

## **GENERAL COMMENTS**

### **Biological and Socio-economic Environments**

This section provides a generally comprehensive overview of the species that may be impacted by seismic activity in the Study Area, but there appears to be a general lack of supporting references for this information. Typically, all scientific statements should be properly cited and referenced. It should also be noted that at least two fish species under moratoria (2+3K American Plaice and Witch Flounder) and possibly other sensitive species are found in this area, so even a small event may have a large impact for some of these species. There also seems to be a lack of recent studies on the life history of some species. For example, there are more recent DFO reports for Greenland Halibut than the studies referenced in this report, which should be considered during this assessment. Please refer to the NAFO Scientific Council Studies for annual studies and updates on Greenland Halibut. Also, if additional information is required on specific species please contact respective DFO Scientists.

It should be noted that there are no studies that support the following statement: "*Planktonic organisms are so ubiquitous and abundant and many have such rapid generation times that there will be essentially no effect on plankton communities from the seismic program*". And even if this statement was true, this does not necessarily mean that there is no potential for influence on other organisms which depend on these planktonic organisms for food. For example, it is possible that timing of the survey may significantly affect feeding for certain species.

### **Effects of the Project on the Environment- Marine Fish**

The unknown long term effects of seismic activities continue to concern harvesters. There have been reports from harvesters that fish behaviour has been affected following seismic blasts and shellfish have disappeared from areas following seismic work being undertaken. There have also been reports from vessel captains that groundfish catches have been impacted when oil and gas activities have been ongoing. While the research has not determined any direct mortality of fish or shellfish attributable to seismic activity it needs to be recognized that there may be behavioural changes that could affect migration and/or reproductive and spawning activities as well as movement of the exploitable biomass in an area. While Atlantic cod is not a significant commercial species in the project area, some stocks do migrate off the Labrador coast during the time that Chevron proposes to conduct its activities. There is a possibility that seismic work may induce some behavioural changes in the stock(s).

### **Effects Assessment**

The effects assessment section contains a comprehensive review and interpretation of known risks of sound and seismic on marine organisms. Expertise has been applied to evaluating risks to fish, shellfish and other aquatic

organisms in the survey area and conclusions are consistent with what is known to date about the risks of seismic and the present guidelines for evaluating risk. The report also correctly notes in several places that this data is very limited. It is still important to note that the few studies which have been carried out for this type of assessment have considered different species and even fewer have replicate studies for any particular species. It should also be noted that extrapolating results of individual studies to population scale effects may be difficult, especially since it may require a large response for an effect to become obvious in any one study or survey. Population scale effects may therefore not become obvious until some time has passed. Furthermore, to date studies have involved different species, environments, sound levels as well as field and lab conditions, making comparisons difficult.

Considering the broader question regarding the potential risks of seismic, the assessment notes a somewhat dated paper in which a variety of effects were recorded in brown shrimp chronically exposed to a relatively low level of sound. Included were effects on growth and reproduction. This dated paper reinforces the question of acute versus chronic effects, which is a major knowledge gap for aquatic organisms in general. Given that shrimp is a major fishery in the Study Area, and that 2D and 3D surveys may be carried out along the Labrador coast for a number of years (by Chevron as well as others), regulators should address the question on whether chronic exposure of shrimp to low levels of sound poses any risk to these species during surveys of 3 weeks duration or more. Addressing this question would provide a basis for providing an informed opinion on whether a risk might exist or not. Any such studies on shrimp would also be of value for application to other crustaceans.

Overall, this section provides little discussion regarding the impacts on less mobile invertebrates. Mobile organisms may be able to avoid impacts of seismic sound, but those with less mobility may have increased susceptibility to repeated exposures to high levels of sound. Effects on organisms such as invertebrates may have an added effect on the food web as a whole. This may lead to problems such as reduced prey availability for important species such as Atlantic Cod.

It is indicated that "*spatial and temporal avoidance of critical life history times*" would mitigate airgun sound. This statement is very general and it is not clear how this strategy would be implemented. Would there be monitoring for large aggregations of fish? It is possible that the July to November time period may overlap with the spawning period of some species.

Although a general outline of the project area was indicated, information on specific proposed seismic survey lines would be beneficial to more accurately evaluate project footprint and seismic survey impacts.

### **Effects of the Project on the Environment- Marine Mammals and Sea Turtles**

A discussion of factors such as visibility, which may impact timing of the survey as well as the effectiveness of mitigation measures, such as the ability of marine mammal observers (MMOs) to detect marine mammals should be included in the assessment.

This section mentions that surveys will not likely affect the prey of sea turtles, including jellyfish. Given the fragile nature of jellyfish, it would be useful to have more information to examine this likelihood more closely. As for other species, the possible interruption of prey availability due to seismic activity should be noted as a potential negative effect.

### **Mitigations and Follow-up**

In Table 5.19 (p. 220) it was noted that delayed start-up will be used for marine mammals and sea turtles within 500 m, but that shutdown will occur only for endangered/threatened species. However, harming or disturbing any marine mammal is prohibited under s. 32 of the *Fisheries Act* and all mitigation measures identified in Appendix 2 of the “Geophysical, Geological, Environmental and Geotechnical Program Guidelines (C-NLOPB 2008), as well as those identified in Table 5.19, should be considered. Also in this regard, it is suggested that multiple MMOs be utilized to ensure sufficient rest during the course of the survey. While it is emphasized that MMOs will be utilized during daylight hours, it is not clear whether these mitigation measures will exist for nighttime survey activity.

To mitigate potential conflicts with fishing vessels and fishing gear it is recommended that Chevron utilize a Fisheries Liaison Officer (FLO) during the various seismic activities proposed. FLOs have experience with vessel traffic and gear deployment and can provide a communication platform for the fishing industry. They are also trained as MMOs.

### **Cumulative Effects**

Cumulative effects should also include other seismic studies which are expected to occur near the Study Area within the same time frame (2010 to 2017). It is likely that other seismic surveys will be conducted in adjacent areas of the Labrador Shelf during this time period, and it is suggested that this should be carefully considered when timing the present study in order to avoid concurrent surveys, which may lead to greater stress and displacement of organisms.

With the recognition that there may be three concurrent seismic programs in the project area, more quantitative analyses, with respect to the potential cumulative effects of these operations, would be helpful. With this in mind, a follow-up and monitoring program for fish and shellfish within the area is recommended by the Nunatsiavut Government.

As there is the possibility of concurrent seismic programs in the area, the potential conflicts with fishing vessels and gear and the potential influence of seismic activity on important fish and shellfish resources are increased.

### **SARA**

For the purposes of this assessment, it is sufficient to simply include species listed under Schedule 1 of SARA and omit the COSEWIC designations, since this is the official list (federally) of species at risk.

Please note all species designated under Schedule 2 of SARA have been reassessed and 13 out of 103 species designated under Schedule 3 have been reassessed. Please refer to the links below for more information:

[http://www.sararegistry.gc.ca/species/schedules\\_e.cfm?id=2](http://www.sararegistry.gc.ca/species/schedules_e.cfm?id=2);

[http://www.sararegistry.gc.ca/species/schedules\\_e.cfm?id=3](http://www.sararegistry.gc.ca/species/schedules_e.cfm?id=3).

### **Potentially Sensitive Areas**

The study and project areas are both located in Canada's NL-Labrador Shelves Marine Ecoregion. This is important to note, as two primary uses of this biogeographic classification system are i) assessing and reporting on ecosystem status and trends, and ii) spatial planning for the conservation of ecosystem properties and management of human activities. In addition, these areas (and information) will be useful towards guiding the selection of future representative marine protected areas.

### **Commercial Fisheries**

The commercial fishery is very important to many communities on the south coast of Labrador. While the membership of the Fish, Food and Allied Workers' Union (FFAWU) live in communities as far north as Fish Cove Point (north of Nain), members fish in NAFO divisions 2J, 2H and 2G for crab, shrimp, turbot, cod and other species. Harvesters in 4R (northern Newfoundland) have rights to fish in 2J, and members on the northeast coast still have fishing rights off the coast of Labrador. FFAWU members fish quotas for the Natuashish Government in NAFO zone 2H.

Communication between the proponent and the FFAWU during a multi-year seismic program is essential as harvesters are spread out over a wide geographic area and communication is essential to the safety of all involved. There is a need for good planning and further consultation with the fishing industry several months prior to the start of the various components of the seismic program to avoid potential conflicts at sea.

Fishing activity can change from year to year and during season as well. As an example, turbot is becoming more of an important commercial species and many harvesters have geared up to fish turbot in 2010. The fishery uses fixed gear that may introduce more potential interactions between the fishing and oil and gas sectors in the coming years. The fishery is also being actively prosecuted at the

time that Chevron is proposing to conduct its program. The peak month for shrimp landings within the project area is June, the peak time for harvesting snow crab is July and August and turbot fishing peaks in August and September. It is therefore important that Chevron maintain regular communication with the FFAWU to keep apprised of ongoing developments in the fishing industry.

### **Aboriginal Fisheries**

It is extremely important to the Nunatsiavut Government that the aboriginal fishery (offshore and nearshore) is not disturbed or negatively affected by the proposed seismic program. The area proposed for seismic activity is extremely important to the Nunatsiavut fishery and will probably become more important in the future. As a mitigating factor, it is recommended that the Torngat Joint Fisheries Board have input into the EA process and the seismic program during its implementation.

A follow-up and monitoring program regarding catch rates (fishing success) for the aboriginal fishery in and near the study area to ensure that catch rates are not decreasing is recommended. If there are effects being detected, then mitigative measures will have to be put in place over the duration of the seismic program.

### **Traditional Ecological Knowledge**

It has been demonstrated within the scientific literature that Inuit Knowledge (or Traditional Ecological Knowledge, more broadly) is a valuable source of knowledge that can complement and augment knowledge and information from a western scientific standpoint. In most studies of Arctic ecosystems, such as those that are completed within Environmental Assessments, it is recognized that the absence of Traditional Ecological Knowledge is a gap. After reviewing the EA, nowhere is Inuit Knowledge integrated into the environmental assessment in a meaningful way in terms of potential issues associated with the physical environment or marine resources. The incorporation of Inuit Knowledge should be required within the environmental assessment. In this way, Inuit Knowledge and western science can come together to form a combined, and much more holistic and accurate understanding of the potential effects of the proposed seismic program on the project and affected areas, through collaborative inquiry and analysis.

### **Guide Vessels**

It is recommended by the Nunatsiavut Government that the Proponent use a local fishing guide vessel to reduce conflicts with fishing vessels and gear. This would result in local employment opportunities while providing more effective communications with fishing vessels due to intimate knowledge of the local area and fishery.

### **Specific Comments**

**§ 2.2.5 Personnel, Page 7** -The report states that the seismic vessel “may have a FLO and a MMO(s) on board”. The wording should be “the seismic vessel will have a FLO and a MMO(s) on board”. The commitment has been made by Chevron in other sections of the EA to include a FLO and qualified MMO as mitigation. Moreover, the Nunatsiavut Government would like to see Aboriginal Labradorians, especially Inuit, employed as FLOs and MMOs for the purposes of this work. Inuit are keen observers of the ocean and many have previously been employed as observers onboard marine vessels in these sorts of capacities.

**§ 2.2.5 Personnel, Page 7** – Appendix 2 of the “*Geophysical, Geological, Environmental and Geotechnical Program Guidelines*” (C-NLOPB 2008) states that Operators are expected to implement a seabird and marine mammal observation program throughout survey activities. Such a program should involve a designated observer trained in marine mammal and seabird observations. A report on the monitoring program and its results should be submitted to the C-NLOPB.

### **§ 3.0 Physical Environment, Page 12**

*1<sup>st</sup> para*- Within this section Oceans (2009) is summarized and refers the reader to Sikumiut (2008). While this may be appropriate in some circumstances, it appears that some information, which is important to the timing of the survey and assessing the effectiveness of certain mitigation measures, such as MMOs has been overlooked in this section.

### **§3.3 Climatology, Page 12**

*1<sup>st</sup> para*- It mentions that “...*maritime climate tends to be fairly humid, resulting in reduced visibilities, low cloud heights, and significant amounts of precipitation*”. These factors should be discussed in more detail as they relate to the timing of the proposed surveys and the implementation of various mitigation measures. This would include data on wind, waves and especially visibility.

### **§3.3 Climatology, Page 13**

*3<sup>rd</sup> para*- The discussion of storm occurrence is informative, but is not likely to have much of an effect on seismic activities as they would not likely occur under these conditions.

### **§3.4 Physical Oceanography, Page 14**

Captions for tables and figures in Section 3.4 should include information on the source of the data. This is particularly important for comparisons purposes. This generalization also applies to other tables and figures throughout the report.

### **§3.4.2 Water Properties in the Project Area, Page 20**

*Figure 3.5*- The resolution in this figure is poor, particularly the numbers associated with the contours. It appears the data in this figure is for July only. This should be clarified.

### **§3.4.2 Water Properties in the Project Area, Page 20**

*2<sup>nd</sup> para-* It is noted that differences in salinity and temperature may be related to geographic variability, but the statement that this is "*more related*" to geographical rather than seasonal variation is not likely, particularly for surface waters.

### **§3.5 Ice and Icebergs, Page 25**

There should be a discussion in this section as to whether more icebergs have been observed recently due to increased effort. Is there any way to know the "error rate" for observing icebergs? It seems likely that monthly sightings would be more relevant to the proposed study.

### **§3.5 Ice and Icebergs, Pages 26-27**

*Figures 3.6 and 3.7,* it is unclear what the colours are referring to when the y-axis represents percent coverage. Should the axis be percent observations while the bar colours refer to percent coverage? Simple monthly median values would likely be sufficient to convey the necessary information.

**§5.7.1 Generic Activities – Air Quality, pg 127 & §5.7.3 Generic Activities – Waste Handling, pg 128** – "Vessel Incinerators" and "Solid combustibles will be incinerated". It has been identified in potential interactions tables (e.g. Tables 5.2, 5.5, 5.8, 5.11, 5.16) that "garbage will be brought to shore" and assessed accordingly. What is being proposed?

**§5.7.2 Generic Activities – Marine Use, pg 127** – Will streamers be deployed outside the Project Area (e.g. transit routes) and if so, has this activity been adequately assessed within the EA.

### **§5.7.4.2 Effects of Exposure to Airgun Sound, Page 133**

*2<sup>nd</sup> para-* Although it states that "*design problems*" may have impacted the results from DFO (2004b), it does not define these problems or how they would impact the findings.

### **§5.7.4.2 Effects of Exposure to Airgun Sound, Page 135**

*1<sup>st</sup> para-* Further explanation should be provided regarding the following: Saetre and Ona (1996) determined the mortality rates for eggs and larvae by employing a "worst-case scenario" computer model. How is this defined? It also appears that few of the variables used here are understood well enough to make this type of model useful.

### **§5.7.4.2 Effects of Exposure to Airgun Sound, Page 137**

*3<sup>rd</sup> para-* It states that, "*...even if masking does occur in some invertebrates, the intermittent nature of airgun sound is expected to result in less masking effect than would occur with continuous sound.*" However, there seems to be little data to support this assertion. While it was mentioned in the assessment that fish

may produce sounds in various behavioral contexts such as mating, the potential effect of masking in this context is not discussed within the report. Atlantic Cod have been shown to produce sounds during spawning and therefore this may be a potential impact in this area.

**§5.7.4.3 Effects of Exposure to marine Vessel Sound, Page 143**

4<sup>th</sup> para- Reference to "...Subsection 5.7.5.2...." is incorrect and should be Subsection 5.7.4.2

Also in this section, Snow Crab and Atlantic Cod were chosen as representative species that have been studied in the context of exposure to airgun sound. However, it is not clear how specifying Atlantic Cod guides the assessment of these effects, especially when there is generally little information available about the effect of seismic sound for this species. While it appears there have been a number of studies on Snow Crab, there appeared to be only two studies referenced for cod at different life stages (Wardle et al 2001 - juvenile cod; Thomsen 2002 - cod catch data).

**§5.7.4.4 Other Project Activities Not Related to Sound, Page 145**

Table 5.3 indicates that there is evidence of existing negative impacts in the assessment of effects on fish and fish habitat, yet the basis for this assessment does not appear to have been described in the text.

**§5.7.4.4 Other Project Activities Not Related to Sound, Accidental Events, Page 146**

Many of the references pertaining to the effects of accidental spills on eggs and larvae appear to be rather dated. It is uncertain as to whether or not these studies are reflective of the present level of knowledge.

**§5.7.6.1 Vessel Lights, line 6, pg 159** – Is more recent information regarding Storm-petrels on drill rigs available from Suncor. U. Williams, pers. comm. appears to be a dated reference.

**§5.7.7.2 Categories of Noise Effects- (B) Masking Effects of Airgun Sounds, Pages 167-169**

The assessment of masking suggests repeatedly that the "*intermittent nature*" of airgun pulses would reduce any masking impact. However, this statement is somewhat speculative. While whales may continue to call during seismic activity, it is not clear whether they can still hear under these conditions. Whale calls may actually be longer than the time between pulses and therefore important information may be lost to them. The data required to truly assess the importance of masking in this context is still rather sparse, making an accurate assessment of effects difficult. Similarly, based on the data available, it appears that little is known about how turtles detect sound. Therefore it is also speculative to assume that sea turtles will be able to receive important sound information between airgun pulses.



**§5.7.7.2 Categories of Noise Effects- (C) Disturbance by Seismic and Geohazard Vessels, Page 173**

2<sup>nd</sup> para- Regarding the ramp-up procedure, there seems to be some indication that certain species of pinnipeds may move towards an array, and it was also noted in the report that some male whales had approached an array. This questions the assumption that mammals will necessarily move away from airgun sound and avoid injury. Therefore, data indicating that the ramp-up procedure is effective for these species should be included if available or the appropriate uncertainties should be described.

**§5.7.8 Effects of the Project on Species at Risk, last line, 1st para., pg 211 –**  
This is the first time salmon has appeared.

**§5.8 Cumulative Effects, 4th para., line 3, pg 219 –** “It should be noted...mitigate them”. This statement is not appropriate in the context of this EA.

**§5.8 Mitigations and Follow-up, pg 219 –** As per Appendix 2 of the Geophysical, Geological, Environmental and Geotechnical Program Guidelines” (C-NLOPB 2008), “Where more than one survey operation is active in a region, the operator(s) should arrange for a :Single Point of Contact: for marine users that may be used to facilitate communication”. This should be included in Table 5.19.

**§5.10 Residual Effects of the Project, Page 222**

Table 5.20 indicates a high level of confidence for the effect of the airgun array. A medium level of confidence seems more warranted based on the limited data available. Other surveys have maintained small airgun pulses during line changes. Will this be done in the present study or will this involve ramp-ups? Is this considered necessary?