sec. Sci. Advis. Rep. 2014/041.

DFO [Fisheries and Oceans Canada]. 2014c. Recovery Strategy for the North Atlantic Right Whale (Eubalaena glacialis) in Atlantic Canadian Waters [Final]. Species at Risk Act Recovery Strategy Series. Fisheries and Oceans Canada, Ottawa. vii + 68 pp.

DFO [Fisheries and Oceans Canada]. 2015a. Review of Mitigation and Monitoring Measures for Seismic Survey Activities in and near the Habitat of Cetacean Species at Risk. DFO Can. Sci. Advis. Sec. Sci. Advis. Rep. 2015/005.

DFO [Fisheries and Oceans Canada]. 2015b. Oceanographic conditions in the Atlantic zone in 2014. DFO Can. Sci. Advis. Sec. Sci. Advis. Rep. 2015/030.

DFO [Fisheries and Oceans Canada]. 2015c. 2014 Assessment of Atlantic Halibut on the Scotian Shelf and Southern Grand Banks (NAFO Divisions 3NOPs4VWX5Zc). DFO Can. Sci. Advis. Sec. Sci. Advis. Rep. 2015/012.

DFO [Fisheries and Oceans Canada]. 2015d. Underwater World: Sandlance. Available from: http://www.dfo-mpo.gc.ca/science/publications/uww-msm/project-eng.html?id=33 Accessed September 2015.

DFO [Fisheries and Oceans Canada]. 2015e. Underwater World: Witch Flounder. Available from: http://www.dfo-mpo.gc.ca/science/publications/uww-msm/project-eng.html?id=46 Accessed September 2015.

DFO [Fisheries and Oceans Canada]. 2015f. Underwater World: Yellowtail Flounder. Available from: http://www.dfo-mpo.gc.ca/science/publications/uww-msm/project-eng.html?id=55 Accessed September 2015.

DFO [Fisheries and Oceans Canada]. 2015g. 2015 Assessment of 4VWX Herring. DFO Can. Sci. Advis. Sec. Sci. Advis. Rep. 2015/040.

DFO [Fisheries and Oceans Canada]. 2015h. Underwater World: North American Lobster. Available from: http://www.dfo-mpo.gc.ca/science/publications/uww-msm/project-eng.html?id=20 Accessed September 2015.

DFO [Fisheries and Oceans Canada]. 2015i. Managed Fisheries – Jonah Crab. Available from: http://www.bio.gc.ca/science/research-recherche/fisheries-pecheries/managed-gere/jonah-nordique-en.php Accessed September 2015.

DFO [Fisheries and Oceans Canada]. 2015j. Managed Fisheries – Scallops. Available from: http://www.bio.gc.ca/science/research-recherche/fisheries-pecheries/managed-gere/scallops-coquilles-en.php Accessed September 2015.

DFO [Fisheries and Oceans Canada]. 2015k. Underwater World: Northern Shrimp. Available from: http://www.dfo-mpo.gc.ca/science/publications/uww-msm/project-eng.html?id=20 Accessed September 2015.

DFO [Fisheries and Oceans Canada]. 2015l. Assessment of Northern Shrimp on the Eastern Scotian Shelf (SFAs 13-15). DFO Can. Sci. Advis. Sec. Sci. Advis. Rep. 2015/004.

DFO [Fisheries and Oceans Canada]. 2015m. Underwater World: Shortfin Squid. Available from: http://www.dfo-mpo.gc.ca/science/publications/uww-msm/project-eng.html?id=41 Accessed September 2015.

DFO [Fisheries and Oceans Canada]. 2015n. Assessment of Nova Scotia (4VWX) Snow Crab. DFO Can. Sci. Advis. Sec. Sci. Advis. Rep. 2015/034.

DFO [Fisheries and Oceans Canada]. 2015o. Recovery Strategy for the Leatherback Sea Turtle (Dermochelys coriacea) in Atlantic Canada [Draft]. Species at Risk Act Recovery Strategy Series. Fisheries and Oceans Canada Ottawa. vii + 48 pp.

DFO [Fisheries and Oceans Canada]. 2015p. Orders Registry. Available from: http://www.mar.dfo-mpo.gc.ca/Maritimes/Orders-Registry/.

DFO [Fisheries and Oceans Canada]. 2015q. Radio Aids to Marine Navigation 2015 (Atlantic, St. Lawrence, Great Lakes, Lake Winnipeg and Arctic). Available from: http://www.ccg-gcc.gc.ca/folios/01148/docs/RAMN-2015-ATLANTIC-eng.pdf.

DNV [Det Norske Veritas]. 2011. Final Report Assessment of the Risk of Pollution from Marine Oil Spills in Australian Ports and Waters. Report to Australian Maritime Safety Authority. Report No. pp002916, Rev 5.

Doherty, P., and Horsman, T. 2007. Ecologically and Biologically Significant Areas of the Scotian Shelf and Environs: A Compilation of Scientific Expert Opinion. DFO Can. Tech. Rep. Fish. Aquat. Sci. 2774: 57 + xii pp.

Dooling, R.J., and Therrien, S.A. 2012. Hearing in birds: what changes from air to water. In: Popper, A.N., and Hawkins, A. (eds.). The Effects of Noise on Aquatic Life: Advances in Experimental Medicine and Biology. Vol. 730, pp. 77-82.

Dow Piniak, W.E., Eckert, S.A., Harms, C.A., and Stringer, E.M. 2012b. Underwater hearing sensitivity of the leatherback sea turtle (Dermochelys coriacea): Assessing the potential effect of anthropogenic noise. U.S. Dept. of the Interior, Bureau of Ocean Energy Management, Headquarters, Herndon, VA. OCS Study BOEM 2012-01156; 35pp.

Dow Piniak, W.E., Mann, D.A., Eckert, S.A., and Harms, C.A. 2012a. Amphibious hearing in sea turtles. In: Popper, A. N., and Hawkins, A. (eds.). The Effects of Noise on Aquatic Life: Advances in Experimental Medicine and Biology. Vol. 730, pp. 83-87.

Drinkwater, K.F., Mountain, D.B., and Herman, A. 1998. Northwest Atlantic Fisheries Organization (NAFO) Scientific council meeting-June 1998: Recent changes in the hydrography of the Scotian Shelf and Gulf of Maine-A return to conditions of the 1960s? Serial No. N3024. NAFO SCR Doc. 98/37; 16pp. Available from: http://archive.nafo.int/open/sc/1998/scr-98-037.pdf.

Dyndo, M., Wiśniewska, D.M., Rojano-Doñate, L. and Madsen, P.T. 2015. Harbour porpoises react to low levels of high frequency vessel noise. Scientific reports, 5.

Earthquakes Canada. 2015. Earthquake Search (On-line Bulletin). Natural Resources Canada. Available from: http://www.earthquakescanada.nrcan.gc.ca/stndon/NEDB-BNDS/bull-eng.php.

eBird. 2015. An online database of bird distribution and abundance. eBird, Ithaca, New York. Available from: http://www.ebird.ca. (Accessed: Sept. 24, 2015).

ECCC [Environment and Climate Change Canada]. 2016. National Inventory Report 1990-2014: Greenhouse Gas Sources and Sinks in Canada – Executive Summary. Available from: https://www.ec.gc.ca/ges-ghg/default.asp?lang=En&n=662F9C56-1#es-5

Elner, R.W., and Campbell, A. 1987. Natural diets of lobster Homarus americanus from barren ground and macroalgal habitats off southwestern Nova Scotia, Canada. Mar. Ecol. Prg. Ser. 37 : 131-140.

Elphick, C., Warnock, N., and Rubega, M. 2001. Shorebirds in the marine environment. Pgs. 581-616 In: Biology of Marine Birds. Burger, J. and Schreiber, B.A. (eds.). Academic Press.

Encana [Encana Energy Corporation]. 2002. Deep Panuke Offshore Gas Development: Comprehensive Study Report. Available from: http://www.ceaa-acee.gc.ca/68D50708-docs/report_e.pdf.

Encana [Encana Energy Corporation]. 2006. Deep Panuke Environmental Assessment Report. Volume 4 [Document No. DMEN-X00-RP-RE-00-0005 Rev 01U]. Available from: http://www.cnsopb.ns.ca/pdfs/1.pdf and http://www.cnsopb.ns.ca/pdfs/2.pdf.

Encana [Encana Energy Corporation]. 2013. Deep Panuke (updated 2013 Dec 9). Available from: http://www.encana.com/operations/canada/deep-panuke.html.

Encana [Encana Energy Corporation]. 2015. Wellbore construction. Available at: https://www.encana.com/sustainability/environment/water/protection/construction.html.

Engelhardt, R.F. 1978. Petroleum hydrocarbons in Arctic ringed seals, Phoca hispida, following experimental oil exposure. In: Proceedings of the Conference on the Assessment of the Ecological Impacts of Oil Spills, 14-17 June 1978, Keystone, CO. American Institute of Biological Science: 614-628.

Engelhardt, R.F. 1982. Hydrocarbon metabolism and cortisol balance in oil exposed ringed seals, Phoca hispida. Comp. Biochem. Physiol., 72C: 133-136.

Engelhardt, R.F. 1983. Petroleum effects on marine mammals. Aquatic Toxicology, 4: 199-217.

Environment Australia. 2003. Recovery Plan for Marine Turtles in Australia. Prepared by the Marine Species Section Approvals and Wildlife Division, Environment Australia in consultation with the Marine Turtle Recovery Team Canberra (cited 7 March 2011). Available from: www.environment.gov.au/coasts/publications/turtle-recovery/index.html.

Environment Canada 2013c. Atlantic Canada Individual Marine Area Statistics – 50 year Statistics. Available from: http://www.ec.gc.ca/hurricane/default.asp?lang=En&n=59F744F5-1.

Environment Canada. 2006a. Management plan for the Savannah Sparrow, princeps subspecies (Passerculus sandwichensis princeps), in Canada. Species at Risk Act Management Plan Series. Environment Canada, Ottawa. iv + 19 pp.

Environment Canada. 2006b. Recovery Strategy for the Roseate Tern (Sterna dougallii) in Canada. Species at Risk Act Recovery Strategy Series. Environment Canada, Ottawa. vii + 37pp.

Environment Canada. 2007. Management Plan for the Harlequin Duck (Histrionicus histrionicus) Eastern Population, in Atlantic Canada and Québec. Species at Risk Act Management Plan Series. Environment Canada, Ottawa. vii + 32 pp.

Environment Canada. 2010a. Sable Island Air Monitoring Program Report: 2003-2006. Environment Canada, Dartmouth, NS.

Environment Canada. 2010b. Amended Recovery Strategy for the Roseate Tern (Sterna dougallii) in Canada. Species at Risk Act Recovery Strategy Series. Environment Canada, Ottawa. vii + 36pp.

Environment Canada. 2011. Management Plan for the Barrow's Goldeneye (Bucephala islandica), Eastern Population, in Canada (Proposed). Species at Risk Act Management Plan Series. Environment Canada, Ottawa. iv + 15 pp.

Environment Canada. 2012a. National Air Pollution Surveillance Program (NAPS) – Annual Summaries 2012. Available from: http://maps-cartes.ec.gc.ca/rnspa-naps/data.aspx?lang=en.

Environment Canada. 2012b. Sea Ice Climatic Atlas for the East Coast 1981-2010. Canadian Ice Service. Available from: http://www.ec.gc.ca/glaces-ice/.

Environment Canada. 2012c. Recovery Strategy for the Piping Plover (Charadrius melodus melodus) in Canada. Species at Risk Act Recovery Strategy Series. Environment Canada, Ottawa. v + 29 pp.

Environment Canada. 2012d. List of Protected Areas in Nova Scotia. Available at http://www.ec.gc.ca/ap-pa/default.asp?lang=En&n=35D97114-1.

Environment Canada. 2013a. National Air Pollution Surveillance Program (NAPS) – Annual Summaries 2013. Available from: http://maps-cartes.ec.gc.ca/rnspa-naps/data.aspx?lang=en.

Environment Canada. 2013b. Canadian Climate Normals 1971-2000. Station Data-Sable Island, Nova Scotia. Available from: http://climate.weather.gc.ca/climate_normals/results_e.html?stnID=6454&lang=e&dCode=0&province=NS&provBut=Go&month1=0&month2=12.

Environment Canada. 2013d. Canadian Wildlife Service, Atlantic Canada Colonial Waterbird database. Spreadsheet titled "Other seabirds and colonies Nova Scotia-Bay of Fundy" obtained December 2013.

Environment Canada. 2013e. Canadian Wildlife Service, Atlantic Canada Colonial Waterbird database. Spreadsheet titled "Gull survey Nova Scotia 2013" obtained December 2013.

Environment Canada. 2013f. Guidelines to avoid disturbance to seabird and waterbird colonies in Canada. Available from: https://www.ec.gc.ca/paom-itmb/default.asp?lang=En&n=E3167D46-1#_010.

Environment Canada. 2015a. The National Inventory Report 1990-2013. Greenhouse Gas Sources and Sinks in Canada. The Canadian Government's Submission to the UN Framework Convention on Climate Change. Environment Canada, Gatineau, Quebec. Available online at: http://unfccc.int/national_reports/annex_i_ghg_inventories/national_inventories_submissions/items/8812.php.

Environment Canada. 2015b. Canadian Climate Normals. 1981-2010 Canadian Climate Normals and Averages. Available from: http://climate.weather.gc.ca/climate_normals/index_e.html.

Environment Canada. 2015c. Lightning Activity in Canadian Cities. Available from: https://www.ec.gc.ca/foudre-lightning/default.asp?lang=En&n=4871AAE6-1.

Environment Canada. 2015d. Canadian Tropical Cyclone Season Summaries 2010-2013. Available from: https://www.ec.gc.ca/ouragans-hurricanes/default.asp?lang=En&n=D50DD0ED-1.

Environment Canada. 2015e. Canadian Ice Service. Available from: http://iceweb1.cis.ec.gc.ca/Archive/page3.xhtml.

Environment Canada. 2015f. National Air Pollution Surveillance Program (NAPS) – Annual Summaries 2014. Available from http://maps-cartes.ec.gc.ca/rnspa-naps/data.aspx?lang=en.

Environment Canada. 2015g. Management Plan for the Peregrine Falcon anatum/tundrius (Falco peregrinus anatum/tundrius) in Canada [Proposed]. Species at Risk Act Management Plan Series. Environment Canada, Ottawa. iv + 27 pp. Available from: https://www.registrelep-sararegistry.gc.ca/virtual_sara/files/plans/mp_peregrine_falcon_anatum_tundrius_e_proposed.pdf.

Environment Canada. 2015h. Best practices for stranded birds encountered offshore Atlantic Canada. Draft 2 – April 17 2015. Available from: http://www.cnlopb.ca/pdfs/mg3/strandbird.pdf.

Eppley, Z.A., and Rubega, M.A. 1990. Indirect effects of an oil spill: Reproductive failure in a population of South Polar Skuas following the 'Bahia Paraiso' oil spill in Antarctica. Mar. Ecol.-Prog. Ser., 67: 1-6.

Erbe, C. 2002. Underwater noise of whale-watching boats and potential effects on killer whales (Orcinus orca), based on an acoustic impact model. Mar. Mamm. Sci., 18(2): 394-418.

Erbe, C., Reichmuth, C., Cunningham, K., Lucke, K. and R. Dooling. 2015. Communication masking in marine mammals: A review and research strategy. Marine pollution bulletin. 103(1-2):15-38.

ERC [Environmental Research Consulting]. 2014. Analysis of Potential Blowouts and Spills from Offshore Wells and Activities: Perspectives on Shelburne Basin Venture Exploration Drilling Project (2014 Jan 17). Prepared by Etkin, D.S. for Shell Canada Limited, Stantec Consulting Ltd., RPS ASA.

Erikson, D.E. 1995. Surveys of Murre colony attendance in the Northern Gulf of Alaska following the Exxon Valdez oil spill. In: Wells, P.G., Butler, J.N., and Hughes, J.S. (eds.). Exxon Valdez Oil Spill: Fate and Effects in Alaskan Waters. ASTM STP 1219. American Society for Testing and Materials. Philadelphia, PA. 965 pp: 780-819.

Erskine, A.J. 1992. Atlas of the Breeding Birds of the Maritime Provinces. Nimbus Publishing Ltd. and the Nova Scotia Museum. 270 pp.

Esler, D., Bowman, T.D., Trust, K.A., Ballachey, B.E., Dean, T.A., Jewett, S.C., and O'Clair, C.E. 2002. Harlequin duck population recovery following the 'Exxon Valdez' oil spill: progress, process and constraints. Mar. Ecol.-Prog. Ser., 241: 271–286.

ExxonMobil [ExxonMobil Canada Properties Incorporated]. 2012. Annual Report 2011 (Revised). Offshore Environmental Effects Monitoring Program. ExxonMobil Canada Properties-Sable Offshore Energy Project. Available from: http://www.cnsopb.ns.ca/sites/default/files/pdfs/2011_annual_report_-_offshore_eem_-_revision_final.pdf.

Farstad. 2012. PSV Vessels. Available at: https://www.farstad.com/fleet/psv-vessels.

Fewtrell, J.L., and McCauley, R.D. 2012. Impact of air gun noise on the behaviour of marine fish and squid. Mar. Pollut. Bull., 64(5): 984-993.

Fifield, D.A., Lewis, K.P., Gjerdrum, C., Robertson, G.J., and Wells, R. 2009. Offshore seabird monitoring program. Environ. Stud. Res. Funds Rep. No. 183: v + 68pp. + App.

Fingas, M. (ed.). 2015. Handbook of Oil Spill Science and Technology. Hoboken, New Jersey: John Wiley & Sons, Inc.

Finneran, J.J. 2015. Auditory Weighting Functions and TTS/PTS Exposure Functions for Cetaceans and Marine Carnivores. San Diego, CA:SSC Pacific.

Finneran, J.J. and Jenkins, A.K. 2012. Criteria and thresholds for U.S. Navy acoustic and explosive effects analysis. SPAWAR Systems Centre Pacific, San Diego, California.

Fisheries Hydroacoustic Working Group. 2008. Agreement in Principle for Interim Criteria for Injury to Fish from Pile Driving Activities. Memorandum. Available from: http://www.wsdot.wa.gov/NR/rdonlyres/4019ED62-B403-489C-AF05-5F4713D663C9/0/BA_InterimCriteriaAgree.pdf.

FLMNH [Florida Museum of Natural History]. 2013a. Education-Biological Profiles: Black Dogfish. Available from: http://www.flmnh.ufl.edu/fish/Gallery/Descript/Blackdogfish/blackdogfish.html.

FLMNH [Florida Museum of Natural History]. 2013b. Education-Biological Profiles: White Marlin. Available from:http://www.flmnh.ufl.edu/fish/Gallery/Descript/whitemarlin/whitemarlin.html.

Fodrie, F.J., and Heck, Jr., K.L. 2011. Response of coastal fishes to the Gulf of Mexico oil disaster. PLoS ONE, 6(7): e21609. doi: 10.1371/journal.pone.0021609.

Fraker, M.A. 2013. Killer whale (*Orcinus orca*) deaths in Prince William Sound, Alaska, 1985–1990, Human and Ecological Risk Assessment: An International Journal, 19(1): 28-52.

Freedman, B. 2014. An Ecological and Biodiversity Assessment of Sable Island. Final Report to Parks Canada.

Freethy, R. 1987. Auks: an ornithologist's guide. Blandford Press, Poole, Dorset, U.K. 208pp.

French, D., Reed, M., Jayko, K., Feng, S., Rines, H., Pavignano, S., Isaji, T., Puckett, S., Keller, A., French III, F. W., Gifford, D., McCue, J., Brown, G., MacDonald, E., Quirk, J., Natzke, S., Bishop, R., Welsh, M., Phillips, M., and Ingram, B.S. 1996. The CERCLA Type A Natural Resource Damage Assessment Model for Coastal and Marine Environments (NRDAM/CME), Technical Documentation, Vol. I -VI, Final Report, submitted to the Office of Environmental Policy and Compliance, U.S. Dept. of the Interior, Washington, D.C., Contract No. 14-0001-91-C-11, April, 1996.

French-McCay, D.P. 2009. State-of-the-art and research needs for oil spill impact assessment modeling. In: Proceedings of the 32nd AMOP Technical Seminar on Environmental Contamination and Response, Emergencies Science Division, Environment Canada, Ottawa, ON, Canada, pp. 601-653. Available from: http://www.asascience.com/about/publications/pdf/2009/FrenchMcCay_AMOP09-biomodel-with-cite.pdf.

French-McCay, D.P. 2011. Oil spill modeling for ecological risk and natural resource damage assessment. 2011 International Oil Spill Conference. February 13, 2011. 9 p.

French-McCay, D.P. and Rowe, J.J. 2004. Evaluation of bird impacts in the historical oil spil cases using the SIMAP Oil Spill Model. In: Proceedings of the 27th Arctic and Marine oil Spill Program (AMOP) Technical Seminar, Emergencies Science Division, Environment Canada, Ottawa ON Canada, pp. 421-452.

French-McCay, D.P., Reich, D., Rowe, J., Schroeder, M., and Graham, E. 2011. Oil Spill Modeling Input to the Offshore Environmental Cost Model (OECM) for US-BOEMRE's Spill Risk and Cost Evaluations. In: Proceedings of the 34th Arctic and Marine Oil Spill Program (AMOP) Technical Seminar, Emergencies Science Division, Environment Canada, Ottawa, ON, Canada.

Frink, L., and White, J. 1990. A perspective on the effects of oil on birds. In: The Effects of Oil on Wildlife: Research, Rehabilitation and General Concerns, Proceedings from the Oil Symposium, Herndon, VA, Volume 2, October 16-18, 1990. Presented by International Wildlife Research, Tri-State Bird Rescue and Research, Inc., and International Bird Rescue Research Center, pp. 13-16.

Frost, H. 2004. Fog. Carpstone Press.

Fry, D.M. 1990. Oil exposure and stress effects on avian reproduction. In: The Effects of Oil on Wildlife: Research, Rehabilitation and General Concerns, Proceedings from The Oil Symposium, Herndon, VA, Volume 2, October 16-18, 1990. Presented by International Wildlife Research, Tri-State Bird Rescue and Research, Inc., and International Bird Rescue Research Center.

Gates A.R., and Jones, D.O.B. 2012. Recovery of Benthic Megafauna from Anthropogenic Disturbance at a Hydrocarbon Drilling Well (380 m Depth in the Norwegian Sea). PLoS ONE 7(10): e44114. doi:10.1371/journal.pone.0044114.

Gauthreaux, Jr., S.A., and Belser, C.G. 2006. Effects of artificial night lighting on migrating birds. In: Rich, C., and Longcore, T. (eds.). Ecological Consequences of Artificial Night Lighting. Island Press, Washington, D.C. pp. 67-93.

Gehring, J., Kerlinger, P., and Mannville, A.M. 2009. Communication towers, lights, and birds: Successful methods of reducing the frequency of avian collisions. Ecological Applications, 19: 505-514.

Gendron, L., Fradette, P., and Godbout, G. 2001. The importance of rock crab (Cancer irroratus) for growth, condition and ovary development of adult American lobster (Homarus americanus). Journal of Experimental Marine Biology and Ecology 262(2): 221-241.

Geraci, J.R. 1990. Cetaceans and oil: physiologic and toxic effects. In: Geraci, J.R., St. Aubin, D.J., editors. Sea Mammals and Oil: Confronting the Risks. Academic Press, San Diego, CA. 282 pp: 167-197.

Geraci, J.R., and Smith, T.G. 1976. Direct and indirect effects of oil on ringed seals (Phoca hispida) of the Beaufort Sea. J. Fish. Res. Board Can., 33: 1976-1984.

Geraci, J.R., and St. Aubin, D.J. 1980. Offshore petroleum resource development and marine mammals: A review and research recommendations. Mar. Fish. Rev., 42: 1-12.

Geraci, J.R., and St. Aubin, D.J. 1982. Study of the Effects of Oil on Cetaceans [Final report]. Report from University of Guelph for US Bureau of Land Management, Washington, DC. NTIS PB83-152991. 274 pp.

Gilde, K., and Pinckney, J.L. 2012. Sublethal effects of crude oil on the community structure of estuarine phytoplankton. Estuar. Coast., 35(3): 853-861.

Gill, S. D., Bonke, C. A., and Carter, J. 1985. Management of the Uniacke G-72 Incident. International Oil Spill Conference Proceedings 1985 (1): 311-313.

Gjerdrum, C., Allard, K., and Bolduc, F. 2012. Pelagic seabird monitoring in the northwest Atlantic. Northwest Atlantic Fisheries Organization. Scientific Council Meeting-June 2012. Serial No. N6055. NAFO SCR Doc. 12/029. Available from: http://archive.nafo.int/open/sc/2012/scr12-029.pdf.

Gjerdrum, C., Head, E.J.H., and Fifield, D.A. 2008. Monitoring seabirds at sea in eastern Canada. Atlantic Zone Monitoring Program (AZMP) Bulletin No. 7, March 2008: 52-58. Available from:http://www.meds-sdmm.dfo-mpo.gc.ca/isdm-gdsi/azmp pmza/docs/bulletin_7_09.pdf.

GMRI [Gulf of Maine Research Institute]. 2014. Atlantic Herring-Biology. Available from: http://www.gma.org/herring/biology/default.asp.

Goossen, J.P., and Amirault-Langlais, D.L. (eds.). 2009. The 2006 International Piping Plover Census in Canada. Technical Report Series No. 490. Canadian Wildlife Service (Environment Canada), Edmonton, Alberta and Sackville, New Brunswick.

Gordon, J., Gillespie, D., Potter, J., Frantzis, A., Simmonds, M.P., Swift, R., and Thompson, D. 2004. A review of the effects of seismic surveys on marine mammals. Mar. Tech. Soc. J., 37(4): 16-34.

Gorsline, J., Holmes, W.N., and Cronshaw, J. 1981. The effects of ingested petroleum on the naphthalene-metabolizing properties of liver tissue in seawater-adapted Mallard Ducks (Anas platyrhynchos). Environ.Res., 24: 377-390.

Goudie, R.I. 1990. The Status of the Harlequin Duck (Histrionicus histrionicus) in eastern North America. Unpublished report to the Committee on the Status of Endangered Wildlife in Canada (COSEWIC), Ottawa.

Government of Canada. 2012. Species Profile Ivory Gull (cited 2014 Feb). Available from: http://www.registrelep-sararegistry.gc.ca/species/speciesDetails_e.cfm?sid=50.

Government of Nova Scotia (Nova Scotia Department of Fisheries and Aquaculture). 2014. Economic Impact. Available from: http://novascotia.ca/fish/aquaculture/economic-impact/.

Government of Nova Scotia (Nova Scotia Finance and Treasury Board). 2015. Current Economic Environment and Outlook, December 23, 2015. Available from: http://www.novascotia.ca/finance/statistics/topic_news.asp?id=11449&fto=22v&rdval=2015-12.

Graham, W.M., Condon, R.H., Carmichael, R.H., D'Ambra, I., Patterson, H.K., Linn, L.J., and Hernandez, Jr., F.J. 2010. Oil carbon entered the coastal planktonic food web during the Deepwater Horizon oil spill. Environ. Res. Lett., 5(4): 045301, doi:10.1088/1748-9326/5/4/045301.

Gramentz, D. 1988. Involvement of loggerhead turtle with the plastic, metal and hydrocarbon pollution in the central Mediterranean. Mar. Pollut. Bull.,19: 11-13.

Green, D.M., DeFerrari, H.A., McFadden, D., Pearse, J.S., Popper, A.N., Richardson, W.J., Ridgway, S.H. and Tyack, P.L. 1994. Low-frequency sound and marine mammals: current knowledge and research needs. National Research Council, Washington, DC.

Haig, S.M., and Elliott-Smith, E. 2004. Piping Plover. In: Poole, A., editor. The Birds of North America Online Database. Available from: http://bna.birds.cornell.edu/BNA/account/Piping_Plover/.

Hall, R.J., Belisle, A.A., and Sileo, L. 1983. Residues of petroleum hydrocarbons in tissues of sea turtles exposed to the Ixtoc 1 oil spill. J. Wildlife Dis.,19: 106-109.

Halvorsen, M.B., Casper, B.M., Woodley, C.M., Carlson, T.J., and Popper, A.N. 2011b. Predicting and mitigating hydroacoustic impacts on fish from pile installations. National Cooperative Highway Research Program Transportation Research Board of The National Academies, (in press).

Halvorsen, M.B., Woodley, C.M., Casper, B.M., Carlson, T.J., and Popper, A.N. 2011a. Derivation of a response severity index model for physiological quantification of fish response to impulsive sound. J. Acoust. Soc. Am. 129(4):2435.

Han, G., and Loder, J.W. 2003. Three-dimensional seasonal-mean circulation and hydrography on the eastern Scotian Shelf. J Geophys. Res., 108(C5), 3136. doi:10.1029/2002JC001463.

Haney, J.C., Geiger, H.J., Short, J.W. 2014. Bird mortality from the Deepwater Horizon oil spill. II. Carcass sampling and exposure probability in the coastal Gulf of Mexico. Mar Ecol Prog Ser 513:239-252. Available from: http://www.int-res.com/articles/meps_oa/m513p239.pdf.

Hanson, J., Helvey, M., Strach, R. (eds.). 2003. Non-fishing impacts to essential fish habitat and recommended conservation measures. Long Beach (CA): National Marine Fisheries Service (NOAA Fisheries) Southwest Region. Version 1. 75 p.

Harris, M. P. 1984. Movements and mortality patterns of north Atlantic Puffins as shown by ringing. Bird Study 31: 131-140.

Harris, M.P., and Birkhead, T.R. 1985. Breeding ecology of the Atlantic Alcidae. Pages 155-204 in Nettleship, D.N., and Birkhead, T.R. (eds.). The Atlantic Alcidae: the evolution, distribution, and biology of the auks inhabiting the Atlantic Ocean and adjacent water areas. Academic Press, N.Y.

Harris, R.E., Miller, G.W., and Richardson, W.J. 2001. Seal responses to airgun sounds during summer seismic surveys in the Alaskan Beaufort Sea. Mar. Mamm. Sci. 17(4): 795-812.

Hartung, R. 1965. Some effects of oiling on reproduction of ducks. J. Wildlife Manage., 29: 872-874.

Hartung, R. 1995. Assessment of the potential for long-term toxicological effects of the Exxon Valdez oil spill on birds and mammals. Pp. 693-725. In: Wells, P.G., Butler, J.N., and Hughes, J.S. (eds.). Exxon Valdez Oil Spill: Fate and Effects in Alaskan Waters. ASTM STP 1219. American Society for Testing and Materials, Philadelphia, PA. 965 pp.

Harvey, J.T., and Dahlheim, M.E. 1994. Cetaceans in oil. In: Loughlin, T.R., editor. Marine Mammals and the Exxon Valdez. Academic Press, San Diego, CA. 395 pp: 257-264.

Hastings, K., King, M., and Allard, K. 2014. Ecologically and biologically significant areas in the Atlantic coastal region of Nova Scotia. Can. Tech. Rep. Fish. Aquat. Sci. 3107: xii + 174 p.

Hastings, M.C., and Popper, A.N. 2005. Effects of Sound on Fish. California Department of Transportation Contract 43A0139, Task Order 1. Available from: http://www.dot.ca.gov/hq/env/bio/files/Effects_of_Sound_on_Fish23Aug05.pdf.

Hawkins, A.D. and Popper, A.N. 2014. Assessing the impact of underwater sounds on fishes and other forms of marine life. Acoustics Today. Spring 2014.

Hazel, J., Lawler, I.R., Marsh, H., and Robson, S. 2007. Vessel speed increases collision risk for the green sea turtle Chelonia mydas. Endang. Species Res., 3: 105-113.

HCDA [Horizons Community Development Associates Inc.]. 2008. Exploring Health Priorities in First Nation Communities in Nova Scotia. Available from: http://www.tripartiteforum.com/files/health/2TFReportLow.pdf.

HDR Inc. 2015. Net Environmental Benefit Analysis in Support of the Shelburne Basin Venture Exploration Drilling Project. June 2015.

Health Canada. 2010. Useful Information for Environmental Assessments. Available from: http://publications.gc.ca/collections/collection_2015/sc-hc/H128-1-10-599-eng.pdf.

Hebert, D., Petitpas, R., Petrie, B., and Brickman, D. 2012. Meteorological, sea ice and physical oceanographic conditions on the Scotian Shelf and in the Gulf of Maine during 2011. DFO Can. Sci. Advis. Sec. Res. Doc. 2012/055. iv + 42pp. Available from: http://www.dfo-mpo.gc.ca/Csas-sccs/publications/resdocs-docrech/2013/2013_058-eng.pdf.

Heintz, R.A., Short, J.W., and Rice, S.D. 1999. Sensitivity of fish embryos to weathered crude oil. Part 2. Environ. Toxicol. Chem., 18: 494-503.

Hendon, L.A., Carlson, E.A., Manning, S., and Brouwer, M. 2008. Molecular and developmental effects of exposure to pyrene in the early life-stages of *Cyprinodon variegatus*. Comp. Biochem. Physiol., 147: 205-215.

Hildebrand, J.A. 2005. Impacts of anthropogenic sound. In: Reynolds, J.E., Perrin, W.F., Reeves, R.R., Montgomery, S., and Ragen, T.J. (eds.). Marine Mammal Research: Conservation Beyond Crisis. John Hopkins University Press, Baltimore, Maryland. pp.101-124.

Holmes, W.N., Cronshaw, J., and Cavanaugh, K.P. 1978. The effects of ingested petroleum on laying in mallard ducks (*Anas platyrhynchos*). In: Lindstedt-Siva, J. (ed.). Proceedings of Energy/Environment '78, Los Angeles. Society of Petroleum Industry Biologists. 321 pp: 301-309.

Hooker, S.K. and Whitehead, H. 2002. Click characteristics of northern bottlenose whales (Hyperoodon ampullatus). Marine Mammal Science 18: 69-80.

Horsman, T.L., and Shackell, N.L. 2009. Atlas of Important Habitat for Key Fish Species of the Scotian Shelf, Canada. DFO Can. Tech. Rep. Fish. Aquat. Sci. 2835 viii + 82pp. Available from: http://www.dfo-mpo.gc.ca/Library/337080.pdf.

Houser, D.S., Helweg, D.A., and Moore, P.W.B. 2001. A bandpass filter-bank model of auditory 45 sensitivity in the humpback whale. Aquat. Mammals, 27: 82-91.

HPI [Hydrocarbon Processing Industry]. 1987. Crude Assay Database.

Hurley, G., and Ellis, J. 2004. Environmental Effects of Exploratory Drilling in Offshore Canada: Environmental Effects Monitoring Data and Literature Review-Final Report. Prepared for

the Canadian Environmental Assessment Agency-Regulatory Advisory Committee. 61pp. + App.

Hurley, G.V. 2011. Strategic Environmental Assessment-Petroleum Exploration Activities on the Southwestern Scotian Shelf (Consultant report). Prepared by Hurley Environment Ltd. for the Canada-Nova Scotia Offshore Petroleum Board: Nov., 2011. 94pp. + App.

Husky Energy. 2011. White Rose Environmental Effects Monitoring Program. Prepared by Jacques Whitford Environment Limited for Husky Energy, St. John's, NL.

Hutt, D.L., and Vachon, P.W. 2003. Estimating underwater acoustical parameters from space-based synthetic aperture radar imagery. American Meteorological Society. P6.10. Available from: https://ams.confex.com/ams/pdfpapers/58594.pdf.

IAGC-OGP [International Association of Geophysical Contractors and International Association of Oil and Gas Producers]. 1999. Glossary of HSE Terms. Report No. 6.52/244. Available from: http://www.ogp.org.uk/pubs/244.pdf

IBA Canada. 2014. Available from: http://www.ibacanada.ca/.

IBA Canada. n.d.(a). Brier Island and Offshore Waters IBA Summary. Available from: http://www.ibacanada.ca/site.jsp?siteID=NS021.

IBA Canada. n.d.(b). Scatarie Island, Main-a-Dieu, Nova Scotia IBA Summary. Available from: http://www.ibacanada.ca/site.jsp?siteID=NS052.

IBA Canada. n.d.(c). Grand Manan Archipelago, Grand Manan, New Brunswick IBA Summary. Available from: http://www.ibacanada.ca/site.jsp?siteID=NB011.

IBA Canada. n.d.(d). Muquodoboit, Dartmouth, Nova Scotia IBA Summary. Available from: http://www.ibacanada.ca/site.jsp?siteID=NS014.

ICCAT [International Commission for the Conservation of Atlantic Tunas]. 2012a. Report of the 2011 Yellowfin Tuna ICCAT Stock Assessment Session.

ICCAT [International Commission for the Conservation of Atlantic Tunas]. 2012b. Report of the 2011 Bigeye Tuna ICCAT Stock Assessment Session.

ICCAT [International Commission for the Conservation of Atlantic Tunas]. 2012c. Report of the 2011 Swordfish ICCAT Stock Assessment Session.

Imber, M. 1975. Behavior of petrels in relation to the moon and artificial lights. Notornis, 22: 302-306.

IMO [International Marine Organization]. 2007. Routing Measures Other than Traffic Separation Schemes. SN.1/Circ 263. 23 October 2007.

Incardona, J.P., Collier, T.K., and Scholz, N.L. 2004. Defects in cardiac function precede morphological abnormalities in fish embryos exposed to polycyclic aromatic hydrocarbons. Toxicol. Appl. Pharm., 196: 191-205.

Incardona, J.P., Swartsa, T.L., Edmundsa, R.C., Linboa, T.L., Aquilina-Becka, A., Sloana, C.A., Gardnerb, L.D., Blockb, B.A., and Scholza, N.L. 2013. Exxon Valdez to Deepwater Horizon: Comparable toxicity of both crude oils to fish early life stages. Aquatic Toxicology 142–143 (2013) 303– 316.

Intertek Moody Marine. 2012. Second Annual Surveillance Report Clearwater Seafoods Ltd.Partnership Eastern Canada Offshore Lobster (Homarus americanus), 2012. Canada Offshore Lobster Fishery-Surveillance Report 2 2012.

IOGP [International Association of Oil & Gas Producers]. 2016. Environmental fates and effects of ocean discharge of drill cuttings and associated drilling fluids from offshore oil and gas operations. Report # 543. Available from: http://www.iogp.org/pubs/543.pdf.

IPIECA [International Petroleum Industry Environmental Conservation Association]. 2015. Tiered Preparedness and Response:Good Practice Guidelines for Using the Tiered Preparedness and Response Framework. Available from: http://www.ipieca.org/publication/tiered-preparedness-and-response

IPIECA-OGP [International Petroleum Industry Environmental Conservation Association and the International Association of Oil and Gas Producers]. 2015. Dispersants: subsea application. Available from: http://www.iogp.org/pubs/533.pdf

Irwin, R.J. 1997. Environmental Contaminants Encyclopedia Crude Oil Entry. National Park Service, Water Resources Divisions, Water Operations Branch, CO.

ITOPF [International Tanker Owners Pollution Federation Limited]. 2011. Recognition of oil on shorelines. Technical Information paper No. 6. Available from: http://www.itopf.com/knowledge-resources/documents-guides/document/tip-6-recognition-of-oil-on-shorelines/.

ITOPF [International Tanker Owners Pollution Federation Limited]. 2011. Effects of Oil Pollution on Fisheries and Mariculture. Technical Information Paper 11. Available from: http://www.itopf.com/fileadmin/data/Documents/TIPS%20TAPS/TIP11EffectsofOilPollutiononFisheriesandMariculture.pdf.

ITOPF [The International Tanker Owners Pollution Federation Limited]. 2004. Oil Spill Effects on Fisheries. Technical Information Paper No. 3.

James, M.C., Martin, K., and Dutton, P.H. 2004. Hybridization between a green turtle, Chelonia mydas and loggerhead turtle, Caretta caretta, and the first record of a green turtle in Atlantic Canada. Can. Field Nat., 118(4): 579-582.

James, M.C., Ottensmeyer, C.A., and Myers, R.A. 2005. Identification of high-use habitat and threats to leatherback sea turtles in northern waters: new directions for conservation. Ecol. Lett., 8: 195-201.

Jensen, A.S., and Silber, G.K. 2003. Large whale ship strike database. US Department of Commerce, NOAA Technical Memorandum, NMFS-OPR-25. 37pp.

Jenssen, B. M., and Ekker, M. 1991. Effects of plumage contamination with crude oil dispersant mixtures on thermoregulation in common eiders and mallards. Arch. Environ. Contam. Toxicol, 20: 398-403.

Jenssen, B.M. 1994. Review Article: Effects of Oil Pollution, Chemically Treated Oil, and Cleaning on the Thermal Balance of Birds. Environmental Pollution 86: 207-215.

Jewett, S.C., Dean, T.A., Smith, R.O., and Blanchard, A. 1999. Exxon Valdez oil spill: impacts and recovery in the soft-bottom benthic community in and adjacent to eelgrass beds. Mar. Ecol.-Prog. Ser.,185: 59-83.

Johnson, S.R., Richardson, W.J., Yazvenko, S.B., Blokhin, S.A., Gailey, G., Jenkerson, M.R., Meier, S.K., Melton, H.R., Newcomer, M.W., Perlov, A.S., *et al.* 2007. A western gray whale mitigation and monitoring program for a 3D seismic survey, Sakhalin Island, Russia. Environ. Monit. Assess., 134(1-3): 1-19.

Jones, D.O.B., Gates, A.R., and Lausen, B. 2012. Recovery of deep-water megafaunal assemblages from hydrocarbon drilling disturbance in the Faroe-Shetland Channel. Mar. Ecol. Prog. Ser. Vol. 461:71-82.

JWEL [Jacques Whitford Environment Limited]. 2001a. Kerr-McGee Offshore Canada Ltd. Characterization of Benthic Habitat in the Pinehurst and Pembroke Blocks Exploratory Licenses 2396 and 2386. iii + 45pp.

JWEL [Jacques Whitford Environment Limited]. 2001b. Environmental Assessment of Deepwater Exploration Drilling on Torbrook, Weymouth, Barrington, Plympton, Caledonia, and Highland. Report prepared for PanCanadian Energy Corporation.

JWEL [Jacques Whitford Environment Limited]. 2002a. Environmental Assessment of Exploration Drilling of the Pinehurst and Pembroke Licenses (EL2396 and EL2386). Kerr-McGee Offshore Canada Ltd. vii + 115pp.

JWEL [Jacques Whitford Environment Limited]. 2003. Shell Canada Limited Characterization of Benthic Habitat Exploration Licenses 2381 and 2382. Iii + 53pp.

Kasuya, T. 1986. Distribution and behavior of Baird's beaked whales off the Pacific coast of Japan. Sci. Rep. Whales Res. Inst., 37: 61-83.

Kenchington, E., Siferd, T., and Lirette, C. 2012. Arctic Marine Biodiversity: Indicators for Monitoring Coral and Sponge Megafauna in the Eastern Arctic. DFO Can. Sci. Advis. Sec. Res. Doc. 2012/003: v + 37pp.

Kennedy, E., Bennett, L., Campana, S., Clark, K., Comeau, P., Fowler, M., Gjerdrum, C., Gregoire, F., Hannah, C., Harris, L., *et al.* 2011. The Marine Ecosystem of Georges Bank. DFO. Can. Sci. Advis. Sec. Res. Doc. 2011/059: xiv + 232pp. (Erratum: October 2011).

Ketten, D.R., and Bartol, M. 2005. Functional Measures of Sea Turtle Hearing. Woods Hole Oceanographic Institution: ONR Award No: N00014-02-1-0510.

Kilduff, C. and Lopez, J. 2012. Dispersants: The Lesser of Two Evils or a Cure Worse Than The Disease? Ocean and Coastal Law Journal, 16: 375 – 394.

Kite-Powell, H.L., Knowlton, A., and Brown, M. 2007. Modelling the effect of vessel speed on Right whale ship strike risk. Project report for National Oceanic and Atmospheric Administration and National Marine Fisheries Service. Project No. NA04NMF47202394. 8 pp.

Kooyman, G.L., Davis, R.W., and Castellini, M.A. 1977. Thermal conductance of immersed pinniped and sea otter pelts before and after oiling with Prudhoe Bay crude. In: D.A. Wolfe (ed.). Fate and Effects of Petroleum Hydrocarbons in Marine Ecosystems and Organisms. New York. Pp. 151-157.

Kostyuchenko, L.P. 1973. Effects of elastic waves generated in marine seismic prospecting on fish eggs in the Black Sea. Hydrobiol J 9:45–46.

Kraus, S.D., Prescott, J.H., and Stone, G.S. 1983. Harbour porpoise, Phocoena phocoena, in the U.S. coastal waters off the Gulf of marine: a survey to determine seasonal distribution and abundance. NMFS. NA82FAC00027 22 p.

Kvenvolden, K.A. and C.K. Cooper. 2003. Natural seepage of crude oil into the marine environment. Geo-Mar Lett (2003):23:140-146.

Lacroix, D.L., Lancot, R.B., Reed, J.A., and McDonald, T.L. 2003. Effect of underwater seismic surveys on molting male long-tailed ducks in the Beaufort Sea, Alaska. Can. J. Zool., 81: 1862-1875.

Laist, D.W., Knowlton, A.R., Mead, J.G., Collet, A.S., and Podesta, M. 2001. Collisions between ships and whales. Mar. Mammal Sci., 17(1): 35-75.

Lambert, G., Peakall, D.B., Philogrne, J.B.R., and Engelhardt, F.R. 1982. Effect of oil and oil dispersant mixtures on the basal metabolic rate of ducks. Bull. Environ. Contam. Toxicol., 29: 520-4.

Larsen, E.M. and Richardson, S.A. 1990. Some effects of a major oil spill on wintering shorebirds at Grays Harbor, Washington. Northwestern Naturalist, 71: 88-92.

Law, R., Kelly, C., Graham, K., Woodhead, R., Dyrynda, P., and Dyrynda, E. 1997. Hydrocarbons and PAH in Fish and Shellfish from Southwest Wales following the *Sea Empress* Oil Spill in 199. Available from: http://ioscproceedings.org/doi/pdf/10.7901/2169-3358-1997-1-205.

Lawson, J.W. and Lesage, V. 2013. A draft framework to quantify and cumulate risks of impacts from large development projects for marine mammal populations: A case study using shipping associated with the Mary River Iron Mine project. DFO Can. Sci. Advis. Sec. Res. Doc. 2012/154 iv + 22 p.

Lawson, J.W., Davis, R.A., Richardson, W.J., and Malme, C.I. 2000. Assessment of noise issues relevant to key cetacean species (northern bottlenose and sperm whales) in the Sable Gully Area of Interest. Prepared for Oceans Act Coordination Office, Maritimes Region, Department of Fisheries and Oceans Canada.

Lebreton, J.D., Hines, J.E., Pradel, R., Nichols, J.D., and Spendelow, J.A. 2003. Estimation by capture-recapture of recruitment and dispersal over several sites. Oikos, 101: 253-264.

Lee, K., Armsworthy, S.L., Cobanli, S.E., Cochrane, N.A., Cranford, P.J., Drozdowski, A., Hamoutene, D., Hannah, C.G., Kennedy, E., King, T., *et al.* 2011. Consideration of the Potential Impacts on the Marine Environment Associated with Offshore Petroleum Exploration and Development Activities. DFO. Can. Sci. Advis. Sec. Res. Doc. 2011/060: xii + 134pp.

Lee, K., Bain, H., and Hurley, G.V. (eds.). 2005. Acoustic Monitoring and Marine Mammal Surveys in the Gully and Outer Scotian Shelf before and during Active Seismic Programs. Environmental Studies Research Funds Report No. 151.

Lee, K., Boufadel, M., Chen, B., Foght, J., Hodson, P., Swanson, S., Venosa, A. 2015. Expert Panel Report on the Behavior and Environmental Impacts of Crude Oil Released into Aqueous Environments. Royal Society of Canada, Ottawa, ON.

Lee, K., T. Nedwed, R.C. Prince, and D. Palandro. 2013. Lab tests on the biodegradation of chemically dispersed oil should consider the rapid dilution that occurs at sea. Marine Pollution Bulletin 73(2013):314-318.

Leggat, L.J., Merklinger, H.M., and Kennedy, J.L. 1981. LNG Carrier Underwater Noise Study for Baffin Bay. Canadian Acoustics, 9(4):31-51. Available at: http://jcaa.caa-aca.ca/index.php/jcaa/article/view/472/139>.

Leighton, F.A. 1993. The toxicity of petroleum oils to birds. Environ. Rev., 1: 92-103.

LGL [LGL Limited]. 2013. Environmental Assessment of Shell Canada Limited's Shelburne Basin 3D Seismic Survey in Exploration Licenses 2423, 2424, 2425, and 2426. Prepared for Shell Canada Limited LGL Rep. SA1175. 127p + App.

LGL [LGL Limited]. 2014. Environmental Assessment of BP Exploration (Canada) Limited's Tangier 3-D Seismic Survey. BP Document No. NS-HS-REP-BP-B01-0001. March 2014.

Ljungblad, D.K., Würsig, B., Swartz, S.L., and Keene, J.M. 1988. Observations on the behavioral responses of bowhead whales (Balaena mysticetus) to active geophysical vessels in the Alaskan Beaufort Sea. Arctic, 41(3): 183-194.

Lock, A.R., Brown, R.G.B., and Gerriets, S.H. 1994. Gazetteer of Marine Birds in Atlantic Canada. An Atlas of Seabird Vulnerability to Oil Pollution. Canadian Wildlife Service, Environmental Conservation Branch, Environment Canada, Atlantic Region. 137 pp.

Loder, J.W. and Geshelin, Y. 2009. Currents and Temperature Variability from moored measurements on the outer Halifax Line in 2000-2004. AZMP Bulletin 2009 No 8. Pg 44-50. Available from: http://www.meds-sdmm.dfo-mpo.gc.ca/isdm-gdsi/azmp-pmza/docs/bulletin_8_2009.pdf.

Lowry, L.F., Frost, K.J., and Pitcher, K.W. 1994. Observations of oiling of harbor seals in Prince William Sound. In: Loughlin, T.R., editor. Marine Mammals and the Exxon Valdez. Academic Press, San Diego, CA. 395 pp: 209-225.

Lucas, Z., Horn, A., and Freedman, B. 2012. Beached bird surveys on Sable Island, Nova Scotia, 1993 to 2009, show a decline in the incidence of oiling. Proceedings of the Nova Scotian Institute of Science., 47: 91-129.

Luksenburg, J.A., and Parsons, E.C.M. 2009. The effects of aircraft on cetaceans: implications for aerial whalewatching. International Whaling Commission, SC/61/WW2. 10pp. Available from: http://www.researchgate.net/publication/228409420_The_effects_of_aircraft_on_cetaceans_implications_for_aerial_whalewatching/file/9fcfd50b0a3b9d8a7a.pdf.

Lutz, P.L., Lutcavage, M., and Caillouet, C.W. 1989. The effects of petroleum on sea turtles: applicability to Kemp's Ridley. In: Landry, A.M. (ed.). Proceedings of the First International symposium on Kemp's Ridley Sea Turtle Biology, Conservation and Management, October 1-4, 1985, Galvaston, TX, Texas A&M University Sea Grant Program. pp. 52-54.

M&NP [Maritimes and Northeast Pipeline]. 2009. Maritimes and Northeast Pipeline (updated 2013 Dec 9). Available from: http://www.mnpp.com/canada/.

MacLaren Plansearch [MacLaren Plansearch (1991) Limited]. 1996. Sable Offshore Energy Project. Volume 3: Environmental Impact Statement. Available from: http://www.soep.com/cgi-bin/getpage?pageid=1/15/0&dpa=3/0/0/0.

MacLean. M., Breeze, H., Walmsley, J., and Corkum, J. (eds). 2013. State of the Scotian Shelf Report. Can. Tech. Rep. Fish. Aquat. Sci. 3074.

Maersk Energy. n.d. Available at: http://www.maersk.com/en/industries/energy.

Maguire, J.J., and Lester, B. 2012. Bluefin tuna (Thunnus thynnus) in Atlantic Canadian Waters: Biology, Status, Recovery Potential, and Measures for Mitigation. DFO Can. Sci. Advis. Sec. Res. Doc. 2012/002: vi + 28pp.

Malme, C.I., Miles, P.R., Clark, C.W., Tyack, P., and Bird, J.E. 1984. Investigations of the Potential Effects of Underwater Noise from Petroleum Industry Activities on Migrating Gray Whale Behavior / Phase II: January 1984 Migration. BBN Report 5586 from Bolt Beranek & Newman Inc., Cambridge, MA, for US Minerals Management Service, Anchorage, AK. Various pages.

Malme, C.I., Miles, P.R., Tyack, P., Clark, C.W., and Bird, J.E. 1985. Investigation of the Potential Effects of Underwater Noise from Petroleum Industry Activities on Feeding Humpback Whale Behavior. BBN Report 5851 from BBN Labs Inc., Cambridge, MA, for US Minerals Management Service, Anchorage, AK. OCS Study MMS 85-0019.

Malme, C.I., Wursig, B., Bird, J.E., and Tyack, P. 1988. Observations of feeding gray whale responses to controlled industrial noise exposure. In: Sackinger, W.M., and Jeffries, M.O. (eds.). Port and Ocean Engineering Under Arctic Conditions. Volumn II. University of Alaska, Fairbanks, AK, Geophys. Inst. 131pp: 55-73.

Manly, B.F.J., Moulton, V.D., Elliott, R.E., Miller, G.W., and Richardson, W.J. 2007. Analysis of Covariance of Fall Migrations of Bowhead Whales in Relation to Human Activities and Environmental Factors, Alaskan Beaufort Sea: Phase I, 1996-1998. LGL Rep. TA2799-2; OCS Study MMS 2005-033. Rep. from LGL Limited, King City, Ont., and WEST Inc., Cheyenne, WY, for U.S. Minerals Manage. Serv., Herndon, VA, and Anchorage, AK. 128pp.

MAPC [Maritime Aboriginal Peoples Council]. 2014. Maritime Aboriginal Aquatic Resources Secretariate. Regional Community. Available from: http://www.mapcmaars.ca/community.php

Marine Stewardship Council. 2009. Eastern Canada Offshore Lobster. Available from: http://www.msc.org/track-a-fishery/fisheries-in-the-program/certified/north-west-atlantic/Eastern-Canada-offshore-lobster.html

Marquenie, J.M., and van de Laar, F. 2004. Protecting migrating birds from offshore production. Shell E&P Newsletter: January 2004.

Marquenie, J.M., Wagner, J., Stephenson, M.T., and Lucas, L. 2014. Green Lighting the Way: Managing Impacts from Offshore Platform Lighting on Migratory Birds. Presentation at the Society of Petroleum Engineers International Conference on Health, Safety and the Environment, Long Beach, California, USA, March 17-19, 2014.

Marty, G.D., Hose, J.E., McGurk, M.D., Brown, E.D., and Hinton, D.E. 1997. Histopathology and cytogenetic evaluation of Pacific herring larvae exposed to petroleum hydrocarbons in the laboratory or in Prince William Sound Alaska, after the Exxon Valdez oil spill. Can. J. Fish Aquat. Sci., 54: 1846-1857.

Matkin, C.O., Ellis, G.M., Dahlheim, M.E., and Zeh, J. 1994. Status of killer whales in Prince William Sound, 1985-1992. In: Loughlin, T.R., editor. Marine Mammals and the Exxon Valdez, Academic Press, San Diego, CA. 395 pp: 141-162.

Matkin, C.O., Saulitis, E.L., Ellis, G.M., Olesiuk, P., and Rice, S.D. 2008. Ongoing population-level impacts on killer whales *Orcinus orca* following the 'Exxon Valdez' oil spill in Prince William Sound, Alaska. Mar. Ecol.-Prog. Ser., 356: 269-281.

McCauley, R.D., Fewtrell, J., Duncan, A.J., Jenner, C., Jenner, M.-N., Penrose, J.D., Prince, R.I.T., Adhitya, A. Murdoch, J., and McCabe, K. 2000a. Marine Seismic Surveys: Analysis of Airgun Signals and Effects of Air Gun Exposure on Humpback Whales, Sea Turtles, Fishes and Squid. Report prepared by the Centre for Marine Science and Technology (Report R99-15), Curtin University, Perth, WA, for Australian Petroleum Production Association, Sydney, NSW.

McCauley, R.D., Fewtrell, J., Duncan, A.J., Jenner, C., Jenner, M.-N., Penrose, J.D., Prince, R.I.T., Adhitya, A., Murdoch, J., and McCabe, K. 2000b. Marine seismic surveys-A study of environmental implications. Australian Petroleum Producers and Exploration Association. APPEA J., 40: 692-706.

McEwan, E.H., and Whitehead, P.M. 1980. Uptake and clearance of petroleum hydrocarbons by the Glaucous-winged Gull (Larus glaucescens) and the Mallard Duck (Anas platyrhynchos). Can. J. of Zoolog., 58: 723-726.

McGregor [McGregor GeoScience Limited]. 2012. Offshore Environmental Effects Monitoring for Deep Panuke. Program Annual Report 2012. McGregor Project Number: 1113-EEMRDP. Prepared for Encana Corporation. Available from: http://www.cnsopb.ns.ca/sites/default/files/pdfs/2012-1113_eemrdp_rev1.pdf.

McLaren, I.A.1981. The Birds of Sable Island. Nova Scotian Institute of Science, Halifax, N.S.

MGS [Membertou Geomatics Solutions] and UINR [Unama'ki Institute of Natural Resources]. 2014. Traditional Use and Mi'kmaq Fisheries of the Shelburne Basin, Nova Scotia: Draft Report. Submitted to Stantec by MGS & UINR, April 17, 2014. 39pp.

MGS [Membertou Geomatics Solutions] and UINR [Unama'ki Institute of Natural Resources]. 2016. Traditional Use and Mi'kmaq and Maliseet Commercial Fisheries of the Scotian Basin, Nova Scotia. Draft Report. Submitted to Stantec by MGS & UINR, January 18, 2016.

Miller, G.W., Moulton, V.D., Davis, R.A., Holst, M., Millman, P., MacGillivray, A., and Hannay, D. 2005. Monitoring seismic effects on marine mammals-Southeastern Beaufort Sea, 2001-2002. In: Armsworthy, S.L., Cranford, P.J., Lee, K. (eds.). Offshore Oil and Gas Environmental Effects Monitoring: Approaches and Technologies. Battelle Press, Columbus, OH. 631 pp: 511-542.

Milton, S., Lutz, P., and Shigenaka, G. 2010. Oil Toxicity and Impacts on Sea Turtles In: Shigenaka, G. (ed.). Oil and Sea Turtles: Biology, Planning, and Response. National Oceanic and Atmospheric Administration, 112 pp.

Montevecchi, W.A. 2006. Influences of artificial light on marine birds. In: Rich, C., Longcore, T. (eds.). Ecological Consequences of Artificial Night Lighting. Island Press, Washington, D.C. 478 pp: 94-113.

Montevecchi, W.A., Wiese, F.K., Davoren, G.K., Diamond, A.W., Huettmann, F., and Linke, J. 1999. Seabird Attraction to Offshore Platforms and Seabird Monitoring From Offshore Support Vessels and Other Ships: Literature Review and Monitoring Designs. Prepared for the Canadian Association of Petroleum Producers. 56pp.

Moore, J. 2006. State of the marine environment in SW Wales 10 years after the *Sea Empress* oil spill. A report to the Countryside Council for Wales from Coastal Asssessment, Liaison and Monitoring, Cosheston, Pembrokeshire, CCW Marine Monitoring Report No: 21. 30pp.

Moore, J., and A. Couturier. 2011. Canadian Important Bird Areas Criteria. 2nd Edition. Available at: http://www.ibacanada.ca/documents/current_Canadian_IBA_Criteria.pdf.

Moors, H.B. 2012. Acoustic Monitoring of Scotian Shelf Northern Bottlenose Whales (Hyperoodon ampullatus). PhD thesis. Dalhousie University. Available from: http://dalspace.library.dal.ca/handle/10222/15238

Moors-Murphy, H.B. 2014. Submarine canyons as important habitat for cetaceans, with special reference to the Gully: A review. Deep-Sea Research II, 104: 6-19.

Mosbech, A. (ed.) 2002. Potential Environmental Impacts of Oil Spills in Greenland. An Assessment of Information Status and Research Needs. National Environmental Research Institute, Denmark. NERI Technical Report No. 415, 118 pp. Available from: http://technical-reports.dmu.dk.

Moulton, V.D., and Holst, M. 2010. Effects of Seismic Survey Sound on Cetaceans in the Northwest Atlantic. ESRF Rep.182.

Moulton, V.D., and Miller, G.W. 2005. Marine mammal monitoring of a seismic survey on the Scotian Slope, 2003. In: Lee, K., Bain, H., Hurley, G.V. (eds.). Acoustic Monitoring and Marine Mammal Surveys in the Gully and Outer Scotian Shelf Before and During Active Seismic Programs. ESRF Rep 151: xx + 154pp: 29-40.

Müeller-Blenkle, C., Jones, E., Reid, D., Lüdemann, K., Kafemann, R., and Elepfandt, A. 2008. Reactions of cod (Gadus morhua) to low frequency sound resembling offshore wind turbine noise emissions. Bioacoustics, 17: 207-209.

Murphy, S.M., and Mabee, T.J. 1999. Status of Black Oystercatchers in Prince William Sound after the Exxon Valdez Oil Spill. Exxon Valdez Oil Spill Restoration Project. Final Report.

National Commission on the BP Deepwater Horizon Oil Spill and Offshore Drilling. 2011. Rebuilding an Appetite for Gulf Seafood after Deepwater Horizon. Staff Working Paper No. 16. Available from: http://permanent.access.gpo.gov/gpo8569/Rebuilding%20an%20Appetite%20for%20Gulf%20Seafood%20after%20Deepwater%20Horizon_0.pdf

NBAPC [New Brunswick Aboriginal Peoples Council]. n.d. Membership with NBAPC: Provincial Zone Map. Available from: http://nbapc.org/image/zone.jpg

NBDAA [New Brunswick Department of Aboriginal Affairs]. 2015. Aboriginal Affairs Secretariat: Mandates. Available from: http://www2.gnb.ca/content/gnb/en/departments/aboriginal_affairs/contacts/dept_renderer.202233.html#mandates

NCC [Nature Conservancy of Canada]. 2015. Featured Projects: Musquodoboit Harbour. Available from: http://www.natureconservancy.ca/en/where-we-work/nova-scotia/featured-projects/musquodoboit_harbour.html?referrer=https://www.google.ca/.

NCNS [Native Council of Nova Scotia]. 2009. Memorandum of Association and By-laws of Native Council of Nova Scotia. Available from: http://ncns.ca/bylaws.pdf

NCNS [Native Council of Nova Scotia]. 2015. Native Council of Nova Scotia. [cited 2013 Nov]. Available from: http://ncns.ca/

NEB [National Energy Board], C-NLOPB [Canadian Newfoundland and Labrador Offshore Petroleum Board], and CNSOPB [Canada-Nova Scotia Offshore Petroleum Board]. 2008. Guidelines Respecting Physical Environmental Programs during Petroleum Drilling and Production Activities on Frontier Lands. Minister of Public Works and Government Services Canada. September 2008.

NEB [National Energy Board], C-NLOPB [Canadian Newfoundland and Labrador Offshore Petroleum Board], and CNSOPB [Canada-Nova Scotia Offshore Petroleum Board]. 2009.

Offshore Chemical Selection Guidelines for Drilling and Production Activities on Frontier Lands. iii + 13 pp. Available from: http://www.C-NLOPB.nl.ca/pdfs/guidelines/ocsg.pdf

NEB [National Energy Board], C-NLOPB [Canadian Newfoundland and Labrador Offshore Petroleum Board], and CNSOPB [Canada-Nova Scotia Offshore Petroleum Board]. 2010. Offshore Waste Treatment Guidelines. Available from: http://www.C-NLOPB.nl.ca/pdfs/guidelines/owtg1012e.pdf

NEB [National Energy Board]. 2015. Market Snapshot: Deep Panuke moves to seasonal production and lowers reserves due to water influx. Available from: https://www.neb-one.gc.ca/nrg/ntgrtd/mrkt/snpsht/2015/07-04dppnk-eng.html.

Neff, J.M. 1985. Polycyclic aromatic hydrocarbons. In: Rand, G.M., Petrocelli, S.R. (eds.). Fundamentals of Aquatic Toxicology. Washington: Hemisphere Publ. Corp. pp. 416-454.

Neff, J.M. 2010. Fates and Effects of Water Based Drilling Muds and Cuttings in Cold-Water Environments. Prepared for Shell Exploration and Production Company, Houston, Texas, x + 287pp.

Neff, J.M., Breteler, R.J., and Carr, R.S. 1989. Bioaccumulation, food chain transfer, and biological effects of barium and chromium from drilling muds by flounder (Pseudopleuronectes americanus) and lobster (Homarus americanus). In: Engelhardt, F.R., Ray, J.P., and Gillam, A.H. (eds.). Drilling Wastes. Elsevier Applied Science Publishers, London. pp. 439-460.

Neff, J.M., Kjeilen-Eilersten, G., Trannum, H., Jak, R., Smit, M., and Durell, G. 2004. Literature Report on Burial: Derivation of PNEC as Component in the MEMW Model Tool. ERMS Report No. 9B. AM 2004/024. 25pp.

Neff, J.M., McKelvie, S., and Ayers, Jr., R.C. 2000. Environmental Impacts of Synthetic Based Drilling Fluids. OCS Study MMS 2000-64. US Department of the Interior, Minerals Management Service, Gulf of Mexico OCS Program, New Orleans, LA. 118pp.

NERI [National Environmental Research Institute]. 2011. Underwater Noise from the Drillship Stena Forth in Disko West, Baffin Bay, Greenland. NERI Technical Report No. 838. 34 pp. Available from: http://www2.dmu.dk/pub/fr838.pdf.

Nettleship, D. N. 1972. Breeding success of the Common Puffin (Fratercula arctica L.) on different habitats at Great Island, Newfoundland. Ecol. Monogr. 42:239-268.

Nevitt, G.A., and Bonadonna, F. 2005. Sensitivity to dimethyl sulphide suggests a mechanism for olfactory navigation by seabirds. Biol. Lett.,1(3): 303-305.

Nightingale, B. and Simenstad, C. 2002. Artificial night-lighting effects on salmon and other fishes in the Northwest. Ecological Consequences of Artificial Night Lighting conference,

February 23-24, 2002, sponsored by the Urban Wildlands Group and the UCLA Institute of the Environment.

Nisbet, I.C.T., and Spendelow, J.A. 1999. Contribution of research to management and recovery of the roseate tern: review of a twelve-year project. Waterbirds, 22: 239-252.

NOAA [National Marine Fisheries Service]. n.d. Marine Mammals: Interim Sound Threshold Guidance (webpage). National Marine Fisheries Service, National Oceanic and Atmospheric Administration, U.S. Department of Commerce. http://www.westcoast.fisheries.noaa.gov/protected_species/marine_mammals/threshold_guidance.html.

NOAA [National Oceanic and Atmospheric Administration NOAA]. 2014a. Historical Hurricane Tracks. Available from: http://www.csc.noaa.gov/hurricanes/#.

NOAA [National Oceanic and Atmospheric Administration]. 2004. NOAA Technical Memorandum NMFS-NE-191 Essential fish habitat source document: northern shortfin squid, Illex illecebrosus, life history and habitat characteristics. Vi + 45pp.

NOAA [National Oceanic and Atmospheric Administration]. 2006. Status of Fisheries Resources off the Northeastern US: Red Hake. Available from: http://www.nefsc.noaa.gov/sos/spsyn/pg/redhake/.

NOAA [National Oceanic and Atmospheric Administration]. 2007. What are Ichthyoplankton? Southwest Fisheries Science Center (SWFSC). Available from: http://swfsc.noaa.gov/textblock.aspx?Division=FRD&id=6210.

NOAA [National Oceanic and Atmospheric Administration]. 2008. Impacts to Marine Fisheries Habitat from Nonfishing Activities in the Northeastern United States. Northeast Regional Office Gloucester, Massachusetts NOAA Technical Memorandum NMFS-NE-209.

NOAA [National Oceanic and Atmospheric Administration]. 2009. NOAA's Centre for Tsunami Research: Frequently Asked Question Results. Available from: http://ptwc.weather.gov/ptwc/faq.php

NOAA [National Oceanic and Atmospheric Administration]. 2010. Deepwater Horizon Response Consolidated Fish and Wildlife Collection Report. 2010 Nov 2: Operational Period 196. Available from: http://www.restorethegulf.gov/sites/default/files/documents/pdf/Consolidated%20Wildlife%20Table%20110210.pdf.

NOAA [National Oceanic and Atmospheric Administration]. 2012a. International Best Track Archive for Climate Stewardship (IBTrACS) Available at: http://www.ncdc.noaa.gov/ibtracs/index.php?name=ibtracs-data.

NOAA [National Oceanic and Atmospheric Administration]. 2012b. White-Beaked Dolphin (Lagenorhynchus albirostris). Available from: http://www.nmfs.noaa.gov/pr/species/mammals/cetaceans/whitebeakeddolphin.htm.

NOAA [National Oceanic and Atmospheric Administration]. 2013a. Fish Watch: North Atlantic Albacore tuna. Available from: http://www.fishwatch.gov/seafood_profiles/species/tuna/species_pages/atl_albacore_tuna.htm.

NOAA [National Oceanic and Atmospheric Administration]. 2013b. Fish Watch: Atlantic Herring. Available from: http://www.fishwatch.gov/seafood_profiles/species/herring/species_pages/atl_herring.htm.

NOAA [National Oceanic and Atmospheric Administration]. 2013c. Fish Watch: Atlantic Mackerel. Available from: http://www.fishwatch.gov/seafood_profiles/species/mackerel/species_pages/atlantic_mackerel.htm.

NOAA [National Oceanic and Atmospheric Administration]. 2013d. Fish Watch: Atlantic Bigeye Tuna. Available from: http://www.fishwatch.gov/seafood_profiles/species/tuna/species_pages/atl_bigeye_tuna.htm.

NOAA [National Oceanic and Atmospheric Administration]. 2013e. Fish Watch: Western Atlantic Bluefin Tuna. Available from: http://www.fishwatch.gov/seafood_profiles/species/tuna/species_pages/atl_bluefin_tuna.htm.

NOAA [National Oceanic and Atmospheric Administration]. 2013f. Fish Watch: North Atlantic Swordfish. Available from: http://www.fishwatch.gov/seafood_profiles/species/swordfish/species_pages/north_atlantic_swordfish.htm.

NOAA [National Oceanic and Atmospheric Administration]. 2013g. Fish Watch: Atlantic Yellowfin Tuna. Available from: http://www.fishwatch.gov/seafood_profiles/species/tuna/species_pages/atl_yellowfin_tuna.htm.

NOAA [National Oceanic and Atmospheric Administration]. 2013h. Fish Watch: Haddock. Available from: http://www.fishwatch.gov/seafood_profiles/species/haddock/species_pages/haddock.htm.

NOAA [National Oceanic and Atmospheric Administration]. 2013i. Fish Watch: Monkfish. Available from: http://www.fishwatch.gov/seafood_profiles/species/haddock/species_pages/monkfish.htm.

NOAA [National Oceanic and Atmospheric Administration]. 2013j. Fish Watch: Atlantic Pollock. Available from: http://www.fishwatch.gov/seafood_profiles/species/pollock/species_pages/atlantic_pollock.htm.

NOAA [National Oceanic and Atmospheric Administration]. 2013k. Fish Watch: Greenland Turbot. Available from: http://www.fishwatch.gov/seafood_profiles/species/turbot/species_pages/greenland_turbot.htm.

NOAA [National Oceanic and Atmospheric Administration]. 2013l. Fish Watch: Yellowtail Flounder. Available from: http://www.fishwatch.gov/seafood_profiles/species/flounder/species_pages/yellowtail_flounder.htm.

NOAA [National Oceanic and Atmospheric Administration]. 2013m. Fish Watch: Atlantic Northern Shrimp. Available from: http://www.fishwatch.gov/seafood_profiles/species/shrimp/species_pages/atl_nothern_shrimp.htm.

NOAA [National Oceanic and Atmospheric Administration]. 2013n. NOAA Fisheries-Marine Mammal Stock Assessment Reports (SARs) by Species/Stock. Available from: http://www.nmfs.noaa.gov/pr/sars/species.htm.

NOAA [National Oceanic and Atmospheric Administration]. 2013o. NOAA Fisheries-Office of Protected Resources. Kemp's Ridley Turtle (Lepidochelys kempii). Available from: http://www.nmfs.noaa.gov/pr/species/turtles/kempsridley.htm.

NOAA [National Oceanic and Atmospheric Administration]. 2013p. NOAA Fisheries-Office of Protected Resources. Green Turtle (Chelonia mydas). Available from: http://www.nmfs.noaa.gov/pr/species/turtles/green.htm.

NOAA [National Oceanic and Atmospheric Administration]. 2013q. Fish Watch: Atlantic Sea Scallop. Available from: http://www.fishwatch.gov/seafood_profiles/species/scallop/species_pages/atlantic_sea_scallop.htm.

NOAA [National Oceanic and Atmospheric Administration]. 2014b. Atlantic White-Sided Dolphin (Lagenorhynchus acutus). Office of Protected Resources. Updated December 23, 2014. Available from:

http://www.nmfs.noaa.gov/pr/species/mammals/cetaceans/whitesideddolphin_atlantic.htm.

NOAA [National Oceanic and Atmospheric Administration]. 2014c. Long-finned Pilot Whale (Glovicephala melas). Office of Protected Resources. Updated June 26, 2014. Available from: http://www.nmfs.noaa.gov/pr/species/mammals/cetaceans/pilotwhale_longfinned.htm

NOAA [National Oceanic and Atmospheric Administration]. 2014d. NOAA Fisheries Office of Protected Resources: Bottlenose Dolphin (Tursiops truncatus). Available from: http://www.nmfs.noaa.gov/pr/species/mammals/cetaceans/bottlenosedolphin.htm.

NOAA [National Oceanic and Atmospheric Administration]. 2014e. Dolphins and Whales and the Gulf of Mexico Oil Spill. NOAA Fisheries: Office of Protected Resources. Available from: http://www.nmfs.noaa.gov/pr/health/oilspill/mammals.htm.

NOAA [National Oceanic and Atmospheric Administration]. 2014f. Sea Turtles and the Gulf of Mexico Oil Spill. NOAA Fisheries: Office of Protected Resources. Available from: http://www.nmfs.noaa.gov/pr/health/oilspill/turtles.htm.

NOAA [National Oceanic and Atmospheric Administration]. 2014g. Sea Turtles and the Gulf Oil Spill: Meet NOAA's Barbars Schroeder. Available from: http://www.noaa.gov/features/04_resources/seaturtle_oil.html.

NOAA [National Oceanic and Atmospheric Administration]. 2015a. 2014. Atlantic Hurricane Season. Available from: http://www.nhc.noaa.gov/data/tcr/index.php?season=2014&basin=atl.

NOAA [National Oceanic and Atmospheric Administration]. 2015b. Draft Guidance for Assessing the Effects of Anthropogenic Sound on Marine Mammal Hearing: Underwater Acoustic Threshold Levels for Onset of Permanent and Temporary Threshold Shifts. In: National Oceanic and Atmospheric Administration and U.S. Department of Commerce. Revised version for Second Public Comment Period. 180 pp. http://www.nmfs.noaa.gov/pr/acoustics/draft%20acoustic%20guidance%20July%202015.pdf.

NOAA [National Oceanic and Atmospheric Administration]. 2016a. Document Containing Proposed Changes to: National Oceanic and Atmospheric Administration Draft Guidance for Assessing the Effects of Anthropogenic Sound on Marine Mammal Hearing - Underwater Acoustic Threshold Levels for Onset of Permanent and Temporary Threshold Shifts. In: National Oceanic and Atmospheric Administration and U.S. Department of Commerce. 24 pp. http://www.nmfs.noaa.gov/pr/acoustics/draft_guidance_march_2016_.pdf.

NOAA [National Oceanic and Atmospheric Administration]. 2016b. What Happens to Dispersed Oil? Available from: http://response.restoration.noaa.gov/oil-and-chemical-spills/oil-spills/resources/9-what-happens-dispersed-oil.html.

NOAA [National Oceanic and Atmospheric Administration]. 2016c. Office of Response and Restoration: Small Diesel Spills (500 – 5,000 gallons). Available from: http://response.restoration.noaa.gov/oil-and-chemical-spills/oil-spills/resources/small-diesel-spills.html.

Normandeau Associates Inc. 2012. Effects of Noise on Fish, Fisheries, and Invertebrates in the U.S. Atlantic and Arctic from Energy Industry Sound-Generating Activities. A Workshop Report for the U.S. Dept. of the Interior, Bureau of Ocean Energy Management. Contract # M11PC00031. 72 pp. plus Appendices.

Nowacek, D.P., Thorne, L.H., Johnston, D.W., and Tyack, P.L. 2007. Responses of cetaceans to anthropogenic noise. Mammal Rev., 37: 81-115.

NRC [National Research Council]. 2003. Committee on Potential Impacts of Ambient Noise in the Ocean on Marine Mammals. National Academics Press, Washington, DC. 192 p.

NRC [National Research Council]. 2005. Marine mammals populations and ocean noise: determining when noise causes biologically significant effects. The National Academies Press, Washington, DC.

NRCan [Natural Resources Canada] and NSPD [Nova Scotia Petroleum Directorate]. 1999. Georges Bank Review Panel Report.

NRCan [Natural Resources Canada]. 2010. Geology of the Scotian Margin. Available from: http://www.nrcan.gc.ca/earth-sciences/energy-mineral/geology/marine-geoscience/geology-of-scotian-margin/7287.

NRCan [Natural Resources Canada]. 2011. Earthquakes in Southeastern Canada. Available from: http://earthquakescanada.nrcan.gc.ca/pprs-pprp/pubs/GF-GI/GEOFACT_earthquakes-SE-Canada_e.pdf.

NSDFA [Nova Scotia Department of Fisheries and Aquaculture]. 2013. Aquaculture Site Mapping Tool. Available from: http://novascotia.ca/fish/programs-and-services/industry-support-services/aquaculture/site-mapping-tool/.

NSDNR [Nova Scotia Department of Natural Resources]. 2011a. Shapefile titled "cormorant_colonies_2011_survey". Obtained January 2014.

NSDNR [Nova Scotia Department of Natural Resources]. 2011b. General Status Ranks of Wild Species in Nova Scotia. Obtained from the Atlantic Conservation Data Center in April 2011. Also available from: http://www.gov.ns.ca/natr/wildlife/genstatus/ranks.asp.

NSDNR [Nova Scotia Department of Natural Resources]. 2013. Shapefile titled "eider_islands". Obtained January 2014.

NSDOE [Nova Scotia Department of Energy]. 2009a. Toward a Greener Future: Nova Scotia's 2009 Energy Strategy. [cited 2014 Jan 15]. Available from: www.gov.ns.ca/energy/energystrategy.

NSDOE [Nova Scotia Department of Energy]. 2009b. Natural Gas: Sable Offshore Energy Project. [updated 2009 Sept 15; cited 2013 Dec 9]. Available from: http://www.gov.ns.ca/energy/oil-gas/offshore/current-activity/sable-offshore.asp.

NSDOE [Nova Scotia Department of Energy]. n.d. Oil and Gas: Offshore economic benefits. [cited 2015 Sept 30]. Available from: http://energy.novascotia.ca/oil-and-gas/offshore/economic-benefits.

NSE [Nova Scotia Environment]. 2010. Terence Bay Wilderness Area. Available from: https://www.novascotia.ca/nse/protectedareas/wa_terencebay.asp

NSE [Nova Scotia Environment]. 2014. Scatarie Island Wilderness Area, Available from: https://www.novascotia.ca/nse/protectedareas/wa_scatarie.asp.

NSE [Nova Scotia Environment]. n.d. The Air We Breathe: Nova Scotia's Air Quality Report, 2000-2007. Available from: https://novascotia.ca/nse/air/docs/TheAirWeBreathe-NS-Air-Quality2000-2007.pdf.

NSOAA [Nova Scotia Office of Aboriginal Affairs]. 2011. Aboriginal People in Nova Scotia: Facts Sheets and Additional Information. Available from: http://novascotia.ca/abor/aboriginal-people/demographics/

NSOAA [Nova Scotia Office of Aboriginal Affairs]. 2012. Proponents' Guide: The Role of Proponents in Crown Consultation with the Mi'kmaq of Nova Scotia. Office of Aboriginal Affairs. Available from: http://www.gov.ns.ca/abor/docs/Proponents%20Guide%20November%202011%20ecopy.pdf.

O'Boyle, R. 2011. Benefits of Marine Protected Areas and Fisheries Closures in the Northwest Atlantic. DFO Can. Tech. Rep. Fish. Aquat. Sci. 2948: iii + 68pp.

O'Brien, K. and Whitehead, H. 2013. Population analysis of Endangered northern bottlenose whales on the Scotian Shelf seven years after the establishment of a Marine Protected Area. Endangered Species Research 21: 273–284.

O'Hara, P.D. and Morandin, L.A. 2010. Effects of sheens associated with offshore oil and gas development on the feather microstructure of pelagic seabirds. Marine Pollution Bulletin, 60: 672-278.

OBIS-SEAMAP [Ocean Biogeographic Information System Spatial Ecological Analysis of Megavertebrate Populations]. 2014. Bottlenose Dolphin (Tursiops truncatus). Available from: http://seamap.env.duke.edu/species/tsn/180426.

Office of Naval Research. 2002. Ocean Life: Green Sea Turtle-Current Research, Science and Technology Focus, Oceanography. Available from: http://www.onr.navy.mil/focus/ocean/life/turtle4.htm.

Offshore Energy Today. 2014a. Statoil gets nod to drill Barents Sea well with West Hercules rig. February 17, 2014. Available at: http://www.offshoreenergytoday.com/statoil-gets-nod-to-drill-barents-sea-well-with-west-hercules-rig/.

Offshore Energy Today. 2014b. CHC Helicopters to transport Statoil's workers to offshore rig in Canada. Available at: https://www.offshoreenergytoday.com/chc-helicopters-to-transport-statoils-workers-to-offshore-rig-in-canada/.

OGP [International Association of Oil and Gas Producers). 2010. Risk Assessment Data Directory. Blowout Frequencies. Report No. 434-2. March 2010.

OLF [Norwegian Oil Industry Association]. 2008. Guideline for risk assessment of effects on fish from acute oil pollution. The Norwegian Oil Industry Association. Norway.

Oropesa, A., Pérez-López, M., Hernández, D., García, J., Fidalgo, L., López-Beceiro, A., and Soler, F. 2007. Acetylcholinesterase activity in seabirds affected by the Prestige oil spill on the Galician coast (NW Spain). Sci. Total Environ., 372: 532-538.

Orr, C.D., and Parsons, J.L. 1982. Ivory gulls Pagophilia eburnean and ice-edges in Davis Strait and the Labrador Sea. Can. Field. Nat., 96: 323-328.

OSPAR [OSPAR Commission]. 2009. Overview of the Impacts of Anthropogenic Underwater Sound in the Marine Environment. Publication number 441/2009. 134pp. Available from: http://qsr2010.ospar.org/media/assessments/p00441_Noise_background_document.pdf.

OSRL [Oil Spill Response Limited]. 2014. SWIS Capping Stack System. Available from: http://www.oilspillresponse.com/globalassets/services/subsea-well-intervention-services/capping/tis-capping-stack-system.pdf.

Ott, R., Peterson, C., and Rice, S. 2001. Exxon Valdez Oil Spill (EVOS) Legacy: Shifting Paradigms in Oil Ecotoxicology. Available from: http://www.alaskaforum.org.

Palka, D. 1995. Influences on spatial patterns of Gulf of marine harbour porpoises. Pages 69-75 in: A.S. Blix, L. Walloe and O. Ulltang, (eds.) Whales, Seals, Fish and Man. Elsevier Science. Amsterdam.

Parks Canada. 2010. Sable Island What We Heard: A Summary of Public Input. [cited 2012 July 4]. Available from: http://www.pc.gc.ca/eng/pn-np/ns/sable/plan/plan01/plan01b.aspx.

Parks Canada. 2011. Canada and Nova Scotia Reach Historic Agreement to Designate Sable Island as a National Park Reserve. Available from: http://www.pc.gc.ca/apps/cp-nr/release_e.asp?id=1785&andor1=nr.

Parks, S., Ketten, D.R., O'Malley, J.T., and Arruda, J. 2007. Anatomical predictions of hearing in the North Atlantic right whale. The Anatom. Rec., 290: 734-744.

Pasch, R.J. 2015. National Hurricane Centre Tropical Cyclone Report – Hurricane Cristobal 23-29 August 2014. AL042014. 14 p. Available from: http://www.nhc.noaa.gov/data/tcr/AL042014_Cristobal.pdf.

Patenaude, N.J., Richardson, W.J., Smultea, M.A., Koski, W.R., Miller, G.W., Wuersig, B. and Greene, C.R. Jr. 2002. Aircraft sound and disturbance to bowhead and beluga whales during spring migration in the Alaskan Beaufort Sea. Marine Mammal Science, 18, 309–355.

Peakall, D.B., Wells, P.G., and Mackay, D. 1987. A Hazard Assessment of Chemically Dispersed Oil Spills and Seabirds. Marine Environmental Research 22: 91-106.

Pecknold, S., Osler, J., and DeTracey, B. 2010. A comparison of measured ocean acoustic ambient noise with estimates from RADARSAT remote sensing, Proceedings of Acoustics Week in Canada 2010, Victoria, BC, October 13-15, 2010.

Pelot, R., and Wootton, D. 2004. Merchant Traffic Through Eastern Canadian Waters: Canadian Port of Call Versus Transient Shipping Traffic. Maritime Activity and Risk Investigation Network. MARIN Report #2004-09. Available from: http://www.marin-research.ca/pdf/2004-09.pdf.

Petersen, G.I., and Kristensen, P. 1998. Bioaccumulation of lipophilic substances in fish early life stages. Environ. Toxicol. Chem., 17: 1385-1395.

Petrie, B. 2007. Does the North Atlantic Oscillation affect hydrographic properties on the Canadian Atlantic Continental Shelf? Atmos. Ocean., 45(3): 141-151.

Pettis, H.M. and Hamilton, P.K. 2014. North Atlantic Right Whale Consortium 2014 annual report card. Report to the North Atlantic Right Whale Consortium, November 2014.

Pezzack, D.S., Frail, C.M., Reeves, A., and Tremblay, M.J. 2009. Offshore Lobster LFA 41 (4X and 5Zc). DFO Can. Sci. Advis. Sec. Res. Doc. 2009/023. vi + 118 p.

Pezzack, D.S., Frail, C.M., Reeves, A., and Tremblay, M.J. 2011. Assessment of the LFA 41 Offshore Jonah Crab (Cancer borealis) (NAFO 4X and 5Zc). DFO Can. Sci. Advis. Sec. Res. Doc. 2010/113: viii + 52 p.

Piatt, J.F., and Nettleship, D.N. 1985. Diving depths of four alcids. Auk, 102: 293-297.

Piggott, C.L. 1964. Ambient sea noise at low frequencies in shallow water of the Scotian Shelf. J. Acoust. Soc. Am., 36(11): 2152-2163.

Piper, D.J.W., and Campbell, D.C. 2002. Surficial Geology of the Scotian Slope, Eastern Canada, Geological Survey of Canada, Current Research 2002-E15.10pp.

Pollino, C.A, and Holdway, D.A. 2002. Toxicity testing of crude oil and related compounds using early life stages of the crimson-spotted rainbowfish (*Melanotaenia fluviatilis*). Ecotox. Environ. Safe., 52: 180-189.

Poot, H., Ens, B.J., de Vries, H., Donners, M.A.H., Wernand, M.R., and Marquenie, J.M. 2008. Green light for nocturnally migrating birds. Ecol. Soc., 13(2): 47. Available from: http://www.ecologyandsociety.org/vol13/iss2/art47/.

Popper, A.N. 2003. Effects of anthropogenic sounds on fishes. Fisheries, 28(10): 24-31.

Popper, A.N., and Hawkins, A. (eds.). 2012. The Effects of Noise on Aquatic Life. Series: Advances in Experimental Medicine and Biology. Vol. 730. Springer. doi: 10.1007/978-1-4419-7311-5

Popper, A.N., Hawkins, A.D., Fay, R.R., Mann, D.A., Bartol, S., Carlson, T.J., Coombs, S., Ellison, W.T., Genrey, R.L., Halvorsen, M.B., Lokkeborg, S., Rogers, P.H., Southall, B.L., Zeddies, D.G., and Tavolga, W.N. 2014. Sound Exposure Guidelines for Fishes and Sea Turtles. A Technical Report prepared by ANSI-Accredited Standards Committee S3/SC1 and registered with ANSI.

Potter, J.R., Thillet, M., Douglas, C., Chitre, M.A., Doborzynski, Z., and Seekings, P.J. 2007. Visual and passive acoustic marine mammal observations and high-frequency seismic source characteristics recorded during a seismic survey. IEEE J. Oceanic Eng., 32(2): 469-483.

Ramsar. 2014. About: The Ramsar Convention and its Mission. Available from: http://www.ramsar.org/.

Reeves, R.R., Stewart, B.S., Clapham, P.J., and Powell, J.A. (eds). 2002. National Audubon Society guide to marine mammals of the world. Chanticleer Press, Inc., New York.

Reichmuth, C. 2007. Assessing the Hearing Capabilities of Mysticete Whales. A Proposed Research Strategy for the Joint Industry Programme on Sound and Marine Life. Long Marine Laboratory; September 12, 2007. Available from:

http://www.soundandmarinelife.org/Site/Products/MysticeteHearingWhitePaper-Reichmuth.pdf.

Renaud, P.E., Jensen, T., Wassbotten, I., Mannvik, H.P., and Botnen, H. 2008. Offshore Sediment Monitoring on the Norwegian Shelf-A Regional Approach 1996e 2006. Akvaplan-Niva, Tromsø, Norway. Report 3487e003. Available from: http://www.norskoljeoggass.no/PageFiles/6544/Milj%C3%B8overv%C3%A5king%20av%20offshorevirksomheten%20-%20Regional%20sedimentoverv%C3%A5king%201996-2006.pdf.

Rice, S.D. 1985. Effects of oil on fish. In: Engelhardt, F.R. (ed.). Petroleum Effects in the Arctic Environment, Elsevier Science Publishing Co., NY. xxiv + 282 pp: 157-182.

Richardson, W.J., and Malme, C. I. 1993. Man-made noise and behavioral responses. In: Burns, J.J., Montague, J.J., Cowles, C.J., editors. The Bowhead Whale. Soc. Mar. Mammal., Spec. Publ. No. 2.

Richardson, W.J., Greene, Jr., C.R., Malme, C.I., and Thomson, D.H. 1995. Marine mammals and noise. Academic Press, San Diego, California. 576 pp: 631-700.

Richardson, W.J., Wursig, B. 1995. Influences of man-made noise and other human actions on cetacean behaviour. Mar. Freshw. Behav. Physiol., 29: 183–209.

Richardson, W.J., Würsig, B., and Greene, C.R. 1986. Reactions of bowhead whales, Balaena mysticetus, to seismic exploration in the Canadian Beaufort Sea. J. Acoust. Soc. Am., 79(4): 1117-1128.

Rigzone. 2015. How Does Dynamic Positioning Work? Available at: http://www.rigzone.com/training/insight.asp?insight_id=342&c_id=20.

Risch, D., Corkeron, P.J., Ellison, W.T., and van Parijs, S.M. 2012. Changes in humpback whale song occurrence in response to an acoustic source 200 km away. PLoS ONE 7(1): e29741, 29741-29746. Available from: http://www.plosone.org/article/info%3Adoi%2F10.1371%2Fjournal.pone.0029741.

Robert, M., Benoit, R., and Savard, J.-P.L. 1999a. COSEWIC Status Report on the Eastern Population of Barrow's Goldeneye (Bucephala islandica) in Canada. Canadian Wildlife Service, Quebec Region.

Robert, M., Savard, J.-P.L., Fitzgerald, G., and Laporte, P. 1999b. Satellite tracking of Barrow's Goldeneyes in eastern North America: location of breeding areas and molting sites. In: Proceedings of the 15th International Symposium on Biotelemetry, Juneau, AK.

Robert, M., Vaillancourt, M.-A., and Drapeau, P. 2010. Characteristics of nest cavities of Barrow's Goldeneyes in eastern North America. J. Field Ornithol., 81(3): 287-293.

Robertson, G.J., and Goudie, R.I. 1999. Harlequin duck (Histrionicus histrionicus). In: Poole, A., Gill, F., editors. The Birds of North America, No. 466. The Birds of North America, Inc., Philadelphia, PA.

Rolland, R.M., Parks, S.E., Hunt, K.E., Castellote, M., Corkeron, P.J., Nowacek, D.P., Wasser, S.K., and Kraus, S.D. 2012. Evidence that ship noise increases stress in right whales. Proc. R. Soc. B. doi:10.1098/rspb.2011.2429.

Ronconi, R. 2013. A report on the latest status and trends of terns and gulls breeding on Sable Island. Prepared for Parks Canada; Contract # 13-2009.

Ronconi, R.A., Allard, K.A., and Taylor, P.D. 2015. Bird interactions with offshore oil and gas platforms: review of impacts and monitoring techniques. Journal of Environmental Management; 147: 34-45.

Rozee, P. 2000. The Fisheries of the Halifax Inlet. Preserving the Environment of Halifax Harbour. (Workshop #1). Halifax Regional Municipality and Fisheries and Oceans Canada. Halifax, Nova Scotia.

RPS Energy Canada. 2014. Wildlife Observation Report. BP Tangier 3D WATS Seismic Survey. Halifax, Nova Scotia.

Rubega, M.A., Schamel, D., and Tracy, D. 2000. Red-necked Phalarope (Phalaropus Lobatus) in Poole, A. (ed.). The Birds of North America Online, Cornell Lab of Ornithology, Ithaca. Website: http://bna.birds.cornell.edu.cat1.lib.trentu.ca:8080/bna/species/538doi:10.2173/bna.538.

Sætre, R., and Ona, E. 1996. Seismiske undersøkelser og skader på fi skeegg og -larver; en vurdering av mulige effekter på bestandsnivå. Havforskningsinstituttet, Fisken og Havet nr. 8–1996. Seismic investigations and damage to fish eggs and larvae: an assessment of potential effects on the population level.

Sanders, H.L., Grassle, J.F., Hampson, G.R., Morse, L.S., Garner-Price, S., and Jones, C.C. 1980. Anatomy of an oil spill: long-term effects from the grounding of the barge Florida off West Falmouth, Massachusetts. J. Mar. Res., 38: 265-380.

SAR [Species at Risk] Registry. 2013a. Species at Risk Public Registry. Species Profile: Porbeagle shark. Available from: http://www.sararegistry.gc.ca/species/speciesDetails_e.cfm?sid=810.

SAR [Species at Risk] Registry. 2013b. Species at Risk Public Registry. Species Profile: Cusk. Available from: http://www.sararegistry.gc.ca/species/speciesDetails_e.cfm?sid=756.

SAR [Species at Risk] Registry. 2014. Peregrine Falcon anatum/tundrius. Available online at: https://www.registrelep-sararegistry.gc.ca/species/speciesDetails_e.cfm?sid=995

SAR [Species at Risk] Registry. 2015. Species at Risk Public Registry. Available from: http://www.sararegistry.gc.ca/default_e.cfm.

SAR [Species at Risk] Registry. 2016. Species at Risk Public Registry: Species at Risk Act. Available online at: http://www.registrelep-sararegistry.gc.ca/default.asp?lang=En&n=8BB77EC2-1

SARA [Species at Risk Act]. 2015. Species at Risk Registry: Species Profile (Atlantic Salmon) Accessed at: https://www.registrelep-sararegistry.gc.ca/species/speciesDetails_e.cfm?sid=672 on October 20, 2015.

Schaanning, M., and Bakke, T. 1997. Environmental fate of drill cuttings in mesocosm and field. WDF97/3/6. In: SEBA, UK National Workshop on Drilling Fluids Aberdeen, UK.

Seiser, P.E., Duffy, L.K., McGuire, A.D., Roby, D.D., Golet, G.H., Litzow, M.A. 2000. Comparison of pigeon guillemot, Cepphus columba, blood parameters from oiled and unoiled areas of Alaska eight years after the Exxon Valdez oil spill. Mar. Pollut. Bull., 40: 52-164.

Seuront, L. 2011. Hydrocarbon contamination decreases mating success in a marine planktonic copepod. PLoS ONE, 6(10): e26283.

Shackell, N.L., and Frank, K.T. 2000. Larval fish diversity on the Scotian Shelf. Can. J. Fish. Aquat. Sci., 57: 1747-1760.

Sibley, D.A. 2000. National Audubon Society: The Sibley guide to birds. Chanticleer Press. 543 pp.

Simpson, R.D., Smith, S.D.A., and Pople, A.R. 1995. The effects of a spillage of diesel fuel on a rocky shore in the sub-Antarctic region (Macquarie Island). Mar. Pollut. Bull., 31(4-12): 367-371.

Slotte, A., Hansen, K., Dalen, J., and Ona, E. 2004. Acoustic mapping of pelagic fish distribution and abundance in relation to a seismic shooting area off the Norwegian west coast. Fish. Res., 67: 143-150.

Smit, M.G.D., Jak, R.G., Rye, H., and Frost, T.K. 2006a. Framework for the environmental impact factor for drilling discharges. TNO-Report 2006-DH-R0045/B. ERMS Report No. 3.

Smit, M.G.D., Tamis, J.E., Jak, R.G., Karman, C.C., Kjelilen, C., Trannum, H., and Neff, J. 2006b. Threshold levels and risk functions for non-toxic sediment stressors: burial, grain size changes and hypoxia. Summary. TNO-report 2006-DH-R0046/A. ERMS Report No. 9.

Smultea, M.A., and Würsig, B. 1995. Behavioral reactions of bottlenose dolphins to the Mega Borg oil spill, Gulf of Mexico 1990. Aquat. Mammals, 21: 171-181.

Southall, B.L., Bowles, A.E., Ellison, W.T., Finneran, J.J., Gentry, R.L., Greene, Jr., C.R., Lastal, D., Ketten, D.R., Miller, J.H., and Nachitgall, P.E. 2007. Special Issue: marine mammal noise exposure criteria: initial scientific recommendations. Aquat. Mammals, 33(4): 411-521.

Spraker, T.R., Lowry, L.F., and Frost, K.J. 1994. Gross necropsy and histopathological lesions found in harbor seals. In: Loughlin, T.R., editor. Marine Mammals and the Exxon Valdez, Academic Press, San Diego, CA. 395 pp: 281-311.

St. Aubin, D.J. 1990. Physiologic and toxic effects on polar bears. In: Geraci, J.R., St. Aubin, D.J., (eds.). Sea Mammals and Oil: Confronting the Risks. Academic Press, San Diego, CA. 282 pp: 235-239.

St. Aubin, D.J., Geraci, J.R., Smith, T.G., and Friesen T.G. 1985. How do bottlenose dolphins, *Tursiops truncatus*, react to oil films under different light conditions? Can. J. Fish Aquat. Sci., 42: 430-436.

Stantec [Stantec Consulting Ltd.]. 2010. Final CEAA Environmental Screening Report for Extension of Pier C at South End Container Terminal. Prepared for Transport Canada on behalf of Halifax Port Authority, June 2010. TC File No. A 7036-28-17-2 U. CEAR No. 09-01-54333.

Stantec [Stantec Consulting Ltd.]. 2012a. Strategic Environmental Assessment for Offshore Petroleum Activities. Eastern Scotian Slope – Middle and sable Island Banks (Phase 1A). v +204 pp.

Stantec [Stantec Consulting Ltd.]. 2012b. Strategic Environmental Assessment for Offshore Petroleum Activities. Eastern Scotian Slope (Phase 1B). v +194 pp.

Stantec [Stantec Consulting Ltd.]. 2012c. Effects of Dispersants on the Environment. Enbridge Northern Gateway Project. February 2012.

Stantec [Stantec Consulting Ltd.]. 2013a. Strategic Environmental Assessment for Offshore Petroleum Activities. Eastern Scotian Slope and Laurentian Fan (Phase 2B). iv + 221 pp.

Stantec [Stantec Consulting Ltd.]. 2013b. Environmental Assessment: Old Harry Prospect Exploration Drilling Program. xxvii + 617 pp.

Stantec [Stantec Consulting Ltd.]. 2014b. Strategic Environmental Assessment for Offshore Petroleum Exploration Activities. Western Scotian Slope (Phase 3B). Prepared for the Canada-Nova Scotia Offshore Petroleum Board, Halifax, NS. iv + 282 pp.

Stantec [Stantec Consulting Ltd.]. 2015. Scotian Basin Exploration Drilling Project – Project Description. Prepared for BP Canada Energy Group ULC.

Stantec [Stantec Consulting Ltd]. 2014a. Shelburne Basin Venture Exploration Drilling Project Environmental Impact Statement. Prepared for Shell Canada Limited.

Statistics Canada. 2011. 2011 Census Program: Data Products. Available from: http://www12.statcan.gc.ca/census-recensement/2011/dp-pd/index-eng.cfm.

Statistics Canada. 2013a. New Brunswick (Code 13) table. National Household Survey (NHS) Aboriginal Population Profile. 2011 National Household Survey. Statistics Canada Catalogue no. 99-011-X2011007. Ottawa, ON. Available from: http://www12.statcan.gc.ca/nhs-enm/2011/dp-pd/aprof/index.cfm?Lang=E

Statistics Canada. 2013b. Nova Scotia (Code 12) (table). National Household Survey (NHS) Aboriginal Population Profile. 2011 National Household Survey. Statistics Canada Catalogue no. 99-011-X2011007. Ottawa, ON. Available from: http://www12.statcan.gc.ca/nhs-enm/2011/dp-pd/aprof/index.cfm?Lang=E

Statistics Canada. 2013c. Nova Scotia (Code 11) (table). National Household Survey (NHS) Aboriginal Population Profile. 2011 National Household Survey. Statistics Canada Catalogue no. 99-011-X2011007. Ottawa, ON. Available from: http://www12.statcan.gc.ca/nhs-enm/2011/dp-pd/aprof/index.cfm?Lang=E

Statistics Canada. 2015a. Census Dictionary. Available from: https://www12.statcan.gc.ca/census-recensement/2011/ref/dict/index-eng.cfm.

Statistics Canada. 2015b. Summary Tables. Available from: http://www.statcan.gc.ca/tables-tableaux/sum-som/index-eng.htm.

Stemp, R. 1985. Observations on the effects of seismic exploration on seabirds. In: Greene, G.D., Engelhardt, F.R., and Paterson, R.J. (eds.). Proceeding Workshop on Effects of Explosives Use in the Marine Environment, January, 1985, Halifax, NS. Canadian Oil and Gas Lands Administration, Environmental Protection Branch, Ottawa, ON. Technical Report No. 5; pp. 217-233.

Stenhouse, I.J. 2004. Canadian Management Plan for Ivory Gull (Pagophila eburnea). Canadian Wildlife Service, St. John's, NL. x + 22 pp.

Stirling, H.P. 1977. Effects of a spill of marine diesel oil on the rocky shore fauna of Lamma Island, Hong Kong. Environ. Pollut., 12(2): 93-117.

Stobo, W.T. and McLaren, I.A. 1975. The Ipswich Sparrow. Nova Scotian Institute of Science, Halifax, NS.

Stone, C.J., and Tasker, M.L. 2006. The effects of seismic airguns on cetaceans in UK waters. J. Cetac. Res. Manage., 8(3): 255-263.

Stubblefield, W.A., Hancock, G.A., Prince, H.H., and Ringer, R.K. 1995. Effects of naturally weathered Exxon Valdez crude oil on mallard reproduction. Environ. Toxicol. Chem., 14: 1951-1960.

Stucker, J.H., and Cuthbert, F.J. 2006. Distribution of Non-breeding Great Lakes Piping Plovers along Atlantic and Gulf of Mexico Coastlines: 10 Years of Band Resightings. US Fish and Wildlife Service, East Lansing, MI and Panama City, FL. 20 pp.

Suchanek, T.H. 1993. Oil impacts on marine invertebrate populations and communities. Integr. Comp. Biol., 33(6): 510-523.

Suncor Energy. 2011. Terra Nova Environmental Effects Monitoring Program (2010). Prepared by Stantec Consulting Ltd. for Suncor Energy Inc., St. John's, NL.

Sundermeyer, J.K., Lucke, K., Dahne, M., Gallus, A., Krugel, K., and Siebert, U. 2012. Effects of underwater explosions on presence and habitat use of harbor porpoises in the German Baltic Sea. In: Popper, A.N., Hawkins, A., editors. Effects of Noise on Aquatic Life. Vol. 730, 289-291.

Swail, V.R., Cardone, V.J., Ferguson, M., Gummer, D.J., Harris, E.L., Orelup, E.A., and Cox, A.T. 2006. The MSC50 Wind and Wave Reanalysis. 9th International Workshop on Wave Hindcasting and Forecasting. Victoria, BC.

Szaro, R.C., Dieter, M.P., and Heinz, G.H. 1978. Effects of chronic ingestion of South Louisiana crude oil on mallard ducklings. Environ. Res., 17: 426-436.

TC [Transport Canada]. 2013. Canada Continues to Align Air Emissions Measures with the United States. [updated 2013 Aug 19; cited 2014 Jan 17]. Available from: http://www.tc.gc.ca/eng/mediaroom/releases-2013-h055e-7161.html

Teal, J.M., and Howarth, R.W. 1984. Oil spill studies: A review of ecological effects. Environ. Manage., 8(1): 27-43.

Thomas, B.R., Kent, E.C., and Swail, V.R. 2005. Methods to Homogenize Wind Speeds From Ships And Buoys, International Journal of Climatology, No. 25, pp. 979–995.

Thomas, H. 2015. Carbon Cycling and pH regulation on the Scotian Shelf, NW. Atlantic. Presentation at the EGU General Assembly 2015, held 12-17 April, 2015 in Vienna, Austria.

Thomas, P. 2010. Status appraisal summary for status retention, Histrionicus histrionicus. Environment Canada-Canadian Wildlife Service.

Thomas, P.W., and Robert, M. 2001. The Updated Status of the Harlequin Duck (Histrionicus histrionicus) in eastern North America. Unpublished report to the Committee on the Status of Endangered Wildlife in Canada (COSEWIC), Ottawa, Ontario.

Thompson, P.M., Brookes, K.L., Graham, I.M., Barton, T.R., Needham, K., Bradbury, G. and Merchant, N.D. 2013. Short-term disturbance by a commercial two-dimensional seismic

survey does not lead to long-term displacement of harbour porpoises. Proceedings of the Royal Society of London B: Biological Sciences, 280(1771):20132001.

Todd, W.E.C. 1963. Birds of the Labrador Peninsula and adjacent areas. Carnegie Museum and University of Toronto Press, Toronto, ON.

Tougaard, J., Kyhn, L.A., Amundin, M., Wennerberg, D., and Bordin, C. 2012. Behavioral reactions of harbor porpoises to pile-driving noise. In: Popper, A.N., Hawkins, A., editors. The Effects of Noise on Aquatic Life. Vol. 730, 277-280.

Tougaard, J.,Wright, A.J., and Madsen, P.T. 2015.Cetacean noise criteria revisited in the light of proposed exposure limits for harbour porpoise. Mar. Poll. Bull. 90,196–208.doi:10.1016/j.marpolbul.2014.10.051.

Transport Canada. 2015. Tanker Safety and Spill Prevention. Available from: http://www.tc.gc.ca/eng/marinesafety/menu-4100.htm

Trudel, K. 1985. Zooplankton. In: Duval, W.S. (ed.). A Review of the Biological Fate and Effects of Oil in Cold Marine Environments. Report by ESL Ltd., SL Ross Environmental Research Ltd. and Arctic Laboratories Ltd. For Environment Canada, Edmonton, AB. 242 pp.

Trust, K.A., Eslerà, D., Woodin, B.R., and Stegeman, J.J. 2000. Cytochrome P450 1A Induction in Sea Ducks Inhabiting Nearshore Areas of Prince William Sound, Alaska. Mar. Pollut. Bull., 40(5): 397-403.

Tufts, R.W. 1986. Birds of Nova Scotia. Numbus Publishing Ltd. and the Nova Scotia Museum. Halifax, NS.

Turnpenny, A.W.H., and Nedwell, J.R. 1994. The Effects on Marine Fish, Diving Mammals and Birds of Underwater Sounds Generated by Seismic Surveys. Report by Fawley Aquatic Research Laboratory Ltd. (FCR 089/94) for U.K. Offshore Operators Association (UKOAA).

Tyack, P.L. 2008. Implications for marine mammals of large-scale changes in the marine acoustic environment. J. Mammal., 89(3): 549-558.

Tyack, P.L., Johnson, M.P., Madsen, P.T., Miller, P.J., and Lynch, J. 2006. Biological significance of acoustic impacts on marine mammals: examples using an acoustic recording tag to define acoustic exposure of sperm whales, Physeter catodon, exposed to airgun sounds in controlled exposure experiments. Eos, Trans. Am. Geophys. Union 87(36), Joint Assembly Suppl., Abstract OS42A-02. 23-26 May, Baltimore, MD.

van der Hoop, J.M., Vanderlaan, A.S.M., and Taggart, C.T. 2012. Absolute probability estimates of lethal vessel strikes to North Atlantic right whales in Roseway Basin, Scotian Shelf. Ecolog. Applic., 22(7): 2021-2033.

van Opzeeland, I., and Slabbekoorn, H. 2012. Importance of underwater sounds for migration of fish and aquatic mammals. In: Popper, A.N., Hawkins, A., editors. The Effects of Noise on Aquatic Life. Vol. 730, 357-359.

Vanderlaan, A.S.M., and Taggart, C.T. 2007. Vessel collisions with whales: the probability of lethal injury based on vessel speed. Mar. Mammal Sci., 23: 144-156.

Vanderlaan, A.S.M., Corbett, J.J., Green, S.L., Callahan, J.A., Wang, C. Kenney, R.D., Taggart, C.T., and Firestone, J. 2009. Probability and mitigation of vessel encounters with North Atlantic right whales. Endang. Species Res., 6: 273-285.

Vanderlaan, A.S.M., Taggart, C.T., Serdynska, A.R., Kenney, R.D., and Brown, M.W. 2008. Reducing the risk of lethal encounters: vessels and right whales in the Bay of Fundy and on the Scotian Shelf. Endang. Species Res., 4: 282-297.

Vangilder, L.D., and Peterle, T.J. 1980. South Louisiana crude oil and DDE in the diet of Mallard hens: Effects on reproduction and duckling survival. B. Environ. Contam. Tox. 25: 23-28.

Vargo, S., Lutz, P., Odell, D., Van Vleet E., and Bossart, G. 1986. Study of the Effects of Oil on Marine Turtles. Final report to Minerals Management Service MMS Contract No. 14-12-0001-30063. 181 pp.

Veirs, S., Veirs, V., and Wood, J.D. 2016. Ship noise extends to frequencies used for echolocation by endangered killer whales. PeerJ, 4:e1657.

Velando, A., Munilla, I., and Leyenda, P.M. 2005. Short-term indirect effects of the Prestige oil spill on European shags: changes in availability of prey. Mar. Ecol.-Prog. Ser., 302: 263-274.

Voigt, B. 1998. Glossary of Coastal Terminology. Washington Department of Ecology Publication No. 98-105. Available from: http://www.ecy.wa.gov/programs/sea/swces/products/glossary.htm

von Ziegesar, O., Miller, E., and Dahlheim, M.E. 1994. Impacts on humpback whales in Prince William Sound. In: Loughlin, T.R., editor. Marine Mammals and the Exxon Valdez. Academic Press, Inc., San Diego, CA. pp. 173-191.

Walcoff and Associates Inc. 1989. Proceedings of the North Atlantic Submarine Canyons Workshop. February 7-9 1989. Volume 1: Synthesis Summary. Volume 2: Verbatim Transcript. U.S. Department of the Interior, Minerals Management Service, Atlantic OCS Region. OCS Study MMS 89-0016. Available from: https://archive.org/details/proceedingsofnor21989nort.

Walmsley, D., and Theriault, J. 2011. State of the Scotian Shelf Report: Ocean Noise. Atlantic Coastal Zone Information Steering Committee [ACZISC]. 25 pp. Available from: http://coinatlantic.ca/docs/ocean-noise.pdf.

Ward, J.G., and Sharp, P.L. 1974. Effects of aircraft disturbance on moulting sea ducks at Herschel Island, Yukon Territory, August 1973. Arctic Gas Biological Report Series, 14(2): 1-54.

Waring, G.T., Josephson, E., Maze-Foley, K., Rosel, P.E. (eds.). 2015. US Atlantic and Gulf of Mexico marine mammal stock assessments -- 2014. NOAA Tech Memo NMFS NE 231; 361 p. http://docs.lib.noaa.gov/noaa_documents/NMFS/NEFSC/TM_NMFS_NE/TM_NMFS_NE_231.pdf.

Watkins, W. A. 1986. Whale reactions to human activities in Cape Cod waters. Marine Mammal Science, 2, 251-262.

WDCS [Whale and Dolphin Conservation Society]. 2004. Oceans of Noise: A WDCS Science Report In: Simmonds, M., Dolman, S., and Weilgart, L. (eds.). 78 pp + App. Available from: http://www.wdcs.org/submissions_bin/OceansofNoise.pdf.

Weir, C.R. 1976. Annotated bibliography of bird kills at man-made obstacles: a review of the state-of-the-art and solutions. Can. Wildl. Serv., Ont. Reg., Ottawa. 85 pp.

Weir, C.R. 2008. Overt responses of humpback whales (Megaptera novaeangliae), sperm whales (Physeter macrocephalus), and Atlantic spotted dolphins (Stenella frontalis) to seismic exploration off Angola. Aquat. Mamm., 34(1): 71-83.

White, C.M., Ritchie, R.J., and Cooper, B.A. 1995. Density and productivity of bald eagles in Prince William Sound, Alaska, after the Exxon Valdez oil spill. In: Wells, P.G., Butler, J.N., Hughes, J.S., editors. Exxon Valdez Oil Spill: Fate and Effects in Alaskan Waters. ASTM STP 1219. American Society for Testing and Materials, Philadelphia, PA. 965 pp: 762-779.

Whitehead, H. 2013. Trends in cetacean abundance in the Gully submarine canyon, 1988–2011, highlight a 21% per year increase in Sowerby's beaked whales (Mesoplodon bidens). Canadian Journal of Zoology 91: 141-148.

Whitehead, H. and Wimmer, T. 2002. Update to the status of the northern bottlenose whale, *Hyperoodon ampullatus* (Scotian Shelf population). Prepared for COSEWIC. 27 November 2002.

Wiens, J.A. 1996. Oil, seabirds, and science: the effects of the Exxon Valdez oil spill. BioScience, 46: 587-597.

Wiens, J.A., Day, R.H., Murphy, S.M., and Parker, K.R. 2004. Changing habitat and habitat use by birds after the Exxon Valdez oil spill, 1989-2001. *Ecological Applications* 14: 1806-1825.

Wiese, F.K., and Montevecchi, W.A. 2000. Marine Bird and Mammal Surveys on the Newfoundland Grand Banks from Offshore Supply Vessels. Report prepared for Husky Oil. Memorial University of Newfoundland, St. John's, NL.

Wiese, F.K., and Robertson, G.J. 2004. Assessing impacts of chronic oil discharges at sea on seabirds: a general oiled seabird mortality model applied to eastern Canada. J. Wildlife Manage., 68: 627-638.

Wiese, F.K., and Ryan, P.C. 1999. Trends of chronic oil pollution in southeast Newfoundland assessed through beached-bird surveys, 1984-1997. Bird Trends, 7: 36-40.

Wiese, F.K., Montevecchi, W.A., Davoren, G.K., Huettmann, F., Diamond, A.W., and Linke, J. 2001. Seabirds at risk around offshore oil platforms in the Northwest Atlantic. Mar. Pollut. Bull., 42: 1285-1290.

Wiese, F.K., Robertson, G.J., and Gaston, A.J. 2004. Impacts of chronic marine oil pollution and the murre hunt in Newfoundland on thick-billed murre *Uria lomvia* populations in the eastern Canadian Arctic. Biol. Conserv,116: 205-216.

William, R. Gero, S., Bejder, L., Calambokidis, J., Kraus, S.D., Lusseau, D., Read, A.J., and Robbins, J. 2011. Underestimating the damage: interpreting cetacean carcass recoveries in the context of the Deepwater Horizon/BP incident. Conservation Letters Vol. 4(3):228-233.

Williams, A.S. 1985. Rehabilitating oiled seabirds. In: Burridge, J., and Kane, M. (eds.). A Field Manual, International Bird Rescue Research Center, Berkely, CA. 79 pp.

Williams, R., Clark, C.W., Ponirakis, D., and Ashe, E. 2013. Acoustic quality of critical habitats for three threatened whale populations. Anim. Conserv., 17(2): 174-185.

Williams, U., and Chardine, J. 1999. The Leach's Storm Petrel: General Information and Handling Instructions. 4 pp. Available from: http://www.cnlopb.nl.ca/pdfs/mkiseislab/mki_app_h.pdf.

Wolfe, D.A., Krahn, M.M., Casillas, E., Sol, S., Thomas, T.A., Lunz, J., and Scott, K.J. 1996. Toxicity of intertidal and subtidal sediments in contaminated by the Exxon Valdez oil spill. In: Rice, S.D., Spies, R.B., Wolfe, D.A., and Wright, B.A. (eds.). Proceedings of the Exxon Valdez Oil Spill Symposium, American Fisheries Society Symposium 18; pp.121-139.

Worcester, T., and Parker, M. 2010. Ecosystem Status and Trends Report for the Gulf of Maine and Scotian Shelf. DFO. Can. Sci. Advis. Sec. Res. Doc. 2010/070. vi + 59 pp.

Work, P.A., Sapp, A.L., Scott, D.W., and Dodd, M.G. 2010. Influence of small vessel operation and propulsion system on loggerhead sea turtle injuries. Journal of Experimental Marine Biology and Ecology 393(1–2):168-175.

Wright, A.J. 2008. International Workshop on Shipping Noise and Marine Mammals, Hamburg, Germany. 21st-24th April 2008. Okeanos-Foundation for the Sea, Auf der Marienhohe 15, D-64297 Darmstadt. 33+ v.

Wright, A.J. 2015. Sound Science: Maintaining Numerical and Statistical Standards in the Pursuit of Noise Exposure Criteria for Marine Mammals. Front. Mar. Sci. 2:99.

Wright, A.J., Aguilar Soto, N., Baldwin, A.L., Bateson, M., Beale, C.M., Clark, C., Deak, T., Edwards, E.F., Fernández, A., and Godinho, A. 2007a. Do marine mammals experience stress related to anthropogenic noise? Intern. J. Comp. Psychol., 20(2-3): 274-316.

Wright, A.J., Aguilar Soto, N., Baldwin, A.L., Bateson, M., Beale, C.M., Clark, C., Deak, T., Edwards, E.F., Fernández, A., and Godinho, A. 2007b. Anthropogenic noise as a stressor in animals: a multidisciplinary perspective. Intern. J. Comp. Psychol., 20(2-3): 250-273.

Wright, A.J., and Kuczaj, S. 2007. Noise-related stress and marine mammals: An introduction. Intern. J. Comp. Psychol., 20(2-3): iii-viii.

Wright, A.J., Deak, T., and Parsons, E.C.M. 2009. Concerns related to chronic stress in marine mammals. IWC Working Pap. SC/61/E16: 7 pp.

Wright, A.J., Deak, T., and Parsons, E.C.M. 2011. Size matters: management of stress responses and chronic stress in beaked whales and other marine mammals may require larger exclusion zones. Mar. Pollut. Bull., 63(1-4): 5-9.

Würsig, B., Lynn, S.K., Jefferson, T.A., and Mullin, K.D. 1998. Behaviour of cetaceans in the northern Gulf of Mexico relative to survey ships and aircraft. Aquat. Mamm. 24(1):41-50.

WWF [World Wildlife Fund]. 2009. An Ocean of Diversity-The Seabeds of the Canadian Scotian Shelf and Bay of Fundy. 24 pp.

Wysocki, L.E., Dittami, J.P., and Ladich, F. 2006. Ship noise and cortisol secretion in European freshwater fishes. Biol.Conserv., 128: 501-508.

Xia, K., Hagood, G., Childers, C., Atkins, J., Rogers, B., Ware, L., Ambrust, K., Jewell, J., Diaz, D., Gatian, N., *et al.* 2012. Polycyclic aromatic hydrocarbons (PAHs) in Mississippi seafood from areas affected by the Deepwater Horizon oil spill. Environ. Sci. Technol., 46(10): 5310-5318.

Yender, R.J., Michel, J., and Lord, C. 2002. Managing Seafood Safety after an Oil Spill. Seattle Hazardous Materials Response Division, Office of Response and Restoration, National Oceanic and Atmospheric Administration. 72 pp.

Yergeau, E., C. Maynard, S. Sanschagrin, J. Champagne, D. Juck, C.W. Greer, T.L. King, B. Robinson, G. Wohlgeschaffen, S. Cobanli, C. McIntyre, and K. Lee. 2014. Monitoring Ecosystem Responses to the Gulf of Mexico Oil Spill by Monitoring the Interaction of Oil and Suspended Particulate Matter, Changs in Microbial Structure, Function and Hydrocarbon Degradation Activity. Prepared for BP Exploration and Production Inc. July 2014.

Zhai, L., Platt, T., Tang, C., Sathyendranath, S., and Hernandez Walls, R. 2011. Phytoplankton phenology on the Scotian Shelf. ICES J. of Mar. Sci., 68: 781-791.

Zwanenburg, K.C.T., Bundy, A., Strain, P., Bowen, W.D., Breeze, H., Campana, S.E., Hannah, C., Head, E., and Gordon, D. 2006. Implications of Ecosystem Dynamics for the Integrated Management of the Eastern Scotian Shelf. DFO Can. Tech. Rep. Fish. Aquat. Sci. 2652: xiii + 91 pp.

Zykov, M.M. 2016. Modelling Underwater Sound Associated with Scotian Basin Exploration Drilling Project: Acoustic Modelling Report. JASCO Document 01112, Version 2.0. Technical report by JASCO Applied Sciences for Stantec Consulting Ltd. February 2010.