

Northern Jeanne d'Arc Basin Seismic Program Environmental Assessment Addendum



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Prepared by



Prepared for



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Calgary, AB
T2P 3G7

18 July 2005

Project No. SA836

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Introduction

This document is an addendum to the Northern Jeanne d'Arc Basin Seismic Program Environmental Assessment that was submitted on 14 March 2005 (LGL 2005). It includes an update to the Project Description to account for the proposed use of the *Western Geco Neptune* in place of the originally proposed *GSI Admiral*. The addendum also contains Husky's responses to regulator comments that were provided on the original submission.

Revised Project Description

The EA is based on a range of potential 3D gear but listed the *GSI Admiral* as the seismic vessel in 2005. Husky is now proposing to use the *WesternGeco Neptune* for the 2005 survey (Husky Wildrose). This vessel and associated equipment have been approved for use in Canadian waters and have undergone a recent 2005 EA for a larger 3D program in the Laurentian Sub-basin. One of the primary differences between the vessels is that the *Neptune* will tow more streamers (ten vs. three). Because it covers a wider swath, the *Neptune* would be on site for a shorter duration than the *Admiral* (about 30 days vs. 83 to 95 days). The steamer length will be the same. The time window for the revised program falls within the original one (1 June to 31 October) and is anticipated to be conducted between 1 September and 31 October depending upon when the vessel comes on charter and on weather conditions.

The revised project description does not change the effects assessment, including the supporting tables.

Seismic Energy Source Parameters

The acoustic source proposed for use in the seismic operations is an airgun array (5,085 in³) composed of three 1,695 in³ sub-arrays with the guns firing alternately. Each 1,695 in³ sub-array is comprised of eight Bolt airguns with volumes ranging from 105 to 290 in³. The estimated source level of the array is 106.4 bar-m peak to peak (~254.5 dB re 1 µPa (0-p) or ~242.5 dB re 1 µPa (rms)). [This compares to an estimated peak to peak source level for the *GSI Admiral* of 251.5 dB re 1 µPa @ 1-m.] The centre of the array is deployed about 250 m behind the vessel and at approximately 7 m below the water surface. The total dimensions of the array are 15 m by 16 m and the sub-arrays are spaced 8 m apart. Each of the sub-arrays is composed, in order, of two 290 in³ guns, two 195 in³ guns, one 280 in³ gun, one 195 in³ gun, one 145 in³ gun and one 105 in³ gun that operate at an air pressure of 2,000 psi. The airguns in the array are strategically arranged to direct most of the energy vertically rather than sideways. Husky will require that the seismic operator ramp up its airgun array (over a 30-minute period) after prolonged periods of shutdown.

Acquisition Vessel, Data Recording Equipment, and Survey Design

The seismic vessel will be the *Western Neptune* (92.5 m LOA) operated by Western Geco. It is anticipated that the vessel will acquire data along 44 sail lines. The seismic lines are oriented in an east-west configuration. Adjacent sail lines will be approximately 500 m apart.

The revised UTM coordinates (WGS1984 datum) are:

717050.2, 5255177.5

717779.6, 5233189.6

683798.3, 5232062.3

683068.9, 5254050.2

These coordinates are only slightly different than the original 2005 survey plan and within the original Project Area as defined in the EA (Figure 1a).

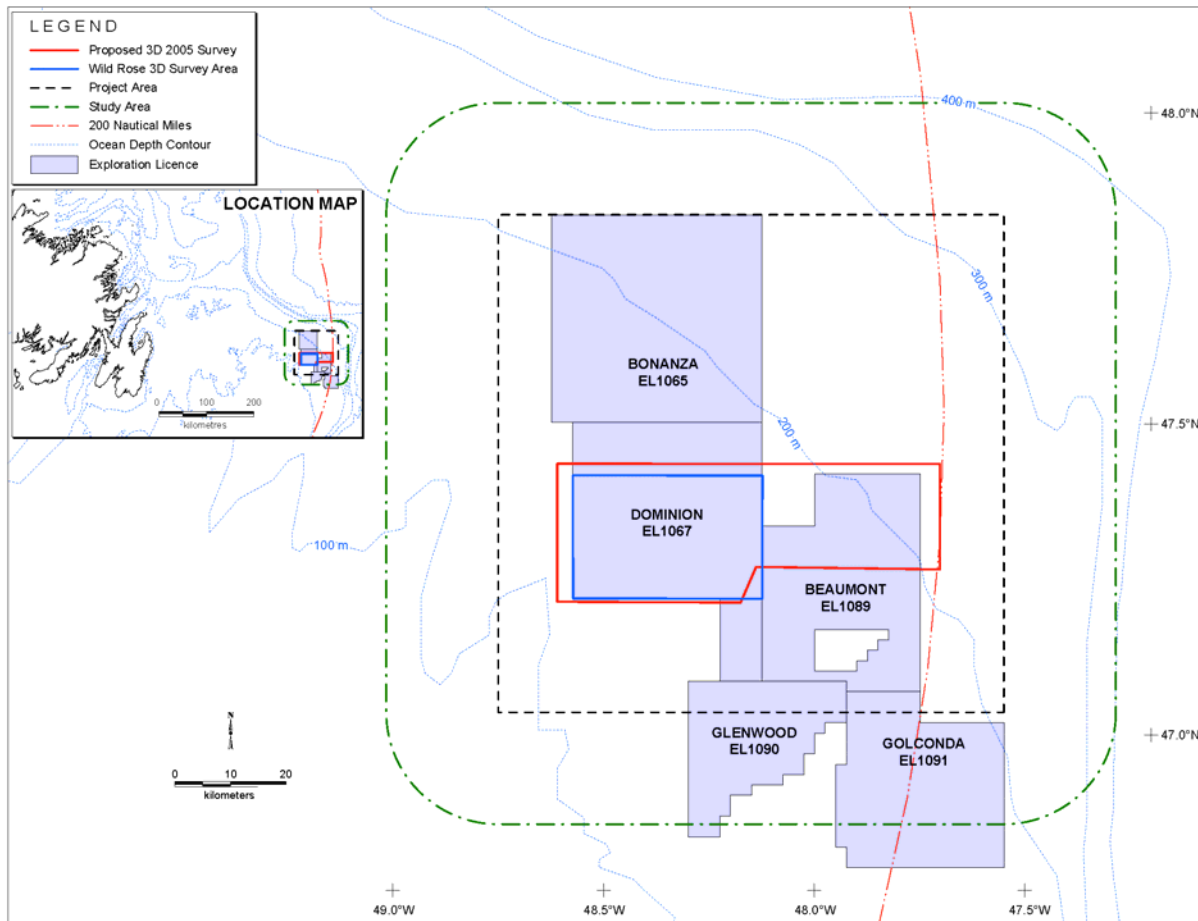


Figure 1a. The Wildrose 2005 3D Survey Area.

The survey vessel is a modern ship built in Norway in 1999 with maximum speed of 14.5 knots and cruising speed of 12 knots. It is equipped with a helicopter deck capable of handling an offshore-rated helicopter. The power systems are diesel-electric (two main Bergen diesel engines) plus auxiliaries and generators, and bow thrusters. Fuel endurance is about 86 days burning 26 m³ of fuel (marine gas-oil) per day at economy speed. The vessel has incinerators, bilge/oily water separators, oily water/sludge holding tanks, sewage treatment plants, and oil spill absorbent/damage control equipment.

The vessel operates echo sounders (e.g., Skipper GDS 101, Kongsberg-Simrad EA-500) that typically operate at 18 kHz and 200 kHz. The ship will deploy a workboat to repair streamers when necessary. The vessel has maximum capacity of 68 individuals according to certifications.

The vessel will tow ten 6,000-m streamers and the streamers will be Western Geco Q-Marine streamers. This type of streamer controls its buoyancy with a fluid called Isopar-M (130 litres per 100-m section). Isopar-M predominantly consists of isoparaffinic hydrocarbons (C12-C15). The streamers will be separated by 100 m and deployed at a depth of 7 m.

Logistical Support

The seismic ship will be supported by a suitably certified Newfoundland/Labrador-based fishing vessel or guard vessel with responsibilities for communications with other vessels (primarily fishing vessels) that may be operating in the area. Heavy re-supply will be conducted by offshore supply vessel. Helicopters will be used to ferry personnel and lightweight supplies to the seismic vessels. Helicopter logistic support will be based in St. John's.

Effects Assessment

The change in seismic vessel does not change the outcome of the effects predictions, namely that the proposed 3D program will have no significant effect on the VECs of the northern Grand Banks given the same mitigation program as described in the EA. The primary components of the mitigation are ramp-ups, shut-downs, utilization of a fisheries liaison officer (FLO), an escort vessel, and a marine mammal observer (MMO), communications with the fishing industry (e.g., Fisheries Broadcast, single point of contact or SPOC, etc.), and compensation if required.

Regulator Comments

The following comments were provided to the Canada-Newfoundland and Labrador Offshore Petroleum Board (C-NLOPB) by Fisheries and Oceans Canada, 9 June 2005. Regulator comments are in italics followed by Husky's responses in normal font.

1. Project Description

- *The Project Description refers to mitigative measures such as utilizing FLOs and environmental observers however details are not provided (i.e., EO training, ramp up or shut down procedures, etc.). Given the importance of mitigative measures related to seismic activity, the reader should be directed to a specific section of the document where the mitigative measures are prescribed and summarized.*

The reader is referred to *Section 6.7 Summary of Mitigations*, pages 202 to 204. Additional discussion of mitigations is contained in the various VEC sub-sections in *Section 6.0 Effects Assessment*.

2. Biological Environment

- *Section 5.1, Page 60: The statement, “The 3-D seismic and geohazard surveys (the Project) have no potential to cause effects at the ecosystem level and thus the discussion in the following sections is limited to only those key parts of the ecosystem that could be affected, albeit in very minor way”, is inappropriate prior to describing the ecosystem and its components or assessing potential effects.*

Duly noted by Husky. The statement was made with the intent of focusing the EA on those components/issues most likely to be affected by the Project which is central to the VEC approach to effects assessment.

- *Section 5.2, Page 60: The statement, “the proposed Project has minimal potential to affect phytoplankton and/or zooplankton to any meaningful degree. For this reason, they will not be discussed further”, should be qualified/explained.*

There is no literature to suggest that seismic programs have a significant effect on plankton populations. Published, peer-reviewed data are not extensive but no one has reported damage to these organisms further than a few metres distance. Preliminary results of recent short term (24 – 48 h) laboratory experiments by DFO using an airgun at one metre distance on potentially sensitive species such as ctenophores (comb jellies), Atlantic cod larvae and snow crab larvae showed no statistically significant damage or mortality (J. Payne, DFO, 7 July 2005, pers. comm.).

3. Species At Risk

- *Section 5.4.3, Page 63: Profiling only those species endangered or threatened on Schedule 1 due to immediate legal implications under SARA is not the preferred approach. There is also a legal requirement to list and describe schedule 1 species of special concern. Timelines for*

SARA going through the listing process should be provided if expected during the lifetime of the project. It is also best practice to list and consider COSEWIC species.

Please refer to Table 1 below for clarification.

Table 1. Species Likely to Occur in the Study Area which are Designated Endangered, Threatened or Special Concern under SARA Schedule 1 or COSEWIC.

Species	SARA Schedule 1			COSEWIC		
	E ¹	T ²	SC ³	E	T	SC
Blue whale (Atlantic population) <i>(Balaenoptera musculus)</i>	X			X		
North Atlantic right whale <i>(Eubalaena glacialis)</i>	X			X		
Leatherback Turtle <i>(Dermochelys coriacea)</i>	X			X		
Northern wolffish <i>(Anarhichas denticulatus)</i>		X			X	
Spotted wolffish <i>(Anarhichas minor)</i>		X			X	
Atlantic wolffish <i>(Anarhichas lupus)</i>			X			X
Ivory Gull <i>(Pagophila eburnea)</i>			X			X
Atlantic cod (NL population) <i>(Gadus morhua)</i>				X		
Porbeagle shark <i>(Lamna nasus)</i>				X		
Cusk <i>(Brosme brosme)</i>					X	
Harbour Porpoise <i>(Phocoena phocoena)</i>						X
Sowerby's beaked whale <i>(Mesoplodon bidens)</i>						X
Fin whale <i>Balaenoptera physalus)</i>						X

Source: SARA website (July 2005) www.sararegistry.gc.ca
COSEWIC website (July 2005) www.cosepac.gc.ca

¹ Endangered

² Threatened

³ Special Concern

- *The EA should include a summary statement which explicitly states whether project effects are expected to contravene the SARA prohibitions (S32, S33 and S58).*

It is not Husky's intent to contravene SARA prohibitions (S32, S33 and S58). Husky's mitigation and monitoring procedures should eliminate the possibility.

- *Figures from Kulka and Simpson 2002 (DFO CSAS Res Doc 02/78) indicating the distribution of young of the year striped wolffish are most relevant to the seismic work and should be included. The following reference should also be considered; Kulka and Simpson. 2005. CSAS Res Doc 2004/113. Changes in Distribution and Habitat Associations of Wolffish (Anarhichidae) in the Grand Banks and Labrador Shelf.*

Very few young-of-the-year (YOY) striped wolffish were collected in the Study Area during IYGPT trawl surveys in August and September, 1996-1999. During DFO fall surveys in 2001, there were substantially more Atlantic (striped) wolffish <55 cm length than spotted wolffish <55 cm length caught in the vicinity of the Study Area. (Simpson and Kulka 2002).

According to Kulka et al. (2004), Atlantic (striped) wolffish presently have a larger distribution in waters off Newfoundland and Labrador than either northern or spotted wolffish. Northern wolffish presently have the smallest distribution. While the distributions of northern and spotted wolffish have reduced since the late 1970s and early 1980s, the distribution of Atlantic (striped) wolffish has remained much the same. However, the abundances of all species have shown substantial decreases since 1978-1984 period. All three species continue to occur in the vicinity of the Study Area.

4. Fish/Fisheries

- *Page 79 and Page 80: The document indicates that 2005 fisheries are expected to be similar to the previous year, however, the timing of the Snow crab fishery has been altered this year due to political reasons. This change and the most recent Snow crab stock status report (DFO SAR 2005/017) should be incorporated into the EA.*

[At the time of writing, the snow crab situation had not developed to the point of threatening to affect the conduct of the fisheries, and the 2005 snow crab stock status report DFO SAR 2005/017 had not yet been released.]

After the submission of the EA report, a dispute developed in the Newfoundland and Labrador snow crab fishery which delayed the start of most activities until mid-May this year. This delay had the potential to alter the timing of the fisheries compared to other years. However, as of early July 2005, fishers pursuing quota in 3L report that fishers expect DFO will close the fishery about 31 July this year, whereas last year it remained open until late August. One fisher reported that the harvest might be completed earlier than the end of July as the quota is close to being taken. This would have the effect of decreasing the likelihood of temporal overlap with Project activities this year.

Another issue that might close the fishery early in some areas is that soft shell crab are being encountered. One vessel contacted reported finding it in the area >200 miles (3L200) and has

moved back to the 170-200 zone (3Lex) as a consequence (C. Roberts, G. Winslow, P. Noseworthy, July 2005, pers. comm.).

The DFO quota reports for snow crab (as of 9 July 2005) also indicate that the great majority of the quota for the snow crab fishing areas that overlap the Project Area (3LeX from 170 miles to 200 miles, and 3L200 beyond 200 miles) has been caught. This is shown in the following table (Table 2).

Table 2. 3LeX and 3L200 Snow Crab Harvests to 9 July 2005.

Licence Category	Quota Area	Quota (Tonnes)	Catch to Date	% Taken	Tonnes Remaining
F-Full-Time	Outside 170 and Inside 200NM (3LeX)	1,110	1,025	92.3%	85
	Outside 200NM (3L200)	950	542	57.1%	408
SL-Supplementary Large	Outside 170 and Inside 200NM (3LeX)	1,585	1,146	72.3%	439
	Outside 200 NM (3L200)	1,990	1,336	67.1%	654
Total		5,635	4,049	71.9%	1,586

Source: http://www.nfl.dfo-mpo.gc.ca/publications/reports_rapports%5CCrab_2005.htm

Overall in 3L (all areas and licence categories), 81% of the quota had been taken by 9 July.

Regarding the 2004 snow crab fishery in 3L, DFO's most recent stock assessment report (DFO SAR 2005/017) notes that "Landings increased by 16% from 22,600 t in 2000 to 26,200 t in 2003, and decreased to 25,800 t in 2004 due to changes in TAC. Meanwhile effort has increased by 75% since 2000."

The following relevant text on 3L is paraphrased from the DFO report:

3L Biomass

The exploitable biomass index (Fig. 15), as determined from fall multi-species surveys, declined from 1996-2000 and remained relatively low until it further decreased in 2004. Offshore CPUE (Fig. 14) remained at a high level despite a decrease of 24% between 2002 and 2004, in agreement with observer data. Disagreement between the exploitable biomass index and CPUE throughout most of the time series introduces uncertainty regarding trends in biomass.

Recruitment Prospects

The fall survey pre-recruit index has been low since 1997 while the observer discard prerecruit index has declined since 1997 (Fig. 16). Recruitment is expected to remain relatively low in the short term.

Longer-term recruitment prospects are unknown.

Mortality

The exploitation rate index increased from 1996-2000 and remained high thereafter (Fig. 17). The percentage of the total catch discarded in the fishery (Fig. 17) increased from 1995- 1997, decreased sharply in 1998, then declined gradually until 2004, implying decreased handling mortality on pre-recruits.

- *Section 5.4.3.2: Rather than Scott and Scott (1988) there are references available regarding Atlantic cod predator and prey relationships specific to the Newfoundland and Labrador area (i.e., Bundy, A. G.R. Lilly, and P.A. Shelton. 2000. A mass model of the Newfoundland – Labrador Shelf. Can Tech. Rep. Fish. Aquatic. Sci. 2310; xiv + 157 p.).*

So noted.

- *Page 23: With respect to the time and location of cod early life stages in the study area, the following excerpt (taken from an overview to be published) with respect to historic (pre-collapse) information regarding timing of spawning could be considered.*

Spawning time of fish in the offshore was more recently determined from analysis of the spawning stage of cod that were visually examined during research trawl surveys (Myers et al. 1993b). The day of the year on which 50% of mature females were in a spent state was..... Julian day 160 ± 37 (June 9) for cod in 3L (< 201 m). Hutchings and Myers (1994b) used a similar approach to examine inter-annual variability and found that spawning in 3L occurred on day 157 ± 18 (i.e. June 6).

This yet-to-be-published work was not available at the time of writing the EA. Based on the statement above, it does not change the final results of the EA especially since the 2005 seismic survey will be conducted in the fall. The work will be considered by Husky in the future if it is available.

- *Page 23: There is little recent information on cod larvae and pelagic juveniles, but these later stages are likely to be in the project area until late summer. A series of papers (both peer-reviewed and DFO research documents) by Anderson and Dalley provide pertinent information for the 1990s in this respect.*

Husky has reviewed these documents in past EAs and concurs that there is a wide range in the timing of fish larvae in the water column.

During 1994-1995 marine pelagic ecosystem surveys (Anderson and Dalley 1997), relatively few cod eggs and larvae were collected in the vicinity of the Study Area. Capelin larvae dominated the ichthyoplankton samples during these two years. Similarly in 1998, relatively few cod ichthyoplankton were collected in the vicinity of the Study Area (Dalley et al. 1999).

Anderson et al. (1999) presented nekton regimes in the Northwest Atlantic Pelagic Ecosystem. The Study Area lies within the ‘Temperate Regime’. Between 1994 and 1998, pelagic juvenile cod (nekton) were collected in the eastern NAFO Division 3L part of the temperate regime in 1995 only. No cod nekton were reported in this area during the other four years of surveying (Anderson and Dalley 1997; Dalley and Anderson 1997; Anderson et al. 1999; Dalley et al. 1999).

- *Page 127: The document states, “Considering the peak pressure and rise/decay time characteristics of seismic airgun arrays used today, the pathological zone for fish and invertebrates would be expected to be small, i.e., within a few meters of the seismic source.” However, recent research has shown that seismic energy may spread much further than theoretically anticipated (McCauley et al. 2000), suggesting that egg or other sensitive life stage effects may occur at a radius much further than currently accepted. It is also generally accepted that there is a knowledge gap with respect to distance/seismic energy effects relationship (DFO HSR 2004/002). The document (page 128-129) also emphasizes the Matishov (1992) study which considers seismic energy mortality rates on fish eggs and larvae to be insignificant compared to natural mortality. The DFO Habitat Status Report (2004/002) qualifies a similar perspective with, “...magnitude of mortality... below that expected to affect populations. However, special life history characteristics such as extreme patchiness in distribution and timing of key life history events in relation to the duration and coverage of seismic surveys may require case by case assessment.”*

Based upon the above, the potential impacts of seismic energy on fish and invertebrate sensitive life stages in the water column should be addressed on a case by case basis. The discussion in section 6.5.3 should be revisited in consideration of this.

Additional applicable reference material include; CSAS HSR 2004/002 and 2004/003; CSAS Res Doc 2004/125; and, McCauley et al. (2000) In: Impacts of marine acoustic technology on the Antarctic environment. July 2002. SCAR Ad Hoc Group on marine acoustic technology and the environment.

The statement “recent research that has shown that seismic energy may spread much further than theoretically anticipated (McCauley et al. 2000)” is unclear. In the information paper “Marine Acoustic Technology and the Antarctic Environment”, a statement attributed to Hirst and Rodhouse (2000) refers to “the more diffuse behavioral impacts occurring at much greater

distances.” While not extensive, most of the evidence to date does indeed suggest that permanent impact (i.e., lethal and sublethal) on eggs and larvae primarily occurs within a few metres of the seismic source. There is no literature to suggest that seismic programs have a significant effect on plankton populations. Published, peer-reviewed data are not extensive but no one has reported damage to these organisms further than a few metres distance. Preliminary results of recent short term (24 – 48 h) laboratory experiments by DFO using an airgun at one metre distance on potentially sensitive species such as ctenophores (comb jellies), Atlantic cod larvae and snow crab larvae showed no statistically significant damage or mortality (J. Payne, DFO, 7 July 2005, pers. comm.).

The EA document did not intend to emphasize the Matishov (1992) study. It only presented this study as another information source.

When the DFO Habitat Status Report 2004/002 spoke of ‘case by case assessment’, it was referring to different geophysical programs. One might interpret the comment to mean that each life stage of each species must be considered on a case-by-case basis. This is not possible given the lack of scientific information and probably not advisable given the need to focus EAs on key substantive issues (i.e., the VEC approach). The EA attempted to overcome these constraints by focusing on sensitive life stages of key representative species where sufficient data exists.

Husky is aware of CSAS HSR 2004/002, CSAS HSR 2004/003 and CSAS Res Doc 2004/125. Not all of these reports were available at the time this EA was produced. McCauley et al. (2000) can be evaluated in future efforts by Husky if the reference can be provided by DFO.

- *Section 6.5.4, Page 130 (Physiological Effects): While the document lists some items from DFO HSR 2004/003, it does not address the more negative summary items including bruised hepatopancreas and ovaries. This should also be included in the discussion.*

The more negative summary items including bruised hepatopancreas and ovaries were merely isolated observations on individual animals with no scientifically defensible link to seismic survey sound. Many DFO scientists at the review meeting upon which this document is based were in agreement that these were only qualitative observations that might deserve further investigation. Inclusion of such ‘observations’ in the EA could be misleading.

- *Page 133: The meaning of, drastic decrease in catch rates, in the discussion of the Christian et. al. (2004) study should be clarified/quantified.*

Please remove the word ‘drastic’ so that the sentence now reads: “No decrease in catch rate was observed after seismic shooting commenced.”

- *Section 6.5.5: Potential behavioral effects of seismic in relation to spawning aggregations should be discussed.*

Potential behavioural effects due to seismic such as startle and avoidance responses were discussed in the EA. No specific information is available about the behavioural effects of seismic in relation to spawning aggregations. However, one could assume that if some species of fish appear to move away from a seismic source and in some cases scatter, they may also do so during spawning aggregations. On the other hand, some species in spawning mode may ignore seismic sound if they are focused on spawning.

- *Section 6.5.6: This section could be improved with respect to life stages of cod. Table 6.1 under “Reproduction”, considers two groupings of life stages: “eggs/larvae“ and “juveniles”. In footnote “a”, a juvenile is defined as young fish that has left the plankton. This is inaccurate as Atlantic cod juveniles remain pelagic for some time before settling to the bottom. Therefore, the pelagic stages include eggs, larvae and pelagic juveniles, this should be reflected in the assessment.*

So noted.

- *Section 6.5.6.1, Page 136-137: While it is recognized that potential effects on eggs and larvae may not be significant in terms of population level effects, spawning peaks and patchiness in distribution needs to be considered on a case by case basis. Therefore the expected timing of peak spawning/eggs and larvae and expected distribution should be provided in this discussion (for all important species including Snow Crab pelagic larvae). This is particularly important with respect to SAR and the required discussion regarding potential adverse effects. Further, it is unclear how pathological and physiological effects can be considered short-term or reversible in nature.*

Please refer to the following Table 3 for some reported spawning times.

Table 3. Spawning Specifics of Important Invertebrate and Fish Species Known/Suspected of Spawning Within or Near the Study Area.

Species	Occurrence of Planktonic Eggs/Larvae	Timing of Eggs/Larvae in Plankton	Depth Distribution of Eggs/Larvae
Snow Crab	Eggs: No Larvae: Yes	Larval hatch generally occurs in late spring/summer. Larvae remain planktonic for 3 to 4 months.	Larvae occur in upper water column.
Atlantic Cod	Eggs: Yes Larvae: Yes	Spawning primarily between April and June.	Fertilized eggs and larvae may occur anywhere within the upper 100 m of the water column, eggs generally most concentrated in the upper 10 m.
Wolffishes	Eggs: No Larvae: Yes	Spawning from early fall to early winter.	N/A
American plaice	Eggs: Yes Larvae: Yes	Spawning between April and June.	Fertilized eggs and larvae both occur in the surface waters.
Northern Shrimp	Eggs: Yes (attached to female) Larvae: Yes	Spawning typically occurs in late June/early July. Eggs remain attached to females from late summer/fall until larval hatch the following spring/summer. Larvae remain planktonic in upper water column for a few months.	Egg depth distribution depends on location of females in the water column. Larvae are in upper water column.
Witch Flounder	Eggs: Yes Larvae: Yes	Spawning between April and August at depths of 60 to 160 m.	Fertilized eggs and larvae are concentrated in the upper 10 to 55 m of the water column.

Sublethal effects such as temporary hair cell damage (pathological) or elevated blood enzyme levels (physiological) are temporary and reversible. Obviously, lethal effects are not reversible on the individual level but could be considered to be reversible at the population level.

- *Although the VEC interaction tables include other projects and activities the effects assessment tables do not. Cumulative effects, both within and between projects, should be included in the VEC assessment tables.*

Cumulative effects are integrated within the assessment and thus it would not be appropriate or practical to include them in the specific assessment tables for the proposed project.

- *Section 6.5.8, Page 141: The statement, “Snow crab, being sedentary benthic species, are not likely to disperse and catch rates are not expected to be effected” is contradictory to the Newfoundland anecdotal information provided on page 133 which suggest that snow crab catch rates may be effected by seismic activity. Further, Snow crab is not a sedentary species.*

Please remove ‘sedentary’ and replace it with ‘relatively slow-moving’. The anecdotal information did imply that catch rates went down. However, quantitative studies have not supported the anecdotal observation. If catch rate is affected, is it because the animals ‘run away’ or is it because they cease movement?

- *Table 6.4, Page 142: The geographic extent of seismic noise may more likely be 3-4 rather than 2-3.*

It is possible that the extent should be 3-4 rather than 2-3, though the upper range of “4” (1,000 km²) would imply a catch success effect at 18 km (radius) from the source, which is not likely. In any case, this does not affect the assessment findings, particularly with mitigations applied.

[Or else just change the geographic extent in the Table to 3-4.]

- *Section 6.5.10, Page 145 and Page 85: DFO science surveys for 3L in 2005 are scheduled for May-June and Oct.-Dec. DFO is pleased that the proponent is committed to establishing temporal and spatial separation plans with the Department in advance of seismic activity.*

No response required.

- *The likely spawning activity in the vicinity of the Project Area was identified for a number of species (Section 5.4.4, Page 67), however, it is stated (page 136), “In the case of eggs and larvae, it is unlikely that the numbers negatively effected by such exposure would not be that different from those succumbing to natural mortality”, therefore one can assume that spawning/eggs/larvae peaks and potential patchiness in eggs/larvae distribution are not addressed. Text should complement the VEC assessment tables specifically addressing each species sensitive life stage particularly those at risk (including wolfish).*

Agreed the wording is awkward, please change to: “It is unlikely that the numbers of eggs and larvae negatively affected by such exposure to seismic would differ from the numbers succumbing to natural mortality.”

Predictions in regard to patchiness cannot be made directly because patchiness by its very nature is unpredictable. Nonetheless, one can logically conclude that patchiness “works both ways” in that high concentrations are adjacent to low or zero concentrations and that the seismic survey will be transiting in and out of patches. When conducting an assessment one can only conclude that organisms are more or less evenly distributed within defined depth strata.

It is Husky’s contention that the text is detailed enough to support the effects predictions on fish eggs and larvae, including wolffish.

5. Marine Mammals

- *Page 108. The Blue Whale is considered endangered by COSWICH (sic) and is listed as endangered under schedule one of SAR.*

Agreed and this is recognized in Husky’s mitigation program.

- *Page 178-179: Although it is acknowledged that rapid rise times may elicit PTS, the proposed geophysical program and the potential impact on marine mammals and sea turtles have not been specifically discussed.*

There is an extensive discussion of TTS and PTS and marine mammals and sea turtles under *Sub-section 6.5.12.1.5 (E) Hearing Impairment and Physical Effects*, pages 174 to 180.

- *Page 103: Sei whales are not considered “late summer visitors”, given the numerous recent sightings in the offshore areas in the last year. Similarly, northern bottlenose would be better listed as a “year-round resident”.*

The literature (e.g., Waring et al. 2004, Horwood 2002 and Perry et al. 1999) suggests that sei whales are most common feeding on the Grand Banks in late summer-early fall. However, in light of the recent sightings mentioned above by DFO, sei whale distributions may not be that well-defined.

Husky agrees that the northern bottlenose occurs “year-round” although it is likely unclear as to what population they belong.

- *Page 108: The blue whale discussion is inaccurate in assuming that this species “has always likely been rare in Canadian waters”. Many individuals were taken in the last century by whalers. Current numbers are likely low but any estimates are speculative given their wide distribution and negative reaction to human approach.*

As referenced in the EA, this statement originated from a DFO scientist. Nonetheless, Husky concurs that it may be a shaky assumption that this species has “likely always been rare in

Canadian waters" given the fact that only a few hundred remain and the uncertainty in whale catch numbers.

- *Page 112: Harbour porpoises are not likely limited to shallow waters as they have been sighted in waters exceeding 3000 m.*

Harbour porpoises are generally thought to prefer shallow waters but they have been sighted in deep water, for example, between Iceland and Greenland and between Iceland and the Faroe Islands (IWC. 1996. Annex H: report of the sub-committee on small cetaceans. Rep. Int. Whal. Comm. 46:160-179).

- *Page 115-116: The DFO sightings database includes records for leatherback turtles near the coastline. Sightings were also made offshore Newfoundland, although none in the project area proposed. This information should be included.*

Husky notes that there are no DFO sightings of leatherbacks in the Project Area although they likely occur there from time to time. It will be appreciated if DFO provides the database to Husky's consultants. Satellite tagging of leatherbacks has shown some migration through the southern Grand Banks but none in the Project Area (James et al. 2005) (see EA Section 5.7.2.1, p. 115). Note that Husky will be monitoring marine mammals and sea turtles in the Project Area as part of the mitigation program.

- *Page 150: Despite their "relatively lower source levels", the geohazards sound sources remain a concern for a variety of species especially toothed whales which have hearing sensitivities in higher frequencies.*

Husky acknowledges that if there are toothed whales in the vicinity at the time of the geohazard survey that they may hear the high frequency sonar. Geohazard survey sources typically operate within a narrow beam and have relatively low source levels. Also, it should be noted that the geohazard survey sound sources will only be operating for a few days at most and that they are significantly less powerful than some of the military sonars that have caused concern in regard to toothed whales.

- *Page 154: It may be possible that marine mammal calls can be received in the gaps between airgun pulses when individuals are relatively close to the array. However, at distances beyond a few kilometers there may be multipath-induced "smearing" such that the signal gap is smaller and the seismic pulse longer. Anecdotal evidence (from Chris Clark at Cornell University) suggests that at great distances the sounds of single or multiple seismic operations can completely mask the calls of blue and fin whales. Therefore the conclusion that masking effects are unlikely due to the intermittent nature of the seismic pulses may be inaccurate.*

The Husky program will occur, for the most part, on the continental shelf. In continental-shelf waters, the "smearing" effect is likely not as severe as suggested in the DFO comment. Extreme multipath effects may only occur under specialized propagation conditions and when seismic pulses are received at very long distances (100s of km) in deep water (i.e., off the shelf). In continental shelf waters, it is unlikely that seismic pulses would be so spread out in time as to mask a high proportion of the inter-pulse interval. There have been Beaufort Sea cases where the seismic boat has been as much as 50-100 km away, and even then the pulses were still well separated, leaving "quiet" times in which whales could be heard. The gaps between pulses are shorter and irregular when pulses are being received from two or more vessels shooting simultaneously. In that situation (e.g., continental shelf of the Beaufort Sea), the pulses were still discrete with "quiet" gaps between them (J. Richardson, LGL, pers. comm.).

It also should be noted that blue whales and fin whales are probably not common in deep water off the shelf in the NW Atlantic. It is believed that they feed primarily in the shallower water of the shelf and shelf break although they may also occur in deeper water (S. Dufault, LGL, pers. comm.). The biological significance of any masking of long range calls, if it occurs, is unknown.

- *Page 159: The summary tables are an effective way to describe the literature on a variety of species emphasizing the within- and between -species variability in seismic exposure response.*

So noted.

- *Page 192: Marine mammal mitigations are based upon 180 dB re μ l Pa (cetaceans) and 190 dB re μ l Pa (pinnipeds received) sound levels to avoid injurious effects, auditory or otherwise. The current safety zone recommended by the C-NLOPB is 500 m, however, there has been no regional acoustic measures to verify the received sound levels at this distance. DFO acousticians found seismic sounds at levels higher than model predictions (~100 km from the array) in Sable Gully based on sound transmission characteristics (2003 Sable Gully project). The complexity of the acoustic environment in the Project Area is essentially unknown. Detailed acoustical modelling should be provided for the proposed array, in the Project Area. Model predictions should be verified with field measurements collected during seismic operations.*

The Gully, a Marine Protected Area, is a special case from a sensitivity and physical environment perspective. It is beyond Husky's purview to address these issues which are broader than Husky's program but it is understood that these fall within the mandate of the Environmental Studies Research Fund (ESRF) and may be pursued under their auspices.

6. Effects Assessment

- *Page 121 (Boundaries): Although the Regional Area (entire Grand Banks and Flemish cap) is consistently used in offshore EAs it is inappropriately large for the current EA. The temporal boundary, “possible 1 April to 31 October in subsequent years” is likely inappropriate as the activities for subsequent years have not been identified and are likely of limited duration (i.e., 3-D seismic survey or limited duration (7 days) wellsite survey).*

Husky agrees that there will be an update to cover future programs.

- *Page 123: Under the definitions of “Magnitude”, the definition of “negligible” and “low” overlap (i.e., a 5% decline in abundance in the immediate vicinity of the array, could be both “negligible” and “low”).*

Understood. This is a function of the imprecision of a prediction at that interface.

7. Knowledge Gaps/Research

- *While readily-observed effects of seismic operations, such as avoidance and displacement, are likely to be localized, sounds from these activities might be detected by marine organisms over much farther distances. How these less-intense sound exposures change the distribution, behavior, and local distribution of marine organisms is largely unknown*

See response below.

- *A class screening document for offshore oil and gas exploratory and production activities on the shelf regions of Newfoundland and Labrador could facilitate project EA.*

See response below.

- *Directed studies of seismic sound propagation and received sound levels should be conducted in the waters of this Region. Studies could include regional acoustic model predictions and subsequent field verification. The results of such work would facilitate the determination of appropriate “safety zones” (i.e., ramp-up/shut-down).*

See response below.

- *Identification of key ecological areas (i.e., feeding areas/prey aggregations, migration routes, etc.) would facilitate evaluation of potential anthropogenic impacts as well as focus further research efforts.*

See response below.

- *Significant knowledge gaps exist with respect to marine mammal distribution and behavior in Newfoundland and Labrador waters. Therefore collection and dissemination of marine mammal observation data (with and without seismic) in a standardized format (preferably digital) in a timely manner would help address this knowledge gap.*

See response below.

- *Further research is needed to qualify the distance - effects relationship of seismic testing on sensitive life stages of fish and invertebrates.*

Knowledge gaps and research recommendations are the mandate of the C-NLOPB, other regulatory agencies such as DFO and EC, and the ESRF and cannot be specifically addressed by Husky at this time.

8. Cumulative Effects

- *Page 201: Rationale for the conclusion that cumulative effects will be “additive”, rather than synergistic or multiplicative should be provided.*

Any cumulative effects, if they occur, are expected to be additive because sound generated by the various projects are not expected to overlap in time or space, at least not at levels known to cause effects on marine biota. [If sounds did overlap they could potentially cause combined effects that could be greater than from the simple addition of effects from two separate events.]

For example, Husky’s proposed 3D program will occur no earlier than September 2005. By that time, White Rose and Terra Nova (and probably Hibernia) geohazard surveys and Lewis Hill exploratory drilling will be complete. Thus, the remaining sound sources will be the ongoing drilling and production activities at Hibernia, Terra Nova and White Rose (i.e., no strong sound sources such as seismic) and possibly the Hibernia geohazard survey (a survey of several days’ duration that may be complete prior to the Husky program). Seismic surveys that may still be ongoing at the time of Husky’s survey include Orphan Basin (Chevron Resources Canada) and Labrador Shelf (GSI). The Laurentian Sub-basin survey will be, by necessity, completed as Husky will use the same vessel. Thus, there will be three seismic programs that overlap in timing. The Orphan Basin and Jeanne d’Arc programs will, by necessity, have to maintain enough separation to avoid affecting each other’s data quality. It has been anticipated that WesternGeco seismic vessels will maintain a separation of at least 40 km in order to prevent interference with data quality. The GSI Labrador Shelf program is at least several hundred kilometres distant and should not be a factor in any geographic overlap of effects. Thus, it has been predicted that some marine mammals may hear more than one program, and if an animal was migrating, say down the Labrador coast to more southern waters, it potentially could be exposed several times (in separate instances) to some level of sound strong enough to cause a

behavioural effect. [Any effects will be limited to behavioural ones because of the ramp-up and shut-down provisions.] Any such effects are predicted to be temporary but could be considered additive in energy expenditure, for example. Nonetheless, any effects if they occur, will be limited to non-significant behavioural ones, within the normal repertoire of their day-to-day behaviour, such as altering course to escape predators.

- *Page 201: The offshore oil and gas activities for 2005 should be updated to include the multitude of geohazard surveys proposed for the Jeanne d'Arc Basin as well as both 2-D seismic programs (GSI and TGs-NOPEC) on the Labrador Shelf.*

See preceding response. Note that TGS-NOPEC will not be operating off Labrador in September (K. Coady, C-NLOPB, pers. comm.).

- *Page 202: While readily-observed effects of seismic operations, such as avoidance and displacement, are likely to be localized, sounds from these activities might be detected by marine organisms over much further distances. This is highlighted by the results of the Scotian Shelf study which found seismic sound propagation distances to be greater than anticipated. There will likely be overlap of the sounds from multiple operations, even those at relatively great distances from each other (i.e., smearing, extended sound footprint, etc.), and therefore, the potential cumulative effects of seismic sound (within and between projects) should be reconsidered.*

See previous responses.

9. Mitigation and Follow-up:

- *Mitigative measures specific to the geophysical programs should be specified as best as possible at this time.*

Agreed. This has been done.

- *In other jurisdictions, seismic operators or monitoring vessels undertake passive acoustic monitoring (PAM) to detect marine mammals (e.g., Encana's seismic project on the Scotian Shelf in 2003). Acoustic monitoring is especially important in poor visibility conditions such as in fog or at night. This is particularly important in areas of special concern (such as where blue whales are feeding, or right whales are present), where SAR could be encountered. DFO considers the use of PAM to be best practice.*

So noted.

- *The contact information for the Single Point of Contact (SPC) and reporting marine pollution incident or accident which might occur as a result of these activities should be provided.*

Such information is typically contained in an EPP type documents and not in an EA. The Single Point of Contact (SPOC) will be Canning & Pitt.

- *As stated in the document, the proponent intends to implement the mitigative measures specified in the CNLOPB Geophysical, Geological, Environmental and Geotechnical Program Guidelines. The CNLOPB or JNCC guidelines do not require operational shut-down if marine mammal is observed within the “safety-zone”. This is based upon the assumption that a marine mammal will avoid an approaching array (function like a ramp-up). A marine mammal cannot be assumed to avoid an array to prevent hearing damage. DFO is very pleased that Husky Energy is committing to shut down at any time an endangered baleen whale (blue whale or North Atlantic right whale) or sea turtle enters the 500 m safety zone. DFO encourages the same action for other potential SAR including the Fin and Sowerby’s beaked whale.*

C-NLOPB policy is to shut down for Schedule 1 marine mammals and sea turtles in the 500 m safety zone

- *The Department requests the mammal monitoring report within 90 days of project completion.*

The present C-NLOPB guideline is one year. Husky will endeavour to complete such reports within sufficient time for incorporation in to subsequent EA updates, if they occur.

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