



## Environmental Assessment North Flemish Pass Gravity Survey 2015 - 2019



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# **Environmental Assessment**

## **North Flemish Pass Gravity Survey 2015-2019**

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**August 2015**

## EXECUTIVE SUMMARY

Bridgeport Holdings Ltd. (Bridgeport) and its partner JEBSCO Seismic (Canada) Co. (JEBSCO) in partnership are proposing to conduct a non-exclusive geophysical program offshore Newfoundland under the jurisdiction of the Canada - Newfoundland and Labrador Offshore Petroleum Board (C-NLOPB) under the *Canada - Newfoundland Atlantic Accord Implementation Act*. Bridgeport has taken the lead role as the Operator respecting the regulatory approval requirements and operations.

The aerial surveys involve an offshore region that encompasses portions of the Grand Banks, Flemish Pass, and Jeanne d'Arc Basin of the northeast Newfoundland Slope in the Atlantic Ocean. The Operator is proposing to conduct one or more gravity surveys from March 1 to the November 30, from 2015 through to 2019. To conduct this survey, Bridgeport plans to acquire survey data, passively, from a fixed-wing twin-engine aircraft flown at a constant altitude.

This document provides a Screening Level Environmental Assessment to allow the Canada – Newfoundland and Labrador Offshore Petroleum Board to fulfill its responsibilities under the *Canadian Environmental Assessment Act*.

The identified valued ecosystem components (VECs) include Marine and Migratory Birds, Marine Mammals, Sea Turtles, Species at Risk, Sensitive Areas and Ocean Resource Users. Engagement of stakeholder groups to collect and compile information on activities and concerns of these groups in the Study Area included several fishing industry organizations, scientists, and government agencies.

Sound is limited in duration by the time over which the source produces it. To be detected by an animal or person at sufficient levels to induce an impact, the receiver must be within sufficient proximity to the source. In other words, the animal or person must be within sufficient range at the time the sound is being produced, for the sound to have an impact on it. In addition, the amplitude, duration and frequency of the noise, as well as the hearing ability and behavioral state of the animal or person, all influence how or if there is an impact on the animal or person.

Airborne sound does not transmit well into water. The aircraft produces a low frequency sound at a level well below the harassment level considered by regulators. Effects studies from aircraft sound on animals are limited. However, low-level aerial surveys of marine mammals, seabirds and sea turtles have been used for many decades and the method is accepted by regulatory agencies and research institutes. This research method has been extensively applied worldwide to fulfill with national and international obligations for the conservation of cetaceans. Among these techniques, visual line-transect surveys, conducted using fixed-wing aircraft with dedicated marine mammal observers counting animals along pre-defined track lines, are probably the most widely used method, particularly when trying to assess and quantify cetacean occurrence and density over large spatial scales.

This environmental assessment predicts that any potential adverse environmental effects on the above VECs will not be significant because there is no potential for physically harmful contact or sound levels emitted. No marine species is expected or known to experience physical harm as a result of these surveys. Avoidance reaction by cetaceans and sea turtles may occur in association with an aircraft directly overhead.

Potential cumulative environmental effects sources associated with activities external to the Project include fishing, research surveys, marine transportation, seismic surveys and drilling programmes. Compared to existing ambient and anthropogenic sounds in the area, the Bridgeporth aircraft sound is considerably less and its effect considered negligible to low. Cumulative environmental effects resulting from any of the Project activities will not be additive or cumulative because the Project activities are transitory, moving about at 222 km/h, with only two to three survey transects flown a day, spaced at 10 to 15 km apart. The aircraft will avoid any seal herds spotted, thus avoiding enforcement flights, DFO research flights and the potential to scare seals eliminating any potential effects on seal harvesting. With the implementation of mitigative measures and the limited spatial overlap with other activities, any potential residual cumulative environmental effect of the Project in conjunction with other projects and activities are not predicted to be significant.

The potential for accidental events is limited to the unlikely occurrence of a ditched aircraft and associated aviation gas spill. Given how unlikely such an event is the residual environmental effect of an accidental event is predicted to be not significant.

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## 1 INTRODUCTION

Bridgeport Holdings Ltd. (Bridgeport) and its partner JEBSCO Seismic (Canada) Co. (JEBSCO) in partnership are proposing to conduct a non-exclusive geophysical program offshore Newfoundland under the jurisdiction of the Canada - Newfoundland and Labrador Offshore Petroleum Board (C-NLOPB) under the *Canada - Newfoundland Atlantic Accord Implementation Acts*. Bridgeport has taken the lead role as the Operator in the regulatory approval requirements and operations.

The aerial surveys involve an offshore region that encompasses portions of the Grand Banks, Flemish Pass, and Jeanne d'Arc Basin of the northeast Newfoundland Slope in the Atlantic Ocean.

The Operator is proposing to conduct one or more gravity surveys from March 1 to the November 30, from 2015 through to 2019. This does not mean that there may be a survey every year. To conduct this survey, Bridgeport plans to acquire survey data, passively, from a fixed-wing twin-engine aircraft flown at a constant altitude.

The Project requires approval through the Canada - Newfoundland and Labrador Offshore Petroleum Board (C-NLOPB). This project is not supported by federal funding. Federal lands are involved and administered by the C-NLOPB.

The Project Description was submitted to the C-NLOPB in November 2014. This document provides an Environmental Assessment to allow the C-NLOPB to fulfill its responsibilities under the *Canada Newfoundland Accord Act*. The technical and scope advice received from the C-NLOPB and stakeholder federal agencies and from industry and public stakeholders consulted by Bridgeport has guided the preparation of this EA.

### 1.1 Purpose and Need for the Project

Discovering and assessing oil or gas deposits requires integration of information culled from geology, geochemistry, drilling, GIS, seismology, electromagnetic potential fields, and other disciplines.

While seismic exploration remains the primary method of exploring for petroleum, use of gravity and magnetic methods has continued to expand, based on their contribution to reliable evaluations (and recent discoveries) in deeper, more challenging environments such as sub-salt structures and deep sea.

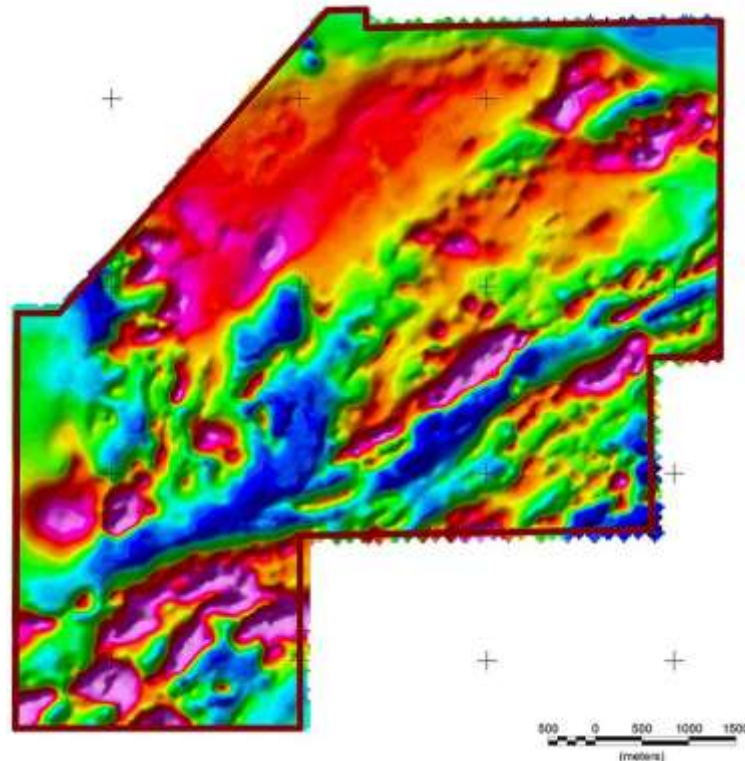
By gathering geophysical data to narrow the search area within large fields, exploration crews can refine their targets and apply seismic techniques more efficiently. Combining seismic and gravity methods enables oil explorers to better define and focus projects early on, and minimize the risk of conducting expensive investigation before potential is determined.

The primary objective of the project is to determine the presence and likely locations of geological structures which may contain hydrocarbon deposits. The application of gravity surveys has been shown to be very complimentary to seismic data, especially as a way to quickly in-fill information between 2D seismic lines in a very cost effective way. The proposed survey data will be acquired to compliment 2D seismic data sets previously acquired in the region, including data collected by JEBSCO. The gravity and magnetic data will be integrated with the 2D seismic to produce a pseudo 3D model of the earth subsurface.

Grav/mag data quality has improved significantly since the 1980s. Data can be acquired more quickly and data resolution is much better to permit resolving more subtle (lower amplitude and shorter spatial wavelength or high frequency) perturbations in both the gravity and the crustal

magnetic fields. This improved resolution now allows users to image very small-scale and shallow lateral variations in density and magnetic susceptibility. These are often associated with the hydrocarbon play itself. Modern grav/mag surveys can now provide a set of observations that is more directly associated with hydrocarbon play character, in addition to the 'traditional' regional information for which we have long used potential field data.

Bridgeporth has two areas in which recent significant advances have been made. These include, in acquisition, airborne gravity, which provides a rapidly acquired, high-resolution image of local gravity anomalies, and in software development, improved 3D inversion algorithms for sophisticated gravity and magnetic earth models (Figure 1.1).



**Figure 1.1. An example of a high resolution aeromagnetic map.** The color patterns represent total magnetic intensity and can be used to interpret lithology, alteration, and structure in the survey area.

## 1.2 Proponent Contact Information

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### 1.3 Regulatory Context

In accordance with its mandate under the *Canada-Newfoundland Atlantic Accord Implementation Acts*, the C-NLOPB may issue an *Authorization to Conduct a Geophysical Program (GPA)* to allow Bridgeport to carry out the Gravity survey program described herein.

The C-NLOPB is the designated federal representative mandated under the *Atlantic Accord Implementation Acts* with input from relevant expert government agencies. Relevant government regulations and guidelines reviewed during the issues scoping process include:

- *Canada-Newfoundland Atlantic Accord Implementation Acts*;
- *Fisheries Act*,
- *Migratory Birds Convention Act (MBCA)*;
- *Canadian Environmental Protection Act*;
- *Species at Risk Act (SARA)*;
- *Aeronautics Act*;
- *Canada Transportation Act*; and
- Geophysical, Geological, Environmental, and Geotechnical Program Guidelines, (C-NLOPB 2012)

### NAV CANADA - Airspace Management

NAV CANADA provides air traffic management and information services to all of Canada. They are responsible for the determination of active runways at airports. NAV CANADA's responsibility lies primarily in the management of air traffic through Canada's airspace. NAV CANADA's mission is to provide safe, efficient and effective delivery of air navigation services.

### Transport Canada

While management and control of airports in Canada has been transferred to local Airport Authorities, Transport Canada remains the federal regulator of airports and aviation in Canada. Transport Canada's role is to develop current and relevant transportation policies and legislation, as well as maintaining a safe and secure air transportation system. Transport Canada's responsibilities are to develop and administer policies and regulations for the Canadian transportation system.

In 2001, the International Civil Aviation Organization (ICAO) developed policies for member states to help manage the impact of aircraft noise on affected populations without unduly inhibiting air traffic growth. The ICAO assembly endorsed an approach to reducing the impact of aircraft noise that focuses primarily on the reduction of noise at source (i.e., quieter aircraft), better land use planning and management, noise abatement operating procedures, and as a last resort operating restrictions. ICAO has also developed policies regarding charges to be levied on aircraft operators who fly noisier types of aircraft.

### 1.4 Canada- Newfoundland and Labrador Benefits

Bridgeport is committed to benefits for Canadian companies with emphasis on organizations from Newfoundland and Labrador. A benefits plan is being finalized for Bridgeport which will govern all company operations in the future with its guiding principles as follows:

- Companies from Canada and Newfoundland and Labrador in particular will be given full and fair opportunity to provide goods and services to Bridgeport;
- Bridgeport must make decisions based on what optimizes value to its projects;

- Value to Bridgeporth will be quantified through vendor impact on project economics, product and/or service quality, timing, vendor experience and reputation and other similar metrics.

## 2 PROJECT DESCRIPTION

### 2.1 Project Name and Location

The official name of the proposed project is North Flemish Pass Gravity Survey.

The Project Area (2015-2019) includes the first acquisition phase. The Project Area is well within the Study Area, as shown in Figure 2.1. The coordinates and extents of the Project Area and Study Area are provided in Tables 2.1 and 2.2.

**Table 2.1: Coordinates for Project Area**

	<b>Longitude</b>	<b>Latitude</b>
1	41° 59' 25.6604" W	44° 29' 21.6839" N
2	51° 35' 27.7980" W	44° 29' 21.6839" N
3	51° 35' 27.7980" W	51° 08' 42.6025" N
4	41° 59' 25.6604" W	51° 08' 42.6025" N

**Table 2.2: Coordinates of Bridgeport Acquisition Study Area**

	<b>Longitude</b>	<b>Latitude</b>
1	51° 52' 35.4672" W	51° 25' 50.2717" N
2	41° 43' 12.0790" W	51° 25' 50.2717" N
3	41° 43' 12.0790" W	44° 14' 2.1904" N
4	51° 52' 35.4672" W	44° 14' 2.1904" N

All boundary lines are within the C-NLOPB jurisdiction and are outside the Canada 12 nautical mile limit.

### 2.2 Project Overview

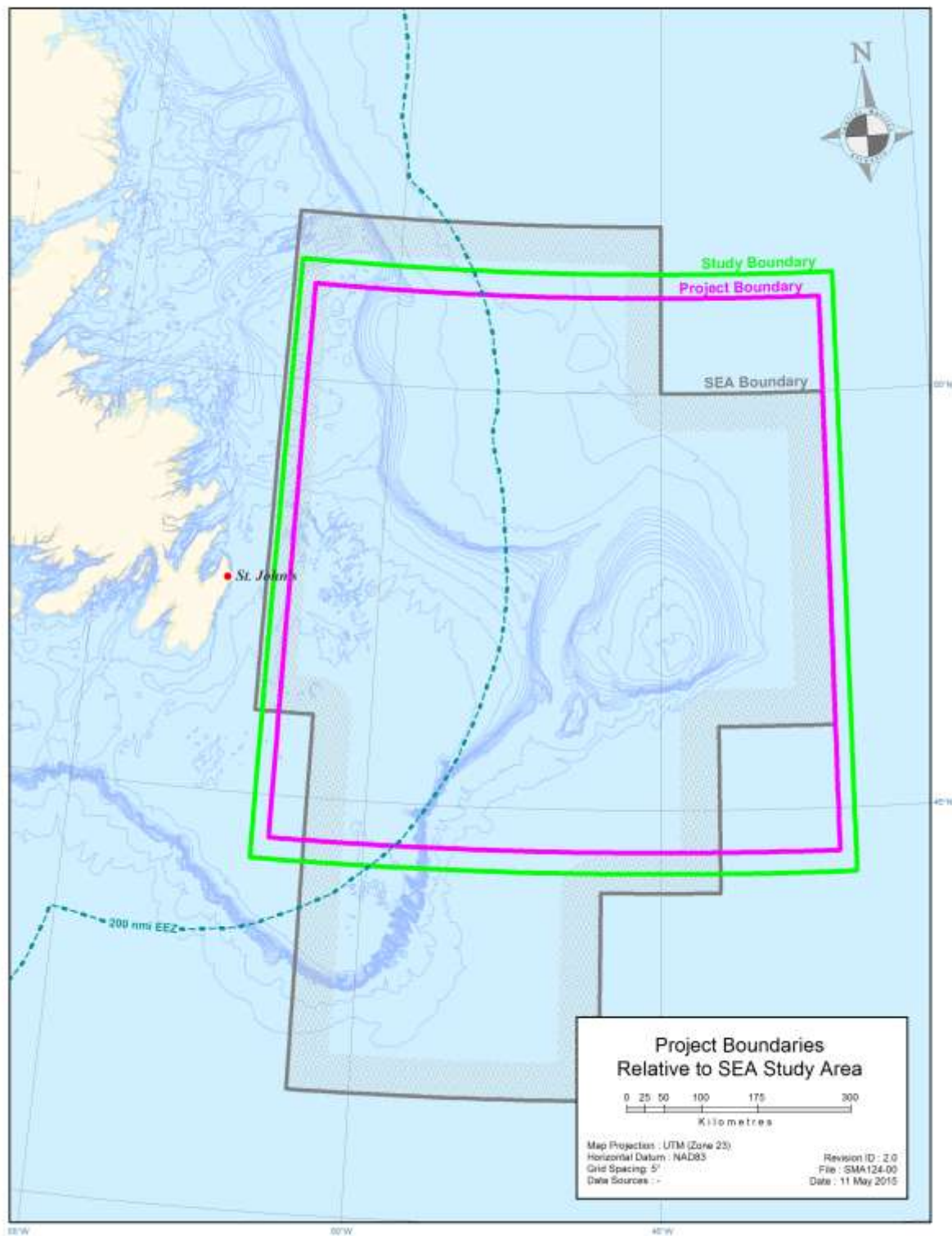
Gravity and magnetic surveys involve measuring the Earth's gravitational and magnetic fields using highly sensitive instruments. These potential field measurements can be made on the Earth surface, on both land and the sea bottom, from ships or from aircraft. The proposed project is comprised of a gravity and magnetics survey, consisting of approximately 472,000 km<sup>2</sup> of data collection between 2015 and 2019 with the first tranche of up to 100,000 km<sup>2</sup> collected in season 1, March to November 2015. It is estimated that the total linear kilometres to be acquired will be about 500,000 kms.

Although the survey lines have yet to be finalized a typical survey grid is comprised of 1000 m or 1500 m flight line spacing with orthogonal tie lines at 4000 m or 6000 m.

#### 2.2.1 Fixed Wing Aircraft

As the aircraft flies, the magnetometer passively measures and records the total intensity of the magnetic field at the sensor, which is a combination of the desired magnetic field generated in the Earth as well as tiny variations due to the temporal effects of the constantly varying solar wind and the magnetic field of the survey aircraft. By subtracting the solar, regional, and aircraft effects, the resulting aeromagnetic map shows the spatial distribution and relative abundance of magnetic minerals (most commonly the iron oxide mineral magnetite) in the upper levels of the

Figure 2.1: Project Activity Area





Earth's crust. Because different rock types differ in their content of magnetic minerals, the magnetic map allows a visualization of the geological structure of the upper crust in the subsurface, particularly the spatial geometry of bodies of rock and the presence of faults and folds. This is particularly useful where bedrock is obscured by surface sand, soil or water. Aeromagnetic data were once presented as contour plots, but now are more commonly expressed as thematic (colored) and shaded computer generated pseudo-topography images. The apparent ridges and troughs are referred to as aeromagnetic anomalies. A geophysicist can use mathematical modeling to infer the shape, depth and properties of the rock bodies responsible for the anomalies.

The gravity meter is deployed in a fixed wing aircraft and flown in a grid pattern over the area of interest at a low altitude (typically 150 to 500 m). A typical flight plan for a survey, dictated largely by fuel consumption, allows for two to three survey lines a day. To account for aircraft turn around, each survey line will be spaced between 5 and 10 km apart and extend between 200 and 550 km long.

The base of operations (typically a regional airport with hanger access) for survey work could be 100s of kms from the survey area. The aircraft makes repeated trips to the project area over a period, gradually building up the grid of measurements. Operations will be limited by weather, as the survey equipment requires low turbulence to record high quality data. Good visibility is also required for safe operations at low altitude, so operations are also restricted by daylight hours and weather conditions.

Magnetic data will also be acquired from the aircraft in a remote module on the wingtips or nose/tail boom. Magnetic data will be very useful for understanding basement geology or the presence of igneous deposits. Both magnetic and gravity measurements are completely passive measurements. This means that no signal is emitted and the systems measure naturally occurring properties of the earth.

## **2.2.2 Project Scheduling**

The survey will not exceed 180 days. Logistics and weather will play an important role in scheduling; therefore, in order to allow flexibility in timing the operator is proposing a March 1 to November 30 from 2015 to 2019 window for data collection.

## **2.3 Alternatives to the Project & Alternatives for the Project**

### **2.3.1 Alternatives to the Project**

Alternatives to the Project are defined as functionally different ways of achieving the same end [Canadian Environmental Assessment (CEA Agency 1997)]. The one alternative to the proposed gravity and magnetic program is the 'do nothing' scenario.

Gravity methods are vital for providing an independent corroboration of total volume and shape of salt when investigating sub-salt hydrocarbon potential. Seismic data quality can be significantly improved when gravity modeling results are used to improve and refine the seismic velocity model of the base of salt. This result is fed back into the seismic pre-stack depth migration processing to provide an improved seismic image of the sub-salt horizons' geometries. Ultimately, this leads to more successful prospecting.

The 'no-go alternative' would mean that Bridgeport would forego exploration in Newfoundland and pursue opportunities elsewhere in the world, in order to assist market demand for data. This would consequently mean that the potential to assess the hydrocarbon potential of this area would not proceed, along with the assessment of opportunity for further subsurface

exploration and drilling programs. Ultimately, the project not proceeding in this case would effectively preclude the potential to evaluate the area's offshore hydrocarbon resources.

### **2.3.2 Alternative Means for the Project**

Alternative means for the Project are defined as methods of similar technical character or methods that are functionally the same (CEA Agency 1997). Alternative means for carrying out this project include variations in technology, project schedule, and location.

#### **2.3.2.1 Alternatives to Survey Method**

There are few alternatives for the proposed survey methodology that would provide the information required to assess the area's submarine hydrocarbon resources. Exploration and production companies would not accept alternatives for their purposes.

#### **2.3.2.2 Alternatives to Program Timing**

The proposed program is scheduled to occur between March and November 2015 to 2019. Specific timing of the program will depend on a variety of factors, including coordination with other weather conditions, timing, and sensitivities associated with biological and socio-economic constraints, such as seal harvesting in the spring. For example, mitigation options to minimize potential impacts can potentially include modification of the operations schedule within specific areas, and the survey plan has been developed on this basis.

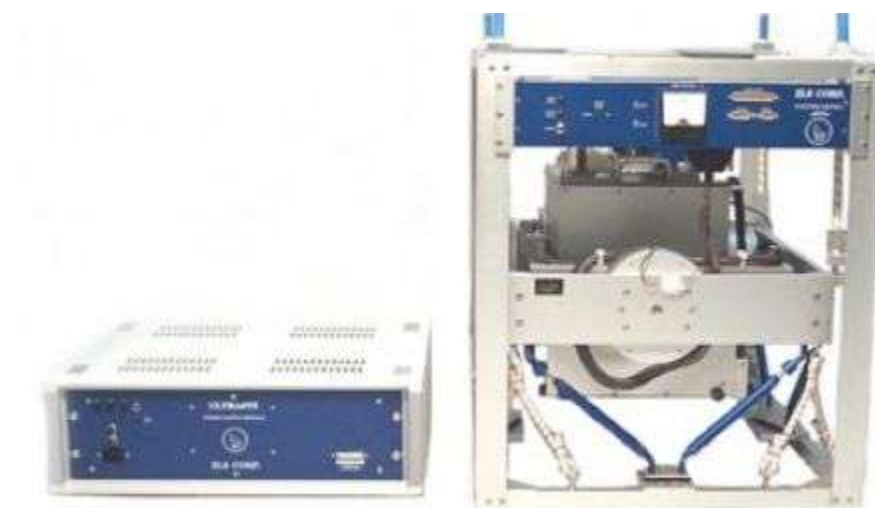
### **2.3.3 Project Activity Area**

The Project Activity Area encompasses the geographic area within which Bridgeporth expects to undertake the gravity survey within the next five years (Figure 2.1).

## 2.4 Project Components

### 2.4.1 Gravity System

System	e.g. GT-2A-Adv / or a ZLS Fluid Dampened Meter
Measurement Range	9.75 to 9.85/m/sec
Dynamic Range	up to + 1.000 Gal (airborne)
Drift (corrected)	<0.1 mGal/day (airborne)
Resolution	0.2 mGal (Airborne)



### 2.4.2 Magnetic System

Airborne specification	
System	three sensors at the wing-tips and tail boom
Sensor Type	Geometrics G-822A Cesium Magnetometer
Range	20,000 – 100,000nT
Sensitivity	<0.0005 nT/sqrtHz rms, typically 0.003nT at sampling rate of 0.1s
Compensation	Aircraft generated fields compensated using digital compensator operating on a measured set of defined maneuvers

### 2.4.3 Aircraft Specifications

The survey aircraft will be a turboprop fixed wing plane such as a Basler BT-67 (Photo 1). The operator of the plane will be Bridgeporth either from its own fleet or on charter.

The plane can fly 1860 nm (2140 statute miles) at a cruising speed of 205 kn and 115 kn when acquiring data. The plane will have two typical engines (e.g. Pratt & Whitney Canada PT6A 67AR Turboprops).



**Photo 1. Basler Twin Engine Aircraft**

#### **2.4.4 Logistical Support**

Details of logistical operations to support the gravity survey program will largely depend on season and weather.

##### Airport Support

Bridgeport will use airport facilities in St. John's, Newfoundland, and alternatively Gander, Newfoundland. The airport chosen will be dictated by refueling requirements.

Bridgeport will establish a representative in St. John's for day-to-day survey management and liaison with local services and regulators.

#### **2.5 Emissions and Waste Discharges**

The aircraft will generate air and underwater noise, and atmospheric emissions. There will be no solid or liquid discharges from the plane. Air emissions from this program will be similar to those of any standard midsize aircraft. These emissions are described below.

##### **2.5.1 Noise Emissions**

Much of International Civil Aviation Organization (ICAO) ICAO's effort to address aircraft noise over the past 40 years has been aimed at reducing noise at source. Airplanes and helicopters built today are required to meet the noise certification standards adopted by the Council of ICAO. These are contained in Annex 16 — *Environmental Protection*, Volume I — *Aircraft Noise* to the *Convention on International Civil Aviation*, while practical guidance to certifying authorities on implementation of the technical procedures of Annex 16 is contained in the *Environmental Technical Manual on the use of Procedures in the Noise Certification of Aircraft* (Doc 9501). The ICAO noise standards are adopted into the Canadian Aviation Regulations, which set the standards for aircraft noise levels permitted in Canada.

There appears to be a lack of aircraft specific sound levels in the literature as well as from manufactures (e.g. Basler Turbo Conversions LLC, pers. comm. 2015) and operators (Kenn

Borek Air Ltd. pers. comm. 2015) for the potential plane types proposed for this survey program. A plane commonly used for research aerial surveys is the de Havilland Twin Otter (2 engines, 3 blades). In the military, the commonly used fixed wing propeller plane is the P-3 Orion (2 engines, 4 blades). The Basler aircraft is built with two engines and three blades, thus the sound produced will be bracketed by the Twin Otter and the P-3 Orion sound levels.

A spectrograph of sound from a cruising P-3 is provided in Figure 2.2. There appears to be no similar graphic for a Twin Otter. While cruising at altitude, maximum sound level from the P-3 aircraft is 82 dB re 20 $\mu$  Pa at < 500 Hz, with one peak at 90 dB re 20 $\mu$  Pa at 160 Hz. With the exception of the one peak, this sound received level is less than the occupational noise exposure limit of 85 dB.

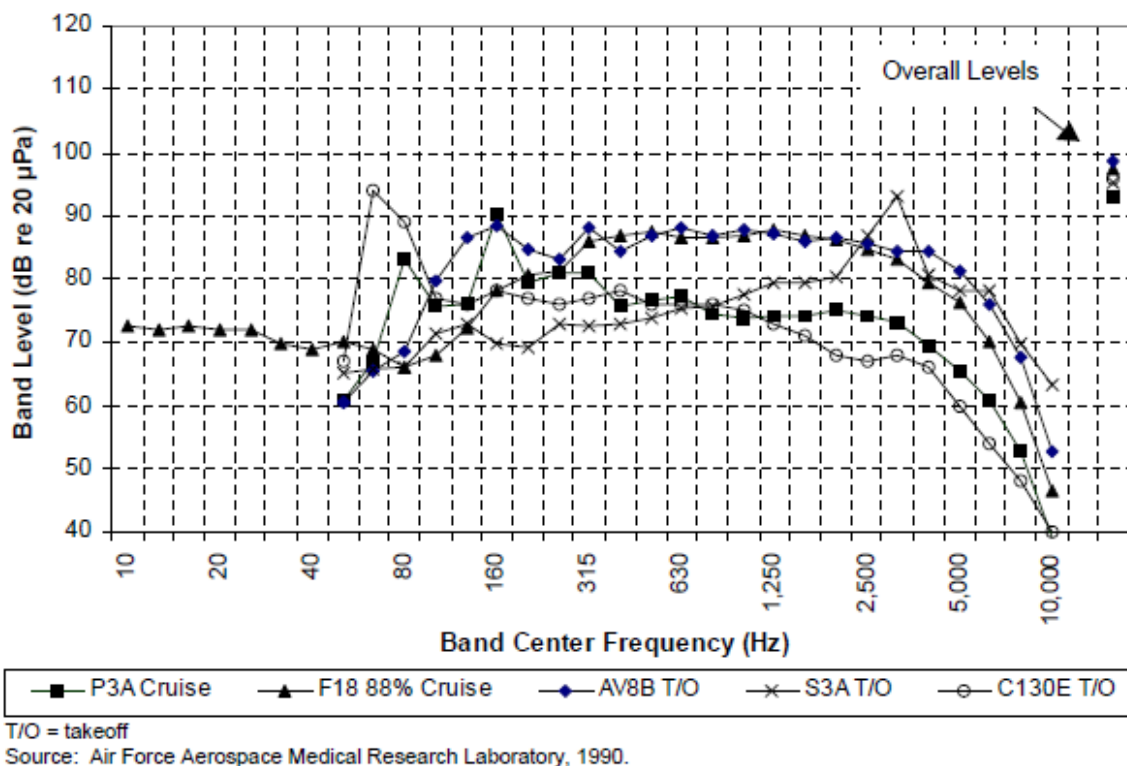


Figure 2.2: Spectrogram of military aircraft (ref. US Navy 2008)

Dominant tones for the two aircraft types are 68 to 84 Hz. Richardson et al. (1995) compiled limited data on aircraft noise, and the characteristics of sound in water at altitude similar to this project range between 107 to 121 dB re 1  $\mu$ Pa (Table 2.3).

**Table 2.3: Aircraft received noise levels at altitude**

<b>Aircraft</b>	<b>Altitude (m)</b>	<b>Received level (dB re 1 µPa)*</b>	<b>Estimated Source Level (dB re 1µPa-m)</b>
P-3 (56-80 Hz)	152	121	162
	305	114	162
P-3 (890-1120 Hz)	152	107	148
Twin Otter	457	107	147

\*As applied to levels received at 3 to 18 m underwater

Part VI of the Canadian Aviation Regulations (CARs), General Operating and Flight Rules, also helps to manage aircraft noise. CAR 602.105 (Noise Operating Criteria) requires that aircraft operating at or in the vicinity of Canadian aerodromes must comply with airport - specific noise abatement procedures and control requirements published in the Canada Air Pilot, a navigation publication for pilots. Noise abatement procedures and controls at Canadian airports may include:

- aircraft departure and arrival procedures designed to minimize the noise impact on surrounding communities; and
- restrictions on engine run - up procedures at the airport as well as on ground service equipment.

## **2.5.2 Atmospheric Emissions**

Atmospheric emissions will result from airplane exhaust. Aircraft are required to meet the engine certification standards adopted by the Council of ICAO. These are contained in Annex 16 – *Environmental Protection*, Volume II – *Aircraft Engine Emissions* to the *Convention on International Civil Aviation*. These were originally designed to respond to concerns regarding air quality in the vicinity of airports. As a consequence, they establish limits for emissions of oxides of nitrogen (NO<sub>x</sub>), carbon monoxide, unburned hydrocarbons, for a reference landing and take-off (LTO) cycle below 915 meters of altitude (3000 ft). *The Canadian Environmental Protection Act* has defined Federal Ambient Air Quality Objectives for numerous pollutants with which airports should adhere. Carbon monoxide, nitrogen dioxide, ozone and total hydrocarbons are among those chemicals associated with airport and aircraft activities that are subject to these objectives.

## **2.6 Bridgeport HSE Management System**

It is the HSE policy of Bridgeport to manage its business and provide services in such a way that it minimizes risks to the health and safety of its employees and other persons for whom it is responsible, and risks to the environment.

The Company shall provide a safe and healthy working environment and equipment and shall act positively to prevent injury, ill health, damage, loss or environmental degradation arising from its operations. This shall be achieved via the implementation, promulgation and application of an HSE Management System (HSEMS), which is integrated with the Company's Quality Management System (QMS).

The Company shall:

- As a minimum, comply with International Standards and all rules and regulations, local regional, national and international, on HSE, which apply to its activities
- Act in accordance with the Bridgeport's Business Principles, Policies, Rules and Procedures.
- Take account of HSE issues when making commercial decisions and prior to any activity
- Work with and contribute constructively to HSE initiatives within the industry
- Identify hazards and reduce associated risks to levels as low as reasonably practicable with the application and use of appropriate control measures and to review these assessments
- Ensure personnel understand their specific HSE responsibilities and that they are competent
- Maintain necessary knowledge of standards, legislation, codes of practice and other material, and ensure that such material is made available within the Company
- Consult with employees when making decisions that affect them
- Necessitate suppliers to comply with the Company's HSE requirements
- Store, use and dispose of energy and materials efficiently and appropriately
- Monitor, measure and analyze HSE data in order to continually improve HSE performance

In compliance with its Safety Policy, every effort will be made by all employees to utilize the HSE Management System. Modeled on ISO-14001 and ISO-9001, the HSE Management System provides a management driven, closed-loop system to expedite issue resolution and ensure continuous improvement.

Various manuals comprise the HSE Management System, including aviation safety policy manual, crisis management manual, emergency response manual, and field safety manual.

Before undertaking any hazardous activity, including fieldwork, it is a requirement of the Management of Health and Safety at Work Regulations that a formal risk assessment is carried out. This risk assessment is designed to identify hazards, assess the risk of an accident occurring and specify actions that must be taken to promote a safe system of work. In all these cases, the leader of the field party must undertake a written risk assessment, which must be submitted for a relevant senior line manager. Employees must comply with all relevant provisions of the risk assessment designed to ensure a safe system of working.

## **2.7 Potential Malfunctions and Accidental Events**

In Environment Canada's review of the project description, it stipulated awareness of the general applicability of Section 36(3) of the *Fisheries Act* which states: *"no person shall deposit or permit the deposit of a deleterious substance of any type in water frequented by fish or in any place under any conditions where the deleterious substances or any other deleterious substance that results from the deposit of the deleterious substance may enter any such water"*. Environmental protection and mitigation measures should reflect the need to comply with Section 36(3) of the *Fisheries Act*. For example, measures should be taken to prevent substances such as lubricating fluids, fuels, etc. from being deposited into water frequented by fish, and drainage from construction and operational drainage must not be harmful to fish.

There are unplanned situations that may be encountered during aircraft operations. Any leakage of fuel or lubricate requires an immediate return to the airport. Volumes of such products would be minor as any loss of fuel or lubricant fluids for aircraft operation are not routine and in small quantity onboard. Potential hazards are addressed during site-specific

planning as part of emergency response planning. Procedures are developed by Bridgeporth to ensure that such events are managed in a safe and environmentally sound manner. Bridgeporth has policies, plans, and procedures to prevent or mitigate effects of malfunctions and accidents. These policies, plans, and procedures will be located on the aircraft, and in the Bridgeporth St. John's (shore office). Aircraft are not prone to accidental releases of fuel.

Best management practices and communications will be used on the aircraft to avoid equipment loss or damage. In the case of severe weather, the aircraft will not fly.



### **3 SCOPE OF THE ASSESSMENT**

A scoping process focuses the environmental assessment on the Project components and activities to be assessed, the key environmental issues, and the appropriate spatial and temporal boundaries. The scope of an EA must be established early in the process to ensure that the analysis remains focused and manageable. The scoping process for this assessment included the following:

- Project Description submitted by Bridgeport (2014);
- the Scoping Document for the environmental assessment led by the C-NLOPB (2014; see Appendix A);
- stakeholder consultation;
- preliminary research, which included a review of existing literature, relevant scientific research publications and regulatory guidelines; and
- professional judgment of the EA study team.

#### **3.1 Factors to be Considered**

Factors to be incorporated into the EA include:

- Purpose of the Project
- Environmental effects of the Project
- Malfunctions or accidents
- Effects on the project caused by the environment
- Cumulative environmental effects of the project
- Significance of the environmental effects
- Mitigation measures
- Significance of residual adverse environmental effects following mitigation
- Results of consultations

#### **3.2 Scope of the Factors to be Considered**

- Use information provided in the Eastern Newfoundland Strategic Environmental (ENSEA) (AMEC 2014) Assessment to support this environmental assessment.
- Discuss biological and physical environments in the Project and Study Areas
- Identify data gaps
- Use a valued ecosystem component (VEC) approach and provide a definition and rationale for each VEC selection.
- Address potential issues identified in the scoping document
- Consider spatial and temporal boundaries
- Define significance of residual adverse environmental effects

#### **3.3 Stakeholder Consultation and Engagement**

Bridgeport recognizes the importance of communications to keep stakeholders informed about its proposed program and to obtain valuable input that may serve to contribute to the Project's overall success. A focused environmental assessment requires a process of scoping to define the components and activities that are to be considered in the assessment, to identify the key environmental issues, and to set the spatial and temporal boundaries of the assessment. Candidates for stakeholder consultations are well established in the environmental assessment arena of Newfoundland and Labrador and include:

- Fisheries and Oceans Canada (DFO)
- Transport Canada
- Environment Canada/Canadian Wildlife Service
- Fish, Food and Allied Workers Union
- One Ocean
- Ocean Choice Limited/ Association of Seafood Producers
- Groundfish Enterprise Allocation Council
- Newfoundland Resources

Bridgeport recognizes the importance of communications to identify key stakeholder, to keep stakeholders informed of their proposed program, and to obtain valuable input that may serve to contribute to the Project's overall success. A critically important aspect of conducting an effective environmental assessment is the participation of appropriate regulatory agencies; fishing representatives and organizations; representatives from users of resource sectors within the Study Area and relevant communities with an interest in the Project. This engagement process employed the strategy of working through appropriate representative organizations, such as the FFAW, to ensure effective information sharing. A first step in the community engagement process was to undertake a pre-assessment of the range of various organizations and agencies that operate within the Study Area, or which may be impacted by the Project activities.

Fisheries organization were contacted regarding meetings to discuss the project; however, it was deemed that as there was no potential for contact between vessels or fishing gear with the aircraft, there was interest in the project but no concern on effects to fisheries.

Fisheries and Oceans Canada researchers and management were approached regarding input to the project. Most contacts did not respond. Those researchers that did respond indicated that the aircraft flights would not interact with fisheries resources.

## **4 ENVIRONMENTAL ASSESSMENT METHODOLOGY**

### **4.1 Approach**

The EA scope and methodology for the Project have been developed to meet the C-NLOPB requirements for environmental assessment of offshore petroleum-related projects under the *Canada-Newfoundland and Labrador Offshore Resources Accord Implementation Act*. The EA methodology for this Project addresses the scope of the Project, as defined in the requirements of the Scoping Document for the Environmental Assessment prepared by the C-NLOPB (Appendix A) and discussions with C-NLOPB representative.

Project stressors may have direct impacts (caused by the action and occurring at the same time and place), indirect impacts (caused at a later time or farther removed) or may cause both due to different mechanisms. Potential project stressors include presence of project operations, acoustic stressors during flights, and potential contamination in the event of an accident or malfunction, which have the potential to result in both direct and indirect impacts. For each of these stressors potential impacts are evaluated on key marine species and ocean resource users by comparing primary stressor characteristics with pre-determined thresholds. Using this systematic methodology, the aim is to use threshold criteria, where they exist, to predict a level of significance for identified stressors, flag any eventual potential high impacts on species and ocean resource users and identify mitigation measures for implementation.

Following scoping of the Project's stressors, a review was conducted of the biological and socio-economic context and potential susceptibility, based on likelihood of exposure, of those species that may be locally present during the Project's proposed timeline (March to November). Key biological context criteria include seasonal occurrence, population demographics, listed status, and habitat use for critical life functions, habitat suitability and known/presumed susceptibilities to the key stressors identified. The review aimed at identifying those receiver species potentially sufficiently ecologically sensitive to lead to potentially significant adverse effects. After identifying the stressors and the key recipients, severity and impact matrices are derived to identify potential significant impacts and synthesize the results into an adverse effects conclusion.

The evaluation of potential cumulative effects with regard to other projects and activities generally includes past, present and future activities that will be carried out and will interact temporally or spatially with the proposed Project.

#### **4.1.1 Temporal Scope**

The temporal boundaries considered for this assessment include survey activities from the time the aircraft arrives within the Project Area, until it departs the Project Area. Effects of the routine activities associated with the proposed Project have been assessed from March 1 to November 30 for each year from 2015 to 2019.

#### **4.1.2 Spatial Scope**

Spatial boundaries encompass those areas within which, the VECs are likely to interact with, or be influenced by, the Project. Geographic ecological boundaries may be limited to the Study Area, or may extend well beyond the immediate project footprints, as the distribution and/or movement of an environmental component can be local, regional, national or international in extent. Spatial boundaries for the assessment vary according to the VEC. Such factors as population characteristics and migration patterns are important considerations in determining ecological boundaries and may influence the spatial extent and distribution of an environmental effect, and are particularly important for assessing cumulative environmental effects.

This assessment considers three levels of spatial boundaries: the Project Area, Study Area (Figure 4.1), as directed by the Scoping Document, and the Regional Area:

- Project Area includes the area where gravity gradient survey activities are to occur, including the area of the buffer zone normally defined for line changes.
- The Study Area encompasses the Project Area; which includes a 20 km estimated distance to account for a turning radius. This area also includes potential interactions with other vessels.
- The Regional Area extends beyond the Study Area in all cases. The Regional Area varies according to the life history of the biological VEC. For fisheries, the boundary is defined largely, for the purposes of this assessment, by the Northwest Atlantic Fisheries Organization (NAFO) Unit Areas 3K, 3L, 3M, 3N, 3O.

#### **4.1.3 Description of Existing Conditions**

Section 5.0 of this report provides a description of the existing conditions (i.e., pre-Project) for each VEC. The description is focused on the status and characteristics of the VEC within the boundaries established for the assessment and focuses on aspects that are relevant to potential Project interactions. In some cases, baseline data are only available on a larger regional basis extending beyond the boundaries of the assessment, but are still considered relevant and appropriate for the purposes of the assessment.

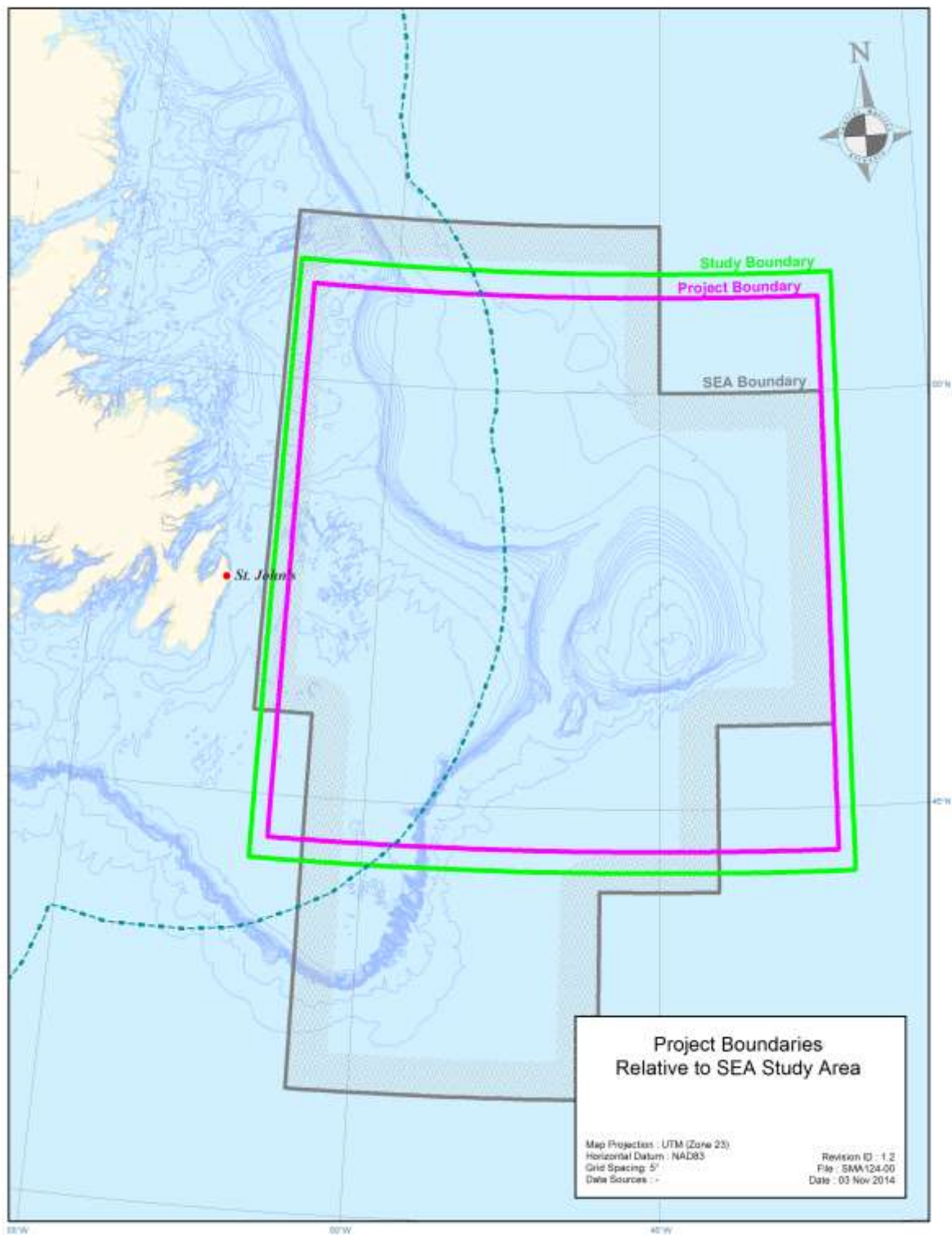


Figure 4.1: Project Boundaries

#### 4.1.4 Significance Criteria and Evaluation

Accepted practice of setting significance rating involves establishing and applying criteria for the determination of significance (significance criteria). Residual environmental effects evaluation criteria are established based on information obtained in issues scoping, available information on the status and characteristics of each VEC, and may involve the application of environmental standards, guidelines, thresholds or objectives, where these are available.

Canada does not currently have established received-level standards for potential effects of aircraft generated noise on marine mammals, but typically uses criteria developed by the US National Marine Fisheries Service (NMFS) primarily with respect to seismic surveys and continuous noise. Aircraft noise is neither. NMFS has set two statutory thresholds for stressors on marine mammals; Level A and Level B harassment, which can lead to a 'take'. A Level A take occurs when the stressor causes an injury or mortality in the animal whereas a Level B take occurs when a significant behavioral change is caused by the stressor. In terms of acoustic injury from any sound type (Level A), NMFS relies on the High Energy Seismic Survey (HESS) (1999) panel assessment based on information available at that time (prior to most of the existing literature on marine mammal Temporary Threshold Shift). These Level A thresholds are 180 dB re: 1  $\mu$ Pa (rms) for all cetaceans and 190 dB re: 1  $\mu$ Pa (rms) for all pinnipeds. Level B is presently set by NMFS at 160 dB re: 1  $\mu$ Pa (rms) for impulsive sound sources and 120 dB re: 1  $\mu$ Pa (rms) for continuous sound sources. The effects estimates for acoustic thresholds rely on calculating the amount of area ensonified by the stressor, and identifying areas where the thresholds are exceeded.

Section 7 of the U.S. NMFS Marine Mammal Regulations states "*no person shall disturb a marine mammal except when fishing for marine mammals under the authority of these Regulations.*" Defining magnitude for disturbance (Level B) effects is considered particularly subjective.

##### Magnitude – the nature and degree of the predicted environmental effect

Negligible	Essentially no effect, less than 1 ESA-listed species and less than 5 percent for a non-listed species minimum population	rating = 0
Low	Affects a specific group or critical habitat for one generation or less; within natural variation	rating = 1
Medium	Affects a portion of a population or critical habitat for one or two generations; temporarily outside the range of natural variability	rating = 2
High	Affects a whole stock, population or critical habitat (may be due to the loss of an individual(s) in the case of a species at risk) outside the range of natural variability. rating	rating = 3

##### For socio-economic components – the magnitudes of potential effect

Negligible	Essentially no effect	rating = 0
Low	Does not have a measurable effect on fishing, catchability or air traffic	rating = 1
Medium	Has a measurable effect on with air traffic and other offshore operators or on fishing or catchability, but is within natural variability	rating = 2
High	Has a measurable and sustained adverse effect on air traffic and offshore operations or fishing activities or catchability beyond natural variability	rating = 3

##### Geographic extent – the area over which the particular effect will occur.

Immediate	Effects are adjacent to aircraft, within 100s of metres	rating = 1
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Local	1 – 10 km of aircraft	rating = 2
Regional	Outside Project boundary	rating = 3

**Frequency – how often the effect will occur.**

Isolated	occurring once or twice	rating = 1
Intermittent	occurring repetitively	rating = 2
Continuous	occurring non-stop	rating = 3

**Duration – how long the disturbance will occur.**

Immediate	limited to seconds	rating = 1
Short-term	limited to minutes	rating = 2
Mid-term	limited to one hour	rating = 3
Long term	limited to one day	rating = 4

**Reversibility** – the ability of a VEC to return to an equal, or improved, condition once the disturbance has ended (for example, reclaiming habitat area equal or superior to that lost). Predicted effects are rated as reversible (R) or irreversible (I), based on previous research and experience.

**Ecological/Socio-cultural and Economic Context** – rating 1 relatively pristine area or area not adversely affected by human activity; 2 = evidence of existing adverse effects.

**Uncertainty** - This allows for disclosure of the level of scientific confidence in the predicted outcomes, and the general reliability of the data and models used to predict impacts.

Judging whether the impact is potentially significant at the stock or local population level also requires integration of information on its capacity to withstand the impact, taking into account whether the impact might occur during a sensitive or critical part of the year, within potentially important habitat and the assumed flexibility of the species to adjust to disturbance. Given the uncertainty levels in many components, consideration is given to potential variability, for example, in predicted animal densities, behavioral response and the environmental factors that may influence temporal and spatial distribution.

#### 4.1.5 Scope of Potential Project Stressors

The scope of the proposed Project includes all of the components and activities detailed in Section 3.0 of this report, including any potential accidental events that may occur in relation to the Project. To further focus the assessment, the interactions between Project activities and the VECs need to be identified (Table 4.1). A full assessment of these interactions is contained in Section 6.0 (planned events and accidental events). An interaction may be negligible due to the limited nature of the activity and interaction, strict regulations, or lack of sensitive receptors.

**Table 4.1: Potential Project-environment Interaction Matrix**

Stressor	Source	Pathway
Acoustic	Aircraft engine/propeller	Direct disturbance/harassment
		Indirect disturbance/harassment
Presence	Aircraft	Direct disturbance/harassment
		Indirect disturbance/harassment
Fuel Contamination	Ditched aircraft	Life function effects
Aircraft Interaction	Aircraft	Air space conflict

## 4.2 Identification of Valued Environmental Components

The issues scoping process identified a focused list of environmental components. Scoping considerations for these components are presented in Table 4.2 along with the rationale for inclusion or exclusion of a VEC for further evaluation.

To ensure that the assessment is holistic, the CEA Agency (1994) suggests a description of each VEC, and its ecological and/or socio-economic context. Identification of VECs for consideration of potential substantial adverse effects by the Project was based on a qualitative integration of the following broad criteria:

- protected status and population;
- key biological resource information (Section 5.0) about the occurrence, level and type of use (e.g., breeding, feeding, migrating, etc.), and seasons of use in the study area; and
- known or inferred sensitivity of a VEC to low-frequency sounds from aircraft or aircraft presence

**Table 4.2: Summary of Ecological and Socio-economic Context and Effects Scoping Review**

Component	Scoping Considerations	Candidate for Analysis
Marine and Migratory Birds	Under the current Migratory Birds Regulation, no permits can be issued for the incidental take of migratory birds caused by development projects or other economic activities. Section 5.1 of the MBCA describes prohibitions related to deposit of substances harmful to migratory birds. The Ivory Gull ( <i>Pagophila eburnean</i> ) is listed as Endangered (Schedule 1) under SARA. The Ivory Gull is usually associated with pack ice and may be found in the project area during winter months. This VEC must be considered in the environmental assessment.	Yes
Marine Fish and Shellfish	Air to water interface sound transmission is poor. Modeling of low level flights show sound penetration is restricted to surface waters at sound levels that do not likely have a potential effect on marine fish or shellfish. World renown researchers have no knowledge of any effects studies on fish or shellfish from aircraft noise over the ocean. Low level aircraft surveys are a commonly used method for marine life population censusing wildlife.	No



Component	Scoping Considerations	Candidate for Analysis
Marine Mammals	Several species of marine mammals of special status are likely to be present in the study area year-round and could potentially be affected by aircraft noise and presence while at surface or near the surface.. This VEC must be considered in the environmental assessment.	Yes
Sea Turtles	Several species of sea turtles of special status are likely to be present in the study area in the summer months and could potentially be affected by aircraft noise and presence while at surface. This VEC must be considered in the environmental assessment	Yes
Species at Risk	The Project may interact with mammal, turtle and bird species at risk or their critical habitat. Of particular concern are the species currently listed on Schedule 1 of the SARA. Therefore, an assessment of the potential for significant adverse environmental effects on species at risk in the study area shall be included in the EA.	Yes
Commercial Fisheries	The commercial fishery is an important element in Newfoundland's socio-economic and cultural environments. Aircraft operations may interact with commercial seal harvesting indirectly ( <i>i.e.</i> , potential disturbance effects on seals on pack ice). The assessment will focus on commercial seal harvesting occurring within the study area. Exposure of fishers to low flying aircraft and aircraft noise may result in startle reaction; therefore human exposure to aircraft noise is addressed.	Yes
Ocean Resource Users	Other resources users ( <i>e.g.</i> , air traffic) conduct activities along the coast and on the waters offshore Newfoundland within the Study Area, thereby potentially interacting with the Project aircraft for space. Various research surveys and government surveys are conducted within the study area that may interact with Project activities and are included in the assessment of other ocean users. Other projects and activities are considered in the assessment of cumulative effects as appropriate.	Yes

#### 4.3 Follow-Up and Monitoring

Monitoring by the proponent may be undertaken for a number of reasons including compliance, permit approval/renewal, evaluation of mitigating measures, strengthening predictive capacity in future EAs, and commitments to third parties.

Monitoring and follow-up requirements are evaluated for each VEC and are linked to the sensitivity of a VEC to both Project related and cumulative environmental effects. The likelihood and importance of such effects, as well as the level of confidence associated with the adverse residual effects rating, are also taken into consideration.

#### 4.4 Cumulative Environmental Effects Assessment

Individual environmental effects can accumulate and interact to result in cumulative environmental effects. Past and ongoing human activities have affected the region's natural and human environments. The description of the existing (baseline) environment reflects the effects of these other actions. An environmental assessment pursuant to CEAA must, however, include

consideration of the “cumulative environmental effects that are likely to result from the Project in combination with other projects or activities that have been or will be carried out.” A critical step in the environmental assessment, therefore, is determining what other projects or activities have reached a level of certainty (e.g., “will be carried out”) such that they must be considered in an environmental assessment.

Past and present activities that may impact cumulatively with the Project have been assessed as part of the assessment of routine Project activities in Section 7.0. Future activities that have the potential to interact cumulatively with the Project include:

- air traffic (domestic and international);
- commercial fishing activities;
- research surveys; and
- monitoring surveys.

#### **4.5 Information and Data Gaps**

There are major limitations in the existing information available to support the accurate assessment of potential aircraft sound impacts on sea bird, marine mammal and sea turtle population's offshore Newfoundland, where area specific scientific measurements of their potential impact have not been measured. Consequently, the level of scientific uncertainty underpinning many elements of the EA framework varies considerably. Notably, data are clearly limited in determining appropriate species -specific noise thresholds to determine the radius of both hearing and behavioral impacts, as well as quantitatively linking subsequent cumulative individual -level effects to population demographic parameters (NRC 2005)

Despite increasing studies in the past decade on marine mammals, there are still large data gaps and uncertainty. For example masking can be tested directly in captive species (e.g., Erbe 2008), but in wild populations it must be either modeled or inferred from evidence of masking compensation. Likewise, in studies of hearing loss, tests can be done in captivity and models applied to estimate this impact in the wild. All of these impact models rely on three main inputs; the propagation of the noise, the hearing abilities of that species, and the behavioral reaction of that species to the noise. All of these inputs are complex and require a number of other additional inputs themselves. Modeling noise propagation has benefited from concerted efforts over many years, but can vary a great deal with local bathymetry and local oceanographic conditions, such that noise level is not always lower the further it has travelled (e.g., Madsen et al. 2006).

Hearing in marine mammals is multifaceted and much more complicated than just understanding the hearing sensitivity across frequencies (auditory curve). For example, robust masking predictions require knowledge of the frequency integration of the ear (critical bandwidth), as well as temporal integration, critical ratio, directivity index, etc. Hearing loss is affected by the amplitude, frequency, duration, duty cycle, and directionality of the noise to which the animal is exposed, as well as intrinsic features of the exposed animal including its susceptibility to and recovery from noise exposure. Many of these variables can only be tested accurately in captive animals, but it is costly, time consuming and limited to certain marine mammal groups given logistical considerations (e.g., the lack of a sufficient facility to house and test the hearing of a large whale). Due to this fact, while the hearing abilities of over 20 species have been tested so far, only a few species (3-4) and a few individuals have been tested comprehensively.

Therefore, most of these variables have not been tested directly in most species of marine mammals, and little to nothing is known about the individual variation of these variables within a species. Likewise, behavioral reactions are easier to quantify in captivity, but suffer from small

sample size and difficulty in extrapolating these measurements to wild populations. Meanwhile behavioral reactions in wild populations are difficult to quantify (especially if the reaction is subtle), are logistically challenging to determine, and can vary a great deal depending on a number of factors (see behavioral reaction section below). This leads to a situation where the ability to predict acoustic impacts is impaired by the lack of appropriate input parameters and lack of understanding of the variability in those parameters.

## **5 MARINE ECOSYSTEM SETTING**

### **5.1 Bathymetry and Physiography**

The proposed Study Area includes portions of the Grand Banks, Orphan Basin, Flemish Pass, and Jeanne d'Arc Basin of the northeast Newfoundland Slope. The depth of the Study Area ranges from around 100 m to beyond the abyssal zone of  $\geq 4000$  m. About half of the Study Area lies within depths of  $\geq 2000$  m.

The Grand Banks is a region with average depths of about 75 m. The Grand Banks extend from the western boundary of the Study Area.

The bathymetry of Orphan Basin is discussed in great detail by Campbell (2005) as a bathymetric embayment in 2000 to 3000 m water depth and forms part of the continental margin off eastern Canada. To the west and south, the Basin is bounded by the Newfoundland Shelf and Flemish Cap, and by the Orphan Knoll to the northeast. Canyons incise the southwestern slope while broad submarine channels on the southern Orphan Basin floor appear to coalesce towards the gap between Orphan Knoll and Flemish Pass. Otherwise, the floor of Orphan Basin is relatively flat and gently slopes towards the east. Figure 5.1 shows the area bathymetry and seafloor features.

The Flemish Pass is described by Jacobs (1985) as a 1 km deep trough running almost north south between the Grand Banks of Newfoundland and Flemish Cap. The pass is flanked by fairly steep slopes on both sides, from the shelf break (200 m in the south, 300 m in the north) down to approximately 1100 m. Gentle concave slopes between 1100 m and 1170 m allow the centre of the pass to be almost flat.

Jeanne d'Arc Basin extends southeast from the southern end of the Orphan Basin. Similar in size and shape of the Flemish Basin, it is bound to the west by the Grand Banks and to the east by Flemish Cap. The western slope has a low gradient in comparison to the eastern slope and depths range from approximately 300 m in the west, 500 m to the east, 2000 m to the south, and 1000 m on the Basin bottom.

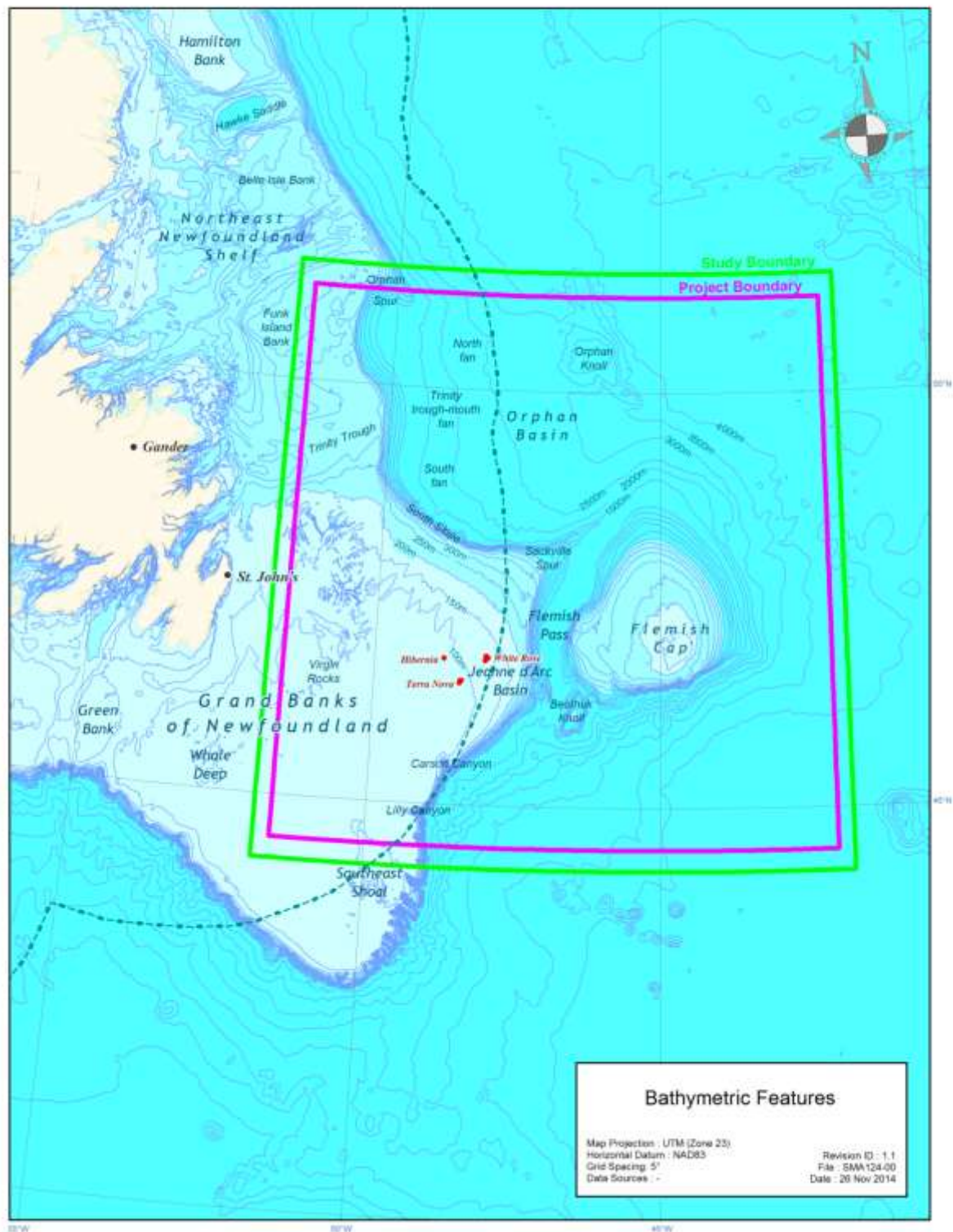


Figure 5.1: Bathymetry and seafloor features of the Study Area

## 5.2 Geology

The five surficial sediment formations found in the Study Area range are described in detail in § 4.1.1.2 ENSEA (AMEC 2014) and § 5.1.1 (YOLO 2012) and include: Grand Banks Drift, Downing Silt, and Placentia Clay, Grand Banks Sand and Gravel, and Adopholus Sand. .

## 5.3 Climatology

Weather is crucial to aircraft flight and operations. The wind climatology is characterized using statistics derived from the latest Meteorological Society of Canada (MSC)50 wind and wave hindcast dataset, spanning the period from 1954 to 2011 inclusive and described in detail in § 4.1.3.1 of the ENSEA (AMEC 2014).

The climate for a majority of the Study Area has been extensively covered in § 4.3 of the Eastern Newfoundland SEA. The proceeding information is a general overview and summary of the climate; air and sea-surface temperatures; visibility; precipitation; wind and wave analysis and storms expected in the Study Area.

The climate for the Study Area is of a typical marine environment. It is influenced heavily during the fall and winter by passing systems. The temperature in a marine environment is moderated by the surrounding waters. Summers are generally cool and winters milder than continental climates. Persistent high levels of humidity reduces visibility, increases precipitation levels, and increases levels of fog.

### 5.3.1 Wind

For the wind and wave climatology the SEA Study Area has been characterized using four MSC50 hindcast node points in §4.1.3.1. These points provide coverage for the large regional Bridgeport aerial survey.

Wind predominantly blows from the southwest, west and northwest. The mean hourly wind speed ranges between 6.2 to 6.7 m/s. Gale force winds can occur year round ( $17.0 \leq 24.2$  m/s) and were recorded less than 5% of the time. Storms can occur year round as well but are least likely in July. Sustained hurricane force winds can occur in winter.

During the annual 100-year extreme 1-hour wind speed analysis, strongest extreme winds were determined to be between 31.5 to 33.4 m/s. The highest extreme wind was determined to occur in winter, December to February, with an estimate of 30.7 m/s to 32.8 m/s.

#### 5.3.1.1 Wind and Wave – Extreme Analysis

Characterization of the wind and wave climate in the offshore Newfoundland and Labrador area is frequently made using the long-standing MSC50 year Wind and Wave Climatology (an update of the Atmospheric Environment Service (AES) 40 year) of North Atlantic Wind and Wave Climatology (Swail et al., 1998; Swail et al., 2006; Meteorological Service of Canada, 2006; Meteorological Service of Canada, 1999; Oceanweather Inc. 2001). The hindcast was developed at Oceanweather with support from Climate Research Branch of Environment Canada (Oceanweather Inc. 2001). The hindcast involved the kinematic re-analysis of all significant tropical and extra-tropical storms in the North Atlantic for the continuous period 1958 to 1998. Oceanweather's 3rd generation wave model (OWI3G) was adopted onto a 0.625 by 0.833-degree grid. Wind and wave fields were archived at all active model gridpoints. The AES40 methodology and validation has been extensively documented and presented in peer-reviewed journals and conferences (Swail et al. 1998). In 2005, the AES40 hindcast in Canadian waters was improved by a shallow water version of the OWI3G on a 0.1-degree grid covering much of the Canadian Maritimes. The North Atlantic basin model was similarly

upgraded and run at a 0.5-degree resolution. The MSC50 also extended the time-series to include the 52 years 1954 to 2005 (Swail et al. 2006).

Oceans (2011) Section 2.2 to 2.4 provides an in-depth analysis and discussion for wind and wave characteristics. As part of their analysis, they refer to four MSC50 grid points used in the extreme wave and wind analysis. Figure 5.2 shows the four points in relation to this Study Area. According to Oceans (2011), Grid Points 10255 and 11820 were chosen to represent the conditions in the Jean d'Arc Basin region and the western side of Flemish Pass, while Grid Points 13428 and 14697 were chosen to represent conditions in Flemish Pass and the Orphan Basin.

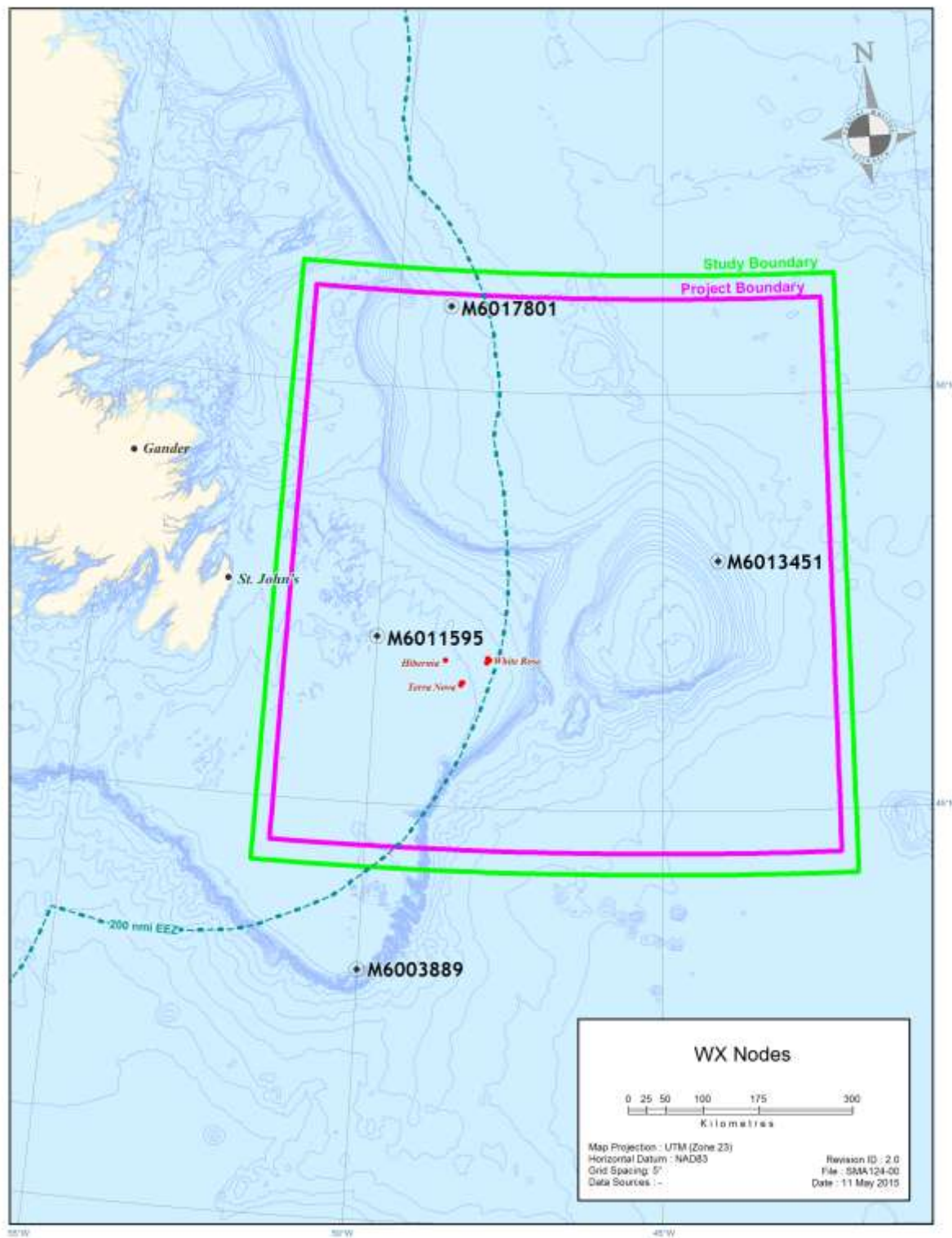


Figure 5.2: MSC50 grid points within the Study Area



### **5.3.2 Precipitation**

A variety of precipitation types occur through the Study Area due to the migratory high and low pressure systems transiting the temperate middle latitude of the Northern Hemisphere. Overall, the occurrence of rain/drizzle is the most likely form of precipitation to be experienced in the Study Area during the proposed operating period of March to November. The Study Area is likely to experience the lowest occurrence of precipitation during the months of July.

Snow is likely during the months of April, May, October and November. The frequency of snow occurring in the Study Area increases in the southeast, northeast, and northwest regions. During the months of September and October, moderate to heavy rainfall has occurred most frequently. The risk of freezing precipitation is high for the Project window of activities in March and April.

### **5.3.3 Visibility**

The biggest factor for reduced visibility in the area is the formation of fog, which becomes quite frequent by mid-spring and remains until late summer. Advection fog is primarily observed within the Study Area beginning during the months of April and May and extending through July, with July having the highest percentage of obscuration to visibility of about 40 to 50% visibility of <1 km.

### **5.3.4 Tropical Storms**

The hurricane season in the North Atlantic basin normally extends from June through November. Section 2.6 of Oceans (2011) provides information on the types of tropical systems that are likely to occur within the Study Area. There has been a significant increase in the number of hurricanes that have developed within the Atlantic Basin within the last 15 years. Also, there has been little change in the 5-year trend for hurricanes coming through the Study Area.

## **5.4 General Ocean Circulation**

Ocean circulation is described in § 4.1.4 of the ENSEA (2014). Also, Oceans (2011 - Section 4.0) provided a detailed description of the physical oceanography and current velocities expected within the Study Area.

## **5.5 Air and Sea Surface Temperature**

Section 4.1.3.2 of NESEA describes air surface temperature for two regions: the Grand Banks and the Orphan Basin. ICOADS data sets were used and it was found that in both regions the mean atmospheric temperature was coldest in February (-2.9°C; -0.1°C) and warmest in August (11.7°C; 14.6°C).

Surface sea temperatures were coldest in March (0.3°C; 1.6°C) and warmest in August (13.7°C; 12.3°C).

## **5.6 Sea Ice**

Sea ice and icebergs are described in § 4.1.5 of the ENSEA (2014). The airplane or data collection operations will not be directly or indirectly affected by sea ice conditions and this aspect is not addressed further.

## **5.7 Noise Environment**

### **5.7.1 Airborne Noise Characteristics**

For this EA, consideration of sound exposure is given to humans located offshore on vessels and platforms, birds, and marine mammals in air while at surface (i.e. seals on ice floes), and marine mammals (cetaceans) and sea turtles at surface and near surface water depth.

#### **5.7.1.1 Aircraft Noise**

When an aircraft flies slower than the speed of sound or subsonically, noise is produced by the aircraft's engine, propellers, and by effects of aircraft movement through air. Airborne noise that originates in higher altitudes is seldom heard on the ground. This is due to the upward bending of sound that takes place in temperature inversions, where the surface temperature is warmer than the temperature at the higher altitude of the sound source. At lower altitudes, a plane can be heard about 8 to 24 km away; however many factors dictate that reception, such as wind, humidity, altitude, plane type, and other ambient sounds and noise. Sound transmission characteristics are different for sounds in air versus sounds in water. Similarly, sound reception sensitivities vary for in-air sound and in-water sound.

#### **5.7.1.2 Vessel Engine Noise**

In consideration of humans in the Study Area, specifically located on a vessel (e.g. commercial fishing, cargo, tanker, production or drilling platform, etc.) vessel sourced engine noise would dominate. It is important to understand that flyovers of vessels by the survey plane are under the influence of that vessel noise regime. Vessel engine room noise is primarily generated by emissions from the individual engine components and their surfaces, which cause the air to pulsate. The average engine noise levels measured, for example according to the International Council on Combustion Engines's (CIMAC's) 'Recommendations for Measurements of the Overall Noise for Reciprocating Engines', or other similar standards, are used to express the typical airborne sound pressure level of the engine. In general, depending on the type of engine, the average airborne noise level of a nominally rated engine will be around 105 dB(A), whereas the maximum level measured around the engine, and normally near a turbocharger, will be about 110 dB(A), but higher for bigger engines and lower for smaller engines.

Because of the reverberations of sound in the vessel engine room, the sound pressure based noise levels measured in the vessel may be 1-5 dB higher than the calculated sound intensity based noise levels. The possibility of reducing the noise from an existing engine is greatly limited because, as previously mentioned, the noise stems from many different sources, and because the noise transmission paths through which vibrational energy is transferred from one area to another through the engine are numerous. However, in principle, the transmission of airborne noise from the engine room to other locations (e.g. accommodation quarters), normally has no influence on the actual noise level in these locations.

Limits for the maximum sound pressure level are defined either specifically between owner/shipyard and engine builder, or indirectly by referring to local, national or international legislation on the subject. Many owners refer to the SBG (Berufsgenossenschaft) specifications or the IMO (International Maritime Organisation) recommendations. On the bridge wing, where it is the exhaust gas noise that predominates, there are certain limitations, as the bridge wing is regarded as a listening post. The requirement here, depending on the noise standard to be met, is a maximum of 60-70 dB(A). Table 5.1 provides some IMO noise limits on a vessel.

**Table 5.1: IMO Noise Limits for Vessels**

<b>Work Spaces</b>	<b>Sound Pressure Level dB(A)</b>
Machinery spaces – continuously manned	90
Machinery Spaces – not continuously manned	110
Machinery control room	75
Workshops	85
Unspecified work spaces**	90
Navigation bridge and chartroom	65
Radio room	70
Radar room	65
Cabins and hospital	60
Mess rooms	65
Recreation room	65
Open recreation room	75
offices	65
** Ear protection should be used when the noise level is above 85 dB(A)	

### 5.7.2 Underwater Noise Characteristics

Underwater sound is generated by many sources, and in the uppermost part of the ocean, weather has a significant impact on the sound level. Ambient noise is that sound received by an omni-directional sensor, which is not from the sensor itself or the manner in which it is mounted. Ambient noise is made up of contributions from many sources, both natural and anthropogenic. These sounds combine to give the continuum of noise against which all acoustic receivers have to detect required signals. Ambient noise is generally made up of three constituent types – wideband continuous noise, tonals and impulsive noise and covers the whole acoustic spectrum from below 1 Hz to well over 100 kHz. Above this frequency, the ambient noise level drops below thermal noise levels.

There are a number of basic mechanisms by which ambient noise is generated. All of the sources of ambient noise involve one or more of these basic generation mechanisms:

**Impact noise** - Impact noise occurs when water strikes water, e.g. breaking waves; water strikes solid, e.g. waves hitting a rock; solid strikes water, e.g. hail hitting the water surface; or solid strikes solid underwater, e.g. sediment noise (“siltation”). It is usually a broadband, transient noise, possibly with resonant peaks if solids are involved.

**Bubble noise** - There are several types of bubbles in sea water. Passive bubbles are quiescent and do not generate noise. Active bubbles are formed during an energetic process such as breaking waves or rain striking the surface. These bubbles oscillate and generate comparatively narrowband signals centered on the resonant frequency of the bubble, typically in the range 15 to 300 kHz. Collective oscillations of bubble clouds, particularly under breaking waves, can have resonant frequencies, which are much lower than this.

**Turbulence** - Turbulence associated with surface disturbance or turbulent tidal flow around an obstruction generates low frequency continuous noise.

**Seismic** - Movement of the seabed can be coupled into the water column and generate very low frequency noise.

**Cavitation** - Propellers and other fast moving objects in the water can cause cavitation noise when the pressure in the flow around the moving object goes sufficiently negative. This causes a

cavitation bubble which very quickly collapses, causing a loud transient sound. The resulting spectrum is wideband but generally has a peak between 100 Hz and 1 kHz.

Machinery noise - Machinery generally produces a broadband continuous spectrum with tonals superimposed resulting from the rotation rates of the various parts of the machinery. There may also be impulsive sounds.

Tonals - Some systems either deliberately, or as a by-product, generate high levels of tonal signals (e.g. sonar systems, seal scarers).

Sources of ambient underwater noise include:

- wind-sea noise
- precipitation noise
- surf noise and sediment transport
- commercial shipping and leisure craft
- industrial noise
- military noise
- sonar
- fishing activity
- aircraft
- biological noise
- thermal noise

### **5.7.3 Sound Transmission Air-Water Interface**

The sound sources considered in this EA are from aircraft, but a significant portion of the concern about noise impacts involves marine animals at or below the surface of the water.

Sound is transmitted from an airborne source to a receiver underwater by four principal means: (1) a direct path, refracted upon passing through the air-water interface; (2) direct-refracted paths reflected from the bottom in shallow water; (3) lateral (evanescent) transmission through the interface from the airborne sound field directly above; and (4) scattering from interface roughness due to wave motion (Figure 5.3).

Several papers are available in the literature concerning transmission of sound from air into water. Urick (1972) presents a discussion of the effect and reports data showing the difference in the underwater signature of an aircraft over flight for deep and shallow conditions. He includes analytic solutions for both the direct and lateral transmission paths and presents a comparison of the contributions of these paths for near-surface receivers. Young (1973) presents an analysis which, while directed at deep-water applications, derived an equivalent dipole underwater source for an aircraft over flight that can be used for direct path underwater received level estimates. A detailed description of air-water sound transmission is given in *Marine Mammals and Noise* (Richardson et al., 1995). The following is a short summary of the principal features.

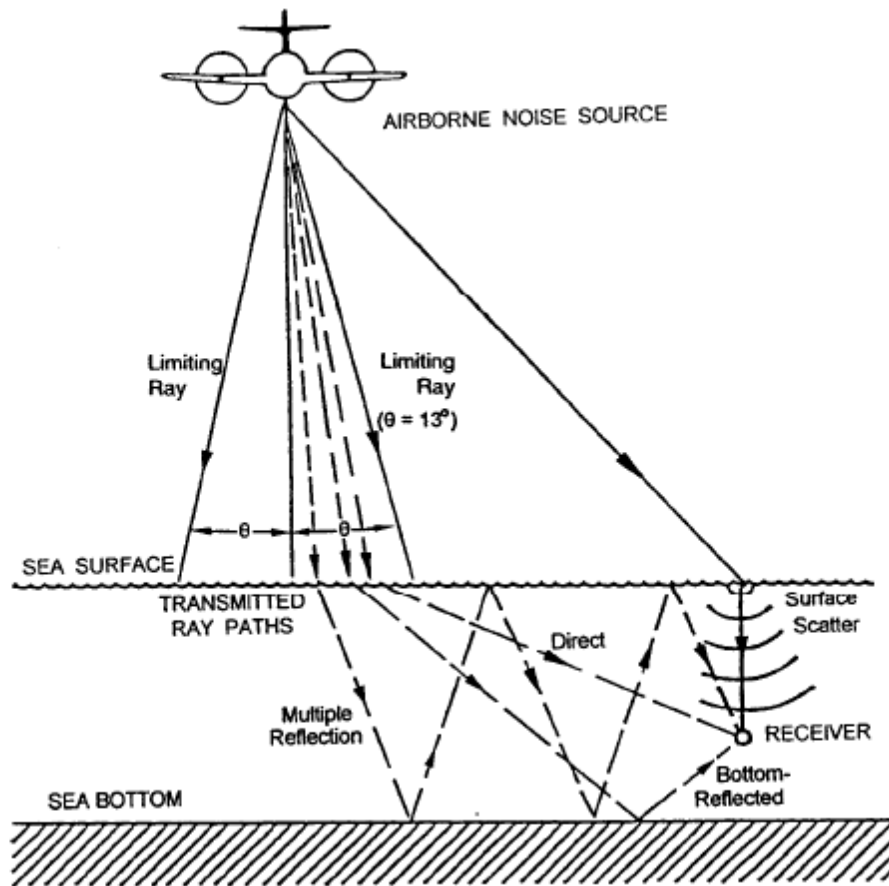


Figure 5.3: General Characteristics of Sound Transmission Through Air to Water From Aircraft

Sound from an elevated source in air is refracted upon transmission into water because of the difference in sound speeds in the two media (a ratio of about 0.23). Because of this difference, the direct sound path is totally reflected for grazing angles less than  $77^\circ$ , i.e., if the sound reaches the surface at an angle more than  $13^\circ$  from vertical. For smaller grazing angles, sound reaches an underwater observation point only by scattering from wave crests on the surface, by non-acoustic (lateral) pressure transmission from the surface, and from bottom reflections in shallow water. As a result, most of the acoustic energy transmitted into the water from a source in air arrives through a cone with a  $26^\circ$  apex angle extending vertically downward from the airborne source. For a moving source, the intersection of this cone with the surface traces a "footprint" directly beneath the path of the source, with the width of the footprint being a function of the altitude of the source.

For this proposed survey, at an altitude of 150 m, the footprint would be about 70 m in diameter, directly under the aircraft, moving at a constant 222 km/h.

To a first approximation, it is only the sound transmitted within this footprint that can reach an underwater location by a direct-refracted path. Because of the large difference in the acoustic properties of water and air, the pressure field is actually doubled at the surface of the water, resulting in a 6 dB increase in pressure level at the surface. Within the direct-refracted cone, the in-air sound transmission paths are affected both by geometric spreading and by the effects of refraction.

In shallow water within the direct transmission cone, the directly transmitted sound energy is generally greater than the energy contribution from bottom reflected paths. At horizontal distances greater than the water depth, the energy transmitted by reflected paths becomes dominant, especially in shallow water. The ratio of direct to reverberant energy depends on the bottom properties. For hard bottom conditions the reverberant field persists for longer ranges than the direct field. However, with increasing horizontal distance from the airborne source, underwater sound diminishes more rapidly than does the airborne sound.

Near the surface, the laterally transmitted pressure from the airborne sound is transmitted hydrostatically underwater. Beyond the direct transmission cone this component can produce higher levels than the underwater-refracted wave. However, the lateral component is very dependent on frequency and thus on acoustic wavelength. The level received underwater is 20 dB lower than the airborne sound level at a depth equal to 0.4 wavelength.

Figure 5.4 shows an example of the model prediction for a representative source-receiver geometry.

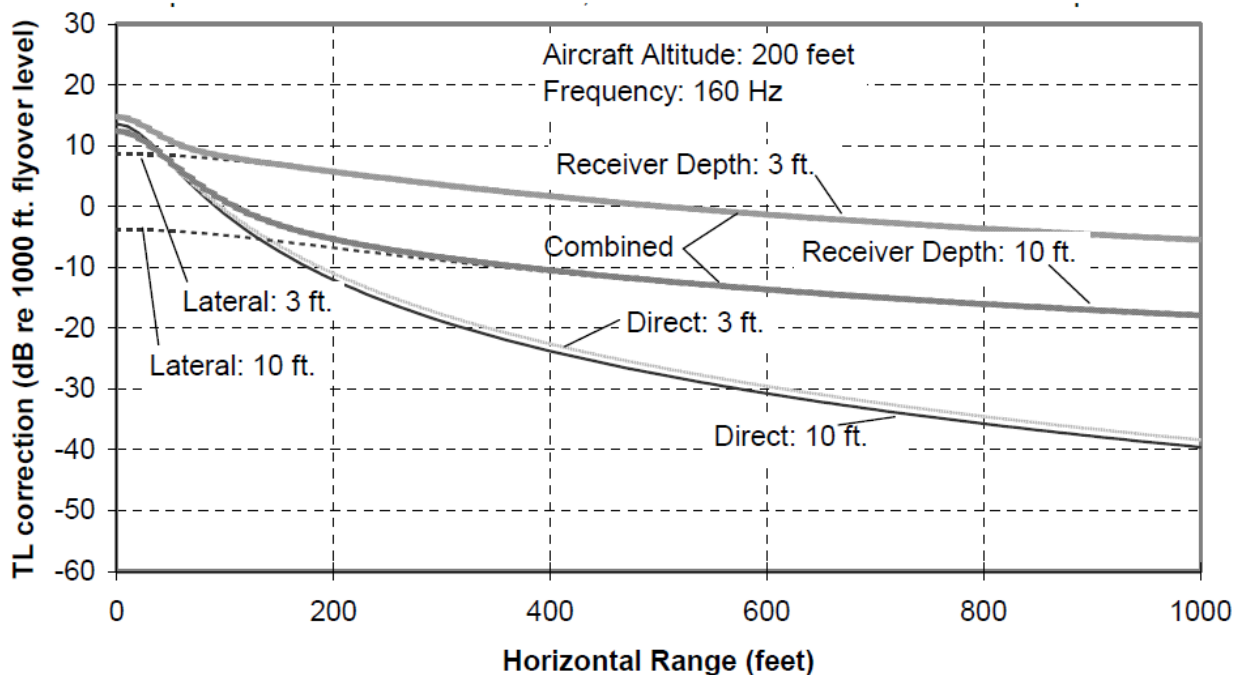


Figure 5.4: Transmission Loss of Sound through Air-Water Interface (ref. US Navy 2008)

The transmission loss (TL) for the direct-refracted wave, the lateral wave, and their resultant energy-addition total is shown. Directly under the aircraft, the direct-refracted wave is seen to have the lowest TL. For the shallowest receiver at a one meter depth, the lateral wave is seen to become dominant at about a horizontal range of 12 m. Beyond this point, the underwater level is controlled by the sound level in the air directly above the receiver and follows the same decay slope with distance. For the deeper receiver at 3 m, the lateral wave does not become dominant until the horizontal range is about 40 m. When sound reaches the receiver via the direct-refracted path, it decays at about 12 dB/distance doubled (dd), consistent with a surface dipole source. In contrast, when the sound reaches the receiver via the lateral path, it decays at about 6 dB/dd, consistent with the airborne monopole source. Underneath the aircraft, the drop

in sound level with depth change from 1 to 3 m is only about 2 dB, but beyond about 60 m, a 12 dB drop occurs for the same change in depth.

Figure 5.5 shows the influence of frequency (wavelength) change on transmission loss. Here the loss at a depth of 1 meter can be seen to increase significantly with frequency in the region where the lateral wave is dominant. Thus marine mammals near the surface will benefit from high frequency attenuation when they are not directly below the source track.

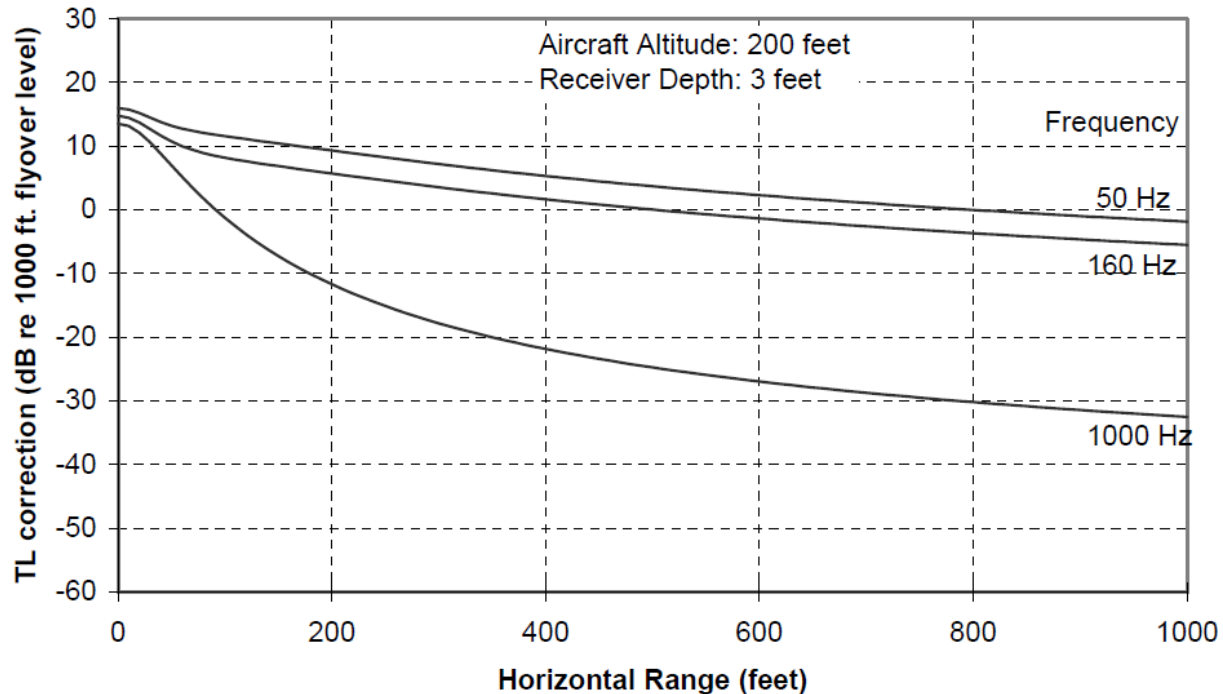


Figure 5.5 Air-Water Transmission Loss versus Frequency (US Navy 2008)

Figure 5.6 shows the change in TL with receiver depth for low-frequency sound. Near the source track, a 6 dB drop in level occurs for a change in depth from 0.3 to 10 m, but beyond a horizontal range of 600 m, there is a 20 to 30 dB drop in level for the same change in receiver depth. Note, however, that for an increase in depth from 10 to 100 m, the received level increases because of the effective source directionality.

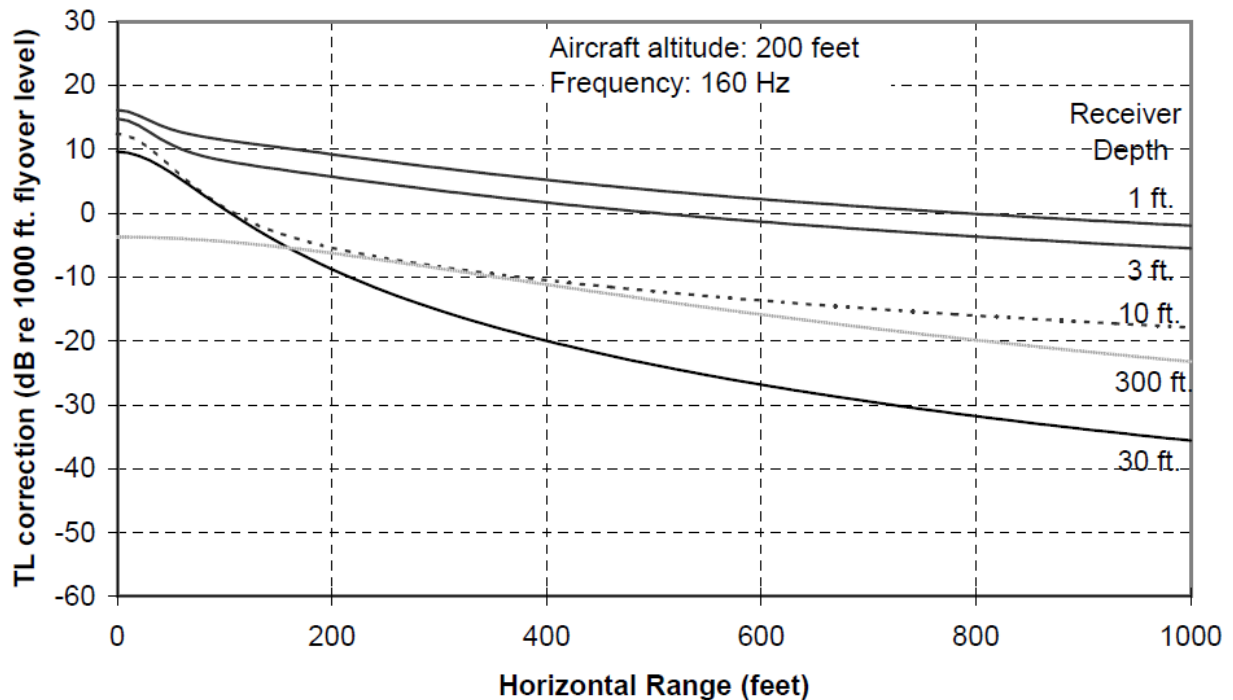


Figure 5.6: Air-Water Transmission Loss versus Receiver Depth (US Navy 2008)

For a passing airborne source, received level at and below the surface diminishes with increasing source altitude, but the duration of exposure increases. The maximum received levels at and below the surface are inversely proportional to source altitude, but total noise energy exposure is inversely proportional to the product of source altitude and speed because of the link between altitude and duration of exposure.

In summary, airborne sound does not, in general, transmit well into the water because of the difference in sound speeds between air and water. If the sound reaches the surface at an angle more than  $13^\circ$  from vertical, the sound is generally reflected rather than transmitted into the water. While scattering from waves also facilitates sound entering the water, in the ocean this is also somewhat offset by bubbles at the surface introduced by breaking waves. A  $13^\circ$  cone from the source's altitude to the ocean's surface traces a "footprint" along the source's flight, but as size of the footprint increases with altitude, the sound level reaching the ocean surface decreases as a result of transmission loss through the air.

Considering the survey aircraft will be traveling about 120 knots (222 k/h, 61 m/s), surface and underwater exposure under the footprint will be for about 1.14 seconds in duration to the maximum sound level. Richardson et al. (1995) sums up their analysis: underwater noise from a passing aircraft is generally brief in duration, when compared with the duration of audibility in the air. An approaching aircraft will be inaudible or only weakly audible underwater.



### 5.7.3.1 Comparison of Noise Levels

A comparison of natural and potential exploration-related noise levels is provided in Table 5.2.

**Table 5.2: Comparison of Natural and Seismic Exploration-related Noise Levels**

Source	Source Level (dB re 1µPa)	Sound Frequency (Hz)	Notes
Ambient Noise			
Calm Seas	60	-	
Moderate Waves/surf	102	100 to 700	
Fin whales	160 to 186	20	Fin whales produce series of one to five second noise pulses across 3 to 4 Hz around the 20 Hz level.
Seismic Exploration			
GSC 7900 Array	259	10 to 5,000	0 to peak
ARCO 4000 Array	255	10 to 5,000	0 to peak
GECO 3100 Array	252	10 to 5,000	0 to peak
Supply boats	170 to 180	100	
Other Industrial Noise			
Fishing trawlers	158	At 100	
Commercial freighter	172	-	
Supertanker Chevron London	190	dominant tone of 6.8 Hz	
Helicopter (Sikorsky @ 305 m above water)	105	-	
Twin Otter	107	890-1120 Hz	
Source: Richardson et al. 1997; Lawson et al. 2000			

Wenz (1962) published a thorough study of noise in the ocean, and a composite of his conclusions is given in Figure 5.7. The figure also gives the limits of prevailing noise, showing that for the frequency band 10 to 100 Hz, the noise density level is between 40 and 120 dB, but with a strong increase with lower frequencies. At sound frequencies below 500 Hz, (the frequency of aircraft) shipping noise is an important factor and above 500 Hz, wind and wave conditions are the primary cause of deep ocean ambient noise (Davis et al. 1998). Most of the man-made noise is continuous signals, such as from shipping. Industrial activities and oil exploration create repeated signals of short duration.

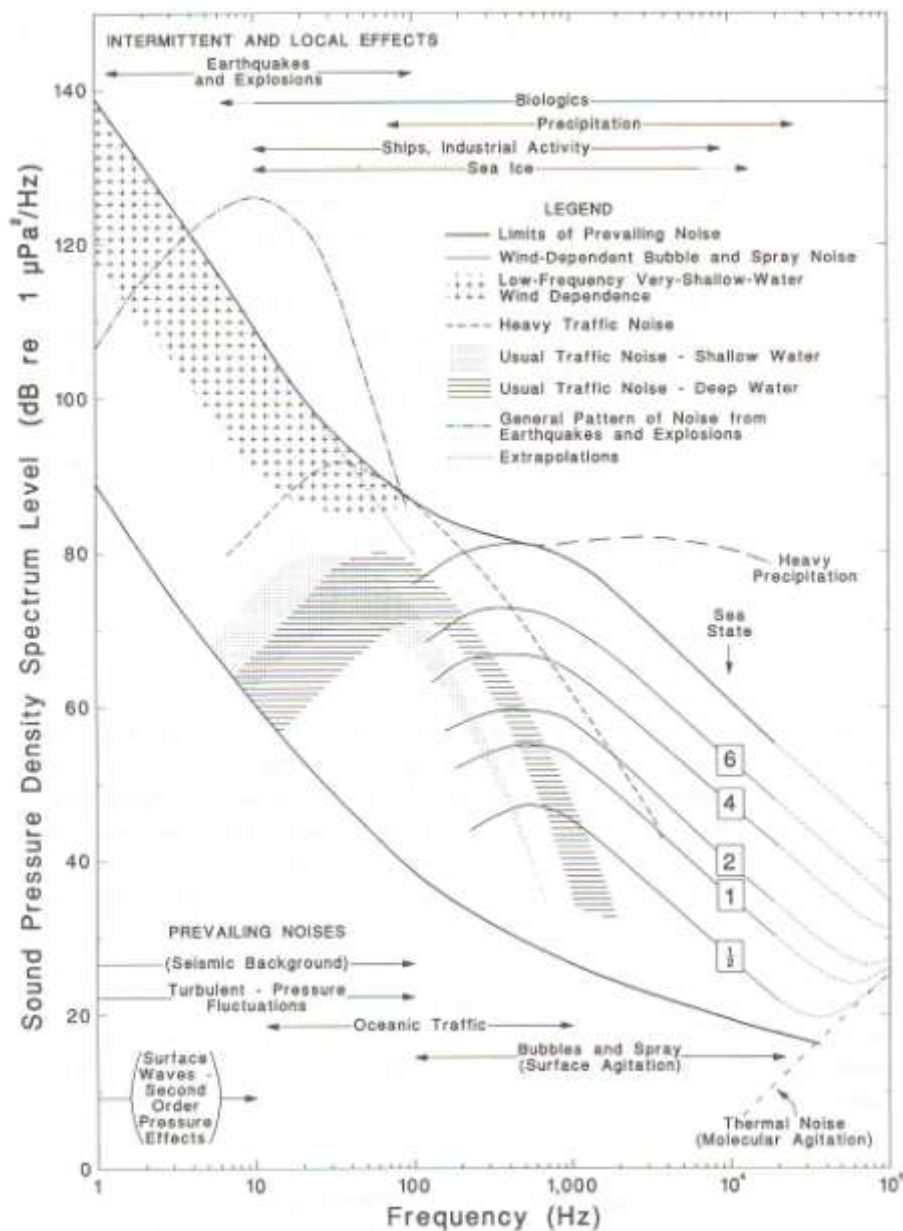


Figure 5.7: Ambient noise spectra attributable to various sources (Wenz 1962)

## 5.8 Ocean Resources

This section presents an overview of the Study Area as it relates to the biophysical and socio-economic environment. These areas have been extensively covered in previous reports that include the Eastern Newfoundland SEA and most recently in large regional EAs for MKI AS (YOLO 2012 § 4.0). For completeness, updated information is provided on marine and migratory birds, marine mammals, sea turtles, species at risk, sensitive areas and other airspace and ocean users.

### **5.8.1 Marine and Migratory Birds**

Information on distribution, species habitats, feeding, breeding and migratory characteristics for the seabirds in the Jeanne d'Arc and Orphan Basin area has been reviewed in § 4.2.2 of the NESEA.

#### **5.8.1.1 Seabird Distribution**

Seabirds that occur in the marine waters off Eastern Newfoundland include cormorants, gannets, phalaropes, gulls, terns, alcids, jaegers, skuas, fulmars, petrels, and shearwaters. According to data from Fifield et al (2009), the largest concentration of seabirds in the Study Area occurs from March to August. Seabirds are least abundant in the Study Area in the fall (September - October), when most survey blocks had fewer than 10 birds/km<sup>2</sup>.

Some species of seabirds arrive at the colonies as early as February (Black-legged Kittiwakes) and March (Northern Gannet), and egg-laying commences in mid to late May and into June. The young of most species depart the colony by July to August, and as late as November for Northern Gannets.

Data on avian presence and abundance in and near the ENSEA (2014) Study Area were obtained from various sources. EC-CWS was consulted for information on seabird colonies off Eastern Newfoundland, as well as for recent data (2010 to 2013) on seasonal and spatial trends in seabird abundance from the Eastern Canadian Seabirds at Sea (ECSAS) program. Records from the Atlantic Canada Shorebird Survey (ACSS) and the Important Bird Areas (IBAs) of Canada programs provided further information on species presence and were used to identify avian "hotspots". The ECSAS surveys identified that of all the areas identified as hotspots, the Grand Banks was the most important region for seabirds. The data were considered current by CWS (CWS Biologist, pers, comm. 2014)

A summary of the predicted abundance status for each species per month known to occur in the Study Area is provided in Table 5.3.

**Table 5.3: Distribution and Abundance of Seabirds Known to Occur in the Study Area**

Common Name	Scientific Name	Distribution	Monthly Abundance											
			J	F	M	A	M	J	J	A	S	O	N	D
Northern Fulmar	<i>Fulmarus glacialis</i>	Offshore, coastal	C	C	C	C	C	C	C	C	C	C	C	C
Greater Shearwater	<i>Puffinus gravis</i>	Offshore, coastal					U	U-C	C	C	C	C-U	S	
Sooty Shearwater	<i>Puffinus griseus</i>	Offshore, coastal				S	S	S	S-U	S-U	S-U	S	S	
Manx Shearwater	<i>Puffinus puffinus</i>	Offshore, coastal					VS	VS	S	S	S-VS	VS		
Wilson's Storm Petrel	<i>Oceanites oceanicus</i>	Offshore				VS	VS-S	VS	S	S	VS			
Leach's Storm-Petrel	<i>Oceanodroma leucorhoa</i>	Offshore				U-C	C	C	C	C	C-U	U		
Northern Gannet	<i>Sula bassanus</i>	Offshore, coastal				VS-S	S	S	S	S	S	S		
Phalaropes	<i>Scolopacidae</i>	Offshore, coastal					S-U	S-U	S-U	S-U	S-U	S-U	S-U	S-U
Herring Gull	<i>Larus argentatus</i>	Coastal, offshore	S	S	S	S-U	U	S	VS	VS	VS	VS	VS	
Iceland Gull	<i>Larus glaucoides</i>	Coastal, offshore	VS	S	S	S	VS					VS	VS	VS
Lesser Black-backed Gull	<i>Larus fuscus</i>	Coastal, offshore		VS	VS		VS	VS	VS	VS	VS	VS	VS	VS
Greater Black-backed Gull	<i>Larus marinus</i>	Coastal, offshore	S-U	U-C	U	U	U	S	S	S	S	S-U	S-U	S-U
Glaucous Gull	<i>Larus hyperboreus</i>	Coastal, offshore	S	S	S	S	VS					VS	S	S
Black-legged Kittiwake	<i>Rissa tridactyla</i>	Offshore, coastal	C	C	C	C	C	S	S	S	U	C	C	C
Arctic Tern	<i>Sterna paradisaea</i>	Coastal, offshore					S	S	S	S	VS			
Great Skua	<i>Stercorarius skua</i>	Offshore					VS	VS	VS	VS	VS	VS		
South Polar Skua	<i>Stercorarius maccormicki</i>	Offshore					S	S	S	S	S	S		
Pomarine Jaeger	<i>Stercorarius pomarinus</i>	Offshore				S	S	S	S	S	S	S		
Parasitic Jaeger	<i>Stercorarius parasiticus</i>	Offshore					VS	VS-S	S	S	S-VS	VS		
Long-tailed Jaeger	<i>Stercorarius longicaudus</i>	Offshore				VS	VS	VS	VS	VS	VS			

Common Name	Scientific Name	Distribution	Monthly Abundance											
Dovekie	<i>Alle alle</i>	Offshore, coastal	C	C	C	C	C	C	C	C	VS	VS	C	C
Common Murre	<i>Uria aalge</i>	Offshore, coastal	S	S-U	U	U	U-C	S	S	S	S	S	S-U	S-U
Thick-billed Murre	<i>Uria lomvia</i>	Offshore, coastal	U	U	U-C	U-C	U	S	S	VS-S	VS	S-U	C	U-C
Razorbill	<i>Alca torda</i> ,	Offshore, coastal		S	VS	VS	VS	VS	VS			VS	VS	
Black Guillemot	<i>Cepphus grille</i>	Coastal		S										
Atlantic Puffin	<i>Fratercula arctica</i>	Offshore, coastal	S	S	VS	S	U	U	U	U	S	S	U	U
Notes: C = Common, present daily in moderate to high numbers; U = Uncommon, present daily in small numbers; S = Scarce, present, regular in very small numbers; VS = Very Scarce, very few individuals or absent. Blank spaces indicate not expected to occur in that month. Sources: P. Chamberland, EC, March 2012 (data set 1966 to 2011) and Fifield et al. (2009).														

### 5.8.1.2 Seabird Colonies & Important Bird Areas

As the Study Area is far offshore and does not contain islands, no seabird breeding colonies occur within its boundaries. There are no Important Bird Areas (IBAs) identified within the Study Area (§4.2.2.6 ENSEA 2014). The closest IBA is about 60 km from the Study Area (Figure 5.8). An IBA is a site that provides essential habitat for one or more species of breeding or non-breeding birds. It was the exceptional concentrations of nesting seabirds that qualified the sites off the east coast of Newfoundland as IBAs ([www.ibacanada.com](http://www.ibacanada.com)).

Distances from study area boundary to closest sites are in table below.

Site	Dist_km
Quidi Vidi Lake	60
Cape St. Francis	63
Witless Bay Islands	65
Grates Point	66
Baccalieu Island	71
Funk Island	86
Mistaken Point	91

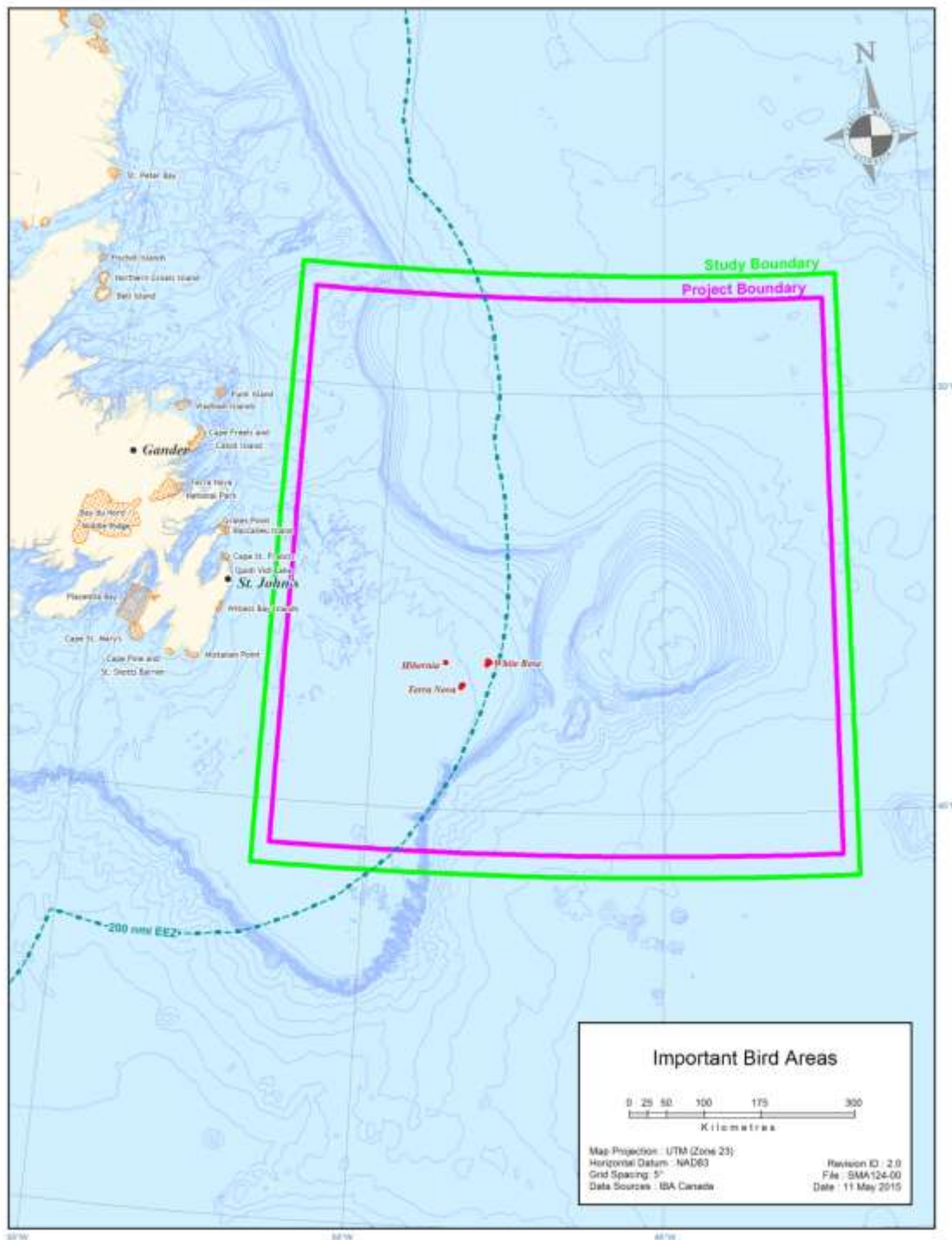
### 5.8.1.3 Coastal Waterfowl

Section 4.2.2.2 of the ENSEA 2014 describes coastal waterfowl species. As these birds are coastal in distribution and thus, they are well outside the Project Area boundary.

### 5.8.1.4 Migrating Shorebirds and Passerines

In the Americas, bird migration routes are north and south as opposed to east and west across the Atlantic Ocean to Europe. Thus migrating birds will not be traversing across the Project Area, however, the Atlantic Flyway does encompass a route between Newfoundland and Greenland which may cross the northeast side of the Project Area. Newfoundland does not host a high proportion of fall migrating shorebirds along the Atlantic Flyway, and the west coast of Newfoundland hosts the greatest proportion of migrating shorebirds within the province. Fall migrating shorebirds do occur along the eastern coast of Newfoundland and are well outside of the Project Area.

Passerine bird species are primarily inland based although some use coastal habitats. Night migrations in the Survey Area will not be affected, as the aircraft will operate solely during daylight hours. The aircraft is likely to fly between the airport and the Survey Area before sunrise to commence low-level flights at first light.



**Figure 5.8:** Locations of Important Bird Areas (IBAs) and seabird nesting colonies relative to the Study Area (Source: \*<http://www.ibacanada.ca> & \*\*Canadian Wildlife Service, Environment Canada, unpublished data)

### 5.8.2 Marine Mammals

Marine mammal species present in the waters of Newfoundland and Labrador belong to the order Cetacea (whales, dolphins, and porpoise) and the order Pinnipedia (seals and walruses). Walruses are not known to be present in the Study Area, as such; pinnipeds will be reported as true seals. This report is not considering marine mammal members of the mustelids (otters, minks, etc.) nor polar bears (*Ursus maritimus*) because they do not occur within the Study Area.

Sections 4.2.3.1 and 4.2.3.2 of the ENSEA (2014) provides a summary of marine mammal species and previously available sighting data for the Study Area and adjacent waters. Marine mammals known to occur in the Study Area include six species of baleen whales (Mysticetes) and 13 species of toothed whales (Odontocetes) of which six species are dolphins and porpoises. Cetacean species that occur and may occur in the study area include: blue whale, fin whale, sei whale, north Atlantic right whale, humpback whale, minke whale, sperm whale, killer whale, northern bottlenose whale, long-finned pilot whale, Sowerby's beaked whale, beluga whale, Atlantic white-sided dolphin, white-beaked dolphin, common bottlenose dolphin, common short-beaked dolphin, Risso's dolphin, striped dolphin and harbor porpoise

True seals (Phocids) account for five species found in the Study Area: harp seal, harbour seal, grey seal, hooded seal and bearded seal. Most marine mammals use the Study Area seasonally, and the region likely represents important foraging areas for many species.

The sighting database provided by Fisheries and Oceans marine mammal section (Newfoundland) in Figure 5.9 illustrates marine mammal occurrence within the extent of the Study Area from 1877 to 2013.t



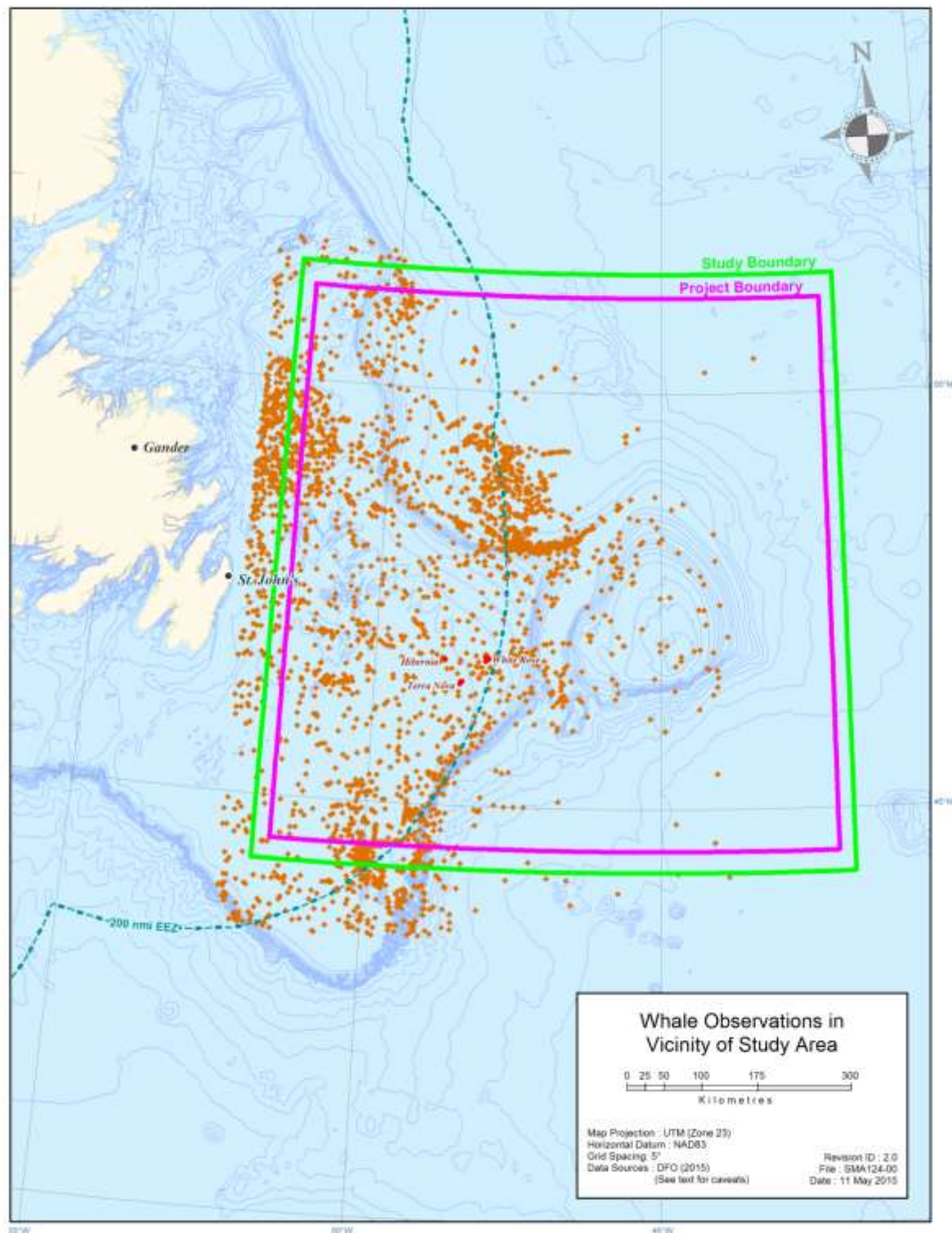


Figure 5.9 Cetacean Observations Offshore Eastern Newfoundland

### 5.8.3 Sea Turtles

Sea turtles are fairly uncommon in the offshore waters of Newfoundland; however, they may be found in summer and fall. Species of turtles that may be found in the area of the Project include the Atlantic loggerhead (*Caretta caretta*), leatherback turtle (*Dermochelys coriacea*) and Kemp's ridley. Species information is provided in § 4.2.3.4 of the ENSEA (AMEC 2014).

There are no breeding critical habitats for sea turtles in the North Atlantic. Foraging in the north Atlantic is important to this species based on the growing evidence from a variety of monitoring methods (James et al. 2006, DFO).

### 5.8.4 Species at Risk

Species are listed under SARA on Schedules 1 to 3 with only those designated as endangered or threatened on Schedule 1 having immediate legal implications. Schedule 1 is the official list of wildlife Species at Risk in Canada. Once a species/population is designated, the measures to protect and recover it are implemented. Schedules 2 and 3 of SARA identify species that were assessed at risk by COSEWIC prior to October 1999 and must be reassessed using revised criteria before they can be considered for addition to Schedule 1.

Under SARA, a 'recovery strategy' and corresponding 'action plan' must be prepared for endangered, threatened, and extirpated species. Final recovery strategies have been prepared for four species currently designated as either endangered or threatened under Schedule 1 that occur in the Study Area:

- leatherback sea turtle (ALTRT 2006),
- Ivory Gull (Environment Canada 2014);
- blue whale – NW Atlantic population (Beauchamp et al. 2009), and
- North Atlantic right whale (Brown et al. 2009).

#### 5.8.4.1 Marine Mammals

There is no change in the number or species of marine mammals listed in Schedule 1 of the SARA in the Study Area as described in § 4.2.3.5 of the ENSEA (2014). Four currently designated species of marine mammals include:

- blue whale - Atlantic population;
- North Atlantic right whale;
- Sowerby's beaked whale; and
- fin whale - Atlantic population.

The main reason for the original decline of most marine mammal species includes commercial whaling mortality, and life history characteristics have been preventing full recovery.

DFO has identified several key ecologically and biologically significant areas (EBSAs) on the banks, of which the Northeast Shelf and Slope EBSA, Lilly Canyon – Carson Canyon EBSA, Virgin Rocks EBSA and Southeast Shoal EBSA are found within or near the Study Area (DFO 2007, 2013). These EBSAs have been specifically identified as important feeding habitat for many cetacean and pinniped species (CPAWS 2009). Marine mammals in the Grand Banks EBSAs include the blue, North Atlantic right, fin, sei, humpback, minke, long-finned pilot, killer, northern bottlenose whales; harbour porpoise; white-beaked dolphin, Atlantic white-sided dolphin; and hooded, harbour, ringed, grey, and harp seals (CPAWS 2009).

The Northeast Shelf and Slope EBSA has been identified as important feeding habitat for marine mammals, while Lily Canyon – Carson Canyon EBSA has been noted to have cetaceans and pinnipeds aggregate in the area throughout the year to feed and over-winter

(CPAWS 2009). Localized concentrations of food in the Southeast Shoal EBSA signify important feeding and aggregation habitat for marine mammals and it is estimated that 15% to 30% of the population of Northwest Atlantic humpback whales feed in the Southeast Shoal (CPAWS 2009). The North Atlantic right whale is also believed to use the Southeast Shoal (CPAWS 2009).

#### **5.8.4.2 Sea Turtles**

There are no newly listed species or change in status of sea turtles occurring in the Study Area since the production of the ENSEA (2014) (§4.2.3.4).

The Southeast Shoal EBSA has been identified as a possible important feeding and aggregation habitat for the leatherback turtle (CPAWS 2009). The Southeast Shoal's northern boundary is found near the Study Area's southwestern boundary.

#### **5.8.4.3 Marine and Migratory Birds**

There are no newly listed species of marine birds occurring in the Study Area since the production of the ENSEA in 2014 (§4.2.2.5). The Ivory Gull is the only species at risk marine bird that might be present within the Study Area. The gull is a medium-sized, long-lived and rare species that is associated with polar pack ice at all times of year (Gilchrist and Mallory 2004), which is unusual for a gull species (Stenhouse et al. 2004).

This species is declining globally and there are well-documented, ongoing declines in the Northwest Atlantic population from which juveniles routinely enter and forage in Atlantic Canadian waters. The Canadian population is threatened directly by commercial fishing, particularly bycatch in the pelagic longline fleet, and by loss and degradation of nesting beaches in the southeastern USA and the Caribbean. Other threats include bycatch from bottom and midwater trawls, dredging, gillnets, marine debris, chemical pollution and illegal harvest of eggs and nesting females.

The Ivory Gull is designated as endangered by SARA, and has a status of vulnerable by the Newfoundland and Labrador Government *Endangered Species Act* (2002). It is also protected under the *Migratory Birds Convention Act* (1994) and Migratory Bird Regulations. It has a circumpolar breeding distribution and disperses south during winter, but remains along the edges of pack ice (Renaud and McLaren 1982). Sightings of Ivory Gull are rare in the Study and Regional Areas in the winter.

#### **5.8.5 Sensitive Areas**

There are no newly identified sensitive areas occurring in the Study Area since the production of the ENSEA in 2014 (§4.2.4). Potential sensitive areas are described in the following section and include descriptions of ecologically and biologically significant areas (EBSAs). Considering the process of EBSAs is evergreen as new research reveals information, there remains potential for further identification of EBSAs, Areas of Interest, Marine Protected Areas and other sensitive areas within the Study Area.

No National Wildlife Areas and thus, no Marine Wildlife Areas (MWAs) are located in Newfoundland and Labrador (Environment Canada 2013).

There are no Migratory Bird Sanctuaries located in the Study Area.

### 5.8.5.1 Ecologically and Biologically Significant Area (EBSA)

DFO (NL Region) identified 11 EBSAs within the Placentia Bay Grand Banks Large Ocean Management Area (PBGB LOMA) as potential areas of interest (AOIs) for Marine Protected Area (MPA) designation (DFO 2007). DFO recently identified 15 EBSAs north of the PBGB LOMA, of which one, Orphan Spur, occurs in the Study Area (DFO 2013).

Five EBSAs overlap the Study Area as shown in Figure 5.10:

- Southeast Shoal and Tail end of the Banks;
- Northeast Shelf and Slope;
- Lily Canyon-Carson;
- Virgin Rocks; and
- Orphan Spur.

For the exception of the SE Shoal EBSA which has an overall 'high priority' rating, the other EBSAs have an overall 'low priority' rating relative to other EBSAs within the PBGB LOMA. Aspects of these EBSA's, relative to other areas within the same LOMA, considered during its assessment include the following (DFO 2007, 2013):

- Uniqueness (rarity) – the EBSA may be deemed significant to some species, based on function, but has no apparent uniqueness otherwise;
- Aggregation (density/concentration) – (1) the greatest proportion of spotted wolffish is aggregated in this EBSA in the spring; and (2) the highest concentration of Greenland halibut is aggregated in this EBSA in the spring;
- Fitness Consequences (importance to reproduction/survival) – (1) important to the short- and long-term sustainability of the spotted wolffish; and (2) potentially important feeding area for marine mammals; and

The common conservation objectives for the PBGA LOMA identified within the Study Area is to ensure that the features listed below are not altered and/or disrupted by human activities to the point they can no longer be considered a unique feature and/or fulfill the ecological function that initially triggered their identification as significant in the area (DFO 2007). Table 5.4 identifies specific measures for conservation, depleted species, and top 10 Trophic and Structural Ecologically Significant Species (ESSs).

Another ecologically important area in the Study Area is the Bonavista Cod Box, which is an important spawning and migration area for Atlantic cod, American plaice and redfish

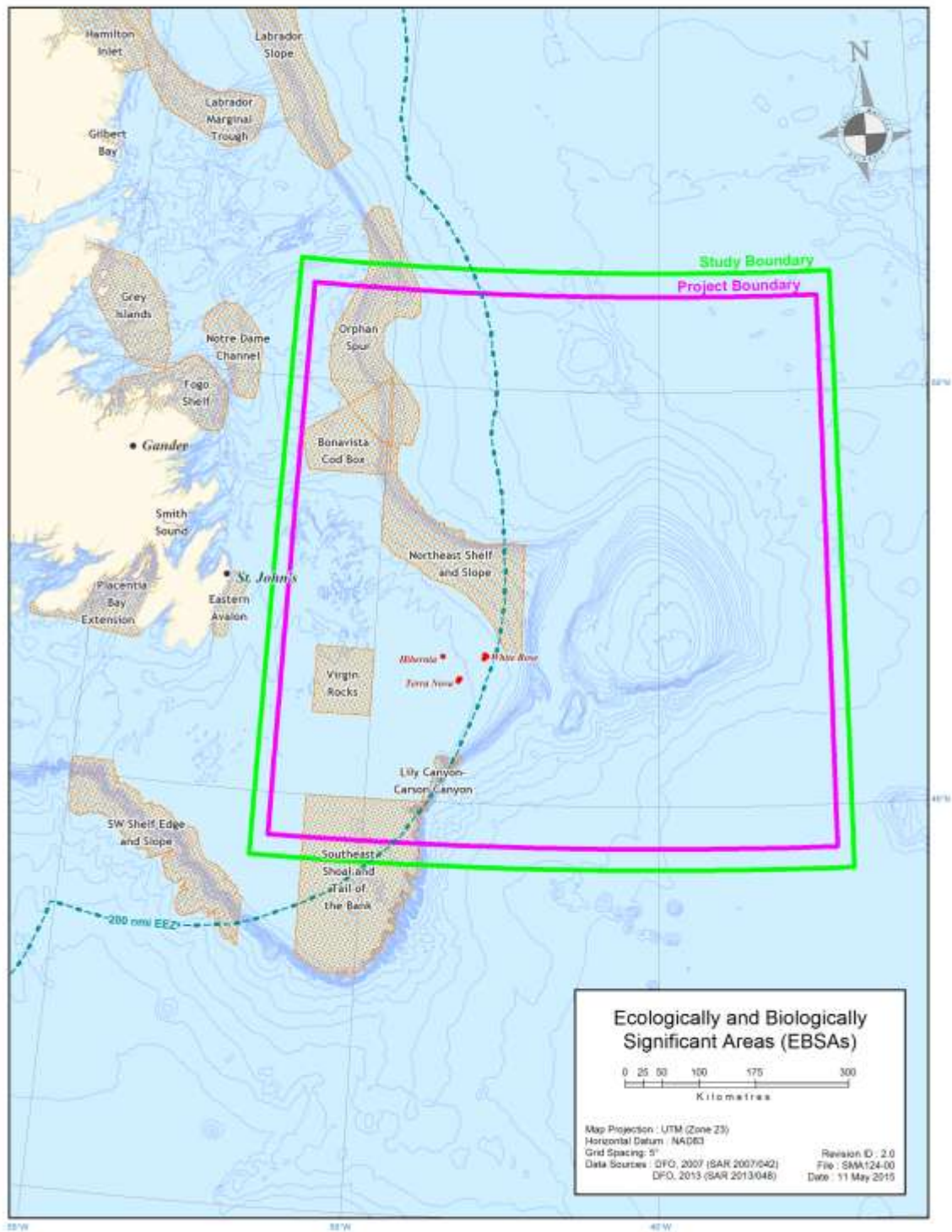


Figure 5.10: Locations of the PBGB LOMA, Newfoundland and Labrador Shelves Bioregion EBSAs, and Bonavista Cod Box relative to the Study Area

**Table 5.4: Conservation Measures, Depleted Species, and Top 10 Trophic and Structural Ecologically Significant Species (ESSs)**

<b>EBSA</b>	<b>Identified Features for Conservation</b>	<b>Identified Depleted Species</b>	<b>Identified Top 10 Trophic and ESS's</b>
Southeast Shoal and Tail end of the Grand Banks	<ul style="list-style-type: none"> <li>○ Are of highest overall benthic biomass on the Grand Banks</li> <li>○ Unique offshore capelin spawning</li> <li>○ Unique yellowtail nursery</li> <li>○ Unique shallow, sandy habitat with glacial history</li> <li>○ <b>Cetacean aggregation and feeding</b></li> <li>○ <b>Seabird aggregation and feeding</b></li> <li>○ American plaice (nursery habitat)</li> <li>○ Atlantic cod spawning</li> <li>○ Reproduction and survival of striped wolfish</li> <li>○ Unique relict populations of blue mussels and wedge clams</li> </ul>	<ul style="list-style-type: none"> <li>○ Atlantic cod</li> <li>○ American Plaice</li> <li>○ Capelin (3NO)</li> <li>○ Leatherback sea turtle</li> </ul>	<ul style="list-style-type: none"> <li>○ Atlantic cod</li> <li>○ Capelin (3NO)</li> <li>○ <b>Seabirds</b></li> <li>○ Benthos</li> </ul>
Northeast Shelf and Slope	<ul style="list-style-type: none"> <li>○ Spotted wolfish and Greenland halibut aggregations</li> <li>○ <b>Cetacean aggregation at Sackville Spur (esp. pilot whale)</b></li> <li>○ <b>Pinniped (harp and hooded) aggregation at Sackville Spur</b></li> <li>○ Coral concentrations north of Tobin's Point and Funk Island Spur</li> </ul>	<ul style="list-style-type: none"> <li>○ Northern wolfish</li> <li>○ Spotted wolfish</li> </ul>	<ul style="list-style-type: none"> <li>○ <b>Harp seals</b></li> </ul>
Lilly Canyon-Carson Canyon	<ul style="list-style-type: none"> <li>○ Iceland scallop concentration</li> <li>○ Reproduction and survival of Iceland scallops</li> <li>○ <b>Cetacean aggregation and refuge/overwintering</b></li> <li>○ <b>Pinniped aggregation and refuge/overwintering</b></li> </ul>	<ul style="list-style-type: none"> <li>○ None</li> </ul>	<ul style="list-style-type: none"> <li>○ Corals</li> <li>○ <b>Harp Seals</b></li> </ul>
Virgin Rocks	<ul style="list-style-type: none"> <li>○ Unique geological feature/habitat</li> <li>○ Atlantic cod spawning</li> <li>○ American plaice spawning</li> <li>○ Yellowtail flounder spawning</li> <li>○ Congregation for capelin</li> <li>○ <b>Seabird feeding</b></li> <li>○ <b>Common eider overwintering</b></li> </ul>	<ul style="list-style-type: none"> <li>○ Atlantic cod</li> <li>○ American Plaice</li> </ul>	<ul style="list-style-type: none"> <li>○ Atlantic cod</li> </ul>
Orphan Spur	<ul style="list-style-type: none"> <li>○ Aggregations of fish</li> <li>○ High concentration of coral species</li> <li>○ <b>Female hooded seal aggregation</b></li> <li>○ <b>Aggregation of seabird species</b></li> </ul>		

Source: DFO 2007, 2013

**5.8.5.2 Corals and Sponges**

The aircraft operations will not interact directly or indirectly with any benthic, sublittoral organism or habitat, including deep sea corals or sponges and are not considered in the EA.

### **5.8.5.3 NAFO Fishing Closures**

Given the nature of aircraft surveys, survey equipment and procedures will not interact with nor exert any fishing stress on these fish species or seamounts. Figure 4.2.4.1 in the NS SEA depicted the closure areas.

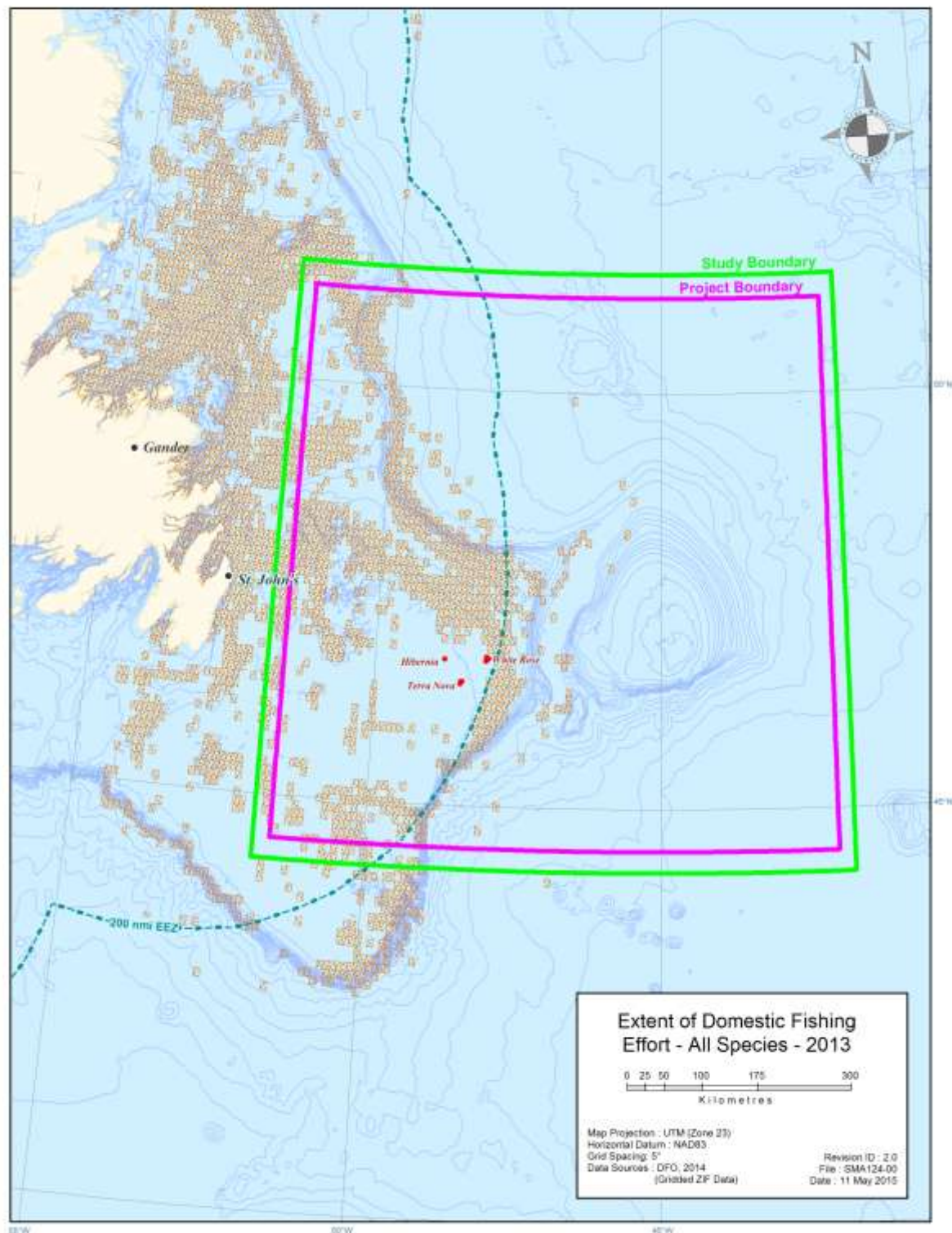
## **5.9 Ocean Resource Users**

### **5.9.1 Commercial Fisheries**

#### **5.9.1.1 Harvesting Locations**

The following map shows DFO dataset fishing locations in relation to the Study Area for the period May to November, for 2013. Much of the effort focused along the shelf break (Figure 5.11).





**Figure 5.11: Commercial fishing effort – 2013, all months and all species combined**



### **5.9.1.2 Harvest Season**

The timing that commercial species are harvested may change, depending on seasons and regulations set by DFO, quotas, the harvesting strategies of fishers, or on the availability of the resource itself. During the 2008 to 2012 period occurred throughout the year, with the highest landings by weight occurring in the summer (May - August) period, which also accounted for approximately 75 percent of the total value of fish harvested (§4.3.4.2ENSEA 2014) by month for all species.

In summary, fishing vessels and fishers will occur with the Study Area within the March to November timeframe.

### **5.9.1.3 Seal Harvesting**

The commercial harvest of seals is carried out using longliners (vessels 35'-65' in length) or small boats (vessels under 35' in length). In addition to the individual commercial fishery licenses, personal use licenses are issued. Since 1995, residents adjacent to sealing areas throughout Newfoundland and Labrador and Quebec have been allowed to harvest up to six seals annually for their own use. Aboriginal peoples and non-Aboriginal coastal residents who reside north of 53°N latitude can continue to harvest seals for subsistence purposes without a license, or as determined by specific Aboriginal rights.

Where there is solid ice and seals are close to shore, sealers may harvest on foot or using snowmobiles. The harvest provides important seasonal income and food to residents of small coastal communities where there have been fishery closures and employment opportunities are limited. Of the six seal species, the northwestern Atlantic harp seal is the most abundant of all seal species in Atlantic Canada, and accounts for almost all the seals harvested commercially, with small numbers of grey seals and very few hooded seals making up the balance.

#### **5.9.1.3.1 Seasons and Areas**

Seasons and areas (Figure 5.12) are set by within the Marine Mammal Regulations (MMR) under the *Fisheries Act*. As per the MMR, the season is from November 15 to May 15. The season for the commercial harvest of harp and hooded seals is established in consultation with sealing fleets and is set out in Variation Orders pursuant to the MMR, taking into account environmental and biological conditions. It can be adjusted by Variation Orders to accommodate changing circumstances.

The majority of sealing occurs between late March and mid-May, beginning around the third week in March in the southern Gulf of St. Lawrence, and about the second week in April off Newfoundland (the Front). The timing of harvest activities in the northern Gulf of St. Lawrence depends largely on the movement of ice floes on which seals are located. The peak commercial harvest in this area is in early April.

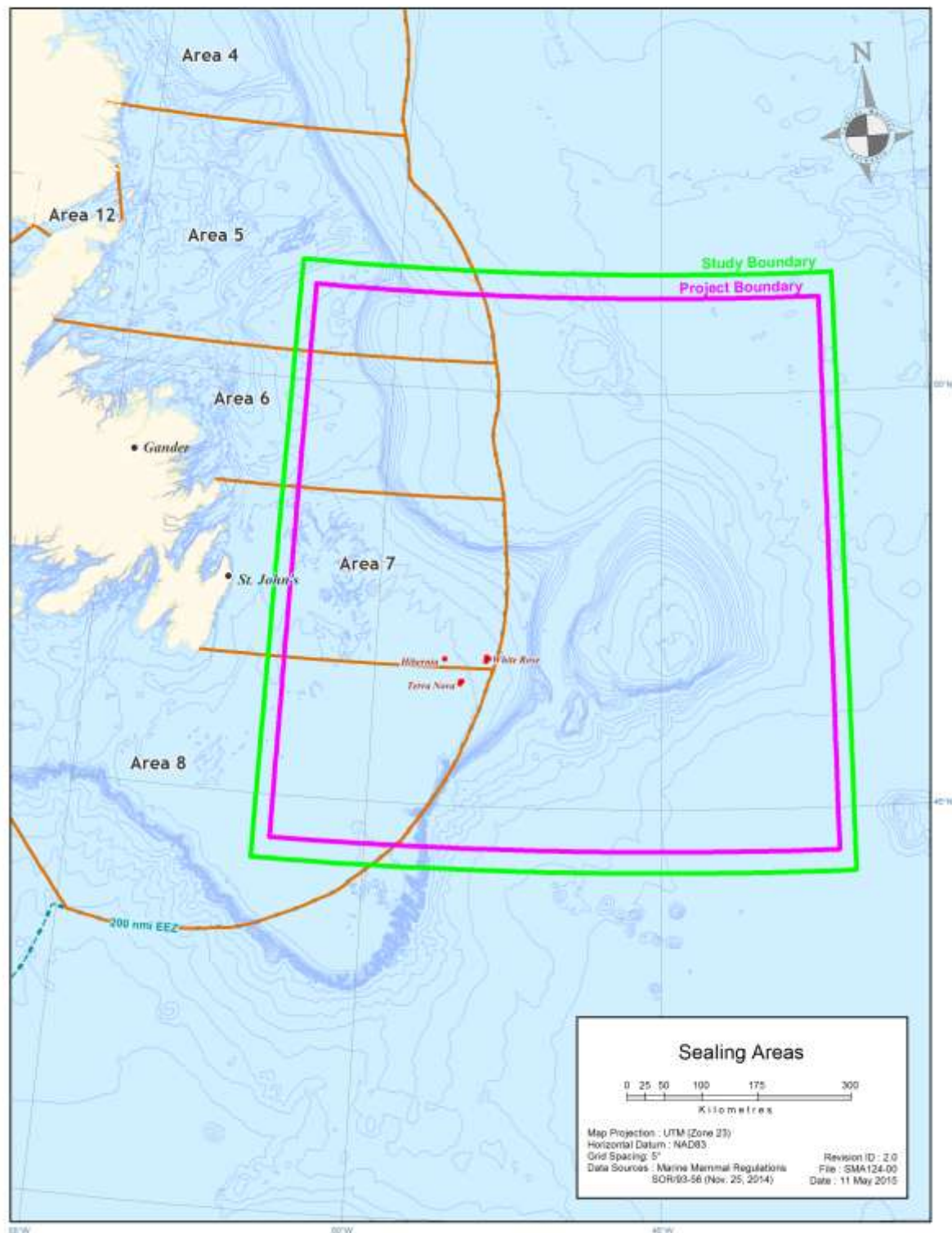


Figure 5.12: Sealing areas off eastern Newfoundland and Labrador

Within the Project Area, harp seals are harvested on offshore ice floes in the spring. This targeted species is concentrated primarily off Southern Labrador, the Gulf of St. Lawrence area and off Northern Newfoundland. The Eastern Newfoundland harvest commences at The Front around the second week of April. The Front quota includes hunting in four Sealing Zones: 5, 6, 7 and 8, which are all adjacent to the Eastern Newfoundland coastline. In recent years, the sealing activity has decreased due to some international bans on the import of seal products resulting from the controversy surrounding the harvesting methods.

Movement of ice floes and ice conditions often determines the degree of effort in any given area. Approximately 70% of the seal harvest occurs on the Front, an area off the north and east coasts of Newfoundland and southern Labrador.

Although variable ice conditions have been observed historically, there has been a dramatic decline in harp seal-friendly ice cover in recent years. 2010 saw the lowest ice cover ever observed in the Gulf, and suitable ice occurred much further north than is normal at the Front.

#### **5.9.1.4 DFO Research and Joint Industry Surveys**

##### *5.9.1.4.1 Vessel Finfish and Shellfish Surveys*

The DFO research vessel (*CCGS Needler* and *CCGS Teleost*) multispecies bottom trawl surveys occur in the spring in Divisions 2J3KLMNOP (March to June) and in the fall in Divisions 2J3KLNO (September to November). Primarily, these surveys are used as fisheries independent tools to estimate stock abundance (the magnitude of the marine populations) and recruitment (the abundance of juveniles) over time for a number of fish and invertebrate species. This information is then used along with fisheries catch data to assess the status of commercial species.

Industry-DFO Collaborative Post-season Trap Surveys for Snow Crab in the late summer through the fall (late August/early September to end of November), in Divisions 2HJ3KLNO, provide data that are used to predict changes in biomass and recruitment for the upcoming snow crab fishery in the following year.

##### *5.9.1.4.2 Aerial Seal Surveys*

Typically between March 7 and 25, harp seal pup assessments consist of aerial surveys using a Twin Otter aircraft to detect all concentrations of pups, a survey to count the pups using visual / photographic methods and a survey to determine the timing of births, so that counts can be corrected for births occurring after the surveys were flown. These surveys are flown near the coast and up to 322 km (200 mi) offshore over pack ice, ice floes and open water. These flights are low level at about 198 m (650 ft) and 204 kph (110 kn). The total survey time is about 100+ hours flying time, with each survey about 5 hours in duration. Tightly grouped survey transects are flown between 10:00 and 15:00 in the day, with the goal to count the entire whelping patch in one day.

This aerial survey is flown every 4 to 5 years, to count the number of pups born on the pack ice in the Gulf of St. Lawrence and off the east coast of Newfoundland and Labrador. This method is the main tool used to evaluate the status of the population. Additional information is collected annually, when DFO scientists use a Beechcraft King Air turboprop aircraft and circle around the area to better understand where the seal whelping concentrations are located. This survey may include data on weekly location surveys where the seals are pupping, what the ice is like and how that ice persists. Information on age-specific reproductive rates, harvest levels in Canadian and Greenland harvests, and mortality estimates of young of the year on the ice is also obtained.

Other aerial surveys include DFO monitoring for regulatory hunting compliance using aerial surveillance by helicopters and fixed wing aircraft.

### **5.9.2 Air Traffic**

NAV Canada (Manager of Operations, pers. comm. 2015) in Gander, NL will control and manage all flights offshore Newfoundland and Labrador and ensure communication occurs between aircraft operators. Bridgeport submits their flight plans to NAV Canada.

NAV Canada advised that the proposed Bridgeport flight altitude is below other commercial flights described below.

#### **5.9.2.1 International Ice Patrol**

From February 1 through August 31, the U.S. Coast Guard International Ice Patrol actively patrols the area of the Grand Banks of Newfoundland for the extent of iceberg danger as required. Fixed wing Coast Guard aircraft conduct the primary reconnaissance work for the Ice Patrol. Ice reconnaissance flights are made on the average of five days every other week during the ice season. The aircraft used for the Ice Patrol flights is the HC-130J long-range surveillance aircraft operated out of Elizabeth City, NC. The usual patrol time for these long-range multi-engine planes is between 5 to 7 hours, with each flight covering an expanse of water of 30,000 square miles or more.



#### **5.9.2.2 Commercial Passenger Flights**

St. John's International Airport is located in the capital city of St. John's, Newfoundland and Labrador. The Airport is considered a "downtown" airport as it is situated just minutes from the downtown core, but has no noise restrictions. The Airport is the second largest in Atlantic Canada based on the number of passengers and is the most easterly in North America.

On a daily basis, St. John's International Airport has over 80 arriving and departing flights to and from 12 destinations in Canada, the US and Europe (on a seasonal basis), with connections to

anywhere in the world (Figure 5.13). The Airport is served by six major airlines: Air Canada, WestJet, Porter Airlines, United Airlines, Provincial Airlines, and Air Saint Pierre. In addition, Sunwing and Air Transat provide seasonal service to destinations within Canada and to the Caribbean.



**Figure 5.13:** Commercial Passenger Flight Routes

Flights that would cross over the Study Area are easterly to London and Dublin.

Gander Airport provides passenger flights via Air Canada to St. John's, Goosebay and Halifax; and to Toronto and charter vacation flights to some Caribbean destinations via Sunwing. Other flights are categorized as technical stops by cargo, military, and government.

### 5.9.2.3 Offshore Operator Helicopter Support

At present, Cougar Helicopters out of St. John's Airport, provides helicopter support services to ExxonMobil, Suncor and Husky Energy for six exploration drilling or production platforms. There are about seven to eight flights daily.

CHC Helicopters Canada provides flight support to Statoil out of the St. John's Airport for their exploration-drilling project. There are two flights daily.

Both companies may provide crew change flight support for the various geophysical exploration. This service tends to be on a less frequent rotation basis compared to the offshore MODUs and platforms.

Helicopters fly at an altitude of controlled airspace, significantly above that of the low-level flights proposed by Bridgeporth.

### 5.9.3 Marine Traffic

#### 5.9.3.1 Commercial Marine Traffic

The aircraft will be flying over marine vessels at sea and there will not be a space conflict on a routine flight.

If there was an emergency related to a vessel or other aircraft in the region while the plane was conducting a survey, JRCC may request its assistance in reconnaissance.

#### 5.9.4 Submarine Cables

Given that there is no water and certainly, no bottom-founded activity associated with aircraft surveying, the Project will neither impact cable operations, or be impacted by submarine cables.

#### 5.9.5 Petroleum Industry

During the Project's six year (2015 to 2019) operating season of March 1 through November 30, other exploration drilling and seismic surveys are currently underway and subject to C-NLOPB approval ([www.cnlopb.ca](http://www.cnlopb.ca)) (Figure 5.14). These projects may use helicopter support for crew transfers. Table 5.5 describes temporal and spatial boundaries associated with each undertaking.

**Table 5.5: Study Areas of Proposed / Occurring Projects within the Project Area**

Operator	Program	Region	Schedule
<b>Exploration Projects</b>			
WesternGeco Canada	2D and 3D seismic	Jeanne d'Arc Basin	May 1–Nov 30 2012-2015 40 to >150 days
Husky Energy	2D, 3D or 4D seismic, well site geohazard surveys, and vertical seismic profiling (VSP)	Jeanne d'Arc Basin and Flemish Pass	Mar 1-Nov 30 2012-2020 20 to 60 days
Statoil Canada	3D, 2D profiles including geohazard and electromagnetic surveys	Jeanne d'Arc and Flemish Pass Basins	Apr 1 to Oct 31 2011-2019 40 to >100 days seismic 5 days geohazard
Statoil Canada	Exploration well drilling	Jeanne d'Arc and Flemish Pass Basins	Year round 2008 to 2016
Chevron Canada	2D and 3D seismic geohazard	Northern Grand Banks to the Orphan Knoll	May to Nov 2012 to 2017 30 to 120 days seismic 14 days geohazard
Husky Energy	Exploration well drilling	Jeanne d'Arc Basin	Year round 2008 - 2017
Suncor Energy	Exploration well drilling	Jeanne d'Arc Basin	Year round 2009 2017
Suncor Energy	2D, 3D, 4D seismic, geohazard, VSP	Jeanne d'Arc Basin, geohazard, VSPs	May 1 to Dec 31 2014-2024 Mar 1 to Dec 31 geohazard
HMDC	2D, 3D, 4 D seismic	Grand Banks	May to Dec 2013 to 2036
GXT	2D, gravity, magnetic	Grand Banks and wider NL offshore area	May 1 to Dec 31 2014 to 2018
MKI AS and TGS-NOPEC	2D and 3D seismic	Labrador Sea	May 1 to Nov 30 2014 to 2018
MKI AS and TGS-NOPEC	2D and 3D seismic	Southern Grand Banks	May 1 to Nov 30 2014 to 2018
<b>Operating Projects</b>			
Exxon Mobil - Hebron	Development -	Jeanne d'Arc Basin,	Production by 2017

	Production	Grand Banks	
Suncor Energy-Terra Nova	Production	Jeanne d'Arc Basin, Grand Banks	2027
Husky Energy - White Rose	Production	Jeanne d'Arc Basin, Grand Banks	2020
Hibernia MDC	Production	Grand Banks	2036



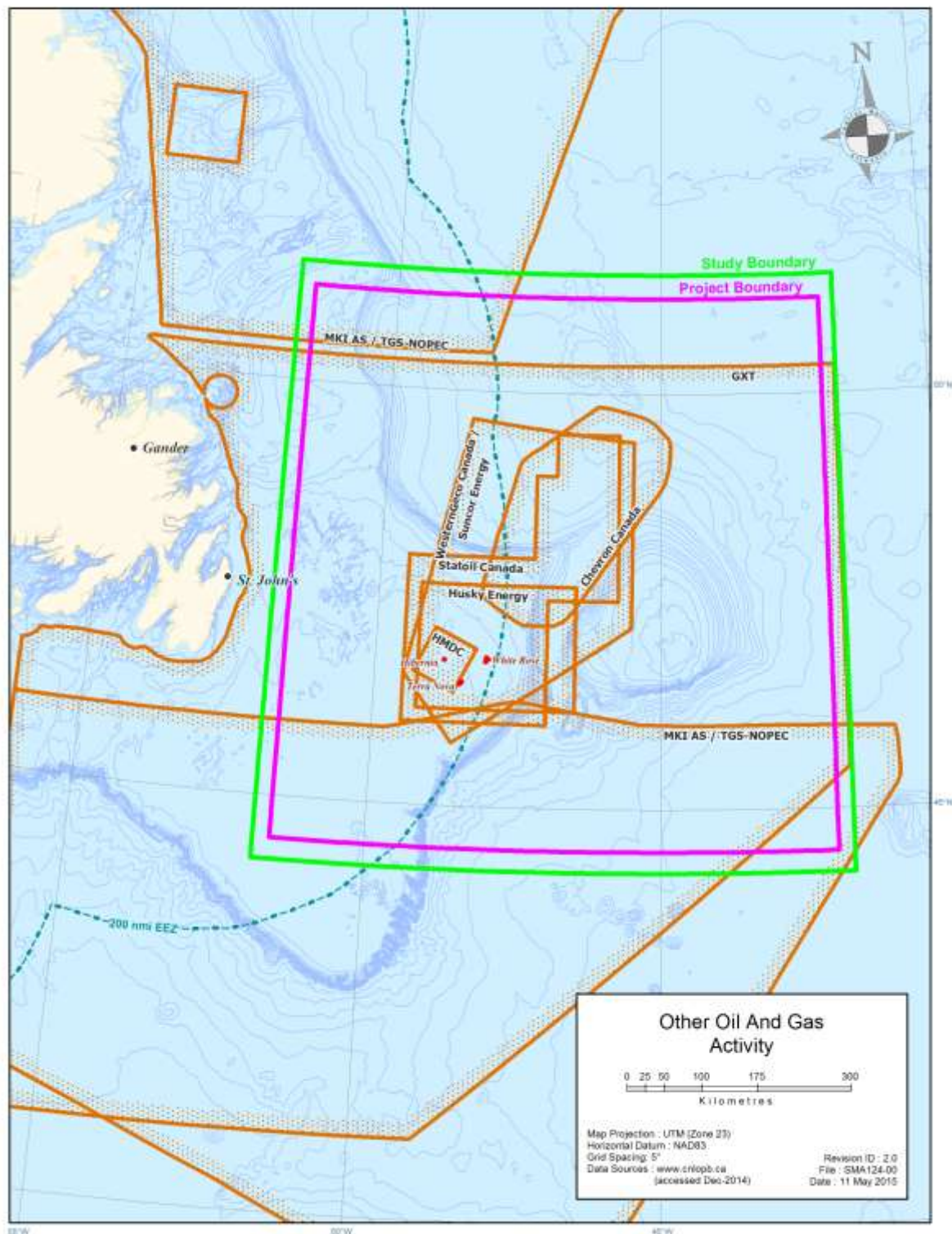


Figure 5.14: Delineated EA study areas for proposed or current petroleum projects



## 6 EFFECTS ASSESSMENT OF PROJECT ACTIVITIES

### 6.1 Marine and Migratory Birds

Marine and migratory birds are protected by legislation (*Migratory Birds Convention Act*) and the *Species at Risk Act* and thus, are a regulatory consideration.

Migratory birds, their eggs, nests, and young are protected under the *Migratory Birds Convention Act* (MBCA). Migratory birds protected by the MBCA generally include all seabirds except cormorants and pelicans, all waterfowl, all shorebirds, and most land birds (birds with principally terrestrial life cycles). Most of these birds are specifically named in the Environment Canada (EC) publication, *Birds Protected in Canada under the Migratory Birds Convention Act*, Canadian Wildlife Service Occasional Paper No. 1.

Under Section 6 of the *Migratory Bird Regulations* (MBR), it is prohibited to disturb, destroy or take a nest or egg of a migratory bird; or to be in possession of a live migratory bird, or its carcass, skin, nest or egg, except under authority of a permit. It is important to note that under the current MBR, no permits can be issued for the incidental take of migratory birds caused by development projects or other economic activities.

Furthermore, Section 5.1 of the MBCA describes prohibitions related to deposit of substances harmful to migratory birds:

*“5.1 (1) No person or vessel shall deposit a substance that is harmful to migratory birds, or permit such a substance to be deposited, in waters or an area frequented by migratory birds or in a place from which the substance may enter such waters or such an area.*

*(2) No person or vessel shall deposit a substance or permit a substance to be deposited in any place if the substance, in combination with one or more substances, results in a substance — in waters or an area frequented by migratory birds or in a place from which it may enter such waters or such an area — that is harmful to migratory birds.”*

#### 6.1.1 Boundaries

With respect to temporal boundaries, the potential interactions considered are those related to the aircraft flights that could occur in March to November for surveys during a five-year (2015 to 2019) time period.

The ecological spatial boundary for marine bird species includes the offshore foraging habitats.

#### 6.1.2 Potential Issues

The following impact pathways potentially influencing marine and migratory birds are considered in the analysis of the proposed gravity survey:

- noise disturbance from aircraft including both direct effects (physiological), or indirect effects (foraging behaviour or prey species);
- physical displacement as a result of aircraft presence (e.g., disruption of foraging activities);
- nocturnal disturbance from light (e.g., increased opportunities for predators, attraction to aircraft and subsequent collision, disruption of incubation);
- exposure to contaminants from accidental spills (e.g., fuel, oils)

### 6.1.3 Significance Criteria

A significant adverse effect on marine and migratory birds is one likely to cause:

- A death or life-threatening injury of one or more individual of a listed species; and or
- Death or life-threatening injury on non-listed species in sufficient numbers to affect the population adversely; and/or
- Long-term or permanent displacement of any species from preferred feeding, breeding or nursery habitats; and or
- Destruction or adverse effects on critical habitat for any listed species.

An adverse, but not significant effect on marine birds and migratory is one that is likely to cause:

- Death or life-threatening injury of individuals in small numbers that would not adversely affect the population; and or
- Short-term displacement of any species from preferred feeding, breeding, nursery grounds or migratory routes

### 6.1.4 Effects Assessment and Mitigation

#### 6.1.4.1 Aircraft Presence

##### 6.1.4.1.1 Physical Displacement

Low-level aerial surveys of seabirds are conducted routinely on a global scale, primarily for population census and distribution studies. The studies are too numerous to list. As an example, routine aerial seabird surveys are conducted off the US coasts of California (see OBIS SEAMAP database, USGS, MMS), Oregon and Washington and Alaska (see NOAA). The Aarhus University in Denmark routinely conducts aerial seabird surveys related to offshore wind turbine projects. The National Environmental Research Institute of Denmark developed aerial seabird survey methods (Kahlert et al. 2000, Camphuysen et al. 2004). European governments have established standardised seabird survey techniques. On the Bay of Biscay on the French Atlantic coast, Certain & Bretagnolle (2008) established that aerial protocols of altitude and speed can be fixed in a relatively wide range (140 to 180 m, 150 to 200 km/h) without affecting detection probability. Researchers in New Zealand set a sampling approach of the aircraft flown at a height of 150 m travelling at 185 km/h ground speed (Handley & Sagar 2011, Buckland et al. 2001, Ronconi & Burger 2009). The Joint Nature Conservation Committee conducts many seabird and seabird colony studies along the UK coastline (Dean et al. 2003). The JNCC has developed survey techniques that entailed using twin-engine aircraft (typically a Partenavia P 68) flying at 76 m altitude at 185 km/h to minimize flushing seabirds.

During a phone conversation in 2014, a Canadian Wildlife representative did not express concern for marine or migratory birds disturbance or harm from this survey. The daily survey lines will be limited to two to three transects occurring over a widely spaced grid so birds should not be repeatedly exposed to the aircraft.

The aircraft operations will be limited to routes in the Project Area and take the most direct path between the airport and Project Area. The aircraft will be flying at 150 to 500 m altitude, which is consistent with and higher than many seabird research surveys that occur over open water, coastal bays and bird colonies. Avifauna species that occupy the Study Area are not expected to be disturbed by aircraft flights if roosting on the water surface. It is expected that marine birds will more react by flushing upon the approach of a large object flying overhead and or a shadow. However, because the global scientific community is not concerned with effects of their aerial surveys and due to the transitory nature of the aircraft and in keeping with helicopter and other airplane survey traffic currently experienced in the region, no population effects, and

no physical or behavioral harm are anticipated upon at either the level of the individuals or flocks.

The area of interest for this survey is located well offshore and, therefore, the survey is not expected to interact with, and thus not adversely affect coastal breeding avifauna colonies.

#### 6.1.4.1.2 Attraction to Lights

Aircraft have navigation lights for night flying: steady red and green (port/starboard) lights and white strobe on the wing tips; a red strobe under the plane nose; a red strobe on the tail; and a white steady tail light. Headlights are used for landing at night. As the aircraft will be operating in daylight, there is no requirement for headlights and strobes will not be visible. There will not be a bird attraction effect to aircraft lights.

#### 6.1.4.2 Noise Emissions

The audiograms of many animal species listening in air are not known. Several species of concern, such as birds, have reduced sensitivity at low frequencies as compared with at moderate frequencies (the same pattern as in humans). Therefore, the A-weighting response appropriate for humans was examined as a potential basis for estimating the levels perceived by species exposed to a variety of noise sources.

For birds, a comparison of real and perceived levels from a P-3 aircraft was made by using the reported hearing thresholds of selected bird species. The results of the analysis show that the measured difference in overall received noise levels for the aircraft produced by the A-weighting function is comparable to the estimated differences in perceived levels for birds (Table 6.1). The measured difference using unweighted overall sound levels is much smaller and thus would provide a poor estimate of the potential noise impact of these sources on birds. This comparison indicated that A-weighting (which attenuates low frequencies) is effective in simulating the hearing function of birds, since the difference in the A-weighted aircraft spectra is similar to the difference in the perceived levels. A-weighted metrics are; therefore, considered appropriate for use in determining potential noise impacts on birds.

**Table 6.1: Analysis of A-weighted Sound Levels vs. Flat Overall Level as a Measure of Loudness for Birds**

Aircraft	Measured Sound Level (304 m alt re 20 µPa)		Perceived Sound Level (Received Level – hearing threshold)	
	dB flat	dBA	Anseriforms	Passeriforms
P-3	99.0	84.0	65.0	59.0

dB (flat) - overall sound level with no weighting.

dBA - overall A-weighted level.

Perceived Sound Level - overall sound level of the aircraft above the hearing threshold. It is an estimate of the loudness perceived by a given species.

Anseriforms are waterfowl (e.g., ducks, geese, swans).

Passeriforms are perching birds or passerines (i.e., songbirds).

Brown (1990) videotaped seabird responses to simulated aircraft over flights and these tapes were subsequently analyzed by scoring the behavioral response of each bird in the seabird colony. Results of a trial of this experimental procedure for one species, the Crested Tern (*Sterna bergii*), indicate that the maximum responses observed, preparing to fly or flying off, were restricted to exposures greater than 85 dB(A). A scanning behavior involving head-turning was the minimum response, and this, or a more intense response, was observed in nearly all birds at all levels of exposure. However, an intermediate response, an alert behavior, demonstrated a strong positive relationship with increasing exposure. While the experiment has

provided good control on simulated aircraft noise levels, preliminary observations of response of the colonies to balloon over flights suggests that visual stimulus is likely to be an important component of aircraft noise disturbance.

JNCC conducted winter seabird survey where the target altitude and cruising speed were standardized at 76 m (250 feet) and 185 km/h (100 knots) respectively. Based on test flights using this type of aircraft in the Kattegat, Denmark, Kahlert et al. (2000) suggest that these standards optimise detection and identification of birds, while minimizing the flushing of birds from the water by the approaching aircraft.

### 6.1.5 Accidental Events

There is only one conceivable accidental event with an aircraft that could potentially affect the marine environment – a loss in altitude resulting in a controlled or uncontrolled ditching. Exposure to seabirds could be upon contact with or inhalation of aviation fuel from the fuel tanks and engines.

The aircraft will be fuelled with A1 aviation gas with tank capacity of 2865 L. Jet-A1 fuel is primarily kerosene and contains petroleum hydrocarbons comprised of six to sixteen carbon atoms (in the C<sub>6</sub>-C<sub>16</sub> carbon range). A1 fuel is highly volatile and with the small volume, it will dissipate rapidly. Containment of spilled kerosene on open ocean water is neither possible nor necessary. Kerosene products are often used in oil spill dispersants. Therefore, exposure of seabirds is highly unlikely if the aircraft enters to the water and the fuel tanks rupture on impact.

There will be no intended or unintended operational releases of any hydrocarbon products. These aircraft do not release fluids while in-flight. The plane will not be carrying hazardous material cargo. Effects due to accidental events associated with the proposed operation therefore are considered, overall, to be detectable if they occur, negligible, but neither significant nor likely.

### 6.1.6 Monitoring and Follow-up

There will be no planned monitoring or follow-up on seabirds. Canadian Wildlife Service requested a seat onboard to record marine birds during the survey program, if such passenger space is available and approval is provided. It is the HSE practice that non-company persons are not permitted on flights. Bridgeport is considering this request. There is no statutory requirement to monitor for wildlife from aircraft and the aircraft is not designed with a bubble window for effective seabird monitoring.

### 6.1.7 Summary

Table 6.2 provides a summary of the potential for interaction, impact analysis, mitigations and residual effects for marine and migratory birds.

**Table 6.2: Summary of Environmental Assessment for Marine and Migratory Birds**

<b>Interactions and Issues</b> <ul style="list-style-type: none"> <li>• Disturbance from aircraft noise and lights</li> <li>• Accidental surface spills causing harm to birds</li> </ul>
<b>Impact Analysis</b> <p>There are no documented adverse effects directly on seabirds by aircraft offshore Newfoundland or globally from the popular low altitude research methods. There will be no likely anticipated measurable effects associated with aircraft presence. Negligible effects will be similar to what marine and migratory birds are exposed to now with the existing commercial air traffic to and from offshore oil production and exploration platforms and FPSOs. Helicopter flights (which are louder than fixed wing) effects on seabirds is not a consideration in previous strategic environmental assessment or project specific environmental assessments. The aircraft is in transit for a limited duration; therefore, it</p>

is not in one area for long to exert temporary or long term disturbance effects.						
<b>Mitigation</b> <ul style="list-style-type: none"><li>Avoidance of seabird colonies</li></ul>						
<b>Project Activity</b>	<b>Magnitude</b>	<b>Geographic Extent</b>	<b>Frequency</b>	<b>Duration</b>	<b>Reversibility</b>	<b>Ecological/Socio-Cultural and Economic Context</b>
Aircraft Presence	1	2	1	1	R	1
Aircraft Noise	0	2	1	1	R	1
Accidental Event	0	1	1	1	R	1
Significance of Effect Not adversely significant						
<b>Confidence</b> High level of confidence based on previous seismic surveys, monitoring observations and research.						
<b>Magnitude</b> 0=negligible 1=low 2=medium 3=high	<b>Geographic Extent</b> 1= 100s of metres 2= 1-10 km 3= >50 km	<b>Duration</b> 1=seconds 2=minutes 3=day 4= week	<b>Frequency</b> 1= isolated 2= intermittent 3 = continuous	<b>Reversibility</b> R=reversible I=Irreversible		
<b>Ecological/Socio-cultural and Economic Context</b> 1 Relatively pristine area or area not adversely affected by human activity 2 Evidence of existing adverse effects						

## 6.2 Marine Mammals

Marine mammals, as a group, are considered a VEC due to their significant role in the offshore ecosystem, and because of regulatory protection under the Marine Mammal Regulation of the *Fisheries Act*. However, Fisheries and Oceans Canada did not provide comment to C-NLOPB on marine mammals in its review of the project description. This analysis considers cetaceans and pinnipeds that may live and/or migrate through the Study Area.

### 6.2.1 Boundaries

The spatial boundary of interaction is primarily the zone of influence of both the presence of the aircraft and generated noise. The spatial distribution of individual species of marine mammals in the Northwest Atlantic is not well known, however, as data continues to be gathered, the diversity and seasonality's of many marine mammals are becoming better known.

Temporal boundaries for this analysis are defined by the Project schedule (March to November). Temporal ecological boundaries for cetaceans and pinnipeds vary according to species. Most cetaceans are migratory and occur in the Study and Regional Areas predominantly during the summer and fall months. Pinnipeds will occur year round. They may be present in the Study Area in the early spring on pack ice and ice floes.

Canada does not currently have established received-level standards for potential effects of noise on marine mammals; Canada does, and however, typically uses criteria developed by the US National Marine Fisheries Service (NMFS) primarily with respect to seismic air sources. Impact criteria for potential damage or disturbance to marine mammals have been developed for peak-to-peak and energy flux density values, primarily based on seismic activity (Southall et al. 2007).

### 6.2.2 Potential Issues

Limited information exists on the effect of aerial surveys over marine mammals. Behavioral responses have been documented; however, the importance of this has yet to be determined. Potential interactions between the Project and marine mammals relate primarily to noise disturbance in air for pinnipeds and near surface and at depth for cetaceans. These disturbances have the potential to lead to the following effects:

- behavioural effects associated with aircraft noise and presence (e.g., avoidance, changes in feeding behaviours); and
- communication masking (e.g., interception of vocalizations).

### 6.2.3 Significance Criteria

A significant adverse environmental effect occurs when:

- population or portion thereof is affected in such a way as to cause a decline or change in abundance and/or distribution of the population over one or more generations (may be due to loss of an individual(s) in the case of an endangered species); and/or
- the displacement of any species at risk from critical habitat; and/or
- long term avoidance of the area; and/or
- a disturbance of behavioural patterns adversely affects the ecological functioning of the species population.

A non-significant adverse environmental effect on marine mammals occurs when:

- mortality or serious injury to marine mammals occurs, but does not affect the stock or species at risk; or
- short term displacement from preferred habitat occurs; or
- limited disturbance occurs that does not affect the ecological functioning of the species or stock.

### 6.2.4 Effects Assessment and Mitigation

Over the last decade, there has been an increasing amount of new science to assess the potential effects of noise on marine life, including marine mammals. Recently, an expert panel was convened to summarize the available data on marine mammal hearing and behavioral and physiological responses to sound and to propose new exposure thresholds (Southall et al. 2007).

#### 6.2.4.1 Aircraft Presence/Noise Emission

Table 6.3 provides examples of low-level aerial marine mammal and protected species surveys that have been conducted around the world. Much like the marine and migratory bird section, an exhaustive search was not conducted for this EA as this method of characterizing marine mammal distribution and censusing populations has been used for many decades and it is accepted by regulatory agencies and research institutes. This research method has been extensively applied worldwide to fulfill with national and international obligations for the conservation of cetaceans. Among these techniques, visual line-transect surveys, conducted using ships or fixed-wing aircraft with dedicated marine mammal observers counting animals along pre-defined tracklines, are probably the most widely used method, particularly when trying to assess and quantify cetacean occurrence and density over large spatial scales (e.g., Smultea and Jefferson 2014, Kaschner et al. 2012). For example, in the USA, the National Marine Fisheries Service of NOAA is routinely using it within the framework of national commitments to

the US Marine Mammal Protection Act. The research is endorsed by the Agreement on the Conservation of Cetaceans in the Black Sea Mediterranean Sea and Contiguous Atlantic Area (ACCOBAMS), as it's carrying out presents a clear statement from the member states of their aim in securing favorable conservation status of this species in their national waters. All relevant national institutions of Adriatic countries (Italy, Slovenia, Croatia, Montenegro and Albania) have supported this project and issued needed research and flight permits.

Inter-agency agreements have been established between the Bureau of Ocean Energy Management (BOEM), Department of Interior and the National Marine Mammal Laboratory, Alaska Fisheries Science Center, National Marine Fisheries Service, National Oceanic and Atmospheric Administration, Department of Commerce. The intent of these agreements is to provide funding to conduct surveys of bowhead whales (*Balaena mysticetus*) and other marine mammals in the Alaskan Arctic.

The Aerial Surveys of Arctic Marine Mammals project is a continuation of the Bowhead Whale Aerial Survey Project (BWASP) and Chukchi Offshore Monitoring in Drilling Area (COMIDA) marine mammal aerial survey project. The goal of these studies is to document the distribution and relative abundance of bowhead, gray, right, and fin whales, belugas, and other marine mammals in areas of potential oil and natural gas exploration, development, and production activities in the Alaskan Beaufort and northeastern Chukchi Seas.

DFO scientists from the Quebec, Newfoundland and Nova Scotia Regions have conducted numerous multiyear aerial surveys of beluga, narwal, ringed seal and marine mammals in general in Hudson Bay, Nunavut, Gulf of St. Lawrence, and Atlantic Canada (e.g. DFO 2009, 2011, 2014, Hammill and Stenson 2000, 2011; Hammill et al 2009, Smith and Hammill 1986, Gosselin et al 2009, Stobo and Fowler 1994).

Of the aerial surveys in Table 6.3 only one noted the altitude of the aircraft was set to minimize the disturbance effect on whales, which appeared to be arbitrarily chosen. None of the authors made note that effect assessments or noise modeling were conducted before the surveys.

**Table 6.3: Examples of Marine Mammal, Seabird and Sea Turtle Aerial Surveys Using Fixed Wing Aircraft**

Organization	Survey Year	Location	Species	Aircraft	Altitude (m)	Speed (kph)
National Oceanic Atmospheric Administration ( NOAA)	1995, 1998, 1999, 2002, 2004, 2006, 2007, 2008, 2010, 2011, 2012	North Carolina to GoSL	Marine mammals and sea turtles	De Havilland DH-6 Twin Otter	various	various
Blue World Institute of Marine Research & Conservation	2010	Adriatic Sea	Cetaceans and sea turtles	Partenavia-P68	198	90-100 kn
North Atlantic Sightings Surveys (NASS)	20 year period	Norway to Canada	Megafauna	Multinational effort, various	various	various
Cetacean Offshore Distribution & Abundance Survey (CODA)	2005	Western Europe	cetaceans	unidentified	183	167
National Marine Fisheries Service (NMFS)	Multiyear, 1995-1996-2004	Gulf of Maine to Bay of Fundy	Harbor porpoise	de Havilland DH-6 Twin Otter	183	204
		Florida to Nova Scotia	Beaked whales	Cessna Skymaster 337	198	185
Gulf of Alaska Aerial Survey	1995, 1996 2002	Cook Inlet, Alaska	beluga	Aero Commander Twin Otter	244	185
Minerals Management Service (MMS) Low Altitude Survey	1975-1978 1980-1983	Southern California Bight Seabirds,	marine mammals		61 229-305	
USWTR JAX Aerial Survey	2010-2011	Florida	Marine protected spp	Cessna Skymaster	300	185
DFO Maritime Seal Aerial Survey	1985-1987, 1991-1992	New Brunswick, Nova Scotia	seals	Messerschmidt helicopter Bell 206 JetRanger	Not given	hover
DFO Cetacean Survey (2007 NASS)	2007	Atlantic Canada, GoSL	megafauna	De Havilland DH Twin Otter + Cessna Skymaster 337	183 198	
DFO Cetacean Survey	1985, 1993, 2001, 2004, 2008			Cessna Skymaster 337	213	155/204
DFO Beluga Survey	1985, 1993, 1995,1996, 2001, 2004,	Gulf of St Lawrence	beluga	Cessna Skymaster 337	304	185



	2009	Hudson Bay				
DFO whale survey	2013	Nunavut	cetaceans	Kenn Borek Twin Otter		
NOAA	1991, 1992	California	cetaceans, turtles, pinnipeds	De Havilland Twin Otter	213	135-185
NOAA North Atlantic Marine Mammal and Turtle Aerial Abundance Survey	2007	Cape Hatteras to Bay of Fundy	Marine mammals and sea turtles	De Havilland Twin Otter	183	
North Atlantic Sightings Surveys	1986 -2001	Iceland	Minke whale	Partenavia Observer P-68	229	46 m.s
MMS	1989-1990	Oregon, Washington	Seabirds, cetaceans, pinnipeds	de Havilland Twin Otter	60	185
	1990	Oregon, Washington	grey whale	Cessna 337		
Aerial Surveys of Arctic Marine Mammals (ASAMM)	1979-2012 2013	Beaufort and Chukchi Seas	cetaceans	Aero Commander 690A twin turbine de Havilland Twin Otter Series 300	305-458	213
MMS	1980-1983 biweekly	California	marine mammals, seabirds		60-300	
	1988-1996	California	marine mammals, seabirds		60-300	

Directly relevant to the Study Area, Figure 6.1 illustrates the survey transects and dotted observations of the Fisheries and Oceans Canada's aerial marine megafauna (marine mammal and sea turtle) survey around Atlantic Canada.

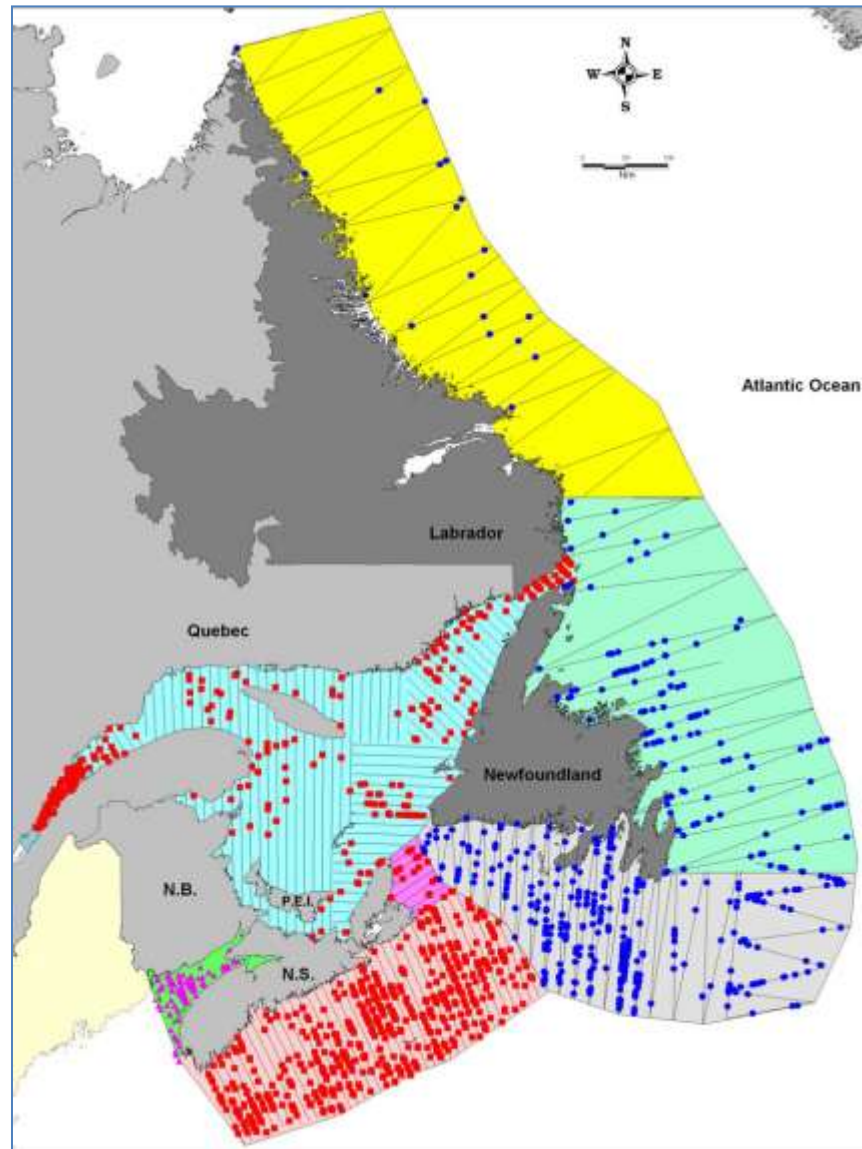


Figure 6.1: Aerial survey effort (Lawson and Gosselin 2009)

#### 6.2.4.1.1 Hearing Abilities and Sound Production

Southall et al. (2007) classify marine mammals into five functional hearing groups defined based on similarities in known or expected hearing capabilities, as well as underwater and aerial hearing for relevant groups. These groups include three cetacean groups (low-frequency, mid-frequency, high-frequency) and two pinniped groups (in water, in air). Low frequency cetaceans include all the baleen whales (suborder Mysticeti), while toothed whales (suborder Odontoceti) are split between mid and high-frequency groups. The mid-frequency group comprises most dolphin species, false killer whales, sperm whales, beaked whales, etc., while

the high-frequency group is made up of porpoises and a few other high frequency specialists. Pinniped in-air versus in-water reflects this amphibious group's different hearing capabilities in water and air. This group includes all species of seals, sea lions, fur seals and the walrus.

Southall et al. (2007) developed a series of frequency weighting curves (termed M-weighting) that allow one to compensate for the hearing abilities of these groups while calculating the received levels of various sounds.

Table 6.4 provides a range in hearing frequencies for some marine mammal species and groups.

**Table 6.4: Hearing Sensitivity in Marine Mammals**

Species	Hearing Range	Reference
odontocetes whales	150 Hz-16kHz	Southall et al 2006
Gervais beaked whale	5-80 kHz	Cook et al 2006
Gervais beaked whale	80-90 kHz upper limit	Finneran 2009
porpoises	200Hz-180kHz	Southall et al 2007
baleen whales	>1 kHz	Richardson et al 1995 Ketten 2000
baleen whales	≤ 8 kHz	Au et al 2006
humpback	>24 kHz	
Atlantic right whale	50 Hz – 2 kHz	Parks 2003
humpback and minke whales	>22 kHz	Berta et al 2009
Baleen whales	7Hz-22 kHz	Southall et al 2007
pinnipeds	75 Hz-75kHz	Southall et al 2007

Sudden, loud and impulsive sounds can cause hearing damage, as can long exposures to quieter sounds. Temporary or permanent loss of hearing will occur almost exclusively for noise within the animals hearing range, with the maximum hearing loss commonly occurring ~ ½ an octave above the frequency of the main energy of the damaging noise.

Anthropogenic sounds have the potential to disturb behavior and/or interfere with important functions (Richardson and Malme 1995, NRC 2003). A broadband-received sound pressure level of 160 dB re 1  $\mu\text{Pa}_{\text{rms}}$  or greater is currently the best estimate available to cause disruption of behavioral patterns (Level B Harassment) to marine mammals (NRC 2003). Level B Harassment is defined as *“any act of pursuit, torment, or annoyance which has the potential to disturb a marine mammal or marine mammal stock in the wild by causing disruption of behavioural patterns, including, but not limited to, migration, breathing, nursing, breeding, feeding, or sheltering but which does not have the potential to injure a marine mammal or marine mammal stock in the wild”* (NRC 2003).

Richardson et al. (1995), Nowacek et al. (2007), Popper and Hawkins (conferences in 2007, 2010, 2013, an upcoming in 2016) provide good reviews of the knowledge of anthropogenic noise effects on marine mammals (Popper and Hawkins 2012, Hawkins and Popper 2014). Baleen whales (mysticetes) are most sensitive to low-frequency sounds, and not very sensitive to high-frequency sounds. On the other hand, odontocetes or toothed whales (including dolphins and porpoises) are quite insensitive to low frequencies, but very sensitive to mid and high frequencies (Richardson et al. 1995). The potential for survey aircraft noise to induce

induce temporary or permanent threshold shifts in marine mammal hearing is low given the probability of exposure is low and the sound event is transitory. A marine mammal is unlikely to be exposed long enough at high levels for TTS or PTS (>180 and 190 dB re 1  $\mu$ Pa) to occur. Any masking of environmental sounds or conspecific sounds is expected to be temporary, as noise dissipates with the survey aircraft transiting through an area. If behavioral disruptions result from the presence of aircraft, it is expected to be temporary. Animals are expected to resume their migration, feeding, or other behaviors without any threat to their survival or reproduction.

The P-3 (four engines) has dominant propeller noise bands at 63 and 125 Hz. A Twin Otter has a frequency tone of 82 Hz. Richardson et al. (1995) provide information of aircraft noise parameters on a few fixed wing aircraft (Table 2.3) which shows these frequencies overlap with sound frequencies which baleen whales species use to and are sensitive to. Odontocetes hearing frequency ranges (kHz) are much higher and therefore are likely not to detect an aircraft overhead.

Pinnipeds have reduced sensitivity at low frequencies as compared with at moderate frequencies (the same pattern as in humans). Therefore, the A-weighting response appropriate for humans was examined as a potential basis for estimating the levels perceived by species exposed to a variety of noise sources.

Pinniped vocalizations are generally low frequency (<10 kHz) with most pinnipeds produce sounds with dominant frequencies between 0.1 and 3 kHz (Richardson and Malme 1995). The individual calls of harp seals range from less than 0.1 second to greater than 1 second in duration (Watkins and Schevill 1979). Vocalizations are usually associated with mating displays, territoriality or mother-pup interactions (Richardson et al. 1995). Harbor seals produce low frequency (<4kHz) displays under water for courtship and pups make calls with fundamental frequencies of ~350Hz. Some of these sounds either travel through the water when made by an individual with its head above the surface, or are made underwater. However given the nature of the context in which these sounds are made (close distance social situations), they are likely but one of several modalities in which those interactions are mediated.

Data on underwater hearing sensitivities are available for three species of phocoenid seals, two species of monachid seals, two species of otariids and the walrus (*Odobenus rosmarus*) (Richardson and Malme 1995, Kastak and Schusterman 1998, Kastak et al. 1999, Kastelein et al. 2002). The hearing sensitivity of most pinniped species that have been tested ranges between 60 and 85 dB re 1  $\mu$ Pa from 1 kHz to 30 to 50 kHz. In the harbour seal, thresholds deteriorate gradually below 1 kHz to approximately 97 dB re 1  $\mu$ Pa at 100 Hz (Kastak and Schusterman 1998).

#### 6.2.4.1.2 Behavioural Responses

Behavioral responses of marine mammals to noise are highly variable and dependent on a suite of factors (Wartzok et al. 2003). Internal, animal-specific factors can affect an individual's response to noise and external factors related to the context of exposure can mediate the probability of different types of behavioral response. Internal factors include:

- individual hearing sensitivity, activity pattern and motivational and behavioural state at time of exposure;
- past exposure of the animal to the noise, which may have led to habituation or sensitization;
- individual noise tolerance; and
- demographic factors such as age, sex and presence of dependent offspring.

External factors include:

- non-acoustic characteristics of the sound source, such as whether it is stationary or moving;
- environmental factors that influence sound transmission;
- habitat characteristics, such as being in a confined area; and
- location, such as proximity to a shoreline.

Disturbance from noise can take many different forms from very subtle shifts in breathing patterns or slight changes in direction of swim to startle responses that lead to flight of the animal from the area. As more studies have documented noise disturbance in various species, it has become apparent that the response of an individual to noise will vary greatly depending on a number of different factors.

These internal and external factors make it logical to develop separate thresholds for behavioral disturbance for cetaceans and pinnipeds (e.g., Ellison et al. 2011). Behavioral responses of cetaceans and pinnipeds to noise have been extensively reviewed (NSF-USGS 2011; Nowacek et al. 2007; Southall et al. 2007) and all report that responses, even within a species, vary greatly as a function of a number of biological and environmental parameters.

### **Cetaceans**

Response prediction metrics for non-human species such as marine mammals are generally not available. Because of the limited amount of response data available for marine mammals, it is not possible to develop total sound exposure metrics similar to those applied to human population centers. Instead, the potential impacts of noise sources in the Study Area need to be assessed by examining individual source-receiver encounter scenarios typical of flight activities. Assessment of potential effects must consider both airborne noise on marine mammals out of the water (e.g., pinniped), and airborne noise transmitted into the water potentially effecting marine mammals when they are underwater (e.g., cetacea).

Airborne sound from low-flying helicopters or airplanes may be heard by marine mammals while at the surface or underwater. Responses by mammals could include hasty dives or turns, or decreased foraging (Soto et al. 2006). Whales may also slap the water with flukes or flippers, or swim away from low flying aircraft. The startle effect is a reflex; it is an autonomic reaction to loud, sudden noise (Westman and Walters 1981, Harrington and Veitch 1991). Increased heart rate and muscle flexion are the typical physiological responses. Rotary wing aircraft (helicopters) generally induce the startle effect more frequently than fixed wing aircraft (Gladwin et al. 1988, Ward et al. 1999).

The Malme et al. (1984) investigation of gray whales is the only study to provide data on reactions to aircraft sound underwater that was isolated from other potential stimuli such as visual behavioral reactions elicited from low altitude aircraft. As demonstrated by that study, the underwater received levels necessary to elicit reactions (115 dB to 127 dB SPL) would require an airborne source level at the surface of approximately 175 dB to 187 dB. Fixed wing aircraft airborne source level ranges between 147 to 162 dB and this would be considerably less at the water surface with attenuation through the air. Due to the transient nature of sounds from aircraft, such sounds would not likely cause physical effects.

A research team from the Australian Defense Science and Technology Organization (DSTO) predicted that sound from overhead aircraft travelled in a way that reduced the impact on cetaceans (Zhang et al. 2003a, Zhang et al. 2003b). The researchers used computer modeling of noise from fighter jets, helicopters and military transport aircraft flying less than 300 meters above sea level to generate noise maps. Because the (military) aircraft is going fairly fast, the narrow cone of sound is moving across the water very quickly. Thus, the exposure to an animal is actually very short and very limited compared to the hours or days of exposure to noise generated by ships, seismic surveys and oil rigs. The chances of an animal actually being right

under where that cone is are fairly small and it is only very small exposure. The researchers noted that whales at or near the surface would be exposed to more noise. None of the aircraft studied (jet, fixed wing and helicopter) would cause noise above background levels for longer than seven seconds. The DSTO computer model also took account of different water depths and types of underlying seabed structure in shallow and deep ocean conditions.

Whales at or near the surface, however, would be exposed to the noise for a significantly longer period. Apart from hovering helicopters, low flying aircraft were seen to cause much lesser durations of temporal noise disturbance than waterborne sources of noise, as well as having smaller spatial impacts. According to Dr Zhang, "our modeling results show that the heights of aircraft in transit do have a bearing on noise levels for whales at the surface but have little implication below the evanescent waves layer, which is usually less than a few meters deep, and at a horizontal distance beyond the zone of ensonification below the aircraft.

As for military fixed-wing aircraft traveling at subsonic speeds, noise source levels are generally less than 210 decibels (dB) (re 1  $\mu$ Pa at 1 m). For flights at an altitude of 300 m, the maximum sound pressure level at the sea surface would be no greater than about 155 dB (re 1  $\mu$ Pa), which is well below most harassment thresholds in current use (US Air Force 2001, US Navy 2008).

### **Pinnipeds**

Ringed seals near an artificial island drilling site were monitored before and during development of the site. Although air and underwater sound was audible to the seals for up to 5 km, there was no change in their density in that area between breeding seasons before and breeding seasons after development began (Moulton et al. 2003).

There have been several studies of hauled-out pinniped response to airborne noise and sonic booms from aircraft and missile flyovers, although few sound exposure data have been reported. Perry et al. (2002) studied the above-water response of gray seals (*Halichoerus grypus*) and harbor seals (*Phoca vitulina*) to sonic booms. They observed no behavioral responses of gray seals to sonic booms, but harbor seals appeared more vigilant. Similarly, gray seals fitted with heart rate monitors showed no change in heart rate during or after a sonic boom while harbor seals showed a slight increase. Perry et al. (2002) concluded that sonic booms did not affect breeding behavior of the seals.

During high surf conditions, pinnipeds may not hear an approaching aircraft until it is nearly overhead. The resulting rapid noise level increase may cause a panic response that normally would not occur for calm conditions when the approaching aircraft can be initially heard at longer ranges. In the spring when seals are hauled out on pack ice, therefore, no surf condition is present.

To assess the potential impact of airborne noise sources in the Study Area on non-human species, a weighting function related to the hearing characteristics of a specific species is required, analogous to the A-weighting used for human response prediction (Southall et al., 2007). This facilitates the application of sound level criteria based on potential avoidance behavior, potential temporary threshold shift, or some other appropriate response.

#### **6.2.4.1.3 Masking Effects**

Acoustic masking occurs when a noise impedes the ability of the animal to perceive a signal. For this to occur the noise must be loud enough, have similar frequency content to the signal, and must happen at the same time.

Whale species are highly dependent on sound for communicating, detecting predators, locating prey, and in toothed whales, echolocation (Lawson et al. 2000). Natural ambient noise created by wind, waves, ice and precipitation alone can cause masking or interfere with an animal's ability to detect a sound. Whales themselves also contribute to the level of natural ambient noise. Although masking is a natural phenomenon to which marine mammals must be adapted, introduction of strong sounds into the sea at frequencies important to marine mammals will inevitably increase the severity and the frequency of occurrence of masking. For example, if a baleen whale is exposed to continuous low-frequency sound from an industrial source, this will reduce the size of the area around that whale within which it will be able to hear the calls of another whale. In general, little is known about the importance to marine mammals of detecting sounds from con-specifics, predators, prey, or other natural sources. In the absence of much information about the importance of detecting these natural sounds, it is not possible to predict the impacts if mammals are unable to hear these sounds as often, or from as far away, because of masking by industrial sound (Richardson et al. 1995).

When anthropogenic noise from ships, seismic and sonar are layered on natural underwater ambient sounds, the level of noise underwater can be quite loud in some areas. The anthropogenic noise is undetectable for marine mammals once it falls below ambient noise level or the hearing threshold of the animal. Given this and the fact that mammal response will vary by species and between individuals, the zone of potential influence of noise on marine mammals is highly variable. In general, masking effects are expected to be less severe when sounds are transient than when they are continuous.

The minimum amplitude at which a signal can be heard above the background noise is termed the Critical Ratio (CR). More specifically, the CR is the amplitude difference between the pure tone signal (in dB re 1 $\mu$ Pa) and the spectrum level of the background noise at that frequency (in dB re 1  $\mu$ Pa<sup>2</sup>/Hz) that is needed for the animal to hear the signal. A signal that is received at a level below the CR in relation to the background noise will be masked. Critical ratios at low frequencies are fairly constant, but at mid frequencies start to increase with frequency. Johnson et al. (1989) found a roughly constant CR for a Beluga whale from 40 to 2,000 Hz (~18 dB), but that the CR increased up to ~40 dB at 100 kHz. Au and Moore (1990) measured CRs in a bottlenose of ~31 dB at 30 kHz and ~45 dB at 140 kHz. Southall et al. (2003) found increasing CRs with frequency in pinnipeds and also that they were very similar for individual seals and sea lions tested both in air and water; that is, for pinnipeds the masking effect of noise is similar regardless of the medium in which they are exposed.

In addition to the amplitude difference between the signal and the noise, the frequency content of the signal and noise also affect the level of masking. The width of the frequency band over which hair cells are sensitive is called the Critical Bandwidth (CBW). Noise outside the CBW will have little effect on the detection of a signal in that band, unless the noise is very loud. CBWs tend to be proportional to the frequency of sensitivity, rather than a constant bandwidth (i.e. CBW are described as 1/3 of an octave rather than 1 kHz). The wider the CBW the more likely broadband noise is to mask a signal. At the upper and lower end of hearing though, CBWs tend to be wider, and therefore these regions may be more susceptible to masking (Richardson et al. 1995). Structured signals such as echolocation click sequences of small toothed whales may be readily detected even in the presence of strong background sound because their frequency content and temporal features usually differ strongly from those of the background sound (Au and Moore 1988, 1990). It is primarily the components of background sound that are similar in frequency to the sound signal in question that determine the degree of masking of that signal. Low-frequency industrial sound has little or no masking effect on high-frequency echolocation sounds.

The relative timing of a signal and noise also impacts the level of masking. The noise must occur at the same time as the noise to produce masking.

Although some degree of masking is inevitable when high levels of man-made broadband sounds are introduced into the sea, marine mammals have evolved systems and behavior that function to reduce the impacts of masking. Studies demonstrating the masking effects of anthropogenic noise on marine mammals typically find masking impacts by documenting masking compensation strategies (responses the animals use to overcome the masking effects of the noise). For example, in response to anthropogenic noise marine mammals have increased the duration of their calls (humpback whales: Miller et al. 2000), altered the pitch of their calls (right whales: Parks et al. 2007), called more or less often (blue whales: Di Iorio and Clark 2009) and called louder (killer whales: Holt et al. 2009).

Although masking effects have been documented in a number of species, it is very difficult to quantify the survival or reproductive consequences of this masking on an individual, let alone quantifying the effect of masking on the population. The National Research Council (NRC, 2005) developed a conceptual model (termed Population Consequences of Acoustic Disturbance: PCAD) to help guide the process of quantifying these population level effects from acoustic disturbances of individuals. Research in this area is ongoing.

The frequencies contained in aircraft engines and propellers do overlap with some frequencies used by pinnipeds, but the transitory short duration nature of the over flight is expected to result in limited masking of pinniped calls.

Masking effects of aircraft sound on marine mammal calls and other natural sounds are expected to be limited because of the short duration (1.5 to 10 seconds), it is an isolated event and elevated sound is restricted to the surface layers.

### 6.2.5 Malfunctions and Accidental Events

Spilled Jet A-1 fuel from a ditched aircraft may affect marine mammals through inhalation and or ingestion. Potential impacts will be short-lived due to the high volatility and relatively small volume of the aviation gas and confinement to surface water. No significant adverse effects are anticipated for marine mammals as a result of such small volume spatially limited accidental spills.

### 6.2.6 Monitoring and Follow-up

Aerial surveys for marine mammals are used extensively on a global basis and the practice is not considered a harmful activity. There is no regulatory requirement for monitoring marine mammal by aircraft for the offshore petroleum industry off Newfoundland and Labrador.

### 6.2.7 Summary

Table 6.5 summarizes the environmental effects on marine mammals from the Bridgeport gravity surveys.

**Table 6.5: Summary of Environmental Assessment for Marine Mammals**

<b>Interactions and Issues</b>
<ul style="list-style-type: none"> <li>• Disturbance of marine mammals caused by the presence of aircraft.</li> <li>• Noise from aircraft leading to masking of cetacean vocalization; behavioural changes</li> </ul>
<b>Impact Analysis</b>
There is lack of published information regarding avoidance thresholds in whales exhibiting avoidance



behaviours relative to low level flying aircraft. NMFS policy regarding exposure of marine mammals to high-level sounds is that whales should not be exposed to impulse sounds exceeding 180 dB re 1µPa (rms), although behavioural changes are apparent at 160 dB re 1µPa (rms) (NMFS 2000). The aircraft will not generate an impulse noise. The NMFS sound levels will not occur at the surface or underwater from over flights of the propose aircraft. A startle reaction is the most likely resultant effect from the actual plane motion, shadow and associated noise. The proposed Project may result in behavioural effects on marine mammals; however, most studies indicate that such behavioural disturbances are likely to be transitory with normal behaviour resuming. Due to the extensive spacing of the survey lines and small number of daily flights, exposure to the aircraft and noise will be minimal to a onetime event in the course of a day. Repetitive exposure on a daily basis is highly unlikely due to the fact that both marine mammals and the aircraft are transient.

#### Mitigation

- No specific mitigation

Project Activity	Magnitude	Geographic Extent	Frequency	Duration	Reversibility	Ecological/Socio-Cultural and Economic Context
Aircraft Presence	1	2	1	1	R	1
Aircraft Noise	1	1	1	1	R	1
Accidental Spill	0	1	1	1	R	1

#### Significance of Residual Effect

Not adversely significant

#### Confidence

Medium level of confidence related to significance rating given international and local industry experience

Magnitude	Geographic Extent	Frequency	Duration	Reversibility
0=negligible 1=low 2=medium 3=high	1= 100s of m 2= 1-10 km 3= >50 km	1= isolated 2= intermittent 3 = continuous	1=seconds 2=minutes 3=hour 4=day	R=reversible I=Irreversible

#### Ecological/Socio-cultural and Economic Context

- 1 Relatively pristine area or area not adversely affected by human activity  
2 Evidence of existing adverse effects

### 6.3 Sea Turtles

Sea turtles are considered a VEC due to their special conservation status and uncertainty regarding their distribution in the Study Area. Any loss of breeding adults, above that caused by natural predation and disease, can lead to significant declines in population. As well, the leatherback turtle is a SARA-listed species. DFO did not scope in sea turtles in its review of the project description.

#### 6.3.1 Boundaries

The spatial boundaries for the assessment of sea turtles include the Study Area, although it is recognized that sea turtles have widespread distribution patterns from the Caribbean to the Northwest Atlantic, as far north as Labrador.

Temporal boundaries are defined by the Project schedule (March to November). Based on data collected by DFO, marine turtles are likely to occur in the Study Area during the summer and fall months. For the purpose of this assessment, it is assumed that any species of sea turtle that could potentially be present offshore Newfoundland could be present within the Study Area.

### **6.3.2 Potential Issues**

Potential interactions between the Project seismic surveys and sea turtles relate primarily to behavioral effects (e.g., avoidance behavior, increased swimming speeds).

### **6.3.3 Significance Criteria**

A significant adverse environmental effect on sea turtles is one that may result in:

- mortality or serious injury of one or more individuals of a species at risk;
- long-term displacement from preferred or critical habitat; and/or
- change in the preferred or critical habitat.

A non-significant adverse environmental effect on sea turtles is one that may result in:

- minor injury of one or more individual of any sea turtles species; and/or
- short term displacement from preferred or critical habitat.

### **6.3.4 Effects Assessment and Mitigation**

#### **6.3.4.1 Aircraft Presence**

There is no physical risk to marine turtles from interaction with the aircraft.

#### **6.3.4.2 Noise Emissions**

##### *6.3.4.2.1 Hearing Ability*

Studies on sea turtle hearing are limited and the role in their ecological functioning is not well known. It has been suggested that sound may play a role in sea turtle navigation, locating prey, avoiding predation and awareness of surroundings. However, studies suggest that visual, wave and magnetic cues are the principal navigational cues used by hatchling and juvenile sea turtles (Lohmann and Lohmann 1996, Lohmann et al. 2001).

Maximum hearing sensitivity in sea turtles has been observed in the 100 to 700 Hz range (Ridgway et al. 1969, McCauley 1994, Davis et al. 1998). Research by Piniak et al 2012 showed that sea turtle are sensitive to frequencies below 1000 Hz in air and water. This frequency range is within the same frequency produced by the aircraft. Because the aircraft is transient, a surfaced and near surface sea turtle could be exposed to the aircraft within the order of a few seconds.

Low-level aerial surveys are commonly used to census marine turtles as part of megafauna distribution surveys on a global basis. This proposed gravity survey uses aircraft with similar sound characteristics and flight altitude and speed to those used for conducting marine turtle census surveys. As aerial surveys are an apparent acceptable method for sea turtle population study by reputable research institutions, and no publically available environmental assessments have been conducted on such research it is reasonable to conclude that there are no anticipated significant adverse effects upon sea turtle hearing from low flying survey aircraft by the scientific community.

#### 6.3.4.2.2 Behavioral Effects

The over flight, perceived as an overhead motion and creates a shadow, may result in a startle reaction. This effect is expected to be temporary because of the transient nature of the aircraft sound and foraging activities are not anticipated to be adversely affected any more so than a passing vessel or other aircraft in the area.

### 6.3.5 Malfunctions and Accidental Events

Spilled Jet A-1 fuel may affect marine turtles through dermal contact, inhalation or ingestion. The risk of such events occurring is very low, as discussed. No significant adverse effects are likely to occur as a result of an accidental event associated with this Project.

### 6.3.6 Monitoring and Follow-up

No mitigation monitoring is proposed for sea turtles as aerial surveys are used routinely for censusing purposes. There are no predicted effects upon which to monitor.

### 6.3.7 Summary

Table 6.6 summarizes potential interactions, environmental effects, mitigation, residual and cumulative effects on marine turtles from the aerial surveys.

**Table 6.6: Summary of Environmental Assessment for Marine Turtles**

<b>Interactions and Issues</b> <ul style="list-style-type: none"> <li>Aircraft presence</li> <li>Noise from aircraft</li> </ul>						
<b>Impact Analysis</b> Potential interactions between marine turtles and the project aircraft are expected not to be significantly adverse, based on the transitory presence of both sea turtles and the aircraft in the Study Area. Sea turtles would occur sporadically throughout the Study Area and the probability of encounters is expected to be low.						
<b>Mitigation</b> No mitigation proposed as there are negligible effects anticipated.						
Project Activity	Magnitude	Geographic Extent	Frequency	Duration	Reversibility	Ecological/Socio-Cultural and Economic Context
Aircraft Presence	0	1	1	1	R	1
Aircraft Noise	0	1	1	1	R	1
Accidental Spill	1	1	1	1	R	1
<b>Significance of Residual Effect</b> Not adversely significant						
<b>Confidence</b> High level of confidence based on previous seismic surveys, monitoring observations and research.						

<b>Magnitude</b>	<b>Geographic Extent</b>	<b>Frequency</b>	<b>Duration</b>	<b>Reversibility</b>
0=negligible 1=low 2=medium 3=high	1= 100s of m 2= 1-10 km 3= >50 km	1= isolated 2= intermittent 3 = continuous	1=seconds 2=minutes 3=hour 4=day	R=reversible I=Irreversible
<b>Ecological/Socio-cultural and Economic Context</b> 1=Relatively pristine area or area not adversely affected by human activity 2=Evidence of existing adverse effects				

## 6.4 Species at Risk

There is one bird species at risk considered in this section:

- Ivory Gull

There are seven marine mammal species at risk that are known to or may occur in the Study Area:

- North Atlantic right whale (Atlantic population)
- Blue whale (Atlantic population)
- Fin Whale ( Atlantic population)
- Sowerby's beaked whale (Atlantic population)
- Northern bottlenose whale (Scotian Shelf population)
- Harbour porpoise (Northwest Atlantic population)
- Killer whale (Northwest Atlantic/Eastern Arctic population)

There are two sea turtle species at risk that may occur in the Study Area:

- Leatherback sea turtle (Pacific and Atlantic populations)
- Loggerhead sea turtle (Pacific and Atlantic populations)

### 6.4.1 Boundaries

The spatial boundaries of interaction between species at risk and the Project are primarily related to the zone of influence of sound transmission loss from the aircraft.

Ecological spatial boundaries vary between the various species at risk although it is recognized that most species at risk range well beyond the Study Area. The ecological spatial boundary for marine bird species at risk includes the breeding, nesting, foraging and overwintering habitat of the Ivory Gull. As discussed above, there is likely no direct interaction between this Project and Ivory Gulls. There are no known nesting grounds for the Ivory Gull in the Study Area, and any presence in the area is expected to be incidental.

Seven species of cetaceans are listed at risk that occur in the Study Area and can potentially interact with Project activities.

Spatial distribution for sea turtles is vast and encompasses and extends into the southern Newfoundland waters. Leatherback and loggerhead turtles generally migrate between the warm and cold waters seasonally, migrating north to forage and south to breed in the Gulf of

Mexico or in the Caribbean Sea. Sea turtles are likely to occur in the Study Area during the summer and fall months.

With respect to temporal boundaries, the potential interactions of concern are those related to the aircraft flights that could occur sometime between March and November from 2015 to 2019

The presence of Ivory Gull in the Study Area would be incidental; and therefore, there are no relevant temporal boundaries for this species.

The ecological temporal boundaries for cetaceans vary according to species. Most cetaceans are migratory and occur predominantly during the summer and fall months (Reeves and Brown 1994), and thus may be in the Study Area during the proposed aerial surveys.

With regard to administrative boundaries, the SARA is administered by Environment Canada, Parks Canada, and DFO. The boundaries of the critical habitat for each species are defined in species recovery strategies, action plans and management plans.

The technical boundaries of the assessment include limited knowledge on potential effects of aerial sounds on individual species at risk found in the Study Area and the lack of information on the use of the Regional Area by species at risk. Because there is little species-specific information directly related to species at risk in the Study Area, existing scientific information has been reviewed and applied generically where appropriate to the proposed Project aerial surveys.

#### **6.4.2 Potential Issues**

Potential interactions between Project activities and species at risk relate primarily to behavioral effects associated with aerial survey operations and exposure to aviation fuel from an accidental release of hydrocarbons from an aircraft ditching. No physical interactions are expected to occur.

#### **6.4.3 Significance Criteria**

A significant, adverse environmental effect is one that, after application of all feasible mitigation and consideration of all reasonable Project alternatives,

- will prevent the achievement of self-sustaining population objectives or recovery goals;
- will result in exceedance of applicable allowable harm assessments;
- for which an incidental harm permit would not likely be issued. Due to the sensitive nature of species at risk, residual adverse effects on one individual may be considered significant; and/or
- will result in species being permanently displaced from critical habitat.

A non-significant, adverse environmental effect is one that, after application of all feasible mitigation and consideration of all reasonable Project alternatives,

- results in threats to individuals, residences or critical habitat of listed species that does not jeopardize the survival or recovery of the species;
- does not result in exceedance of applicable allowable harm assessments; and/or
- for which an incidental harm permit would likely be issued.

#### **6.4.4 Effects Assessment**

Potential effects on species at risk are discussed for marine and migratory birds, marine mammals and sea turtles. Recovery plans for the species at risk that have the potential to occur in the Study Area are discussed below with respect to mitigation measures applied to the Project.

#### **6.4.4.1 Marine and Migratory Bird Species at Risk**

The threats assessment in the proposed recovery strategy for Ivory Gull lists the potential negative factors relating to their population: illegal shooting in Greenland, predation on nests, industrial activity, contaminants, human disturbance due to monitoring, climate change and oil pollution. Monitoring the gull population is deemed a low threat. The strategy states: “some researchers and Inuit communities (e.g., Grise Fiord) have suggested that visits by researchers to colonies could have caused declines through disturbance during the nesting season. Haney and MacDonald (1995) suggested that Ivory Gulls were sensitive to ground and air traffic near their colonies. Evidence from Canada and Norway suggests that this is probably not always the case. In these two countries, colonies have been visited briefly by helicopter, at which time some of the gulls leave the cliffs but quickly return to their nests (< 1 minute; COSEWIC 2006). Similarly, researchers camped on an island with an Ivory Gull colony for several years in the 1970s, and the gull population returned in good numbers each year to breed. Nonetheless, there may be a threshold level of disturbance that is important, below which gulls are tolerant, and above which they abandon breeding for the year, or possibly the colony site. This would require further investigation to confirm.”

Canadian Wildlife Service (pers. comm. 2014) was of the opinion that the aircraft altitude was high enough to not significantly adversely affect birds.

#### **6.4.4.2 Marine Mammals at Risk**

When wildlife species are listed under the *Species at Risk Act* as endangered or threatened, recovery strategies and action plans must be created. Action plans are created once recovery strategies are complete. They summarize projects and activities to meet recovery strategy objectives and goals, and include information on habitat, details of protection measures, and evaluations of socio-economic costs and benefits. There is no recovery strategy, action plan or management plan for Sowerby's beaked whale or fin whale.

##### **6.4.4.2.1 Vessel Presence**

The physical presence of the aircraft during aerial surveys does not typically result in significant adverse effects as there is no direct means of physical contact.

##### **6.4.4.2.2 Noise Emission**

In the recovery strategy for the blue whale (DFO 2009a) threats are identified originating from shipping traffic, disturbance caused by whale-watching activities, entanglement in fishing gear, pollution, the effects of climate change on prey abundance, ice entrapments and predation. Anthropogenic noise levels, originating from seismic noise, shipping traffic, explosions, low frequency sonar, industrial and military activities in the oceans, could have a harmful impact on marine mammals by: 1) disrupting their ability to passively observe their environment, to detect the sounds emitted by other marine mammals or any other sounds; 2) causing behavioral changes; 3) altering hearing sensitivity or by causing injury which, in certain cases, are fatal (Richardson, et al., 1995; Southall, 2005; Nowacek, et al., 2007; Weilgart, 2007; Stockin, et al., 2008).

Monitoring populations of blue whale is listed as an urgent research need in the recovery plan for the species. Aerial surveys are a component of that monitoring effort. Sound from low-level aircraft is not identified in the Recovery Strategy as threat to blue whale individuals or populations.

The proposed Recovery Strategy for the Northern Bottlenose Whale is specific for the Scotian Shelf population, with mention of the Davis Strait population (DFO 2009b). In general, DFO states that potential threats from acoustic disturbance, discarded materials and vessel collisions, are not limited to the activities of the oil and gas industry. A variety of anthropogenic activities in the marine waters of Atlantic Canada produce underwater sounds within the frequency range detectable by northern bottlenose whales. Potential sources of acoustic disturbance include military exercises (active SONAR, underwater detonations), marine scientific research using sound, oil and gas exploration and extraction, vessel traffic, low-level aircraft traffic in the Gully MPA (<150 meters height), and construction. There is no critical northern bottlenose whale habitat identified offshore Newfoundland and the aircraft will not be flying lower than 150 m.

During aerial surveys conducted in summer of 2007, Sowerby's beaked whales were not observed in the areas off eastern and southern Newfoundland (Lawson and Gosselin 2009). Sowerby's beaked whales have not been observed by some seismic survey operations in large multi-year regional surveys offshore Labrador, northeast Slope and shelf nor southern Grand Banks (RPS 2015a, b, c). However, the deep water depths (>1000 m) in the Study Area are within the preferred habitat characteristics of the species. As recent as February 2015, a Sowerby's beaked whale was found washed up on Point Lance, Newfoundland.

A management plan for fin whales in the Atlantic Ocean is in progress, but unavailable. According to the DFO species at risk website (DFO 2013-07), the most important threat is noise pollution, caused by shipping, seismic exploration, military sonar and industrial development. Other important threats are changes in food availability, toxic spills, whaling – still occurring in Greenland and Iceland – and diseases. Some less important threats which need to be monitored include ship strikes, entanglements in fishing gear, marine life observation activities and harmful algal blooms. Noise from aircraft are not listed as a threat to fin whale populations.

The Recovery Strategy for the North Atlantic Right Whale (DFO 2009c) notes that the most obvious threats that are potentially depressing the growth rate of the North Atlantic right whale population are strikes by vessels and entanglements in fixed fishing gear. While ambient noise levels in right whale habitat can at times be high, for example due to storm and wave activity, increasing levels of human-caused noise are a cause for concern. The two relevant components of noise are duration and intensity. Some sounds are very loud but of short duration (for example some kinds of sonar or seismic activity), while other sounds are loud and also of long duration (e.g. commercial shipping traffic) (Parks and Clark 2007). The sources of noise of most concern to date have related to commercial transport and whale watching vessels, nearby or potential oil and gas exploration, naval activities such as detonations, the use of harassment devices in aquaculture operations, marine construction, and on-shore detonations, military sonar, fish-finding sonar, and bottom mapping sonar. The strategy lists research requirements, including population surveys where "regular boat-based surveys are occasionally supplemented by aerial surveys". This statement clearly indicates that aerial surveys are not a concern for the determinant of north Atlantic right whales. There are no critical habitats delineated for this species offshore Newfoundland. The species has been observed on two occasions.

The DFO marine mammal section (pers. comm. 2015) offshore Newfoundland has not observed significant adverse reactions to their low-level flights during marine mammal surveys at altitude of 180 m.

#### 6.4.4.2.3 Malfunctions and Accidents

As previously describe, aircraft do not routinely leak or discharge petroleum hydrocarbons. In the event of a ditching event and the potential for an aviation gas spill, the kerosene will evaporate rapidly and exposure will be minimal if at all.

### 6.4.4.3 Sea Turtle Species at Risk

#### 6.4.4.3.1 Vessel Presence

There is no direct contact between aircraft and sea turtles. Over flights of sea turtles may only exert a temporary startle reaction from the plane itself and or its shadow.

#### 6.4.4.3.2 Noise Emissions

There are a range of sources of anthropogenic noise in the marine waters of Atlantic Canada that produce underwater sounds within the frequency range detectable by sea turtles. These include oil and gas exploration and development, shipping, fishing, military activity, underwater detonations, and shore based activities (Davis et al. 1998; Greene and Moore 1995; Lawson et al. 2000)

There is no evidence that sea turtles are harmed or adversely affected in any manner from aerial surveys. Like the other biological VECs discussed thus far, aerial surveys are an acceptable method to conduct abundance and distribution censuses. The aircraft altitude will be in the same range as research aircraft and will likely only exert a temporary start reaction from the aircraft noise overhead for a matter of seconds in duration.

#### 6.4.4.3.3 Malfunctions and Accidental Events

Jet A-1 fuel may affect marine turtles through dermal contact, inhalation or ingestion. This risk of a plane ditching occurrence is very low. Potential impacts will be short-lived as the fuel is highly volatile and it will confined to the surface water. No significant adverse effects are likely to occur as a result of an accidental event associated with this Project.

### 6.4.5 Follow up and Monitoring

There will be no monitoring of species at risk.

### 6.4.6 Summary

A summary of potential interactions, environmental effects, mitigation, and cumulative and residual environmental effects is provided in Table 6.7.

**Table 6.7: Summary of Environmental Assessment for Species at Risk**

<b>Interactions and Issues</b> <ul style="list-style-type: none"><li>• Disturbance from aircraft presence.</li><li>• Disturbance from vessel noise.</li></ul>
<b>Impact Analysis</b> <p>There is no evidence that documents that low level aerial surveys results in serious or irreversible harm to the identified species at risk seabirds, marine mammals or sea turtles. The Project is unlikely to result in</p>



population level effects on those species at risk based on scientific research to date. There are no discharges from aircraft.						
<b>Mitigation</b> <ul style="list-style-type: none"><li>Mitigation is not required.</li></ul>						
Project Activity	Magnitude	Geographic Extent	Frequency	Duration	Reversibility	Ecological/Socio-Cultural and Economic Context
Aircraft Presence	0	1	1	1	R	1
Aircraft Noise	0	1	1	1	R	1
Accidental Spill	1	1	1	3	R	1
<b>Significance of Residual Effects</b> Not adversely significant						
<b>Confidence</b> High level of confidence based on previous seismic surveys, monitoring observations and research.						
<b>Magnitude</b> 0=negligible 1=low 2=medium 3=high	<b>Geographic Extent</b> 1= 100s of m 2= 1-10 km 3= >50 km	<b>Frequency</b> 1= isolated 2= intermittent 3 = continuous	<b>Duration</b> 1=seconds 2=minutes 3=hour 4=day	<b>Reversibility</b> R=reversible I=Irreversible		
<b>Ecological/Socio-cultural and Economic Context</b> 1=Relatively pristine area or area not adversely affected by human activity 2=Evidence of existing adverse effects						

## 6.5 Sensitive Areas

Portions of five DFO designated EBSAs occur in the Study Area boundary: Southeast Shoal and Tail, Northeast Shelf and Slope, Lilly Canyon-Carson Canyon, Orphan Spur, and Virgin Rocks. EBSAs do not have any special legal status, rather the identification provides guidance on the standard of management that is considered to be appropriate. For example, EBSAs are candidates for Areas of Interest (AOI).

### 6.5.1 Boundaries

The spatial boundaries of interaction between the Sensitive Areas and the potential yearly gravity surveys are primarily related to the zone of influence as predicted by noise transmission loss from the aircraft.

With respect to temporal boundaries, the Grand Banks is an aggregate area for seabirds and cetaceans.

### **6.5.2 Potential Interactions and Issues**

Potential interactions between Project activities and sensitive areas relate primarily to disruption of cetacean and seabird feeding.

### **6.5.3 Significance Criteria and Evaluation**

A significant adverse environmental effect for sensitive areas is one that disturbs, damages, destroys or removes any living marine organism or any part of its habitat. Disturbance, damage and destruction for the purpose of this EA include:

- an alteration of critical or essential habitat physically, chemically or biologically, in quality or extent, to such a degree that there is a measurable decline in species diversity;
- mortality or serious injury to individuals of a species at risk;
- the abundance of one or more non-listed species is reduced to a level from which recovery of the population is uncertain or more than one season would be required for a locally depleted population or altered community to be restored to pre-event conditions;
- impairment of ecosystem functioning; or
- long-term or permanent displacement of any species from critical habitats.

A non-significant adverse environmental effect is one that does not meet the criteria for disturbance or damage to habitat within the sensitive areas.

### **6.5.4 Effects Assessment and Mitigation**

#### **6.5.4.1 Vessel Presence**

The short term presence of the aircraft in any one location travelling at a speed of 222 kph at an altitude of 150 m or more above the sensitive areas identified will be negligible compared to the daily and regular year round marine traffic currently experienced in the Study and Regional Areas. The aircraft will survey two or three lines a day with a spacing of 10 to 15 km, thus exposure in any one sensitive area will be limited in occurrence to once or twice in any once survey season.

The effect of aircraft presence was assessed for each VEC. The risk to marine bird and migratory birds, marine mammals and sea turtles in the sensitive areas is anticipated to be negligible, as these animal groups are already subject to aerial surveys by government agencies.

#### **6.5.4.2 Noise Emissions**

Aircraft noise will not alter critical habitat, migration, or prey sources and supply for seabirds, marine mammals or sea turtles in the EBAs and VMEs. Sound energy levels emitted from the aircraft are not anticipated to alter the physical, chemical or biological features that support cetacean, seal, sea turtle or seabird aggregations in the EBAs and VMEs.

Aerial surveys for marine wildlife have been conducted on waters that surround Newfoundland without any apparent significant adverse effect on the marine biota. Field observation by DFO noted that the only reaction was from the shadow of their survey aircraft, which created a diving reaction on whales (marine mammal research scientist, pers. com. 2015).

Low level aerial surveys are not unique to the Atlantic region. They are of short duration, with limited geographic scale, and infrequent. No avoidance of EBSAs or operationally restrictive mitigation proposed, as there is none to negligible effects anticipated from aircraft surveys.

### 6.5.5 Malfunctions and Accidental Events

Aviation fuel may affect seabird, cetaceans and marine turtles through dermal contact, inhalation or ingestion. This exposure risk of such events occurring is low. Any ditching aircraft is likely a sufficient disturbance to invoke a fleeing response for any wildlife in the vicinity. As the fuel product is highly volatile, potential impacts will be short-lived and confined to the surface water. No significant adverse effects are likely to occur as a result of an accidental event associated with this Project.

### 6.5.6 Follow-up and Monitoring

Physical habitat of the regional EBSAs will not be altered by aircraft flights. Wildlife foraging or aggregations will not be adversely affected as there is no evidence after decades of such surveys on a global basis that shows low level aircraft surveys are detrimental.

### 6.5.7 Summary

A summary of potential impacts, mitigation, and residual effects is provided in Table 6.8 for routine Project activities and accidental events on sensitive areas.

**Table 6.8: Summary of Environmental Assessment for Sensitive Areas**

<b>Interactions and Issues</b> <ul style="list-style-type: none"> <li>• Alteration of critical habitat</li> <li>• Displacement of species from aggregating habitat and food sources</li> <li>• accidental fuel spill events</li> </ul>						
<b>Impact Analysis</b> Aircraft surveys do not alter the marine ecosystem. Sound levels from flights penetrate surface waters on a small area <100s of metres in diameter for a matter of several seconds. It is unlikely that species will be temporarily or permanently displaced from habitat.						
<b>Mitigation</b> <ul style="list-style-type: none"> <li>• no specific mitigation is proposed.</li> </ul>						
Project Activity	Magnitude	Geographic Extent	Frequency	Duration	Reversibility	Ecological/Socio-Cultural and Economic Context
Aircraft Presence	0	2	1	2	R	1
Aircraft Noise	0	2	1	1	R	1
Accidental Spill	1	1	1	3	R	1
<b>Significance of Residual Effects</b> Not adversely significant						
<b>Confidence</b> High level of confidence based on previous seismic surveys, monitoring observations and research.						

<b>Magnitude</b> 0=negligible 1=low 2=medium 3=high	<b>Geographic Extent</b> 1= 100s of metres 2= 1-10 km 3= >50 km	<b>Frequency</b> 1= isolated 2= intermittent 3 = continuous	<b>Duration</b> 1=seconds 2=minutes 3=hour 4=day	<b>Reversibility</b> R=reversible I=Irreversible
<b>Ecological/Socio-cultural and Economic Context</b> 1 Relatively pristine area or area not adversely affected by human activity 2 Evidence of existing adverse effects				

## 6.6 Commercial Fisheries and Research Vessel Surveys

Commercial fisheries are important to the economy of Newfoundland and considered a VEC for this assessment due to potential interactions between fishing vessel crews and the aircraft presence and noise perspective. There will be no physical interaction with fishing gear or vessels. There is no potential effect of airborne noise on the catchability of fish or shellfish as sound penetration into water is poor and limited to surface water depths. However, for the sealers in the spring harvest of seals on ice floes, there may be the potential for scaring seals into the water thus effecting catchability

### 6.6.1 Boundaries

The boundary of the interaction with other users (commercial fisheries, and scientific surveys) includes primarily overhead flights of the aircraft.

With respect to temporal boundaries, the potential interactions are those that are planned to occur intermittently between March and November in 2015 to 2019.

With regard to administrative boundaries, DFO and NAFO manage the fisheries resources in the area and DFO is primarily responsible for scientific surveys within the area.

### 6.6.2 Potential Interactions

Potential interactions between the Project and commercial fisheries relate primarily to the potential for:

- startling of fishers from the sudden appearance of a low level aircraft; and
- disturbance to seals on ice floes and interruption of seal harvesting.

### 6.6.3 Significance Criteria and Evaluation

A significant adverse environmental effect on commercial fisheries is defined as one that:

- interferes with fishers accessing 10% or more of the targeted species for all or most of the sealing season.

A non-significant adverse environmental effect on commercial fisheries is defined as one that:

- results in a reduction in profits due to a decrease in catchability of target species in less than 10% of the harvesting area for the targeted species.

## **6.6.4 Effects Assessment and Mitigation**

### **6.6.4.1 Aircraft Presence**

Commercial seal harvesting in the Project Area occurs in early April, depending on suitable and safe ice conditions. This harvesting season corresponds to the proposed gravity aerial survey commencing in March. Other potential temporal and spatial overlaps could include the DFO seal pup populations surveys in March and the DFO aerial surveillance for harvesting compliance occurs over the entire harvesting period.

Effects on seal behavior from aircraft noise and aircraft presence are discussed in Section 6.2.4.1.2. Aerial surveying for seals is a common used technique offshore Newfoundland, the Arctic, Hudson Bay, and Alaska. There is no evidence to suggest that seals are physically or psychologically harmed by low-level aircraft, otherwise government researcher would not routinely use this method to census the populations. DFO marine mammal researchers from St. John's fly the survey aircraft at 304 m for the aerial seal surveys and the enforcement activities of DFO protection are likely lower.

To minimize the effects of Project activities on seal harvesting, the following mitigations measures will be implemented.

#### **Avoidance Mitigation**

Considering the seal harvesting season is short, the prime means of mitigating potential impacts on these commercial activities by this proposed project is to avoid active seal harvesting areas, when they are occupied by seal harvesters. The Survey Area is large enough that the flight plans can be organized to survey areas remote from the ice pack and ice floes until after the seal harvest is over.

#### **Communication Mitigation**

Historically, fishers have noted that good communications, exchange of plans and fishing locations, and co-operation at sea are the keys to co-habitation of industry activities in the same areas. The FFAW and One Oceans are the main conduct for information the fishing community at large. A DFO research vessel representative is also included in survey operations.

Bridgeport will establish advance communications with representatives of the fisheries and DFO survey groups that may be present in the aerial Survey Area. Open lines of communication between the commercial fishery and the proposed low-level aerial survey program are intended to prevent potential surprises by the appearance of the aircraft.

The locations of planned survey lines and daily aircraft location reports will be provided to DFO and fisher organizations. Bridgeport will liaises regularly with the FFAW representative who can provide feedback related to operational issues on the Newfoundland side.

The effects are predicted to be negligible, intermittent over a short period of seconds to minutes during an overhead flight. With the next survey lines being 10 to 15 km away, it is highly likely that the aircraft will not be seen or heard. The long term experience with military, government ice surveillance, DFO enforcement and research, and petroleum industry helicopters flights have not resulted in issues being raised as disruptive to fisheries and fishers provides a high level of confidence in this assessment. The socio-economic effects on fishers would be negligible, and thus not adversely significant.

#### 6.6.4.2 Noise Emissions

The normal human ear can detect sounds that range in frequency from about 20 cycles per second or hertz (Hz) to 15,000 Hz. However, all sounds throughout this range are not heard equally well. The human ear can be seen to be most sensitive at 1 to 4 kilohertz (kHz), whereas the sensitive band for the marine mammals that can hear well in air (i.e. seals), extends upward to at least 10 kHz. However, at most frequencies the hearing threshold for these animals listening in air is 20 to 50 dB higher (less sensitive) than that for the human.

Although sound is often measured with instruments that record instantaneous sound levels in dB, the duration of a noise event and the number of times noise events occur are also important considerations in assessing noise impacts. Based on the 10 to 15 km spacing of survey lines and limit on the number of flights per day, exposure to fishers (March to November) and the targeted seals (April) will be a very brief, a matter of seconds. As compared to circling aerial surveys for seals pups and enforcement which are of a considerable longer duration.

The sound exposure level (SEL) measurement provides a means of describing a single, time varying, noise event. It is useful for quantifying events, such as an aircraft over flight, which includes the approach when noise levels are increasing, the instant when the aircraft is directly overhead with maximum noise level, and the period of time while the aircraft moves away with decreasing noise levels. SEL is a measure of the physical energy of a noise event, taking into account both intensity (loudness) and duration.

Occupational exposure limits (OELs) for noise are typically given as the maximum duration of exposure permitted for various noise levels. They are often displayed in exposure-duration tables like Table 6.9 and Table 6.10. The OELs depend on two key factors that are used to prepare exposure-duration tables: the criterion level and the exchange rate.

**Table 6.9: Noise Exposure Limits when Criterion Level = 90 dB(A)**

<b>3 dB(A) Exchange Rate</b>	<b>Maximum Permitted Daily Duration (hours)</b>	<b>5 dB(A) Exchange Rate</b>
Allowable Level dB(A)		Allowable Level dB(A)
90	8	90
93	4	95
96	2	100
99	1	105
102	0.5	110
105	0.25	115

**Table 6.10: Noise Exposure Limits when Criterion Level = 85 dB(A)**

<b>3 dB(A) Exchange Rate</b>	<b>Maximum Permitted Daily Duration (hours)</b>	<b>5 dB(A) Exchange Rate</b>
Allowable Level dB(A)		Allowable Level dB(A)
85	8	85
88	4	90
91	2	95
94	1	100
97	0.5	105
100	0.25	110

The potential for impacts on seal harvesting will; therefore, depend on the location of the surveying activities in relation to these harvesting areas. If the survey work is situated away from these harvesting areas, the likelihood of any impacts on commercial seal harvesting will be greatly reduced.

Approaching aircraft and over flights will be heard by fishers on commercial or research vessels. When the aircraft will be heard depends on the noise masking from the marine weather conditions experienced at that time, vessel engines, exhaust stack and if any hearing protection worn by crew. The aircraft sound level reaching a vessel at its maximum will be less than the regulated level of 85 dB of hear protection requirements. Therefore, no damage to human or seal hearing will result from an over flight.

#### **6.6.5 Malfunctions and Accidental Events**

If a spill of fuel or lubricant entered the water from a ditched aircraft, the quantities would be too small and would occur in too short a time to result in catchability of seals or effects to fishers health. No significant adverse effects are likely to occur as a result of an accidental event associated with this Project.

#### **6.6.6 Follow-up and Monitoring**

Ongoing communications during the survey period, through the avenues described, will be instrumental in minimizing Project effects on commercial seal fisheries. A shore manager will play a large role in communications with fishing organizations and DFO to help avoid potential conflicts at sea.

Bridgeporth will also work collaboratively on the operational issues associated with the survey with the FFAW's Petroleum Liaison. Key shore-based personnel will monitor the progress of key fisheries and completion of quotas in Study Areas to facilitate line scheduling.

#### **6.6.7 Summary**

A summary of residual environmental effects is provided in Table 6.11. Therefore, there is not likely to be a significant adverse environment effect on ocean resource users.

**Table 6.11: Summary of Environmental Assessment for Ocean Resource Users**

<b>Interactions and Issues</b> <ul style="list-style-type: none"><li>• Presence and or noise from seismic recording causing behavioural changes resulting in reduced short-term catchability.</li><li>• Interaction with DFO research and enforcement surveys.</li></ul>						
<b>Impact Analysis</b> <p>Potential adverse disturbance effects on seal harvesting will be mitigated through the implementation of mitigative measures, including: enhanced communications with fishing industry representatives and DFO; and scheduling of survey lines to minimize potential conflicts with research and enforcement aerial surveys.</p>						
<b>Mitigation</b> <ul style="list-style-type: none"><li>• Communication with fishing industry representatives, and DFO</li><li>• Avoidance of seal harvesting area in April</li></ul>						
<b>Project Activity</b>	<b>Magnitude</b>	<b>Geographic Extent</b>	<b>Frequency</b>	<b>Duration</b>	<b>Reversibility</b>	<b>Ecological/Socio-Cultural and Economic Context</b>
Aircraft Presence	0	2	1	1	R	1
Aircraft Noise	0	2	1	1	R	1
Accidental Spill	1	1	1	3	R	1
<b>Significance of Residual Effect</b> <p>Not adversely significant</p>						
<b>Confidence</b> <p>High level of confidence based on previous seismic surveys, monitoring observations and research.</p>						
<b>Magnitude</b> 0=negligible 1=low 2=medium 3=high	<b>Geographic Extent</b> 1= 100s of metres 2= 1-10 km 3= >50 km	<b>Frequency</b> 1= isolated 2= intermittent 3 = continuous	<b>Duration</b> 1=seconds 2=minutes 3=hour 4=day	<b>Reversibility</b> R=reversible I=Irreversible		
<b>Ecological/Socio-cultural and Economic Context</b> <p>1 Relatively pristine area or area not adversely affected by human activity 2 Evidence of existing adverse effects</p>						



## **7 EFFECTS OF THE ENVIRONMENT ON THE PROJECT**

In the Northwest Atlantic, marine operations are primarily affected by wind, waves, currents, visibility, and to a lesser extent air and sea temperatures. Sea ice, icebergs and vessel icing, are potential seasonal hazards to consider. The time of year is a factor in determining the level of risk or impact any of these environmental parameters may have on operational efficiency or success. Planning and executing activities safely requires due consideration of the seasonally variable hazards which may be encountered.

For the Flemish Pass and Grand Banks region, Project activities are proposed to take place during the period March to November. This section characterizes the range of conditions likely to be encountered within this time frame, and some of the potential associated adverse effects. Aircraft used by the Project must be rated to function within the expected conditions and adhere to all standards and codes for safety and data quality.

### **7.1 Metocean**

A weather observation and site-specific forecasting service would be prudent to ensure safe and efficient Project planning and operations.

#### **7.1.1 Wind and Storms**

Wind, precipitation and temperature have the potential to increase stress on aircraft, pilots, and disrupt operations and scheduling. The aircraft must be able to withstand the range of normal wind conditions expected. The aircraft operations planning will avoid storm systems.

#### **7.1.2 Precipitation**

The combination of low air and sea temperature, strong winds, precipitation, and condensation can lead to aircraft icing. For freezing spray to occur, air temperatures must be  $-2^{\circ}\text{C}$  (the freezing point of salt water) or colder, and sea temperatures generally less than  $5^{\circ}\text{C}$ . The aircraft should be flying at an altitude where freezing spray is avoided.

Aircraft icing is the accretion of super cooled liquid onto an airplane during flight. Accreted ice adversely affects flight; thus, it is an important component of an aviation weather forecast. Meteorology associated with in-flight icing begins with the microscale, addressing growth of super cooled droplets and their collision with and adhesion to airframes. Cloud-scale and mesoscale processes control the amount and distribution of super cooled liquid water. Synoptic weather patterns govern the movement and overall location of icing environments. Any planning related to aircraft icing must also include the development and use of numerical weather prediction models as well as in situ and remote sensors for icing detection, diagnosis, and forecasting.

Aircraft icing potential from snow and freezing rain is a risk and a common occurrence in the spring. There is risk for personnel safety and operational issues and as with storms watching, weather forecasting will play a key role. Icing can adversely affect the flight characteristics of an aircraft. Icing can increase drag, decrease lift, and cause control problems. The added weight of the accreted ice is generally a factor only for light aircraft. Aircraft can fly in icing conditions, and to do so legally they must first be certified. For certification of a particular type of airplane, it must be flown in a range of natural icing conditions and demonstrate that these conditions result in no significant effect on the airplane's performance.

Certified aircraft are commonly equipped with devices that either serve to prevent ice from adhering to the airframe or remove it once it has adhered. Such anti-icing or de-icing equipment may be deployed manually or through an automatic system triggered by an icing detection

probe. Equipment includes pneumatic 'boots', heat, and liquid. All three can be applied to the leading edges of the wings and tail, and occasionally to propellers.

### **7.1.3 Visibility**

While the summer to early fall period generally favors calm seas, visibility may be reduced due to formation of coastal fog. In April/May through to July, when warm air masses move over cold water, reduced visibility of less than one kilometer occurs from 40 to 50% of the time. Visibility and ceiling restrictions may be a factor for aircraft. A review of the seasonal range and variation in these conditions will be incorporated into contingency planning.

## **7.2 Sea Ice**

Sea ice and icebergs will occur during the survey timeframe; however, the presence will not affect data collection. There will be no interaction with sea ice.

## 8 CUMULATIVE EFFECTS

Individual environmental effects can accumulate and interact to result in cumulative environmental effects. Past and ongoing human activities have affected the region's natural and human environments. The description of the existing environment reflects the effects of these other actions. The scoping document requires consideration of the cumulative environmental effects. Cumulative effects are the impacts on the environment that results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (federal or non-federal) or person undertakes such other actions

A critical step in the environmental assessment, therefore, is determining what other projects or activities have reached a level of certainty (e.g., "will be carried out") such that they must be considered in an environmental assessment. . Certain requirements must be met to consider cumulative environmental effects:

- there must be a measurable environmental effect of the project being proposed;
- the environmental effect must be demonstrated to interact cumulatively with the environmental effects from other projects or activities; and
- it must be known that the other projects or activities have been, or will be, carried out and are not hypothetical.

### 8.1 Methodology for the CEA

The scoping exercise was undertaken to identify past, ongoing, and reasonably-foreseeable human activities that are likely to interact cumulatively with environmental effects from exploration activities. The next step was to assess the potential impact of cumulative effects on each VEC.

The CEA focused on potential interactions of 'Other Ocean Users'. The other projects and activities considered in this assessment include those that are likely to proceed (such as those listed in the Federal Register), and those which have been issued permits, licenses, leases or other forms of approval. Past, present and future activities that may impact cumulatively with the project are outlined in Table 8.1.

It is an additional requirement that the cumulative environmental effect is likely to occur, that is, there must be some probability, rather than a mere possibility, that the cumulative environmental effect will occur. These criteria were used to guide the assessment of cumulative environmental effects. The other projects and activities considered in this assessment include those that are likely to proceed, such as those listed in the C-NLOPB registry.

**Table 8.1: Summary of Offshore Activities and Interaction with the Survey Project**

Activity	Information	Interaction with Project
Offshore Petroleum Production	Exxon Mobil's HMDC, production until 2036. Suncor – Terra Nova prdn until 2027 Husky – White Rose prdn until 2020	The active production platform located in study area. Temporal and spatial overlap with flights.
Offshore Petroleum Drilling	Exxon Mobil Hebron Project commence offshore 2016-ongoing Husky exploration drilling 2008-2017 Suncor exploration drilling 2009-2017 Statoil exploration drilling 2008-2016	Four drilling rigs planned to operate on the Grand Banks presently and in the future.  Potential spatial overlap

Activity	Information	Interaction with Project
		Temporal overlap.
Seismic Exploration	Husky 2D, 3D, 4D + geophysical surveys, in 2013 – 2020, March to November, Statoil 3D, 2D + geophysical surveys in 2011-2019, April to October Chevron 2D, 3D + geophysical in 2012-2017, May to November, 30 to 120 days Suncor 2D, 3D, 4D, 2014-2024 GXT 2D grav/mag, 2014-2018 MKI AS + TGS NOPEC , 2014-2018	Possible for temporal and spatial overlaps with helicopter support services.
Commercial Fishing	Seal harvesting is the only fishery considered. Fishing effort is well defined in time and location.	Temporal and spatial overlaps may occur
DFO Seal Research Surveys	Seal pup censusing	Temporal and spatial may occur
DFO Enforcement Surveys	Monitoring of harvester compliance	Temporal and spatial may occur
Government Ice Monitoring	Monitoring for ice conditions	Temporal and spatial may occur

In addition to consideration of these projects and activities, the cumulative effects assessment also considers past biological and/or anthropogenic pressures that may have contributed to existing conditions within the Project Area. Where applicable, these pressures and the resulting effects are reflected in the description of existing conditions. Table 8.2 provides an assessment of cumulative effects for those concurrent activities scoped above.

**Table 8.2: Assessment of Cumulative Effects**

VEC/VSC	Cumulative Effects Assessment
Species at Risk	<p>With the possibility of six consecutive seismic programs occurring over the Study Area in the next two years, migratory marine mammal species may be affected as they pass by them. Such species are capable of avoiding the ensonified areas to prevent harmful and disruptive effects.</p> <p>Ivory gulls may occur over the pack ice, but their occurrence is expected to be incidental. Seabird reactions are not expected to cause disruption to foraging at sea, as aerial surveys are routinely used to determine abundance and distribution.</p> <p>Aircraft activity is a minor component of total underwater noise environment compared with the hundreds of commercial tanker, cargo ships, research vessels, cruise ships, fishing vessels and offshore supply vessel trips. The additional intermittent and infrequent aircraft flight from the survey is negligible compared to the other sound generating operations and cumulative impacts on species at risk are not significant.</p> <p>Based on current knowledge and use of low-level aerial surveys to study species at risk the proposed project is not expected to result in or contribute to any significant cumulative impacts on species at risk.</p>
Marine Mammals	<p>Aircraft sound is transient and does not penetrate underwater very well; the most likely cumulative effects will be associated with other concurrent activities (e.g., aerial research, monitoring and enforcement surveys, cargo ships, tankers, other seismic surveys and fishing vessels). High and mid frequency acoustic marine mammals are unlikely to detect the low frequency sound level of an overheard propeller aircraft. Marine mammals at the surface appear to be most reactive to the</p>

	<p>aircraft shadow. Any potential cumulative effect is anticipated to be short term, intermittent and localized, and therefore, not significant with respect to effects on marine mammal species.</p> <p>Based on current knowledge, and the common practice of low level aircraft surveys for marine mammal population research, the proposed project is not expected to result in, or contribute to, any significant cumulative impacts on marine mammal species.</p>
Sea Turtles	<p>As with marine mammals, sea turtle abundance and populations are determined in part by aerial surveys around the globe. Researchers would not conduct such surveys if they were detrimental to the very population studies they were undertaking. Overhead aircraft sound will be one of the most infrequent and short-term duration exposures of the anthropogenic-generated sound offshore. Based on current practices, the proposed project is not expected to result in, or contribute to, any significant cumulative impacts on sea turtles.</p>
Marine Birds	<p>There are no routine discharges from aircraft as there are from platforms and vessels. There are no cumulative effects from exposure of marine birds to petroleum.</p> <p>Despite researchers conducting low-level censusing flights over seabird colonies, there are no seabird colonies or critical habitat in the Study Area. There are no anticipated cumulative adverse effects of this project expected to occur on the distribution, abundance, breeding status and general well-being of marine avifauna inside and outside the Study Area.</p>
Special Areas	<p>This aerial survey is not changing critical or preferred habitats within the protected areas, nor resulting in mass removal of species, and their offspring/eggs and or larvae. The project will not change the physical or chemical requirements that dictate bird, fish, sea turtle and marine mammal presence, and their ability to reproduce. The sound generated from the aircraft will only be detected over a matter of seconds, at low frequency and at a level less than 85 dB that appears to result in a variety of effects to head turning in birds, diving by cetaceans and no reaction.</p>
Air Traffic	<p>In the spring season, the air space offshore Newfoundland could potentially become congested with low level ice monitoring flights, DFO research flights and DFO surveillance flights. NAV Canada will coordinate and manage this air space. Bridgeport will avoid the seal harvesting areas and thus the DFO surveys. Therefore, the cumulative incremental impact attributed to the project flight operations is negligible.</p> <p>Helicopter flights are frequent, on a daily basis between St. John's airport and the platforms and vessels. These aircraft will fly at a higher altitude than the Bridgeport fixed wing aircraft, and NAV Canada will coordinate the air space offshore. There should be no disruption to petroleum activities.</p> <p>The ice monitoring flights also fly at a higher altitude than the Bridgeport gravity survey. NAV Canada will coordinate the air space offshore.</p>
Commercial Fisheries	<p>Potential cumulative effects on commercial seal harvesting would be related to the potential noise associated with other users of the air space overhead. The effect of circling DFO aircraft over seal herds is not documented, so Bridgeport will not contribute to a potential economic risk to sealers by avoiding this area in April.</p>

## 9 SUMMARY AND CONCLUSIONS

The Project Area is not known to be an important rearing or mating area for any of the listed species at risk that could occur in the area. Several of the EBSAs have known important foraging and or aggregating areas. Ecological processes will not be disturbed outside natural variability, and ecosystem structure and function will not be critically affected. Any effects are expected to be at the startling disturbance level at most, reversible, and of limited duration, magnitude, and geographic extent. With the use of avoidance mitigation with respect to seal harvesters, all Project effects have been rated as not adversely significant. Most of the species that could occur in the Project Area are more vulnerable to direct and indirect fishing activities; entanglement in fishing gear; collisions with ships; and/or chronic pollution than to potential effects from interaction with the Project.

As described in the EA Report, aircraft flights will generally be restricted to the immediate Project Area. Noise levels associated with the Project are not predicted to result in physical harm to marine mammals, migratory seabirds or sea turtles because surveys of population estimates and distribution of these animals are routinely conducted around the world and in this region using low-level turboprop aircraft. Based on the above, no harm to listed species or their critical habitat is anticipated to occur as a result of the Project.

Previous and ongoing noise generated by several concurrent drilling, seismic surveys, well site geohazard and VSP surveys conducted in this region for decades have not resulted in claims that significant adverse effects to biological or socio-economic VECs of the area. Therefore, there is high confidence that no harm to listed species, critical habitats or fisheries harvesting is anticipated to occur as a result of the Project.

Significant adverse residual environmental effects (i.e., after mitigation has been applied), including cumulative effects, are not predicted to occur for all VECs. In conclusion, this environmental assessment predicts that Bridgeporth's proposed Gravity program can be conducted with no likely significant adverse effects on the biological and socio-economic resources offshore on the Flemish Pass and Grand Banks.

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## **APPENDIX A – C-NLOPB SCOPING DOCUMENT**



# **Bridgeport Holdings Ltd. and JEBCO Seismic (Canada) Company**

## **North Flemish Pass Gravity Survey, 2015-2019**

### **Scoping Document**

**Prepared by:**  
**Canada-Newfoundland and Labrador Offshore Petroleum Board**  
**Environmental Affairs Department**  
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**Bridgeporth Holdings Ltd. and JEBCO Seismic (Canada) Company**  
**North Flemish Pass Gravity Survey, 2015-2019 Final Scoping Document**

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## **1 Purpose**

This document provides scoping information for the Environmental Assessment (EA) of the proposed gravity and magnetic survey offshore Newfoundland and Labrador in the North Flemish Pass Area and all other related activities (the Project). Bridgeporth Holdings Ltd. (Bridgeporth), in partnership with JEBCO Seismic (Canada) Company (JEBCO), is proposing to conduct a gravity gradient survey via fixed wing twin engine aircraft in one or more years within the 2015 to 2019 timeframe. The primary objective of the Project is to determine the presence and likely locations of geological structures that might contain hydrocarbon deposits.

Included in this document is a description of the scope of the project that will be assessed, the factors to be considered in the assessment, and the scope of those factors.

This document has been developed by the Canada-Newfoundland and Labrador Offshore Petroleum Board (C-NLOPB) in consultation with federal and provincial fisheries and environmental departments<sup>1</sup>.

## **2 Regulatory Considerations**

The Project will require authorizations pursuant to Section 138 (1) (b) of the *Canada-Newfoundland Atlantic Accord Implementation Act* and Section 134(1) (b) of the *Canada-Newfoundland and Labrador Atlantic Accord Implementation Newfoundland and Labrador Act* (Accord Acts).

***The C-NLOPB formally delegates the responsibility of an acceptable environmental assessment report and any supporting documents to Bridgeporth Holdings Ltd., the project proponent.***

## **3 Scope of the Project**

Bridgeporth proposes to conduct a gravity and magnetic survey between March 1 and November 30 in one or more years within the 2015 to 2019 timeframe in the North Flemish Pass Area of the Newfoundland and Labrador Offshore. The survey is to be executed via fixed wing twin engine aircraft.

## **3 Factors to be Considered**

The EA shall include a consideration of the following factors:

- 4.1 The purpose of the project;
- 4.2 The environmental effects of the Project, including those due to malfunctions or accidents that may occur in connection with the Project and any change to the Project that may be caused by the environment. Environmental effect is defined as: any change that the project may cause in the environment, including any effect of any such change on health and socio-economic conditions, on physical and cultural heritage, on the current use of lands and resources for traditional purposes by aboriginal persons, or on

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<sup>1</sup>Appendix 1 contains a list of the departments and agencies consulted during the preparation of the document.

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- any structure, site or thing that is of historical, archaeological, paleontological or architectural significance; and any change to the project that may be caused by the environment, whether any such change occurs within or outside Canada;
- 4.3 Cumulative environmental effects of the Project that are likely to result from the project in combination with other projects or activities that have been or will be carried out;
  - 4.4 The significance of the environmental effects described in 4.2 and 4.3;
  - 4.5 Measures, including contingency and compensation measures as appropriate, that are technically and economically feasible and that would mitigate any significant adverse environmental effects of the project;
  - 4.6 The significance of adverse environmental effects following the employment of mitigative measures, including the feasibility of additional or augmented mitigative measures; and
  - 4.7 Report on consultations undertaken by Bridgeport with interested other ocean users who may be affected by program activities and/or the general public respecting any of the matters described above.

**5 Scope of the Factors to be Considered**

Bridgeport will prepare and submit to the C-NLOPB an EA for the above-described physical activity, and as described in the *“Project Description North Flemish Pass Gravity Survey, 2015-2019 Bridgeport and JEBCO”* (RPS Energy Canada Ltd. November 10, 2014). The EA will address the factors listed above; the issues identified in Section 5.2 (following), and document any issues and concerns that may be identified by the proponent through regulatory, stakeholder, and public consultation.

Program activities are proposed for the North Flemish Pass Area, which has been studied in a number of recent EAs and the recently published Eastern Newfoundland Strategic Environmental Assessment (SEA) (August 2014). For the purposes of this assessment, the information provided in the Eastern Newfoundland SEA should support the EA to avoid unnecessary duplication of information. Appropriate references should be included in the EA.

It is recommended that the “valued ecosystem component” (VEC) approach be used to focus its analysis. A definition of each VEC (including components or subsets thereof) identified for the purposes of environmental assessment, and the rationale for its selection, shall be provided.

The scope of the factors, to be considered in the EA, will include the components identified in Section 5.2 - Summary of Potential Issues, setting out the specific matters to be considered in assessing the environmental effects of the project and in developing environmental plans for the project, and the “Spatial Boundaries” identified below (Section 5.1). Considerations relating to definition of “significance” of environmental effects are provided in the following sections.

Discussion of the biological and physical environments should consider the data available from recent EAs and the recently completed Eastern Newfoundland SEA (August 2014) for the Project and Study Areas. Where data gaps exist, the EA should clearly identify the lack of data available.

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## **5.1 Boundaries**

The EA shall consider the potential effects of the proposed survey program within spatial and temporal boundaries that encompass the periods and areas during and within which the project may potentially interact with, and have an effect on, one or more VECs. These boundaries may vary with each VEC and the factors considered, and should reflect a consideration of:

- the proposed schedule/timing of the gravity survey program;
- the natural variation of a VEC or subset thereof;
- the timing of sensitive life cycle phases in relation to the scheduling of survey activities;
- interrelationships/interactions between and within VECs;
- the time required for recovery from an effect and/or return to a pre-effect condition, including the estimated proportion, level, or amount of recovery; and
- the area within which a VEC functions and within which a project effect may be felt.

The proponent shall clearly define, and provide the rationale for the spatial and temporal boundaries that are used in its EA. The EA report shall clearly describe the spatial boundaries (e.g. Study Area, Project Area) and shall include figures, maps and the corner-point coordinates. Boundaries should be flexible and adaptive to enable adjustment or alteration based on field data. The Study Area will be described based on consideration of potential areas of effects as determined by the scientific literature, and project-environment interactions. A suggested categorization of spatial boundaries follows.

### **5.1.1 Spatial Boundaries**

#### Project Area

The area in which gravity and magnetic survey activities are to occur, including the area of the buffer zone normally defined for line changes.

#### Study Area

The area which could potentially be affected by project activities beyond the “Project Area”.

#### Regional Area

The area extending beyond the “Study Area” boundary. The “Regional Area” boundary will also vary with the component being considered (e.g., boundaries suggested by bathymetric and/or oceanographic considerations).

### **5.1.2 Temporal Boundaries**

The temporal scope should describe the timing of project activities. Scheduling of project activities should consider the timing of sensitive life cycle phases of the VECs in relation to physical activities.

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## **5.2 Summary of Potential Issues**

The EA shall contain descriptions and definitions of EA methodologies employed in the assessment of effects. Where information is summarized from existing reports, the sections referenced should be clearly indicated. Effects of relevant Project activities on those VECs most likely to be in the defined Study Area shall be assessed. Discussion of cumulative effects within the Project Area and with other relevant marine projects shall be included. Issues to be considered in the EA shall include, but not be limited to, the following:

### *Physical Environment*

**5.2.1** The recently published Eastern Newfoundland SEA(August 2014) provides information on the eastern Newfoundland offshore physical environment. This SEA, as well as recent EAs in the area, provides descriptions of the meteorological and oceanographic characteristics, including extreme conditions. Only new information for the Study Area that has become available since the publication of the above noted documents, and that is relevant to the consideration of environmental effects, should be provided in the EA.

### *Biological Environment*

**5.2.2** The recently published Eastern Newfoundland SEA (August 2014) provides information on the eastern Newfoundland offshore biological environment. This SEA, as well as recent EAs in the area, provides descriptions of: marine birds; fish and fish habitat; marine mammals and sea turtles; species at risk; sensitive areas; and human activities, including marine fisheries. Only relevant new information for the Study Area that has become available since the publication of the above noted documents should be provided in the EA, in particular species at risk, sensitive areas, and marine fisheries.

### **5.2.3 Marine and/or Migratory Birds**

The EA shall provide only new or updated information, where applicable, to address any changes to the following:

- Noise disturbance from equipment including both direct effects (physiological), or indirect effects (foraging behaviour, prey species, adult attendance at the nest);
- Physical displacement as a result of aircraft presence (e.g. disruption of foraging activities);
- Nocturnal disturbance from light (e.g. increased opportunities for predators, attraction of birds to aircraft lighting and subsequent collision, disruption of incubation);
- Means by which bird mortalities associated with project operations may be documented and assessed;
- Means by which potentially significant adverse effects upon birds may be mitigated through design and/or operational procedures; and
- Environmental effects due to the Project, including cumulative effects.

### **5.2.4 Marine Fish and Shellfish**

The EA shall provide only new or updated information, where applicable, to address any changes to the following:

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- The means by which potentially significant adverse effects upon fish (including critical life stages) and commercial fisheries may be mitigated through design, scheduling, and/or operational procedures; and
- Environmental effects due to the Project, including cumulative effects.

**5.2.5 Marine Mammals and Sea Turtles**

The EA shall provide only new or updated information, where applicable, to address any changes to the following:

- Disturbance to/displacement of marine mammals and sea turtles due to noise;
- Means by which potentially significant adverse effects upon marine mammals and sea turtles (including critical life stages) may be mitigated through design, scheduling, and/or operational procedures; and
- Environmental effects due to the Project, including cumulative effects.

**5.2.6 Species at Risk (SAR)**

The EA shall provide only new or updated information, where applicable, to address any changes to the following:

- Monitoring and mitigation, consistent with recovery strategies/action plans (endangered/threatened) and management plans (special concern);
- A summary statement stating whether project effects are expected to contravene the prohibitions of SARA (Sections 32(1), 33, 58(1));
- Means by which adverse effects upon SAR and their critical habitat may be mitigated through design, scheduling, and/or operational procedures; and
- Assessment of effects (adverse and significant) on SAR and critical habitat, including cumulative effects.

**5.2.7 “Sensitive” Areas**

The EA shall provide only new or updated information, where applicable, to address any changes to the following:

- Environmental effects due to the project, including cumulative effects, on those “Sensitive” Areas identified; and
- Means by which adverse effects upon “Sensitive” Areas may be mitigated through design, scheduling and/or operational procedures.

*Marine Use*

**5.2.8 Noise/Acoustic Environment**

The EA shall provide only new or updated information, where applicable, to address any changes to the following:

- Disturbance/displacement of VECs and SAR associated with survey activities;
- Means by which potentially significant effects may be mitigated through design, scheduling and/or operational procedures; and
- Effects of survey activities (direct and indirect) including cumulative effects, on the VECs and SAR identified within the EA. Critical life stages should be included.

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**5.2.9 Fisheries and Other Ocean Users**

The EA shall provide only new or updated information, where applicable, to address any changes to the following:

- An analysis of the effects of Project operations and accidental events upon fisheries and other ocean users. The analysis should include consideration of recent scientific literature on effects of survey activity on invertebrate species, including identified data gaps;
- Fisheries liaison/interaction policies and procedures;
- Program(s) for compensation of affected parties, including fisheries interests, for accidental damage resulting from project activities;
- Means by which adverse effects upon commercial fisheries may be mitigated through design and/or operational procedures; and
- Environmental effects due to the Project, including cumulative effects.

**5.2.10 Accidental Events**

- Environmental effects of any accidental events arising from accidental releases from the aircraft. Cumulative effects in consideration of other events () should be included.
- Mitigations to reduce or prevent such events from occurring.
- Contingency plans to be implemented in the event of an accidental release.

*Air Usage*

**5.2.11 Presence of Aircraft**

The EA shall provide a summary description, where applicable, of the information presented in the Eastern Newfoundland SEA (August 2014) and existing environmental reports for the North Flemish Pass Area. New or updated information should be provided, where applicable, to address any changes to the following:

- Effects upon access to fishing grounds;
- Effects upon general air traffic/navigation and mitigations to avoid research surveys;
- Means by which potentially significant effects may be mitigated through design, scheduling and/or operational procedures; and
- Environmental effects assessment, including cumulative effects.

*Environmental Management*

**5.2.12** The EA shall outline Bridgeport's environmental management system and its components, including, but not limited to:

- Pollution prevention policies and procedures;
- Fisheries liaison/interaction policies and procedures;
- Program(s) for compensation of affected parties, including fishery interests, for accidental damage resulting from project activities; and
- Emergency response plan(s).

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*Biological and Follow-up Monitoring*

**5.2.13** Discuss the need for and requirements of a follow-up program to verify the accuracy of the EA, to verify the effectiveness of any mitigation measures identified in the EA, or both. The discussion should also include any requirement for compensation monitoring (compensation is considered mitigation).

Details regarding the monitoring and observation procedures to be implemented regarding marine mammals, sea turtles and seabirds (observation protocols should be consistent with the C-NLOPB *“Geophysical, Geological, Environmental and Geotechnical Program Guidelines”* (January 2012)).

**5.3 Significance of Adverse Environmental Effects**

The Proponent shall clearly describe the criteria by which it proposes to define the “significance” of any residual adverse environmental effects that are predicted by the EA. This definition should be consistent with the November 1994 CEAA reference guide *“Determining Whether a Project is Likely to Cause Significant Adverse Environmental Effects”*, and be relevant to consideration of each VEC (including components or subsets thereof) that is identified. SARA species shall be assessed independent of non-SARA species. The effects assessment methodology should clearly describe how data gaps are considered in the determination of significance of effects.

**5.4 Cumulative Effects**

The assessment of cumulative environmental effects should be consistent with the principles described in the February 1999 CEAA *“Cumulative Effects Assessment Practitioners’ Guide”* and in the November 2007 CEAA operational policy statement *“Addressing Cumulative Environmental Effects under the Canadian Environmental Assessment Act”*. It should include a consideration of environmental effects that are likely to result from the proposed project in combination with other projects or activities that have been or will be carried out. These include, but are not limited to: proposed oil and gas activities under EA review (listed on the C-NLOPB Public registry at [www.cnlopb.ca](http://www.cnlopb.ca)); other geophysical activities; fishing activities, including Aboriginal fisheries; other oil and gas activities; and marine transportation. The C-NLOPB website lists all current and active offshore petroleum activity within the NL offshore area.

**6 Projected Timelines for the Environmental Assessment Process**

The following are estimated timelines for completing the EA process. The timelines are offered based on experience with recent environmental assessments of similar project activities.

ACTIVITY	TARGET	RESPONSIBILITY
EA review upon receipt from Proponent	6 weeks	C-NLOPB & Expert Departments and Agencies
Compile comments on EA	1 week	C-NLOPB
Review of EA Addendum/Response Document <i>(if necessary)</i>	2 weeks	C-NLOPB & Expert Departments and Agencies

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Determination Report (Determination of Significance of Project Effects)	2 weeks	C-NLOPB
Total	11 weeks	



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**APPENDIX 1**

**Departments and Agencies Consulted by C-NLOPB**

**Federal Departments**

Department of National Defence  
Environment Canada  
Fisheries and Oceans Canada  
Health Canada  
Natural Resources Canada  
Transport Canada

**Other Departments/Agencies**

Canadian Environmental Assessment Agency

**Provincial Departments (Government of Newfoundland and Labrador)**

Department of Environment and Conservation  
Department of Fisheries and Aquaculture  
Department of Natural Resources