Fisheries and Oceans Canada | Pêches et Océans Canada

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Your File Votre référence

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BAB 3970-14

Elizabeth Young
Environmental Analyst
Canada-Newfoundland and Labrador Offshore Petroleum Board
140 Water St., 4th Floor
St. John's, NL A1C 6H6

Dear Ms. Young

<u>Subject</u>: DFO Review – Corridor Resources Inc. Environmental Assessment of the Old Harry Prospect Exploration Drilling Program

As requested, DFO has reviewed the document entitled *“Environmental Assessment of the Old Harry Prospect Exploration Drilling Program”* dated December 2011. Based upon the project description, it is understood that, Corridor Resources Inc. proposes to drill a single exploratory well on the Old Harry structure by the end of 2014. The following comments are provided for your review and consideration.

General Comments

The quality of French in the French version of the environmental assessment report is lacking and many sentences are difficult to understand. For example, the French translation is sometimes technically inaccurate, even truncated compared to the English version, making the text incomprehensible. Incomprehensible paragraphs should therefore be reviewed for content or edited by an individual fluent in French and with scientific knowledge.

Overall, the quality of scientific content presented in the environmental assessment (EA) varies across the sections. While the potential environmental impacts of exploratory drilling regarding drilling fluids and cuttings is well-covered and conclusions are in line with many reviews and individual studies dealing with the effects, much of the preceding content relating to Valued Ecosystem Components (VECs) is inconsistent among the various sections. Substantial inaccuracies and omissions here can threaten the ability to properly assess potential effects.

The environmental assessment does not indicate what time of year the project will occur. While the duration is identified, the season of activity is not. This information is particularly important in terms of assessing potential impacts on the ecosystem and its components.

In general, modeling pertaining to assessing the behavior and trajectory of oil spills that might occur during exploration drilling activities requires significant reconsideration of many of the inputs (e.g. currents, winds, tides, outflows, timing, etc.), as well as the models in some cases. Scenarios were also often not clearly described (e.g. for blowouts), and overall, modeling results were not clearly presented. Information gained from the The Gulf of Mexico spill should also be considered for informing this exercise.

The environmental assessment should undergo appropriate and specialized quality control of content for translation, relevancy, agreement between text and figures and tables, and the appropriate use of up-to-date information and references.

General Comment on Spatial Scope of Assessment

The Study Area, the area that could be potentially affected by Project activities, has been defined by the furthest extent of the drill cutting deposition modeling, oil spill trajectory modeling results and supply vessel/helicopter activity to coastal Newfoundland. The parameters of these activities limit the spatial scope (i.e. geographical area) of the assessment.

For example Cohasset oil (i.e. light oil), was used as a surrogate for spill modeling purposes. This directly impacts the spatial extent of any accidental spill event modeling and in turn the assessment of impacts on the VECs, in particular fish, fisheries, sensitive areas, marine ecosystem and coastal areas. Should the nature of the oil discovered be different (i.e. heavier) than that used in modeling the potential impacts and significance of the impacts to the VECs may be different than what has currently been assessed. It may have been more appropriate to consider other oil heavier types during modeling.

Thank you for providing DFO the opportunity to comment on this document. Should you have any questions or comments regarding the above, you can contact Jason Kelly, Environmental Assessment Analyst at 772-8889 or by e-mail (jason.kelly@dfo-mpo.gc.ca).

Sincerely,

"Originally signed by"

Shawna Powell
A/Regional Manager
Environmental Assessment & Major Projects

Specific Comments on the *Environmental Assessment of the Old Harry Prospect Exploration Drilling Program*

Comment No.	Document Section	Comment
1	1.3 Regulatory Context, p. 4, 1st paragraph	Fisheries and Oceans Canada (DFO) has been identified as a Responsible Authority in this section. Please note DFO is not a Responsible Authority for this environmental assessment as an Authorization under the *Fisheries Act* is not required for this project. Rather DFO is a Federal Authority offering expert specialist advice during the environmental assessment review.
	2.6	While the anticipated duration of work is indicated (20-50 days) the season is not. This is information is particularly important in terms of assessing potential impacts on the ecosystem and its components (i.e. fish, marine mammals etc…). It is advised that the proponent should plan the activity around important and sensitive time periods for fish, marine mammals and species at risk.
	2.12.2	The parameters used in the models take into account the seasonal averages of oceanographic and atmospheric conditions recorded for the Gulf of St. Lawrence as well as the properties associated with light hydrocarbons. Should characteristics of the hydrocarbons found differ (i.e. heavier crude oil) from those expected, modeling and assessment of potential impacts may be different.
	3.0 Stakeholder Consultation	A key concern that has been raised repeatedly by stakeholders to DFO is the need for additional consultation with fishery stakeholders including the commercial, recreational, Aboriginal Fisheries and the Aquaculture sector within the Gulf Region. The consultation program focused primarily on the "geographic region", most likely to be affected by the project and included Western Newfoundland and the Magdellan Islands. It should be noted that the proposed exploratory well is near the border of NAFOzones 4R, 4S, 4T and 4VN, where Gulf Region fish harvesters participate in fisheries within close proximity to the proposed well location.
	3.1, p. 64 par 1	The focus on western Newfoundland and Magdellen Islands implies that fish harvesters from other areas of the Gulf are not participating in fisheries in areas close to the proposed well, which is not the case. The C-NLOPB was provided a list of Gulf and Quebec region stakeholders in April 2011 to assist in consultations.
	3.4, p. 66, bullet 1	DFO attendees at the meeting included: - A/Regional Manager - Environmental Assessment and Major Projects NL Region - Environmental Assessment Analyst - Environmental Assessment and

Canada

		Major Projects NL Region - Regional Manager - Environmental Assessment and Major Projects Gulf Region - Senior Advisor for Oil and Gas, Ecosystem Management Branch – Gulf Region - Analyste principale, Évaluation environnementale – Québec Région
	4.1.5	Although the volume measure (3,553 km^3) is from Dufour and Ouellet (2007), it is incorrect. The volume is about 35 000 km^3 (see for example Dufour et al. 2009).
	4.1.7	• While the EA acknowledges that *“Knowledge of ocean currents is essential to the planning of oil and gas related operations in any area”,* the section on ocean currents simply states broad facts and shows maps from different sources without any proper interpretation or comparison. The currents that the EA uses in the report are cited but are never shown (i.e. *Surface water current fields developed by the Ocean Sciences Division, Maritimes Region of DFO (Tang et al. 2008) were used in the spill trajectory modelling*). • The statement, *“Driven by wave and tidal movement, cold, dense water flows into the Gulf through the Strait of Belle Isle from the Arctic via the Labrador Current.”* is incorrect. The inflow through the Strait of Belle Isle is not driven by waves or tides and it isn’t from the Arctic (although contains some dilution of Arctic waters) or from the (deep) Labrador Current. It is noted that this text is out of context in the Ocean Currents section. • Regarding the statement (p.94), *“Tidal mixing is also a permanent and dominant modifier of the intermediate and deeper waters near the head of Jacques Cartier Strait and in the Strait of Belle Isle (Lu et al. 2001; Saucier et al. 2003).”,* Lu et al (2001) showed that where bathymetry was sufficiently shallow that tidal mixing should be strong enough to mix the layer (typically around 50 m depth), and therefore should not by cited in relation to modifying deep water masses. Figure 4.12 – the caption indicates two panels; only one panel shown (French version). Figure 4.13 – panels for M2 and K1 are not identified. Figure 4.19 – surface currents in the Gulf of St. Lawrence (top: February 4, 2011@ 1100 hours and bottom: September 29, 2011 @ 0800 hours) - there is no bottom panel in the EA
	4.1.8	It is not evident that tides were used in spill trajectory modelling within the EA. If this is the case, why not? Sources of water current estimates are included (p.101) in the EA, but are out of context here. This information should appear in Section 4.1.7 and be

		compared with other results shown.
	4.1.11	Regarding the statement, "*All sea ice in EL1105 is first-year ice, ranging in its un-deformed thickness from 30 to 120 cm (SLGO 2011; Figure 4.20).*" Figure 4.20 does not actually show ice. It is not obvious what is meant by *un-deformed thickness* here, but ice thickness in the Gulf has been known to exceed 2 m in places by rafting during heavy ice years. Ridges can be much thicker still (> 10 m). As such, these extremes should be mentioned in the assessment rather than showing median quantities such as average thickness. Based on the above, the reader might surmise that since bathymetry, currents and tides are very predictable, then so is ice cover. However, the premise of the initial statement is misleading: the thermodynamics of the ocean surface layer are not even mentioned here. To produce ice, the winter mixed layer must first be cooled to the freezing point over a large layer (a typical thickness of 75 m was mentioned on Page 92). • The EA states (p.108), *"The Project Area is located in an area that ranges from 51 to 84 percent 30-Year frequency for the presence of sea ice (green and purple color bands) depending upon the month."* However, Figures 1.27 to 4.28 do not have any green as mentioned. Caution should also be used in interpreting these three figures. For example, the March figure shows the average probability of encountering sea ice over the entire month, and not the probability of encountering ice at least once during the month. • The EA states, *"EL1105 is located in the area that has an average ice freeze up date of January 29 (Figure 4.31). The normal ice free period for EL1105 extends from April 9th to February 12th of the following winter…"* However, this seems in contradiction. If the average ice freezup date is January 29, then the area cannot be ice-free after break-up until the following February 12th. Fig. 4.23 – this is unreadable with insufficient resolution. Fig. 4.34 – legend = 2009; figure shows 2010 and not 2009.
	4.2	For the circulation subsection, Han et al. (1999, Journal of Physical Oceanography) provided detailed seasonal mean circulation fields in the Gulf of St. Lawrence, especially in terms of the gulf-shelf interactions, including the inflow from the Labrador Shelf through the Strait of Belle Isle, as well as the outflow on to the Scotian Shelf and the inflow from the Newfoundland Shelf, both through Cabot Strait. This paper should be included in the review under 4.2.2 (p.55).
	4.2.1	• Average daily temperatures in the vicinity of EL1105 could be misinterpreted. Those presented are not the true range of observations, but rather the 30-year monthly average temperature minimum and maximum. Far colder and warmer temperatures have been recorded. Therefore

		variability is missing on the monthly scale, and also at the inter-annual scale. • Reference in the EA to *"…average monthly air temperatures for several land-based weather stations surrounding the Gulf…"* does not add much long term context. Instead, Galbraith et al (2011) show mean winter air temperatures at these land stations since 1971, which should be used to describe interannual variability. • The EA describes (p.114) sea surface temperatures such that *"…the minimum mean temperatures for February and March are approximately -0.8°C."* However, in years of maximum ice year such as 1993, the winter mixed layer was near-freezing at -1.7°C in the area of EL1105. The area also borders the warm waters (T > 0°C) seen in many winters entering the Gulf on the Newfoundland side of Cabot Strait (see Galbraith 2006).
	4.2.2	It is unusual that the MSC50 reanalysis shows no winds above 20 m/s (90 km/h) between June and November, and extremely rarely in other months. The EA presents that the highest winds are less than 2% in winter; however winter interpreted as Dec-Jan-Feb is in fact 0.02%, and the highest as occurring in spring (Mar-Apr-May) at less than 0.2%.
	Section 4.2.2, page 100	Incorrect translation – French version *Habituellement, le mouvement de l'eau suit le détroit de Cabot, coulant dans le sens trigonométrique autour du Golfe* […]. Incorrect translation of "counterclockwise" Incomprehensible translation – French version *Le courant de débordement du fleuve Saint-Laurent produit un fort courant côtier qui coule le long de la péninsule gaspésienne (le courant de Gaspésie), en direction de la mer et dispersant l'écoulement de surface du Saint-Laurent en direction nord-ouest et du sud du Golfe (Dufour et Ouellet 2007).* This excerpt of the document comes from an article by Dufour and Ouellet 2007, which reads as follows: La caractéristique principale du débit sortant du Saint-Laurent est un courant côtier fort le long de la péninsule gaspésienne (courant de Gaspé) qui disperse l'eau du Saint-Laurent dans le nord-ouest et le sud du golfe. (original text)
	Section 4.2.2, page 107	*Incorrect Translation – French version* *Les marées se propageant au-dessus des filons-couches à la tête du chenal Laurentien* […]. Incorrect translation of "sill"
	Section 4.2.6, page 118	Incomprehensible translation – French version *Le PP 1105 est situé dans le secteur dont la date moyenne de congélation de*

		la glace est le 29 janvier (Figure 4.25).
	Section 5.1, page 131	Incomprehensible translation – French version *Cela en raison du fait que le Golfe est séparé partiellement de l'Atlantique Nord, recevant un apport en eau douce de la part de rivières importantes, et aussi par un chenal orienté sur toute sa longueur, une saison des glaces, plusieurs types de masses d'eau, incluant une couche intermédiaire froide, des zones a plateaux et d'eaux peu profondes ainsi qu'une productivité et une diversité biologique élevées (MPO, 2005a).* *Ces zones biologiques bonifiées sont le résultat de facteurs physiques reliés à la topographie particulière du plancher océanique, des vents et courants océanographiques, laquelle, combinée a des facteurs chimiques tels des eaux riches en nutriment, donne naissance a des processus physiques comme une remontée des eaux de fond, des fronts horizontaux ou verticaux entre deux schémas de circulation distincts et des masses d'eau, ainsi que des zones de convergence et des gyres.*
	5.2, Table 5.1	White shark should be included on this list. Scientific Name:*Carcharodon carcharias* Taxonomy Group:Fishes Range:Atlantic Ocean Last COSEWIC Assessment: April 2006 Last COSEWIC Designation:Endangered SARA Status: Schedule 1, Endangered
	5.1	This section indicates that Section 5.2 will cover species at risk from both the St. Lawrence Estuary and the Gulf of St. Lawrence. Section 5.2 states that Table 5.2 covers all species in the Gulf that are designated at risk by COSEWIC. The following Atlantic salmon populations are assessed as at risk by COSEWIC (2010), but are treated neither in the text of Section 5.2 nor in Table 5.2: Quebec Eastern North Shore population - special concern; Quebec Western North Shore population - special concern; Inner St. Lawrence population - special concern. In general, the migration routes of these populations are unlikely to take them close to EL1105 for an extended period of time. However, if it is the intent of the assessment to exclude these populations from consideration, it should be explicitly stated why.
	5.2	The data on which many of juvenile/adult fish distribution figures are based is often dated – and only a single or several years of RV data compiled into figures is also common. As such, updated and additional years are required indicate the current distribution of these species as RV surveys referenced are likely stratified-random surveys and any one year may not yield any sets within the Old Harry project area. Figures are also lacking the location of the exploration licenses covering the Old Harry area superimposed on distribution maps for reference. Information on the size and/or age of juvenile fish should be included with figures and descriptions.
	5.2, Table	• For the 3 wolffish species the table indicates that there is a low potential

	5.1, p. 122-123	for occurrence in EL1105, yet in the first paragraph of Section 7.2.2.1, p.343, it is indicated that wolffish are included with the species which have a moderate to high potential to occur in the project area (same as EL1105?). The information presented should be consistent between sections. • Northern and Spotted Wolffish - "Non-migratory spawning occurs" – based on current information it is unknown if Northern and Spotted wolffish do or do not have spawning migrations. Northern wolfish also occurs in waters shallower than 500m. • Atlantic Wolffish – This species occurs in waters greater than 350m. • White Shark (added to SARA Schedule 1 on July 6, 2011) should be included in the table.
	5.2, Table 5.2, p. 124	• Requires explanation of how potential for occurrence is defined and calculated and what metric is used. • <u>Laurentian South Cod :</u> There are problems with this characterization. Should state that there is a high potential for occurrence. Distribution maps exclude September survey information and winter distribution patterns. The statement, "Eggs and larvae may be present in the upper water column May to April" is inaccurate. There are two populations in this designatable unit; the population of concern here is the southern Gulf of St. Lawrence population. This population is distributed throughout the southern Gulf in summer and overwinters along the side of the Laurentian Channel, with dense aggregations typically occurring in the Laurentian Channel north of St. Paul Island. Cod use two migration routes between these overwintering grounds and summer grounds in the southern Gulf, the Cape Breton Trough and the southern slope of the Laurentian Channel (north of the Magdalen Islands). Essentially the entire population moves through this area in proximity to EL1105 each spring and fall. • <u>Striped bass:</u> The statement the "<u>Gulf population</u> is considered extirpated" is incorrect and should state that the St. Lawrence estuary population is considered extirpated; the Gulf population is designated threatened as previously stated in same text block. This should be clear and as it reads now it is confusing. • The population of Killer Whale being referred to is the Northwest Atlantic/Eastern Arctic population. White Shark should be removed from the table. This species was added to SARA Schedule 1 on July 6, 2011. • Deepwater Redfish - species name is *Sebastes mentella* (not *mentalla*). Spawning does not occur in fall. Mating between males and females occurs in fall but female extrude larvae (=spawn) from April-July. • Acadian Redfish (Atlantic) – spawning does not occur in fall. Mating between males and females occurs in fall but female extrude larvae (=spawn) from May-August. • Winter Skate (Southern Gulf of St. Lawrence population) – the

		description is inaccurate. This population occurs just within the Gulf (are distinct from populations on the Scotian Shelf and Georges Bank). Winter Skate lay egg cases and emerge as juveniles. The seasonality of "spawning" is not well known. • American plaice (Maritime population) – the description is inaccurate. This population overwinters in deep water in the Laurentian Channel. • Table 5.2 should consider Swain et al. (1998); and Chouinard and Hurlbut (2011) as sources of information.
	5.2.1	In this and other sections on fish species (e.g. 5.2 Species at Risk) the EA reproduces a number of juvenile fish distributions from RV surveys. The data on which many of these figures is dated (at least 6 years old) and only a single year of RV data compiled into figures is common. Updated and additional years are required to indicate the distribution of juveniles for these species as RV surveys referenced are likely stratified-random surveys and any one year may not yield any sets within the Old Harry site. It would also be useful for figures to have the location of the exploration licenses covering the Old Harry area superimposed on distribution maps for reference. CSAS Docs are available for porbeagle, mako, basking sharks, spiny dogfish and blue sharks (all can be downloaded from the Publications page of the Shark website) and should be consulted and cited as such within the assessment.
	5.2.1.1	References for depth distribution of northern wolffish are not provided – which also contradicts Table 5.1 content. However, for the Newfoundland and Labrador region, the densest concentrations of northern wolffish tend to be found at 400-900 m (Kulka et al. 2004, Simpson et al. 2011). Fecundity/number of eggs and parental care of northern wolffish are not known in Canadian waters, yet the EA states that northern wolffish can lay up to 27,000 eggs and guard their eggs. References are required for this information.
	5.2.1.1, p. 127, 2nd paragraph 5.2.1.1, p. 131, 2nd line at top of page	There is a reference given as SARA (2010). Does this mean the Species at Risk Public Registry? In the reference section, the Public Registry shows up as Species at Risk Public Registry 2010 and SARA Public Registry 2010. There should be consistency in the use of references within the document and within the reference section itself. It would be preferable to reference the COSEWIC status report or Recovery Strategy documents, rather than the website itself.
	5.2, Figure 5.2	Potential for occurrence of northern wolffish is listed as low in Table 5.2, yet based on this figure its distribution in the Gulf is centered on the EL1105 area
	5.2.1.1, p	Depth discussion of Spotted wolffish contradicts Table 5.1 content

	128	
	5.2, Figure 5.2 to 5.11	The information presented here is dated. More recent data exist from the study area. The data from 2003-2011 should be presented to illustrate current distributions - not the distribution from a decade ago.
	5.2.1.1	Figures 5.6, 5.7 and 5.8 clearly show that highest densities of both juvenile and adult Atlantic wolffish are observed within 50-100 km of EL1105 (off western Newfoundland); but Table 5.1 indicates a low potential of occurrence in relation to EL1105
	5.2.1.2	• The seasonal distributions and migrations need to be described for Atlantic Cod. This should use distribution information from summer surveys in both the southern and northern Gulf (i.e., September survey of the southern Gulf and August survey of the northern Gulf; Summer sentinel trawl surveys in both areas). Migration routes and timing and overwintering distributions should also be described. • An increasing proportion of the southern Gulf stock occurs on summer grounds in the region between the Magdalen Islands and northwestern Cape Breton, including waters along the southern slope of the Laurentian Channel. The entire stock migrates through the Cape Breton Trough or along the southern slope of the Laurentian Channel (past EL1105) each spring and fall. The entire stock overwinters in dense aggregations along the south side of the Laurentian Channel, in particular north of St. Paul Island. • The EA refers to the four populations identified by COSEWIC in this section. However, there are only two residents (Laurentian North and South). Incursions of two other Atlantic populations are possible, but this should be distinguished. • The legend of Figure 5.10 shows "*Atlantic Cod Distribution in the Gulf of St. Lawrence from 1990 to 2002*," however, only the result of the August survey in the northern Gulf is presented. The results of the September survey in the southern Gulf should be added with the result representing the two cod stocks in the Gulf. This mistake occurs in several maps of other species. • The spawning area for cod in the northern Gulf (3Pn, 4RS) that was identified some time ago off St. George's Bay (west coast of Newfoundland) is not mentioned in the EA. This area is closed to all fishing from April to mid-June and occurs approximately thirty miles east of the drilling area. This information is significant as fertilized eggs of cod are at surface and are therefore very vulnerable to any oil spill. • Some key sources of information include: Swain et al. (1998); Chouinard & Hurlbut (2011); Comeau et al. (2002); Benoît et al. (2003); Darbyson & Benoît (2003); and recent CSAS Science Advisory Reports and Research Documents coming from stock assessments.
	5.2.1.2, p. 132, par. 4	First sentence is incomplete “Atlantic cod eggs and larvae are planktonic during and are primarily zooplankton feeders…” Needs editing.

	5.2.1.3	Only general information is presented in this section; not information focused on winter skate in the Gulf. Information is available from Swain et al. (1998); Chouinard & Hurlbut (2011); Comeau et al. (2002); Benoît et al. (2003); Darbyson & Benoît (2003); and recent CSAS Science Advisory Reports and Research Documents coming from stock assessments, as well as CSAS Res Docs 2006/003; 2006/004; Swain et al. 2009 (and the associated supplementary material). It should be noted that winter skate in Gulf are primarily distributed in the southern Gulf, where they are distinct from winter skate elsewhere.
	5.12, p. 135	The legend does not correspond with the figure; lower panel shows distribution in 2005-2009. RV catch rates are not shown for the Newfoundland and Labrador continental shelves and not for the study area and no units (kg/tow?, number of fish/tow?) are shown in this and other figures (Section 5.2).
	5.2.1.5	The EA notes the Porbeagle shark as having a low potential for occurrence in the study area. However, relative to its overall population size, the likelihood of occurrence is moderate or high, although not in large numbers. As such, Table 2 needs to be amended to reflect this. A distribution map should also be presented. Porbeagle shark mating occurs off southern Newfoundland and at the entrance to the Gulf, between late ***August*** and November. Pregnant females are present in this area from late ***August*** through to December and are seldom seen from January through to June (Jensen et al 2002).
	5.2.1.6, p. 136	It mentions that White Shark is designated as endangered by COSEWIC. This should be updated to say that it is listed under Schedule 1 of SARA as endangered. Criteria for low occurrence need to be stated clearly. A distribution map should also be presented.
	5.2.1.7,	The EA states *"…The deepwater redfish has declined by 98 percent since 1984 and the Acadian redfish has declined by 99 percent…."* References to "declines" should be clarified that declines are in mature abundance as per the COSEWIC criteria. The three recent scientific advices on redfish require mentioning in the EA: Stock Discrimination (CSAS SAR 2008/026), Stock Assessment of Units 1 and 2 (CSAS SAR 2010/037) and Recovery Potential Assessment (CSAS SAR 2011 /044). Figure 5.13 The information is dated. More recent data exist from the study

		area. The data from 2003-2011 should be presented to illustrate current distributions.
	Section 5.2.1.7, page 147	Incomprehensible translation – French version *Ces espèces sont d'apparence similaire et sont associées de leur gestion.*
	5.2.1.8	Criteria for low occurrence need to be stated clearly. A distribution map should also be presented.
	5.2.1.9	Information on seasonal distributions is lacking (see sources listed under cod for *information*). Winter distribution for plaice that spend the summer on the Magdalen Shallows and move into deep water in the Laurentian Channel is particularly relevant, and is not mentioned within the EA.
	5.2.1.10,	• The paragraph on Striped bass should be re-edited to reduce confusion. It starts by speaking about extirpated estuary population, and then it states the harvest restrictions put in place in 2000 seem to have assisted in recovery. Confusion exists between Estuary and Gulf populations. Please consult the recovery strategy on the SARA public registry. • COSEWIC's (2004) assessment for striped bass is not a good reference nor is it used properly. • If indicating spawning in the St. Lawrence estuary, reference should also be made to spawning in the Miramichi. The introduction of these two populations should set up the rest of the text as they pertain to EL1105. Further, mention of St. Lawrence striped bass requires St. Lawrence striped bass be introduced in Table 5.1. • There is some evidence that there may be more than one striped bass population in the Bay of Fundy. It is relevant that Miramichi bass are genetically isolated from populations further south. However, Fundy striped bass are not relevant to the assessment and therefore it is not necessary to give any information on their biology. • Spawning of Striped Bass does not occur primarily in freshwater. This occurs near the fresh-salt boundary at the head of estuaries. • The Bay of Fundy (Shubenacadie River) does not occur in the southern Gulf. • “school to fish” requires clarification. This may refer to predatory schooling behavior, in which case should also be qualified by “CAN cover tens….. • Contrary to the EA, striped bass DO currently exist and spawn in the St. Lawrence Estuary. While extirpated there in the 1960s, they were re-introduced in 2002 and have potentially established a successful spawning population (DFO 2010). • Striped bass are highly mobile and range very widely around the edge of the southern Gulf. However, they stay close to land, and hence are very

		unlikely to be in the area of proposed drilling. Therefore the most obvious omission in the text is the link between the striped bass populations and their 'low potential of occurrence' at EL1105. • At a minimum, coastal behaviour at all life stages should be identified, but could be strengthened within the EA easily for the sGSL population by either COSEWIC's (2004) evaluation of Extent of Occurrence and/or its proposed refinement in Douglas and Chaput (2011).
	5.2.1.16	• Use Salmo (genus) instead of salmo. • Much of the material in the 1st paragraph, 1st three sentences is incorrect or only partly correct. Most Atlantic salmon are anadromous, but not all. Many salmon spend two years in fresh water, but many do not. Many salmon migrate to the Labrador Sea, but some also migrate to Greenland. Pertinent literature on Atlantic salmon should be consulted and accurately summarize key points of their life history. In insular NL most Atlantic salmon remain in fresh water for 2 to 5 years. Atlantic salmon over winter in the waters off the Grand Banks, Labrador and west Greenland. • Atlantic Salmon migration timing and routes need to be reviewed and summarized. Reddin (2006) summarizes the broad pattern of migration routes followed by post-smolts out of the Gulf and returning adults into the Gulf. However, routes are generally not known at a detailed level, which leaves some uncertainty as to how often salmon pass through or near EL1105. Recent unpublished studies using acoustic pingers indicate that post-smolts from a variety of Gulf rivers pass through the Strait of Belle Isle during a short period in early July (http://www.asf.ca/projects.php?id=4). • Although the relative importance of the Strait of Belle Isle and Cabot Strait as salmon migration routes is not clearly understood, it seems likely that use of the Belle Isle route would be highest in salmon from the northern Gulf, including those from Anticosti Island. • *"All of these populations are considered to have a low potential for occurrence within EL1105, with any presence being transient in nature"* should be replaced with *"All of these populations are considered to have a moderate potential for occurrence within EL1105 during their post-smolt and returning adult migrations."* "Transient" should not be used to describe these migrations.
	5.2.1.17, p. 140	• This section requires additional information and revision. Most significantly, the assessment does not include bluefin tuna as a potential species at risk based on COSEWIC's recent determination that the Western Atlantic population is endangered. Accordingly, this species should also be included in Table 6.1., and much more consideration of the possible impacts on this high-profile stock is required in the EA. The western population of Atlantic bluefin tuna relies heavily upon the Gulf of St. Lawrence for critical foraging opportunities; and the largest and oldest

		individuals, typically comprising breeding adults, are found in the southern Gulf of St. Lawrence. • It is incorrect (p141) that both the western and eastern populations can occur in the southern Gulf of St. Lawrence. More recent studies have shown convincingly that the fish occupying the southern Gulf of St. Lawrence are almost exclusively western origin fish (Schloesser et al. 2010). • Since the new and evolving recreational fishery for bluefin tuna in the southern Gulf has huge potential for economic development, the EA should include this information and completely examine this in the context of recreational fisheries. • Please refer to the 2011 COSEWIC report and DFO Recovery potential assessment (http://www.dfo-mpo.gc.ca/csas-sccs/Publications/Pro-Cr/2011/2011_049-fra.html).
	5.2.3	The EA cites the TNASS 2007 inventory (Lawson and Gosselin, 2009) as the sole source of data to determine the probability of meeting of various species in the study area and the Gulf of St. Lawrence. However, there are other significant sources of information which should be included; Kingsley and Reeves (1998) and Lesage et al. (2007). Additionally, the level of information provided on the various marine mammal species is very uneven and inconsistent. The following information should be provided for each species: structure of the stock, seasonal movements, reasons for their presence in the Gulf of St. Lawrence, abundance, probability of meeting in the Gulf and the sector of EL1105, and threats to their recovery identified by COSEWIC or SARA.
	5.2.3.1	The presentation of current knowledge on distribution of blue whales does not consider the bias in observation effort / sampling of blue whales. Most past effort has been concentrated in the Northwest of the Gulf. • A pattern of seasonal migration following a North-South axis is not only unrecognized, but is in fact challenged by recent data. Below is a more accurate description of the state of knowledge on seasonal migration by V. Lesage et al., extracted from a research document in prep: *The agreement that blue whales follow a general north-south movement to warmer and less productive waters is not fully supported by current data (CETAP 1982; Charif and Clark 2009, Mitchell 1991, Reeves et al., 2004, Sears 2002, Sergeant 1977). Recent monitoring studies of whale vocal activity over long periods suggest that blue whales and fin whales are still present in winter (December to Jan or February) in the Davis Strait (Simon et al., 2010: fin), off the Grand Banks (Clark 1995: blue whale), as well as west of the British Isles in the north-east Atlantic (Charif and Clark 2009), but some migrate farther south (Nieukirk et al., 2004: fin and blue whales). The ratio of winter and spring catches of blue whales by whaling station*

		south of Newfoundland from December to May (Dickinson and Sanger 1990), mortality in the ice in March-April in southwestern Newfoundland (Stenson et al., 2003), and anecdotal observations in the lower estuary of the St. Lawrence and Gaspé (Sears and Calambokidis 2002, Archives of www.baleinesendirect.com) confirm that at least part of the population of blue whales remains at our latitude throughout the year. • It is incorrect to report this population has 250 mature individuals since its size is actually unknown. Sears and Calambokidis (2002) was the source report for designation of the blue whale as endangered by COSEWIC. In this review of the available scientific information, there is no mention of such a figure (250 mature individuals). In fact, a maximum of 250 mature individuals is the COSEWIC assessment threshold for designating a population as endangered.
	Section 5.2.3.2, page 162	Incomprehensible translation – French version *Le programme de rétablissement de la baleine noire de l'Atlantique Nord de 2009 mentionne que bien que les connaissances soient limitées quant à l'abondance réelle de cette espèce, les cibles d'abondance à long terme ne peuvent être déterminées. Cependant, l'objectif visant à atteindre une augmentation continue de l'abondance de la population a été identifié.*
	5.2.3.3	In recent years, occasional observations of belugas, at times herds of several hundreds of individuals, have been reported (e.g., J. Lawson, DFO NL, unpubl. data). The origin of these animals, whether it is the St. Lawrence population or one of the Arctic stocks, could not be determined. However, it is indisputable that these animals come from a population at risk, as all stocks to which these individuals may belong to are considered as such by COSEWIC.
	5.2.3.5, p. 154	Fin whale – A draft management plan is under review and will be available for public comment in 2012 as part of SARA recovery process. The abundance data cited for this species is incorrect. The estimated abundance is 462 individuals (270−791) for the Gulf of St. Lawrence and Scotian Shelf combined (Lawson and Gosselin, 2009, Table 10) or 1,352 individuals (above 821−2226) for the portion of eastern Canada identified during the TNASS (Table 11). The estimate of abundance was 380 individuals (SD = 300) in 1995−1996 (Kingsley and Reeves 1998).
	5.2.3.7, p. 154	The population of Killer Whale being referred to is Northwest Atlantic/Eastern Arctic.
	5.2	General comment for Section 5.2 – certain subsections refer to the COSEWIC designation and/or SARA status for the species, while other sections do not. It would be good to be consistent among sections.
	5.2.4	In general, the EA relies heavily on citing dated literature documents (e.g. COSEWIC report and Recovery Team documents) rather than the available

		primary scientific literature for sea turtles. The EA contains only slight reference to studies that have specifically focused on leatherback movements in and around the proposed development site and the most recent information available on the biology and distribution of sea turtles in Canadian waters is not integrated into the assessment. Direct consultation of the primary literature is recommended. Notably, the exploration licenses overlap directly with important foraging habitat for leatherbacks – including an area currently being considered critical habitat for the species. Moreover, the exploration site lies directly in line with the route many leatherbacks take in and out of the Gulf of St. Lawrence.
	5.2.4.1	• The COSEWIC document referenced for this section is outdated and precedes most directed research on leatherbacks in Canada. Information of the distribution of leatherbacks in Canadian waters has been published in several articles (e.g., James et al. 2005; James et al. 2006; James et al. 2007). • References should include James et al. (2005; for source of mortality in Canadian waters) as well as to recovery documents as posted on the SARA public registry. • Specific mention of leatherback sightings in the Bay of Fundy can be misleading – while the species has been recorded there, it is conspicuously rare in this area. • It is now known that leatherbacks forage in the vicinity of EL1105 – amend "may occur" to "occurs". • A long lifespan does NOT contribute to species decline as stated in the EA.
	5.2.4.2	• More recent references exist and are available for loggerhead population size – see recent NMFS Loggerhead Turtle Expert Working Group stock assessment. • Most loggerhead nesting in the North Atlantic does ***<u>not</u>*** occur at "near-equatorial nesting areas", and instead occurs in the states of Florida, Georgia, and, to a lesser extent, the Carolinas. • The size distribution (and therefore life history stage) of loggerheads in Canadian waters has not been reported, although sampling in adjacent areas suggests those that forage in Canada are mainly juveniles. • Loggerheads are opportunistic feeders. Therefore, while squid and zooplankton are known prey items, it may be misleading to reference only thoseprey (i.e., maybe preface with "including"). Finfish should also be included as prey as this can contribute to vulnerability of loggerheads hooking in pelagic longline fisheries.
	5.3	It is not accurate that "...fish habitat is divided into two areas, the shelf areas

		and the deep channels. The shallow waters along the shelf areas are characterized by warm, high productivity waters in the summer...” In fact, the bottom over much of the Magdalen Shallows is within the Cold Intermediate Layer (CIL), so that bottom waters are colder than those in the deeper waters of the channels. DFO 2007a is cited but is not listed in the References.
	5.3. p. 156; par. 2	The western Newfoundland SEA (LGL 2005b) and the amended SEA (LGL 2007) cited in this paragraph only cover the NAFO sub-division 4R portion of the Gulf. Given that this project has implications for the entire Gulf of St. Lawrence, this EA should reference SEA documentation for other parts of the Gulf as well. For example, the SEAs for the Baie des Chaleurs, Anticosti and Magdalen basins (see http://www.ees.gouv.qc.ca/english/documents/chapter/sea2_information.pdf).
	5.3.1	**Rocky shores** do not characterize the whole Gulf of St. Lawrence. Both PEI and New Brunswick shorelines are characterized by highly erodible shorelines including barrier beaches, salt marshes and other geographical features.
	5.3.1.1	• Tables 5.3 and 5.4 are based upon a book by G.R. South entitled ‘Benthic Marine Algae’. However, the taxonomy of seaweeds has changed since that publication in 1983[1]. There are also many more species of algae found in western Newfoundland than are listed in the associated tables. A more appropriate and up to date listing can be found in ‘NEAS Keys to Benthic Marine Algae of the Northeastern Coast of North America from Long Island Sound to the Strait of Belle Isle’ (Sears 2002). • Tables 5.3 and 5.4 fail to define those algal and invertebrate species most likely found in the intertidal zone, the zone of greatest impact for an oil spill on a shore. The first column of species is for ‘high water mark to 5m’ rather than high water mark to chart datum (the definition of the intertidal zone). As a result, this column contains a mix of intertidal and subtidal species. Lichens, *Fucus* and *Ascophyllum* are primarily intertidal while the kelps *Alaria* and *Saccorhiza* are mainly subtidal. In order to be more informative this table and section of associated text should describe the intertidal community in more detail, including both algae and associated invertebrates, and describe how this community may be affected by an oil spill. • Table 5.3 and 5.4 – some of these species are not algae (maritime lichens, *cyanophyta?, Balanus, Mytilus, Zostera marina, Spartina sp., Plantago sp.).* Add *Laminaria digitata.*

[1] For example, *Saccharina* is now the genus name for a number of species of kelps formerly associated with the genus *Laminaria*.

		• Table 5.4 – *Ascophyllum*, *Fucus*, *Ahnfeltia* and *Chaetomorpha* are not typically found associated with sand or mud. The listing infers that they may be common on this substrate. • Note: *Agarum cribropsum* (in the french version) should be *Agarum cribrosum* (correct in the English version), but is now called *Agarum clathratum. Lamninaria longicruris* is now called *Saccharina longicruris* Pophyra should be Porphyra
	5.3.1.2;	• It should be noted in the text that, Eelgrass (*Zostera marina*) in eastern Canada has characteristics which meet the criteria of an Ecologically Significant Species. This means that if the species were to be perturbed severely, the ecological consequences would be substantially greater than an equal perturbation of most other species associated with this community (see DFO 2009d). • This section states that "eel grass is also protected by law under the *Fisheries Act."* While eel grass is characterized as an important type of fish habitat it is important to note that all fish habitat is protected under the *Fisheries Act.* • The eelgrass beds described in this section are large and dominate soft bottoms in the shallow subtidal – they are considered extremely important habitat for the region. • Add sea urchin to the list at the end of the first paragraph (p.157).
	5.3.1.3	The high and low salt marsh communities described are also extensive and important habitat for the region. Should an oil spill reach coastlines salt marshes are likely to be impacted.
	5.3.2; Page 160; Para 2	It should be noted in the text that, Cabot Strait is an important migratory corridor for marine mammals moving in and out of the Gulf of St. Lawrence (see http://www.dfo-mpo.gc.ca/CSAS/Csas/DocREC/2001/RES2001_115e.pdf). It should also be noted that, the Esquiman Channel is the main migration corridor for entire populations of ground fish, including cod and redfish (see DFO 2007b).
	5.3.3	• In general, the main source of information for the corals and sponges section of the EA is Cogswell et al (2009), which focuses on the Maritimes region. Additional important data that is available on coral and sponge distributions has not been included in the report – this includes 2010 and 2011 data from the Gulf (mostly for sea pens) and some of the more recent NL records. As a result, the conclusions that EL1105 location is likely not suitable habitat for corals and sponges (p.155) may not be the case. Kenchington et al. (2010) show significant

abundances of sea pens in the Gulf and Laurentian channel that could be considered near EL1105. Sponges also require further consideration and relevance somewhere in this general section of this report.

- The following is offered as an opening paragraph for this section: Deep-water corals are sessile or sedentary, largely colonial animals that can occur individually at low density or in significant concentrations, depending on the taxa considered and ecological conditions. They are generally slow growing, and may represent decades or centuries of growth. They are considered suspension feeders, but not a lot of attention has been given to food and feeding in the scientific literature. Numerous species of deep-water coral are present in the Gulf of St. Lawrence, with significant areas of coral concentrations occurring in the Gulf and Laurentian Channel (Cogswell et al. 2009; Kenchington et al. 2010). At least six species of sea pen occur (*Pennatula borealis*, *Pennatula borealis*, *Anthoptilum grandiflorum*, *Crassophyllum* spp., *Funiculina* quadrangularis, *Halipterus finmarchica*), including significant concentrations located adjacent to EL1105, on the western flank of the Laurentian Channel (Cogswell et al. 2009; Kenchington et al. 2010). Soft corals, especially *Gersemia rubiformis*, but also including *Duva florida* and *Anthomastus grandiflorus*, are also common, especially in the western Gulf. However, they are not considered as vulnerable to disturbance as other types of corals, including sea pens (Fuller et al. 2008; Kenchington et al. 2010). At least two species of large gorgonian corals occur, *Primnoa resedaeformis* and *Paramuricea* spp., as well as the solitary stony cup coral, *Flabellum alabastrum*, but these do not appear to be nearly as common or abundant in the Gulf as either of the other types of coral.

- Orders Stolonifera and Heliporacea are not present in Canadian waters – as such this reference is irrelevant.

- The EA comments on sea pens hundreds of km away off Baffin Island, but ignores other significant records in the Gulf.

- It is incorrect that *Pennatula phosphora* is not observed near the Project - Pennatula phosphorea has been observed “near” the project in great numbers (Kenchington et al. 2010). The EA also needs to define “near”.

- The October 2010 geohazard survey does not identify the presence of any deep-water corals or sponges – however, sea pens are corals.

- It is incorrect that there are no data on presence / absence of corals and sponges within the Laurentian Channel outside the Gulf – data are figured in Cogswell et al. (2009).

		• The statement that "water depth may not be a limiting factor in their distribution" is misleading since factors determining distribution include depth, and most others are typically correlated with depth, therefore responding quite clearly to depth, even though it is not just depth itself. • Many forms and species of deep water coral are not generally found on hard substrate as inferred in the EA. • The report by LGL (2007) indicates that "*In general, the low abundance of corals in the Laurentian Channel (other than the Stone Fence at the southern end of the Laurentian Channel) probably reflects the low cover of cobble and boulder in the area (Mortensen 2006).*" This is out of context (refers to large gorgonians only or is or outdated) See Kenchington et al. (2010). • Deep-water corals may benefit from rather than require higher water current speeds. It's also not clear exactly what they feed on, though plankton is probably an important source for some if not many species, at least at shallow to relatively moderate depths. Occurrence along continental slopes and shelves may also be more to do with the availability of food or increased substrate variability at the appropriate depths rather than currents. • The commentary around favorable habitat for deep-water corals and sea pens in reference to EL1105 is confusing. • Coral and sponge data from NL and the eastern Canadian Arctic is overemphasized, while ignoring or minimizing other relevant information actually from within the Gulf of St. Lawrence and Laurentian Channel. The most recent, peer reviewed, published information is not referenced (e.g. Kenchington et al. 2010). This information is the definitive culmination and summary of all quantitative data concerning coral and sponge from the eastern Arctic to the U.S. border, and should not be ignored. Data is presented within that clearly demonstrates significant concentrations of both coral and sponge in the Gulf, and must at least be presented and considered as being near the proposed development. • There is apparent ambiguity with classifying sea pens as being corals. Sea pens are considered corals, phylogenetically, biologically/ecologically and by policy makers, including DFO. Sea pens are octocorals, belonging to the subclass Octocorallia, along with gorgonian corals and soft corals. Ambiguously framing sea pens in any way confuses the assessment.

		• The term "near" is used often, and proximity is used as potential factor implying mitigation of any impacts. Therefore a clearer definition of "near" should be provided. It is potentially misleading to simply state that corals and sponge are not concentrated "near" the development. Actual distance would be more useful in this context. • Kenchington et al. (2010) report that the highest abundances (trawl catch data) of seapens in eastern Canada occur in the Gulf region. The area is certainly suitable habitat for seapens which are found on unconsolidated sediments (p.154). The EA should review Kenchington et al. (2010) and current information on the classification and conservation considerations for sea pens below, including the geo-referenced map summarizing data on the concentrations of sea pens and sponge near the proposed Old Harry development (see attached). • Figures 5.22 and 5.23 – (coral and sponge records) show high coverage on the Scotian shelf and Gulf regions with almost no occurrences in the Newfoundland region. This is attributable to NL data not being included in the assessment. • The EA states (p.155), *"These factors suggest that the area for which the Project is planned is not a favourable habitat for deep-water corals and likely for sponges as well, since they too depend on plankton for food."* The term 'plankton' as used here is too general. We know that corals and sponges represent a diverse range of trophic groups including carnivores (feeding on zooplankton) and suspension feeders (feeding on suspended organic particulate matter). Their food sources include organisms and detritus resident near the seabed surface and organic matter sinking from surface layers which is why they can survive at deep depths below the photic zone. • Inconsistency exists in the spelling of *Anthoptilum grandiflorum*. This is the correct spelling. • It would be useful to the EA to recognize that various NAFO working groups concluded that for corals the following taxa formed the conservation units (from Kenchington et al. 2010): Sea pen fields (Pennatulaceans); Small gorgonians (*Acanella arbuscula* was the only species in the NAFO Regulatory Area within this group); Large gorgonians (Sea fans: genera: *Primnoa*, *Paragorgia*, *Keratoisis*, *Paramuricea*; *Radicipes*, etc.); Cerianthid anemone fields; Antipatharians (black corals), and Reef-building corals (e.g., *Lophelia pertusa*). • Table 5.9 – the record of *Littorina littorea* from a grab sample (GS-02)

		from a depth of > 400 m is remarkable given that this is primarily an intertidal species extending into the shallow subtidal (< 20 m). This may have been an empty shell that had been transported to deep water.
	5.3.4	• The statement (p.165), "The transect line across Cabot Strait (identified as TDC in the AZMP program) is of most relevance because it spans across the Laurentian Channel between Newfoundland and Cape Breton Island and is situated approximately 70 km southeast of EL1105. General water flow through EL1105 and water properties would likely resemble those at Cabot Strait.", requires second consideration. The continental shelf waters entering the Cabot Strait do not point directly to the EL1105 site. In terms of plankton communities, AZMP transect within the Gulf (especially the center transects - at the eastern tip of Anticosti Island) would be more appropriate in this case.
	Section 5.3.4.2, page 181	*Incorrect translation – French version* *En retour, plusieurs organismes <u>sous des tropiques élevés</u>, tels des poissons et des mammifères marins, incluent le zooplancton dans leur diète.* Incorrect translation of "higher trophic levels"
	5.4.1	• The magnitude of the photographic coverage of the sea floor seems low and mainly located in western margin of the area for which the license is applied (Figure 5.26). The determination of animal biodiversity of soft bottoms, particularly the macro-and mega-benthic fauna, must be based on the use of a variety of sampling tools (grab, drag, epi-and supra-benthic sled, beam trawl). One cannot determine the nature of macro and mega-benthic communities simply based on a number of photos and some samples or grab sampler (three, according to Table 5.9). • Legend of Figure 5.27 should refer to Figure 5.26 for the position of the stations, NOT to Figure 5.23. In the legend of Figure 5.26 and elsewhere in the text, it refers to the "ocean floor". • Table 5.9 – this table does not reflect the extent of benthic biodiversity in the targeted region (see previous comment). At a minimum, the EA report should include an inventory of many benthic species listed in the bilingual document written by Brunel et al. (1998). The study area is included in LCI, historically less well sampled for benthos that LCH, but both areas could have a rather similar fauna. • Table 5.9 – *Limacina helicina* is a pteropod (mollusc) epipelagic, not a benthic species. *Littorina littorea* is a coastal species that likes the intertidal and subtidal: although one may occasionally find it in bathyal environment, it is very rare and certainly not representative of the bathyal fauna. Finally, Brunel et al. (1998) and the virtual catalog WoRMS do not report the presence of *Spio limicola* in the Gulf of St. Lawrence. This species is found further south along the coast of North America.

	5.4.2	• The structure of the introduction may suggest that the species of shellfish listed in the following sentence (e.g. lobster, rock crab ...) are found in the area of EL1105. • The document refers to “giant snow crab”. This is not a species. • The list of other commercially important species in coastal areas around EL1105 does not include the Iceland scallop (*Chlamys islandicus*), sea cucumber (*Cucumaria frondosa*) and sea urchins (*Strongylocentrotus droebachiensis*) which also support established or emerging fisheries in the area. • Northern Stone Crab (*Lithodes maja*) is not mentioned in this assessment. It is not a commercially important species but is present near Old Harry. • The Atlantic razor is not *Siliqua costata* but *Ensis directus*, caught in eastern Canada.
	5.4.2.1	The first paragraph contains inaccuracies and should be re-written. The following is proposed: American lobsters are distributed in localized reefs in nearshore areas around the four Atlantic Provinces and eastern Quebec. The spring fishing season removes individuals from the population prior to moulting and spawning. Adult female moulting and mating occurs during one summer, whereas the second summer is dedicated to laying the eggs. With proper conditions, some young females could moult, spawn and lay eggs in the same summer (DFO 2003). • "Courtship" is not a term that should be applied to Lobsters and crab – ***mating*** is the appropriate term. • The last sentence of the 2nd paragraph of p192 is incorrect – may be bad translation. (French version) • The statement that one in ten fertilized eggs will grow to become adults is likely incorrect. Also stages I II and III are not at the surface and are next to impossible to find. • The diet of juvenile lobsters is significantly different from that of adult lobsters (see Sainte-Marie and Chabot 2002) • Referring to "the coastal zone between the outer Port au Port Bay and Island Shag", these localities are in Newfoundland and Îles-de-la-Madeleine respectively. It is the Laurentian Channel, which separates them, where there are no lobsters, and it is not a ‘spawning’ area.
	5.4.2.2	• Some descriptions of snow crab are not correct. In the southern Gulf of St. Lawrence, snow crab does not move to shallower water to mate. They do not migrate to shallower waters for speeding up embryonic development. Mating does occur for pubescent females after the terminal molt but multiparous females (terminally molted) do not molt before mating. Females can use stored sperm to fertilize oocytes but it is not a general event. When mating partners are present they mate again. The

		statement *"Males continue to molt into adulthood and only a portion will recruit into the fishery"* has to be rewritten as it is ambiguous. Adult is the terminally molted crabs and a portion of terminally molted crab larger than the minimum size limit will recruit to the fishery when they harden their carapace in a following year. The description of snow crab life cycle/biology has to be re-written. • Snow crab distribution is also available from September multispecies survey as well as snow crab annual survey from Gulf Region. A snow crab fishing area (CFA) map in the southern Gulf of St. Lawrence, Eastern Nova Scotia and southwestern NL can be displayed here as it was done for lobster, particularly CFA 12F, 19, 4Vn, and 12A-C which are very close to Old Harry. • Regarding stock structure, Atlantic snow crab have recently been identified as a single stock complex ranging from Labrador to Gulf of Maine and encompassing the Gulf of St. Lawrence (see recent paper by Puebla et al.). This information should be amended in the text. • In reference to presence of green crab *in "the waters off Newfoundland…"* does this mean that green crab is in the area EL1105? Green crab (*Carcinus maenas*) is also present around Cape Breton Island and Prince Edward Island. Reference search should be done to include the recent distribution records of this species in the southern Gulf and northern Cape Breton. • Spermatophores are stored in the ***spermathecae***. • Smaller crabs are ***not*** found *"within the interstitial spaces of harder substrates."* The first benthic stages are furtive and live hidden among woody debris, biogenic structures or buried in the fine silt.
	5.4.2.3	• The following is text is proposed to describe Rock Crab: Rock crabs are decapods crustaceans that congregate in waters typically less than 20 m deep and occupy different substrates from sandy bottom to rocky habitats. There is a sexual dimorphism in the size of rock crab, with males growing to bigger sizes (140 mm) than females (100 mm). Sexual maturity is generally attained at carapace widths of 57 and 75 mm for females and males respectively. Molting peak period for males usually happen in the late winter months to allow carapace hardening before mating with soft-shell females in late summer-early fall. Fertilized eggs are extruded soon after mating and are stored under the female's abdomen for up to 10 months. Larval hatching occurs in the late spring / summer months, with the free-swimming larvae aggregating near the surface. The larvae go through six stages which can take up to three months in total before settling to the seafloor as a benthic crab. Rock crab larvae are omnivorous planktivores. • Rock crabs play an important ecological role in northern subtidal communities, mainly because of their wide abundance. Their diet includes bivalves, snails, green sea urchins, sea stars, amphipods, sand shrimp, and

		polychaetes. Rock crab is an important prey item for lobster of all sizes. Adult male rock crabs will reach commercial size (102 mm) at about six years of age.
	5.4.2.5	Several statements regarding whelk are incomplete or incorrect. Females lay capsules that contain numerous eggs – it is the capsules which are attached to hard substrates, and juveniles emerge from these capsules, not "young larvae".
	5.4.2.6	It is stated that shrimp are usually hermaphroditic. However, this species is always hermaphroditic.
	5.4.3	The EA needs to be clear in which species are/are not being presented with species-specific distribution and life history information and why. For example, Thorny skate are presented within the assessment and not Smooth skate. Accordingly, the entire section following table 5.10 should be amended for clarification. • Atlantic hagfish (also Table 5.10), Thorny skate, Smooth skate, and Black Dogfish are not pelagic species as stated in the text – they are groundfish species. • Contrary to that stated in the EA, there are currently moratoria on directed fishing for cod in the Laurentian South DU.
	5.4.3.1	Overall, the information presented on pelagic fish is incomplete. The most recent DFO CSAS Research documents and Science Advisory Reports pertaining to pelagic fish should be consulted for this assessment. Notably, a section on capelin should be added here. • Table 5.10 – for herring, add “spring spawning”; for mackerel, it is not present all year round, but from May to November, and there are also eggs and larvae, not only adults; for capelin, there is also immature. Also, the text mentions spring spawning which is not presented in Table 5.10. • Table 5.11 – add April to July for herring; and add capelin to the table. • Figure 5.32 – data from the southern Gulf survey (the southern Gulf is presented for some species) should be added. • Figure 5.33 – the distribution presented for Atlantic mackerel in the Estuary and northern Gulf is incorrect. For pelagic fish such as herring, mackerel, capelin, using data from bottom trawl catches does not provide the distribution of these species as shown here. Other techniques are required to establish such a distribution. • Figure 5.33 – this should be replaced by maps of eggs and catches from commercial fishing (purse seine) (the fishing positions of herring and capelin catches should also be included).

	Section 5.4.3.1, p. 201	Incorrect translation – French version *Pendant cette période, les larves survivent sur la vésicule ombilicale […].* Incorrect translation of "yolk sac"
	5.4.3.2	• Figure 5.40 – information is dated. More recent data exists for the study area. The data from 2003-2011 should be presented to illustrate current distributions as opposed to the distribution from a decade ago. Criteria for low occurrence need to be stated clearly. • Figures 5.42, 5.43, 5.48 – only present one year of data. This should be expanded to illustrate current distribution. • It is stated (p.156) *"Yellowtail flounder is a demersal flatfish found in the waters from Chesapeake Bay to Labrador…"* However, Yellowtail flounder are at the northern extension of their range on the northern Grand Bank in 3L off eastern Newfoundland. • Atlantic Halibut – information on distribution is restricted to data from the 2009 and 2010 August surveys of the northern Gulf. There is much additional information available on summer distribution from the sources listed below, including areas not covered or poorly covered by the August survey (information from the 2010 survey appears incomplete, or survey coverage was incomplete). Information on distribution in other seasons should also be presented. Swain et al. (1998); Chouinard & Hurlbut (2011); Comeau et al. (2002); Benoît et al. (2003); Darbyson & Benoît (2003); and recent CSAS Science Advisory Reports and Research Documents coming from stock assessments. • Haddock – information on distribution is limited to an old ECNASAP map. A considerable amount of more current information is available from the sources above. • Turbot and longfin hake – information on distribution is restricted to data from the 2009 and 2010 August surveys of the northern Gulf. This is a particular error since survey coverage was incomplete in 2010 and with the area of greatest interest for this report (the area around EL1105) not sampled. • Greenland Halibut –important information, while only recently published, should be included in this assessment. Ouellet et al (2012) present evidence that the project area corresponds to the main site of the spawning population of Greenland halibut in the Gulf of St. Lawrence. The species lays bathypelagic eggs (which grow in deep water) and eggs and larvae will be therefore abundant in the work area at the time of breeding (February-May). Greenland halibut is a major fish species for fisheries in the Gulf of St. Lawrence. • Monkfish – the text refers to monkfish outside of the Gulf in NAFO areas 3LNOPs. It is likely incorrect that "the Gulf provides habitat for an abundant population [of monkfish] within the warmer shelf waters." • Pollock – the text refers to Pollock outside of the Gulf. • White Hake – this section is inadequate. Information from southern Gulf

		surveys, noting that hake are distributed in either shallow inshore waters or in deep water along the Laurentian Channel in summer, migrating to overwintering grounds in deep waters of the Laurentian Channel should be included in the assessment. Please see: Swain et al. (1998); Chouinard & Hurlbut (2011); Comeau et al. (2002); Benoît et al. (2003); Darbyson & Benoît (2003); and recent CSAS Science Advisory Reports and Research Documents coming from stock assessments.. • Witch Flounder – this section is inadequate. Much of the text is only general in descriptions of species range outside of the Gulf. It should be emphasized that in winter pre-spawning adults appear to be aggregated in the area of EL1105 (Bowering and Brodie 1984). • The pre-spawning aggregation of witch flounder located within or near EL1105 should be considered as a sensitive/significant area. The overwintering aggregations of southern Gulf cod, and their migration route along the Laurentian Channel, represent other sensitive/significant areas near EL1105. • Thorny Skate – this section is inadequate. Much of the text is only general in descriptions of species range outside of the Gulf (e.g., the Grand Banks). See the above sources for information on the seasonal distribution of thorny skate within the Gulf. See Swain and Benoît (2006) for a description of recent changes in summer distribution, with an increasing concentration in deep water along the south side of the Laurentian Channel. Note: Thorny Skate (p.158) has under gone declines and is being considered by COSEWIC as a species at Risk.
	5.6	• Table 5.16 – The conclusion that the potential occurrence of blue whale in relation to the Project is uncommon is incorrect. This probability of occurrence is unknown, and may be higher in the spring and autumn when the blue whales migrate via the Cabot Strait, or in autumn through the area. Moreover, according to table 5.17 and DFO data presented therein, blue whale is a species that would be at least as common as the fin whale. The text should therefore be reviewed, as well as information at the beginning of p. 216 • The frequency of occurrence of belugas is probably very occasional. However, considering the high numbers recently reported along the West coast of Newfoundland (J. Lawson, DFO, Newfoundland, unpublished data), the characterization of rare does not do justice to their possible exposure to activities related to the project. The text of p. 219 should therefore also be edited. • Is Ocean Biogeographic Information System(OBIS) appropriate to establish such an inventory? What proportion of existing data does OBIS include? Does it include inventories mentioned earlier in the section on endangered species?
	5.6.1	Evaluation of abundance and potential presence of species in the study area

		should be carried out taking into account not only the study of Lawson and Gosselin (2009), but also that of Kingsley and Reeves (1998). Lawson and Gosselin (2009) estimates of abundance (with standard deviation) differ substantially from those obtained by Kingsley and Reeves (1998) very likely due to a delay in entry of animals into the Gulf. This hypothesis is substantiated by observations made on the Scotian Shelf and in U.S. waters during the survey period (see discussion of the paper). Estimates of distribution and abundance of Kingsley and Reeves (1998) are therefore also relevant and cover the area of the EL 1105.
	5.6.3	• It is incorrect to state that the four species of seals are hunted commercially in the Atlantic. Harbour seals, hunted to very low levels in the 1960s and 70s, are no longer included on personal sealing licenses. There is no commercial hunt for them anywhere in Canada. • Harp seal diet data requires updating. Capelin and not Arctic cod now appears its main source of food. • It should be noted that the area of the EL 1105 is part of the highly preferred hooded seal habitat, particularly males, when present in the Gulf of St. Lawrence (Lesage et al. 2007, Fig. 22; Bajzak et al. 2009)
	Section 5.6.3, page 241	Incorrect translation – French version *On observe le phoque commun et le phoque gris au même endroit, cependant la répartition est telle que le phoque commun est régulièrement vu dans le Golfe tandis que la population du phoque gris est concentrée au sud (LGL 2005b).* In the English version, the sentence formulated below does not present the same information: *Both the harbour and grey seals are likely to be common in the western Newfoundland offshore regions, with the distribution of the harbour seal being continuous in the Gulf and that of the grey seal to be more concentrated in the south (LGL 2005b).*
	5.6.4	• The leatherback is found in the vicinity of EL1105. Therefore “potentially” should be removed within the text. • There are actually four (not three) species of sea turtles that may be found in the area – need to add green turtle (*Chelonia mydas*) to list. • Include primary publication reference for Kemp’s Ridleys preferring shallow water, and remove “apparently” and repetition of shallow water preference.
	5.7; Page 224; Fig.	• It should be stated in the text that, while the boundary lines depicted on the map represent areas, EBSAs (and species) that are considered, above

	5.57	others, to contribute significantly to the Gulf of St. Lawrence ecosystem, these lines should not be taken as the absolute limits of that particular biological activity or ecological significance which may vary both spatially and temporally over the course of the year. *"The fact that a significant ecosystem component is not included or partially included in an EBSA cannot be considered as an ecologically significant absence. Sensitive populations as well as certain exceptional areas were not – or not entirely/always – included in the EBSA" DFO (2007b).* • Figure should also include the pre-spawning aggregation of witch flounder in EL1105. Although mentioned somewhat in the text of the EA, the overwintering aggregation of cod north of St. Paul Island and the migration paths of southern Gulf cod (and other demersal fish) should also be emphasized, as should the fact that most large demersal fishes in the southern Gulf overwinter in the Laurentian Channel.
	Title of Table 5.11, page 216	Incorrect translation – French version *Résumé des périodes de frai et d'éclosion des principales espèces faisant l'objet d'une pêche commerciale avec le potentiel de survenance dans la zone visée par le PP 1105* Incorrect translation of "occurrence"
	5.7.1, p. 225	The title should be Ecologically and Biologically SIGNIFICANT Areas if this is what is meant. Otherwise, EBSAs should not be used as an acronym as it is more commonly associated with SIGNIFICANT areas within the context of ecosystem based management. Considering the extremely complex and dynamic nature of the Estuary and Gulf of St. Lawrence (EGSL), EBSAs and their boundaries are meant to be presented only as a reference. It should also be recognized that EBSAs require re-evaluation over time (DFO 2011). Analyses leading to the identification of the ten potential EBSAs were based on the best scientific data available at the time – in this, several data sets were not included due to either of lack of geo-referencing or suitable electronic versions as well as large areas of the Gulf being poorly sampled. Therefore it should be noted that EBSAs for the ESGL do not cover all the areas or species that contribute in a significant way to the dynamic of the system. For example, only a small proportion (approximately 0.02%) of the benthic invertebrate species known to be present in the EGSL were considered in the EBSA process (Chabot et al., 2007). • The EA correctly identifies that EL1105 is within several identified important areas – including a wintering area for many demersal fish species; and an area important for marine mammals. However, EL1105 is within an area where the number of overlapping Important Areas (IAs) across thematic layers and dimensions was high (see Figure 17 in

		Savenkoff et al., 2007). The EA also does ***not*** mention the area of interest for the marine protected area surrounding the Îles-de-la Madeleine (project under study by Parks Canada). • The EA should also specify that there is a co-occurrence of several marine mammals in the area in winter for feeding – including deep-divers and blue whale (listed as endangered under the Species at Risk Act in 2005; northwest Atlantic population). • The EA should include that this region is one of the rare significant areas for soft corals and the only area where certain deep water shrimp species are found (*Pasiphaea tarda*, *Sergestes arcticus*, *Atlantopandalus propinqvus*, *Acanthephyra pelagica*) (Chabot et al., 2007).
	5.7.2 (& in Section 6.2); Page 226	There should be more consideration given to sensitive coastal areas throughout the Gulf. For example, with the exception of seabird nesting sites in section 5.7.3, there is no consideration of sensitive coastal areas of southwestern Newfoundland. Significant coastal and marine Areas, based on traditional knowledge, have been mapped for the Bay St. George/Port au Port area [see http://www.longrange.ca/pages/coastal.html]. Other documentation exists for Bay of Islands and the Northern Peninsula.
	5.8, French version of EA Report	To avoid any confusion, we recommend adhering to the official terminology used by Fisheries and Oceans Canada for the names of the following fish species: "Flétan de l'Atlantique" (Atlantic halibut) rather than "Flétan" (halibut) "Flétan du Groenland" (Greenland halibut) rather than "Flétan noir" (black turbot or black halibut) "Chaboisseau" (sculpin) rather than "Chabots" (sculpin) "Crabe araignée" or "crabe hyas" (toad crab) rather than "crabe lyre" (toad crab or lyre crab)
	5.8, Page 230	Fisheries catch data appear to have been collected independently from the 4 Gulf Regions: Newfoundland and Labrador, Maritimes, Gulf and Quebec. DFO National Headquarters (Ottawa) maintains a compiled database of fishing activity from each region and this may be a more complete source of data. Furthermore, regional data systems capture information on landings only for the respective region. Fish may be caught in a NAFO unit area and landed in another unit area. Please contact Rowena Orok DFO HQ (613) 881-6114 to inquire about the appropriateness of "ZIFF" data for this project.
	5.8, Page 230	Inshore fleets are not required to report geocoded landings by latitude and longitude. However, they are required to indicate unit area of their catch. As the fisheries catch information is presented by NAFO unit area it would be prudent to capture all commercial fishing activity, including inshore sectors.
	5.8.1, Page 230	St. Pierre does have fishing rights in 3Ps. Please revise accordingly.
	5.8.1, Page	It would appear that the species listed reflect both directed and by-catch. It

	231	would be useful have a separate list for directed and by-catch species.
	Figure 5.58, Page 232	The boundaries for 4Rd and 4Ss are not correct and should be revised. (i.e 4Rc and 4Sx have been omitted)
	Table 5.19 to 5.23	Source should be included in the tables.
	5.8.1, Page 235 & 237	The commercial fisheries data for 4Rd & 3Pn are not consistent with NL Region's Catch and Effort data. For example the Landings (kg) and Landed Value ($) for 4Rd lobster outlined in the EA document are the same value for each year in the series. *See attached NL data (February 2012).*
	Figure 5.59 to 5.62	Source should be included in the tables.
	5.8.2.1, Page 270	This section is titled Aboriginal Fisheries Newfoundland but it includes content for the entire Gulf region. Suggest that this section be titled "Aboriginal Fisheries." Note that as of 26 Sept 2011, the FNI achieved Landless Band Status and changed their legal name. They are now the Qalipu Mi'kmaq First Nation Band (www.qalipu.ca). They are the sole owner of that firm. The QMFNB have a number of licences with DFO. In total, 8 of their communal commercial licences are held in the name of the QMFNB and 1 is held in the name of Mi'kmaq Commercial Fisheries. They hold 7 licences in 4R. Please contact DFO for more up-to-date information.
	5.8.1.3	Historical fisheries should include a section on redfish.
	5.8.2.2, Page 272	The text references Salmon fishing on the West Coast only (SFA 13 and 14A). As commercial fisheries data are for portions of the south coast and west coast (4Rd and 3Pn) we suggest that to be consistent, information on SFA 12 should also be included.
	5.8.2.2 French version of EA Report	The title should be "Utilisation militaire" rather than "Les militaires emploient." "Pinfold (2009) a étudié l'estimation de la participation" should read "Pinfold (2009) a estimé la participation."
	5.8.2.7, p. 278	The Port of Belledune is a major commercial port in Northern New Brunswick operating within a highly industrialized area. The proponent should be aware that the traffic separation scheme is voluntary. Vessels may therefore be directed toward the drilling area if required by the route recommended in winter (open water area in the middle of the ice). The VHF coverage available in the Magdalen Islands does not cover this sector. The Newfoundland and Labrador region probably has better coverage starting at Port-aux-Basques and at the Table Mountain site. In this case, tests should be required or provisions be made at the very least for an HF installation (2182). This sector is well covered by the Cape Ray DGPS. However, since the AIS signal coming from vessels is not always received by the Magdalen Islands site, we would suggest that the drilling site have its own AIS site or receiving beacon connected to the shipping traffic management system (Innav).

		The document seems to downplay the impact of shipping traffic in the Old Harry region by indicating that between four and eight vessels, mainly container vessels, pass through this sector daily. Given an average of six vessels per day, that nevertheless equals 2,190 vessels annually, concentrated during the summer and fall. This part would have deserved better documentation.
	6.2; Page 282	The Marine Ecosystem VEC should have a broader focus thanjust corals and plankton. These two ecosystem components may represent VECs but do not constitute an assessment of the environmental effects at the marine ecosystem level. The marine ecosystem, in this case, is the entire Gulf of St. Lawrence and could be represented in the EA by the 10 Ecologically and Biologically Significant Areas (EBSAs) identified in DFO 2007b plus any other species or areas considered important at the ecosystem level. EBSAs were identified by DFO as a tool for assessing and managing ecosystem level effects of human activities. Therefore, it is suggested they be used as a way to assess ecosystem level environmental effects in this EA. Coastal systems should be treated as a separate VEC in this EA because the project is situated in a unique ecological area that is almost entirely surrounded by land.
	7.0	Literature on the potential environmental impacts of exploratory drilling is covered quite well and conclusions are in line with many reviews and individual studies dealing with the effects of drilling fluids and cuttings (e.g. MMS2000; CAPP 2001; NEB et al 2002; Buchanan et al 2003; Hurley and Ellis 2004; Neff 2005; Mathieu et al. 2005). Discharges associated with the drilling of a single exploratory well would normally be expected to disturb/impact habitat within a few to tens of meters from a drilling site.
	7.1.1	The EA notes that, *"Such a study has not been done for leatherback turtles; however, this species is recognized as being the fastest reptile 35.2 km/hr (19 knots) when frightened (McFarlan 1992) and might be expected to be better able to avoid a strike."* This is an inappropriate and misleading suggestion, as it is not necessarily the potential top speed of a marine vertebrate which influences its susceptibility to ship strikes. More relevant variables include whether or not the animal is in foraging "mode" versus transiting, as foraging animals are particularly vulnerable. EL1105 is located in key leatherback foraging habitat. It would be prudent to remove this argument from the assessment.
	7.1.2	Barium is the main metal in OBM and WBM. Questions have been raised about the potential for chronic toxicological effects in fish. A recent publication reported no health effects as assessed by a variety of indices, in fish chronically exposed to barite for several months (Payne et al 2011).
	7.1.4; Page	The approximate number of supply vessels that might be used during

	318	exploratory drilling operations should be given. Ship strikes and noise and are among the most frequently identified stressors of marine mammals in the Gulf of St. Lawrence.
	7.1.5	For the impact of noise generated by the work, no modeling of the affected area by the different sources of noise, continuous and impulse, is done to provide realistic estimates of noise levels at different frequencies and to map them on vertical and horizontal plane. • The exploration well is in relatively deep water (~470m). Sound in deep water will propagate to ranges of kilometers to tens of kilometers with less attenuation than characteristic of shallower more typical areas of the Grand Banks or Scotian Shelf – this would be especially so for sound propagating along the axis of the Laurentian Channel. • Considerable seasonable variation might also be expected in the amplitude of long-range propagated sound. In summer near-surface originating sound, as from air guns, will tend to be generally refracted downward by the prevailing sound speed stratification leading to substantial interaction with the bottom and rapid attenuation with range. In winter and spring the conditions in the deep water of the Laurentian Channel may be upward refractive (at least this is the case on the Scotian Shelf) and near-surface sound can be trapped in sound channels in the upper water column leading to substantially reduced sound attenuation at long range. While these effects are probably negligible close to a surface sound source at short range where acute effects on organisms might be expected, they could be of some consequence at long ranges where low levels of sound might, for example, exert behavioral effects on marine mammals such as influencing their movement. This would be especially relevant to the time of year the activities are taking place.
	7.1.5.1	• There appears to be some confusion in the EA in referring to VSP and “well site” surveys. For example, within the text, *“A typical well site survey (VSP survey) could...” - However, the “well site survey”* discussed in the quoted reference (Davis et al. 1998) is a conventional 2-D seismic survey conducted using a smaller, higher frequency air gun array to gather detailed geological/geotechnical info on shallow sediment structures around the well in order to plan well initiation and placement of any necessary equipment on bottom. The VSP survey generally looks at deeper geological structures and requires placing the receiving array down the well bore – and appears to be the type of survey proposed for Old Harry given the quoted source level of 242 dB re 1µPa @ 1m is typical for a true VSP survey. This information requires clarification. • The intent of the sentence *“The energy levels emitted from the VSP will be considerably less in source (760 in^3).”* is unclear. Lower source energy normally implies a lower total volume airgun array. The key point should

be that VSP sources have a sound pressure level intermediate between sources intended for shallow, local geotechnical type surveys and sources typically used for deep 2 or 3-D exploration seismic surveys.

- It has been identified that either a semi-submersible or a drill ship platform may eventually be chosen for the Old Harry exploratory well. As per Table 7.5, semi-submersibles are generally significantly quieter than drill ships. Noise levels emitted by a drill ship are roughly comparable to those emitted by other vessels of similar size; however, a drill ship represents a stationary, long duration noise source (20 – 50 days as per project scheduling) as opposed to a temporary noise source of a passing vessel.
- The statement *"...low frequency noise from a drilling platform might be detectable no more than 2 km away near a shelf break.."* may be best case scenario given that Table 7.5 identifies noise from a moored drill ship will attenuate to 115 to 120 dB (well above quiet ambient noise levels) at distances of 1 to 10 km. This 2 km detection range for drilling is also mentioned (p. 350) in the context of the avoidance of drill platforms by baleen whales.
- Accurate estimates are required. Also, essential measures are not included here: i.e., the levels of ambient noise, noise from the source at the frequencies considered and the estimated losses by propagation. Moreover, to what depths of the water column do we refer?
- Table 7.5 – the "Noise Level (dB re 1µPa)" column contains some error in presentation. Two, and possibly three, quite different acoustic measures are presented in this column without distinction. As such they are misleading for use in making determinations. For example, based on how they are labeled, it is natural to believe these numbers refer to broadband acoustic pressure level measurements at a point in space. However, a numeric level of 60 for "calm seas" appears much too low for a broadband pressure measurement – although is reasonably consistent with a typical power spectral level reported over a 1 Hz bandwidth in the frequency range 10 – 1000 Hz under calm conditions (and the correct units being dB re 1 $\mu Pa/Hz^{1/2}$. The quantity for "Moderate (not 'Modern' sic) Waves/surf" (100 – 700 Hz) seems to be properly labeled as broadband and 102 dB re 1µPa is not unreasonable. The quantity for "Pile-driving" appears to revert to the originally labeled point measurement of broadband noise (given the observation distance of "1 km"). The original literature should be checked to determine how "Fin whale" (probably source level), island drill rigs, or helicopter levels were measured or defined also. This becomes more important if these numbers are used elsewhere in the report to arrive at conclusions about the Old Harry drilling environmental impacts. For example, the EA notes bad weather ambient noise levels are stated in the range 90 to 100 dB re 1µPa – actually less than the moderate wave and surf levels of Table 7.5
- It should be understood and noted that broadband levels are quite dependent on how "broadband" is defined. The "jack-up", "semi-

		submersible", "moored drill ships", and various specialized vessel noise levels would appear to be acoustic source levels where the broadband acoustic noise levels expected from these devices if measured at a (mathematical only) reference distance of 1 m, the correct acoustic units in this case being dB re 1 µPa @ 1m. • Table 7.5 – the EA presents the frequency at which the intensity of the sound is observed. However, none of the sources presented is limited to a single frequency; the energy spreads on a band of frequencies, which may be more or less wide according to the sources. A presentation of the SPL with frequencies for each of the sources would have been much more informative to evaluate the impacts of each. • Table 7.5 – this should specify whether the levels @ 1 m are for discrete sources or other distances (e.g., fin whales, drilling platform) • Table 7.5 – the statement *"Overall broadband sound level did not exceed ambient beyond about 1 km…received levels at 100 m would be approximately 114 dB re 1 µPA."* is inconsistent. How can the overall broadband sound level at 1 km be less than ambient levels beyond 1 km, while it is still as high as 114 dB re 1 µPa at 110 km? This reference is probably not applicable here. In the St. Lawrence, the median broadband in the waterway is approximately 112 dB re 1 µPa (Simard et al. 2010).
	7.1.5.2	• The exploration well will be drilled in the Laurentian Channel, a major shipping channel, which is already subject to frequent high level ship noise. Therefore, near the well, on a long term average, the incremental noise level increase from support vessel activity as a fraction of the pre-existing ambient background should be less than if similar operations were conducted in other areas further removed from shipping lanes. • Figure 7.5 – there is error in the Y axis and legend. The indication of the Y axis is perplexing. From the English version (OB = octave band), one can deduce that these noise levels in third octave. The English legend indicates 1 m, the French 10 km.
	7.1.5.3	• The statement, *"The seismic signals are typically in the range of 10 to 200 Hz (Turnpenny and Nedwell 1994)"* is incorrect. Studies since that time showed that the sounds of airguns are on a broader band (e.g. see Potter et al. 2007). • The EA uses conclusions of Turpenny et al. (1994). These are questioned in the expert review of Popper and Hastings (2009) who note: Turnpenny et al. (1994) examined the behaviour of three species of fish in a pool in response to different sounds, but results are not useable due to lack of calibration of the sound field at different frequencies and depths and many other problems with experimental design. In enclosed chambers that have an interface with air, such as tanks and pools used by Turnpenny et al., the sound field is known to be very complex and will change significantly with frequency and depth (Parvulescu, 1967;

Blackstock, 2000; Akamatsu et al., 2002). As a consequence, responses of the animals in the Turnpenny et al. (1994) study cannot be correlated with any aspect of the acoustic signal, and the findings are highly questionable.

- "250 to 255 dB re 1 μPa" is incomplete in units – lacking "a ... @1m".
- The statement, *"The limited studies available suggest that anthropogenic sounds, even from very high intensity sources, might have no effect in some cases ..."* is incorrect and incomplete. This statement does not match current knowledge. See more references from Hastings, Fay and Popper on the effects of noise on fish.
- The statement, *"There are numerous anecdotal observations of fish under noisy bridges or near noisy vessels indicating that adverse effects are not necessarily overt and obvious, but anecdotal observations are unable to indicate whether fish experience any negative consequences related to the noise (Slabbekoorn et al. 2010)."* is an opposite interpretation of the Slabbekoorn et al. 2010 conclusion, and other information that follows (p.325) that show with references to support it the different ways in which anthropogenic noise can significantly affect fish, including: *"(1) Noise-dependent fish distributions…(2) Reproductive consequences of noisy conditions…(3) Masking effects on communicative sounds…impact the ability of fish to communicate acoustically or use the acoustic 'soundscape' ... (4) Masking effects on predator–prey relationships…ability of fish to find prey (get food) or detect the presence of predators…"*
- The statements, "*Available data suggest that they are capable of detecting vibrations but they do not appear to be capable of detecting pressure fluctuations." and "Crustaceans appear to be most sensitive to sounds of low frequencies (i.e., <10,000 Hz)."* require explanation. How does one distinguish the vibrations of pressure fluctuations? These are contradictory. Also, low frequencies are referred to in reference to frequencies up to 10 000 Hz, which is well beyond the usual range of low frequencies.
- The statement, "*The rate of injury experienced by macroinvertebrates due to the passage of a seismic survey should be less than indicated for planktonic organisms and fish. Lobsters are similar to crab in that they are thought to be resilient to seismic activity because decapods lack the gas-filled voids that would make them sensitive to changes in pressure."* is speculative and must be supported by references or removed. The differences in density and sound velocity of various tissues of crabs and lobsters (hepatopancreas, gonad, muscle, eggs, etc.) do not support this speculation that they are insensitive to pressure changes.

The following is noted on the biological effects of sound on marine mammals:

- The developer assumes that *the discontinuous, short duration nature of* *these pulses is expected to result in limited masking of baleen whale calls.* This is true for short distances. However, periods of silence are reduced as one moves away from the source by the reflection of sound, which increases the potential for masking. Several studies have shown that the propagation effects by multipath have the effect of producing multiple replicas of the pulses, thus increasing the risk of masking over long distances. (e.g. Madsen et al. 2006)

- Figure 7.7 and 7.8 – a source is required for these figures.
- The statement (p.333), *"Whistles have a fundamental frequency below 20 to 30 kHz plus higher harmonics…plus higher harmonics."* is inaccurate here; a reference is required and the list of species which have been shown *"…whistling harmonics above 30 kHz "*
- The statement (p.333), *"Baleen whales communicate using low frequency sounds (generally between 25 Hz…"* is incorrect. This lower limit of 25 Hz excludes the most frequent vocalizations of blue whales and fin whales.
- The EA notes that "Several species of baleen whales have been observed to continue calling in the presence of seismic pulses, including bowhead whales (Richardson et al. 1986), blue whales and fin whales (McDonald et al. 1995)." Continuation of vocal activity during seismic surveys does not imply a lack of masking as proponents claim (see previous sentence of the EA). Animals that vocalize likely cannot be heard by their conspecifics due to noise generated by the project activities. Masking of vocalizations during a period where the voice activity is used for functions such as the search for partners for reproduction may have non-negligible effects on individuals and these life history patterns. This can be particularly significant during the fall for large whales, when an increase in social activity has been documented in species such as the blue whale (Doniol-Valcroze et al. 2011).
- The effects of seismic surveys on echolocation are discussed for the odontocetes within the project. However, the more likely issue will arise due to the masking of vocalizations for communication, which are broadcast in some odontocetes such as beluga, at much lower frequencies (between 0. 5−16 kHz) than discussed in the EA (Sjare et al. 1986; Lesage et al. 1999), and where the beluga's signal components could be obscured by the higher frequencies of seismic pulses.
- The statements (p.335 and 337), *"...masking effects are expected to be negligible for toothed whales."* and *"The sounds produced by seismic air guns are in the frequency range of low hearing sensitivity for toothed whales."* are incorrect. Madsen et al. 2006 shows that the sounds received by the animals reach frequencies of several kHz, audible by odontocetes.
- The EA notes, *"The impact of both natural and man-made noise is less severe when it is intermittent rather than continuous (NRC 2003)*." However, this conclusion is not obviously stated within this reference – therefore it must be qualified within the EA. This assertion is probably

true in the context where the intermittent nature of noise is likely better communication during periods of silence between the pulses. However, to conclude that intermittent noise essentially has less impact on marine mammals is probably not a generality, since a strong impulse noise can have major impacts on an animal rather than a lesser intensity continuous noise.

- Richardson et al. 1995 are cited for *"…limited documented situations…"* This should be updated as it dates back 15 years, and several studies have been conducted since, for many species.
- The statement (p.338) *"In addition, baleen whales have often been seen well within distances where seismic sounds would be audible and yet show no obvious reaction to those sounds (LGL 2005b)…"* is incomplete and requires updated references (e.g. Nieukirk, et al. 2012; Castellote, et al. in press; Yavenko et al. 2007).
- The EA notes, *"The sound emission associated with the VSP and drilling noise would result in avoidance or temporary displacement, negating any potential positive effect. The Project Area does not represent any known critical habitat for any of the species that may pass through the area... The residual adverse environmental effects are therefore assessed as not significant."* The EA uses the project area as the area of influence. However, in the case of seismic surveys, the area of influence is likely much larger than this. The proponent assumes that avoidance of the area insonified (by drilling activity, dynamic repositioning jets of the platform, or seismic surveys) for a period up to 2 months (50 days) in the case of the drilling, has no impact on the use of the area as migration or feeding area. It is actually likely that, at certain times of the year as in the fall and in the spring, this area is a migration route for blue whales in particular. The use of this area for feeding by turtles or large whales is presumed low, whereas in fact, recent data indicate it is used as a foraging area by leatherback turtles.

The following is noted on the biological effects of sound on sea turtles:

- Ketten and Bartol (2005) and other more recent references included in the topic of sea turtle hearing would be useful inclusions in this assessment.

- The following statements in the EA are misleading: "Avoidance of the Project Area by sea turtles as a result of sound is also not expected to cause any adverse biological effects given that the area is not known to congregate jellyfish, a primary prey item. Jellyfish are transitory, with distributions changing within and between years, so there is no more reason to expect jellyfish within the Project Area than any other area of the Gulf." Also, "The Project Area offers no unique habitat or feeding areas for sea turtles."

  The area corresponding to EL1105 is part of a broader high-use foraging

		area for leatherback turtles, as demonstrated through satellite telemetry (see James et al., 2005). As leatherback presence in this area is well documented, spanning multiple years of data collection, etc., there is good evidence that jellyfish *are* concentrated in this areas and that there is a *predictable* concentration of leatherback prey in the Project Area. At this time, it cannot be concluded that the area of EL1105 does not provide unique habitat or feeding areas for leatherbacks.
	Section 7.1.5.3, page 359	Incorrect translation – French version […] *bien que certaines espèces, en particulier les <u>phoques à oreilles</u>, n'aient pas un aussi vaste champ d'audibilité.* Incorrect translation of "otaries"
	7.2, p. 342, 1st paragraph	The statement about Section 32 of SARA is not correct – it is not linked to critical habitat protection. Rather, critical habitat destruction is prohibited under Section 58. Section 32 relates to protection of individuals of listed extirpated, endangered or threatened species.
	7.2.2	The statement (p.343), *"As many Project-related activities are limited to the Project Area, they would only interact with species likely to occur in EL1105."* is unproven. No simulated noise fields have been performed and it is likely they will extend beyond EL1105. Impacts can also spread beyond the area, for example by pushing organisms outside, modifying, interrupting their migrations, as it is repeated several times that the animals avoid the area because of the noise that will be generated.
	7.2.4	Table 7.8 – Suggests that mortality resulting in collision with vessel is reversible? Please be advised that it is unlawful to kill harm, harass, capture or take an individual of a species that is listed as Endangered or Threatened under SARA unless permitted. This measure assists in protecting species, as the loss of an individual could be significant for a certain species (e.g. blue whale).
	7.2.2.5	The potential impacts of drilling noise and duration should also be discussed in this section.
	7.3; Page 352	Corals and plankton are identified even though "deepwater corals and sponges are not considered likely in the area"(see last line on pg 352). Kelp was also identified but eel grass was not although there are significant eelgrass beds in the adjacent coastal areas (see attached) and its importance was noted in section 5.3. Eel grass has been identified by DFO as an Ecologically Significant Species and their sensitivity to oil pollution is well documented, therefore eel grass should be included in the Marine Ecosystem assessment.
	7.1.1 and 7.3.2.1	The total impact of light is not considered in the EA. The effect of light that has not been considered is that on the circadian cycle of diel vertical migrations of pelagic organisms, rising to the surface to feed during the night, and take refuge deep to escape predation by visual predators (e.g., fish,

		birds). The presence of light around the platform at night will change local dynamics.
	7.4.2.1	• Regarding the statement (p.330), *"Several benthic sessile species have a very long generation time (e.g. Corals)."* Sea urchins and brittle stars are not sessile. • There is a lack of references to support recovery in 3-5 years. This is recognizably much longer for corals and sponges.
	Section 7.4.2.2, page 389	Incorrect translation – French version *Les organismes sédentaires qui ont des capacités motrices nulles ou très limitées, comme <u>le pouce-pied</u> et la moule* […]. Incorrect translation of "barnacle" *L'endofaune, comme la plupart des polychètes, amphipodes et palourdes, <u>emprunte des espèces</u>* […]. Incorrect translation of "burrowing organisms"
	Section 7.4.2.2, page 390	Incomprehensible translation- French version *Plusieurs études de terrain et en laboratoire ont été menées sur les effets possibles de la sédimentation et de la boue dans les coraux de forage.*
	7.4.2.5	References or examples are required for *"Most available literature indicates…"*, as well as all other statements of fact contained in this section regarding effects on fish and shellfish.
	7.6.3	While this section lists the mitigation to be implemented, details of these mitigations should be detailed. (i.e. details on implementation marine mammal observer, mitigations included in the Statement of Canadian Practice on Mitigation of Seismic Noise in the Marine Environment)
	7.8.2.1, p. 381	The authority to enforce the exclusion zones must be specified.
	8.7.1.1	• First bullet, second paragraph – the text states that pelagic and benthic fish have low exposure risk because they are highly mobile and able to avoid oiled areas. Larval and early juvenile fish are less mobile than older fish and so may be at greater risk. American eels at the glass eel stage migrate through the EL1105 area. Glass eels may not be able to avoid oiled areas because they cannot swim as rapidly as older eels. • There is no mention in this section about the potential impact of spilled oil drifting towards adjacent areas where marine fish species at risk are found in high densities. For example, residual surface and deep water currents in the project and adjacent areas tend to move from east to west around the southwest and west coasts of Newfoundland (Figs. 4.6-4.7,

		4.9-4.11) where high concentrations of juvenile and/or adult fish occur (e.g. Figs. 5.5 through 5.10). • The EA states (p.402) *"…Perhaps the species of greatest concern would be redfish as the Project Area overlaps a potential redfish mating area. Redfish typically mate in the fall; however, eggs are hatched within the female and are not extruded until the following April to July (Section 5.2.1.7). An oil spill would not affect redfish larvae, as the potential larvae extrusion area is outside (to the north, in the Cabot Strait) of the Study Area (Figure 5.56)."* However, this paragraph suggests the project area overlaps a potential redfish mating area, then goes on to suggest a potential larval extrusion area is outside the Study area. Is this speculation or is there a publication to reference for these claims? It is also possible that the project area is also a potential larval extrusion area.
	8.7.1.3	Sea turtles should be specifically referenced in the title as there is discussion of them in the corresponding text.
	Section 8.7.2; Page 405	Eelgrass is addressed, but the likelihood of direct oiling is minimized due to the distance of the project from shore, although it is well known that direct oiling of coastlines is a frequent result of a large oil spill, with surface slicks moving considerable distances. In addition calm, sheltered shorelines, marshes and river estuaries where eelgrass beds thrive are among the most sensitive areas to oil, providing quiet zones where oils can accumulate and bind to suspended particles, forming dense tar mats. Oil pollution can cause acute mortality of eelgrass beds, and other sea grass and seaweed beds by physically coating the plants, blocking sunlight and preventing photosynthesis. In addition, structural habitat provided by eelgrass can be compromised by the accumulation of toxic components of oil. Clean-up operations can also damage eelgrass beds.
	8.7.5	There is evidence following the recent well blow-out in the Gulf of Mexico (Deepwater Horizon) that hydrocarbon spills can be debilitating and lethal for sea turtles. Suggest including technical reports from NOAA, other sources here, as the impact is not negligible and should be recognized within the assessment.
	8.7.7, Page 410	The text does not reference seafood market price impacts associated with an oil spill – spills have led to food safety concerns and loss of reputation – these in turn have had negative market impacts.
	9.5	• The statement (p.416), *"Richardson et al. (1995) predicted a radius response to noise during development and production activities for baleen and ondontocetes to be less than 100 m."* is erroneous and requires correction. This general source, which contains several hundred

		pages should not be cited. The authors did not predict a "radious response." The effects of changing the behavior of animals can spread over very large distances (e.g. Risch et al. (2012). • Regarding the statement (p.416), *"Limited data suggest that vessels speeds below 26 km/hr (14 knots) may be beneficial in reducing marine mammal vessel collisions (Laist et al. 2001)."* See also: Vanderlaan et al. (2008); and Vanderlaan and Taggart (2007).
	Section 9.6; Page 417	Should consider eelgrass under sensitive areas: Low oxygen levels, typical of sheltered sea grass habitat, limit the biodegradation of oil and result in extremely slow degradation, with oil persisting for as much as ten years or more, depending on the amount and type of oil spilled. Recovery begins rapidly in rocky shorelines, but oil can persist for 6 to 12 years or more in protected soft sediments. When significant eelgrass areas are lost, they can be extremely difficult (or impossible) to re-establish, even with interventions such as transplants or seeding.

Review of Modeling in Support of Corridor Resources Old Harry Exploratory Drilling Environmental Assessment

General comments

In general, the scenarios in this document were not clearly described. The subsurface transport of dispersed oil (majority of the total oil) was not sufficiently modeled. The model only considered the re-entrained oil from surface in a 30m layer and did not consider the dispersion into water column during the rise of oil while oil was released from 470m. Overall, the results were not clearly presented.

Notably, the document did not take the expertise gained from the oil spill in the Gulf of Mexico into consideration for the Gulf of St. Lawrence which shares a good deal of similarities. We do not have the specific oil category that is to be extracted in the Gulf of St. Lawrence. However, the indications show that we expect it to be on the lighter side of the crude, close to the category of the one in the Gulf of Mexico. In short, the nature of the crude and the physical setting of both areas, a semi-enclosed sea, make it appropriate to use the expertise gained in the Gulf of Mexico to project the potential risks in the Gulf of St. Lawrence. As such, it is recommended to project the potential risks in the Gulf of St. Lawrence using the results of the oil spill in the Gulf of Mexico.

2. OIL SPILL SCENARIOS AND MODELING INPUTS

Regarding the trajectories of the oil spill, the trajectories presented in the document are unrealistic and do not serve the purpose. They should be redone with realistic winds and surface currents.

The model used to generate the surface current fields (Tang et al. 2008) is a good one. However, the oil-spill trajectories are calculated using seasonal mean surface water velocities (2.3.3 Water Currents on page 16). This choice of currents is completely unrealistic. There are no tides, no wind induced currents, and no influence of the surface outflow from fresh water runoff. The latter part is surprising given that the seasonal mean surface currents were used. Since in a typical oil spill, all of these components are present, the trajectories should be calculated with the hourly outputs of the model driven with realistic winds from Meteorological Service of Canada outputs.

Within this section, a blow out from the surface is illustrated. However, a blowout from the bottom is not illustrated. The Gulf of Mexico spill did not behave as a text book spill as the blow out was from the bottom; it was not at the surface. Some of the oil did not reach the surface, and a good portion of it stayed near the bottom. There is a need to determine where that oil would go using the hourly bottom currents of the ocean model. The document should therefore track the oil spills using near bottom currents.

2.1.2 Subsea Blowouts 5

- The name of the model for this study is given here, but a description of the formulation, capability, and limitation of the model is not provided. It is unclear if the processes described in section 2.1.2 have been fully or partially included in SLROSM. Justifications need to be provided on why this model (SLROSM) was used instead of other models (published and probably more advanced models, such as DeepBlow by SINTEF, OILMAPDEEP by ASA, or CDOG by Clarkson University). It is important to demonstrate that the selected model is technically sound for the proposed modeling work.

- Figure 3 – the illustration of vertical profile is inaccurate. With the presence of currents, the plume will be deflected rather than straight upwards.

2.3.2 Discharge Volumes and Flow Rates 15

Blowout scenarios were not clearly described in this section or in Table 3. Only the flowrate was provided but did not state the blowout period (10 days, or 3 months, etc.). Such information is key to the extent of oil covered area.

2.3.3 Water Currents

- It was stated that surface water current was used in the modeling. The surface only case is fine for the surface spill scenarios, but it is insufficient in modeling subsurface blowout. Although the 470m depth was classified as shallow in terms of hydrate formation it is deep enough that the subsurface current can play an important role to deflect and affect the plume behaviors. The deep/subsurface currents are particularly important for the study of dispersed oil transport process in the water column. The deep current is important considering the drill site is in a channel.

3. MODELING RESULTS

The duration of the trajectories presented in the document is unrealistic. The choice to stop the trajectories at a given level of ppm concentration is not documented. It is implied that all oil spills will be dispersed and absorbed in the environment at that level. In fact, a greater spill would make the oil go further and eventually reach a coastline. The document did not consider this issue which is a serious flaw.

It is recommended to use the results from the ocean model under the proper conditions and ensure that the duration is long enough to show the coastline potentially at risk.

3.1 Batch Diesel Spill Fate Modeling

- The modeling was conducted in average wind conditions, what about under worst case scenarios without wind? This scenario is missing.

- It is stated that "*The subsurface oil also diffuses laterally as it is moved away from the spill site by the prevailing surface water currents*". Again, this is very confusing that *subsurface oil* is dispersed by *surface* current.

- It is stated that "*It has been assumed that the oil will mix in the upper 30 m of water as this is the minimum surface water mixing depth reported in the literature for the region (Drinkwater & Gilbert 2004)*". Why assume the mixing depth while there are models available to simulate the 3D (including vertical) transport behaviors? This simplification (30m mixing) may cause overestimate of concentration in some areas and underestimations in other areas.

3.2 Subsea Blowout Fate and Behaviour Modeling

Without knowing the blowout period, it is difficult to interpret the results. It was stated that between 16 and 29% will evaporate and the remainder will disperse, but the associated time step was not given as the mass balance will continue to change with continuous blowout (maybe month long). Therefore the results in Table 7 only represent the condition at a given time point but the evolution with time is missing. Furthermore, very little has been presented here about the fate of dispersed oil (84 to 71% of total oil, majority), including the vertical distribution. A contour plot of horizontal and vertical area should be provided, as should the depths where 0.1 ppm concentrations are found. Also, without the use of deep currents, the distances in Table 7 are questionable as the deflection of plumes was not considered. The bathymetry around the site is not provided, which may also affect the behaviors of dispersed oil, but there is no discussion on this subject.

- One important factor that affects the fate of dispersed oil is the droplet size distribution. What distribution was used and how was it calculated?

3.3 Surface Blowout Fate and Behaviour Modeling

The document refers to "*throughout the blowout period*". How long is the period? This is not provided anywhere. Section (4) provides this information for surface oil trajectory, but it was stated there that "This does not represent a scenario that would actually occur in a continuous blowout situation but rather provides a reasonable worst-case assessment of spill behaviour", it is unclear if this "every 6-hour batch for a month" release case used in section 4 was also used in section 3.

<u>4. SURFACE OIL SLICK TRAJECTORIES</u>

4.2 Typical Monthly Surface Oil Slick Trajectories

The document states, *"Each one of these six-hour quantities of oil has been tracked until the surface oil is completely evaporated and dispersed from the surface."* However, have the emulsification process been modeled? Although this may not be important in summer conditions, it cannot be neglected in winter conditions as a fraction of emulsion may stay on surface much long and transport far beyond the modeled 3-4 km radii (Fig 5).

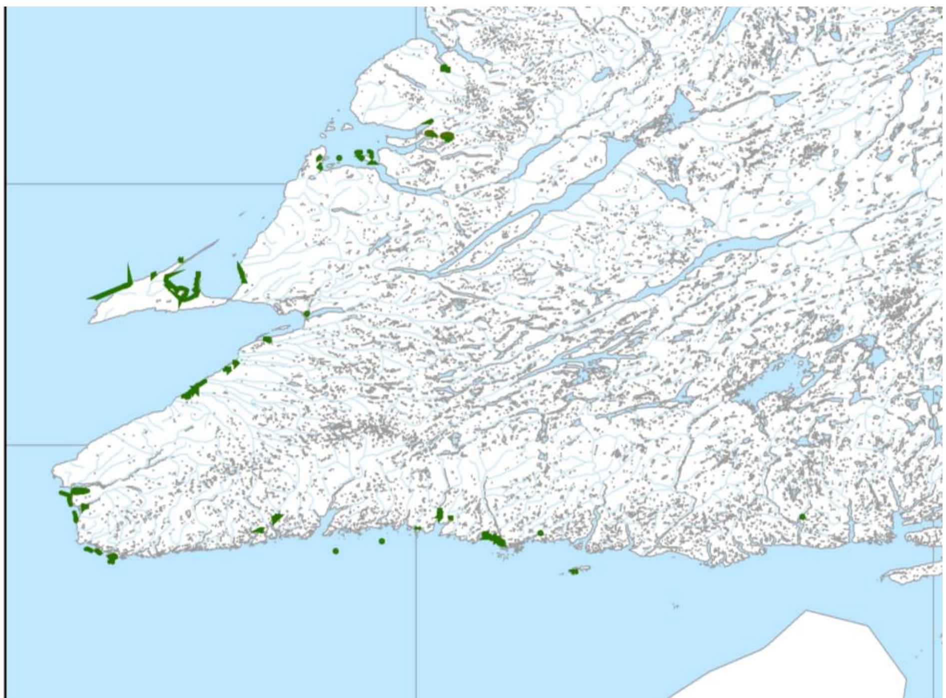
<u>5. DISPERSED OIL PLUME TRAJECTORIES</u>

5.1 Introduction

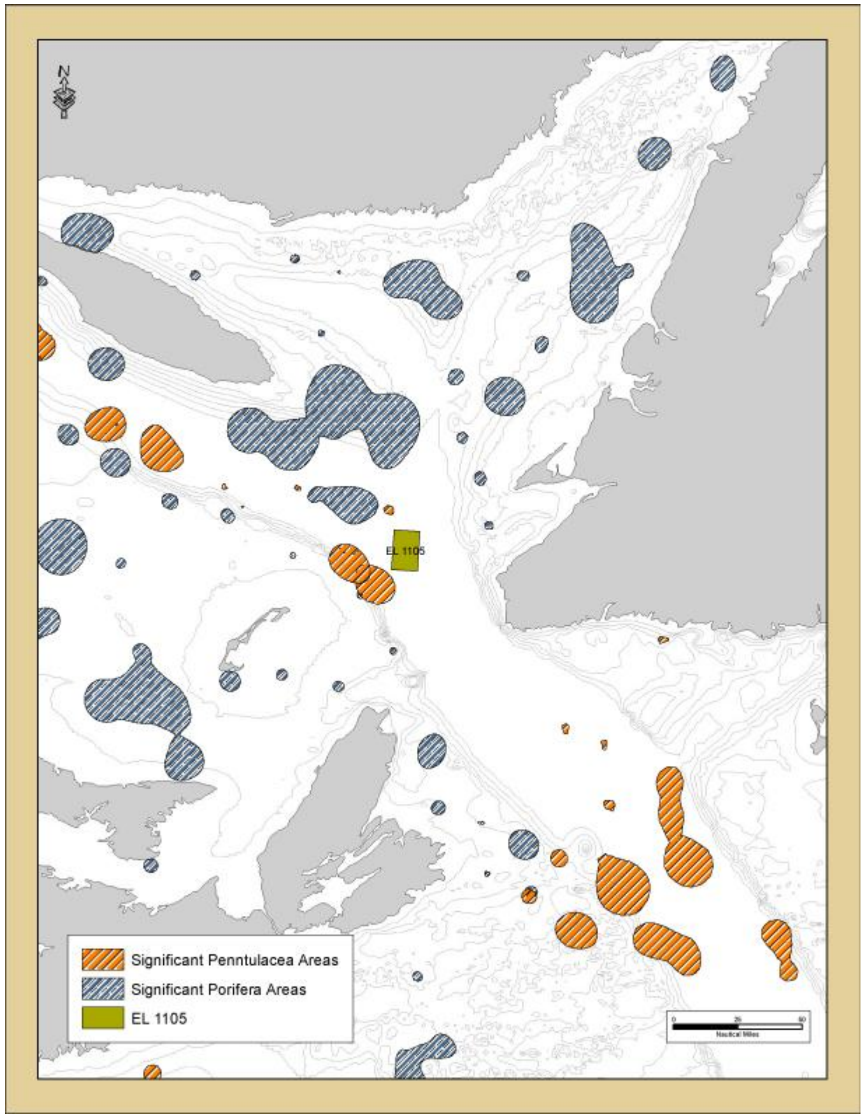
The title is "dispersed oil plume trajectories", however, this section only covers the re-entrained oil from above surface release as mentioned in page 33 "In these simulations, the quantity of oil that would be released from six hours of a continuous above sea blowout has been introduced on the surface at the exploration site as a batch spill every six hours over month-long periods" The behaviour of near bottom release and mass in the water column will be entirely different and are not covered here.

5.2 Typical Monthly Dispersed Oil Plume Trajectories

The document states, *"The initial movement of the dispersed oil plume is assumed to be due to a combination of winds and surface water currents. The prevailing surface water currents alone are assumed to drive the dispersed oil plume once the surface slick is depleted."* As discussed before, once the oil is entrained into water column, surface current should not be used, as the high amplitude of surface current may cause over flushing/dilution and underestimate oil concentration.



Eelgrass Locations in Newfoundland and Labrador
Map compiled by Anuradha Rao, 2007.
Eelgrass data collected by Anuradha Rao, researchers at Memorial University of Newfoundland, and the Department of Fisheries and Oceans.



Summarizing most recent data on deep-sea coral and sponge in the Gulf of St. Lawrence. Figure compiled by Cam Lirette, data from Kenchington et al. 2010.

Landings & Landed Value **4Rd**

Feb 2012 (update)	2004		2005		2006		2007		2008		2009		2010	
	KGMs	Value	KGMs	Value	KGMs	Value	KGMs	Value	KGMs	Value	KGMs	Value	KGMs	Value
American plaice	62,156	$54,211	101,894	$71,685	49,460	$34,690	70,871	$54,302	40,594	$28,253	77,152	$66,171	53,175	$45,289
Capelin	60,958	$17,593	345,640	$98,836	755,673	$230,366	72,999	$19,586	4,083,326	$1,096,536	531,430	$82,011	133,182	$16,149
Cod, Atlantic	310,928	$373,175	394,528	$413,320	716,527	$862,183	556,121	$882,335	639,266	$1,061,415	572,663	$603,397	221,689	$219,627
Crab, Queen/Snow	337,842	$1,830,590	84,652	$279,864	44,796	$98,767	24,126	$85,656	58,691	$201,332	110,557	$351,614	52,703	$156,856
Crab, rock	238	$183	-	-	-	-	-	-	-	-	-	-	-	-
Cusk	34	$13	12	$5	9	$7	-	-	5	$1	14	$4	36	$10
Eels	13,799	$60,170	15,288	$73,759	10,406	$50,933	14,825	$78,231	5,531	$19,252	9,790	$32,772	17,471	$58,035
Greysole/witch	406,796	$355,345	476,428	$418,622	412,128	$361,902	427,218	$373,752	300,847	$212,106	244,097	$212,026	109,264	$77,805
Haddock	2,831	$2,861	9	$9	20	$18	3	$3	20	$22	17	$11	24	$18
Hake, white	12,448	$5,980	8,074	$4,836	3,635	$2,473	2,370	$1,881	5,197	$3,373	2,408	$1,681	2,810	$1,962
Halibut	35,173	$232,757	40,086	$255,356	39,332	$246,352	12,425	$73,964	19,516	$115,823	18,785	$122,305	23,543	$146,455
Herring, Atlantic	7,565,099	$1,170,301	7,646,778	$1,869,925	7,537,987	$1,545,732	374,913	$75,530	11,058,093	$2,054,107	4,134,037	$911,390	8,227,724	$1,632,699
Lobster	263,479	$2,965,587	347,721	$4,085,490	351,275	$3,841,553	333,039	$4,255,267	403,391	$3,856,644	343,451	$2,576,323	320,903	$2,337,825
Mackerel	9,533,066	$2,521,992	7,012,556	$2,512,305	7,110,085	$2,291,493	7,935,416	$2,308,913	4,423,152	$1,460,309	13,817,258	$4,264,614	3,711,353	$1,636,410
Monkfish (Am angler)	768	$756	1,243	$1,301	333	$409	87	$102	32	$21	416	$422	645	$655
Pollock	221	$86	60	$31	17,407	$9,333	124	$76	818	$489	2,326	$1,449	164	$93
Redfish	84,084	$37,075	366,011	$188,564	58,256	$38,511	336	$185	53,723	$31,860	90,083	$66,076	80,731	$53,200
Roe, lumpfish	26,320	$142,164	21,291	$66,515	29,998	$59,520	1,273	$5,583	179	$885	-	-	-	-
Scallop, Sea	12,288	$18,954	1,118	$2,079	-	-	301	$460	6,777	$12,222	-	-	4,141	$6,468
Seal fat	5,329	$2,350	-	-	-	-	-	-	-	-	353	$156	-	-
Seal skins, grey	-	-	-	-	-	-	-	$180	-	-	-	-	-	-
Seal skins, harbour (no.)	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Seal skins, harp, beater (no.)	-	$102,824	-	$1,260	-	$25,515	-	$7,891	-	$244	-	$641	-	-
Seal skins, harp, bedlamer (no.)	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Seal skins, harp, ragged jacket (no.)	-	$1,566	-	-	-	-	-	-	-	-	-	$20	-	-
Shark, mako	2,406	$2,006	1,383	$1,022	1,713	$866	202	$191	164	$156	626	$579	511	$476
Shark, porbeagle/mackerel	-	-	-	-	-	-	-	-	-	-	464	$682	-	-
Shark, unspecified	302	$239	312	$287	-	-	-	-	-	-	571	$251	-	-
Skate	11,209	$2,498	6,202	$1,165	9,607	$1,962	12,073	$3,658	10,169	$2,628	6,918	$1,803	2,082	$450
Smelts	-	-	-	-	-	-	-	-	3,629	$4,400	-	-	-	-
Tuna, bluefin	-	-	-	-	-	-	-	-	501	$3,534	-	-	-	-

Canada

Turbot/Greenland halibut	2,418	$4,257	4,314	$8,291	2,058	$3,799	1,583	$2,538	2,130	$3,329	1,863	$3,047	3,686	$7,845
Winter flounder	49	$18	214	$85	265	$107	157	$77	2,619	$1,339	39	$18	42	$26
Wolffish, Striped/ Atlantic	5,909	$2,611	6,894	$2,579	3,387	$1,208	4,536	$1,369	4,319	$1,499	7,783	$2,679	3,816	$1,271
Yellowtail flounder	240	$179	-	-	-	-	-	-	-	-	-	-	-	-

Landings & Landed Value 3Pn

Feb 2012 (update)	2004		2005		2006		2007		2008		2009		2010	
	KGMs	Value	KGMs	Value	KGMs	Value	KGMs	Value	KGMs	Value	KGMs	Value	KGMs	Value
American plaice	8,908	$7,039	11,254	$7,533	9,285	$6,780	10,455	$8,073	10,013	$6,866	11,472	$9,499	6,327	$5,477
Catfish	3	$1												
Cod, Atlantic	778,578	$936,568	849,090	$883,691	1,208,134	$1,455,492	1,080,830	$1,748,686	1,130,827	$1,894,623	1,357,364	$1,429,240	705,426	$698,639
Crab, Queen/Snow	1,461	$7,909	520	$1,776	2,066	$4,272	2,986	$10,743	1,325	$4,668	649	$2,060	1,039	$3,092
Cusk	319	$123	69	$31	87	$66	83	$26	299	$74	123	$32	64	$23
Eels	6,294	$27,342	3,207	$16,756	2,985	$14,342	2,569	$13,310	2,462	$7,458			4,473	$16,664
Fins, shark			10	$22	9	$20	15	$34	19	$14	6	$3	67	$37
Greysole/witch	4	$4	3	$3			1	$1	6	$4	1	$1	31	$22
Haddock	11	$12	3	$3			2	$2	107	$120	64	$41	83	$62
Hagfish/slime eel	613	$369												
Hake, white	74,874	$35,795	44,887	$26,991	15,864	$10,816	36,004	$28,712	46,658	$39,532	27,354	$19,983	20,920	$17,067
Halibut	28,959	$191,666	22,007	$140,404	17,280	$108,095	29,600	$175,477	42,944	$250,388	61,231	$397,997	46,277	$287,531
Herring, Atlantic	42,582	$8,089	100,834	$20,446	90,399	$21,532	82,491	$18,133	8,594	$1,376	79,030	$16,597	9,371	$2,034
Lobster	12,932	$145,343	28,808	$353,941	47,954	$526,010	93,954	$1,181,238	153,264	$1,455,643	127,342	$925,350	138,738	$1,042,985
Mackerel	29,499	$8,298	81,688	$26,810	76,863	$25,296	51,581	$14,610	5,928	$1,764	5,024,020	$1,550,329	4,343,504	$1,915,063
Monkfish (Am angler)	142	$143	223	$355	91	$148	54	$63	272	$235	43	$42	173	$175
Pollock	5,717	$2,264	1,795	$916	1,648	$901	2,546	$1,577	2,776	$1,654	6,015	$3,247	2,105	$1,165
Redfish	165,127	$72,806	51,812	$26,727	165,881	$109,710	19,230	$10,602	50,572	$29,956	22,932	$16,770	55,645	$36,677
Roe, lumpfish	89,075	$481,116	56,001	$172,855	59,361	$117,781	4,403	$19,567	197	$1,631			1,346	$12,317
Seal fat	19,927	$8,786												
Seal flippers (no.)							0	$194						
Seal skins, harp, beater (no.)	0	$291,652					0	$7,443	0	$99				
Seal skins, harp, bedlamer (no.)	0	$35												
Seal skins, harp, ragged jacket (no.)	0	$9,935												
Shark, mako	671	$526	1,413	$1,036	527	$293	1,355	$1,248	1,406	$1,325	1,454	$1,171	794	$650
Shark, porbeagle/mackerel			28	$21	105	$115					237	$302	467	$927

Shark, unspecified	130	$119	158	$146	169	$104			267	$172	437	$196	477	$210
Skate	11,018	$2,285	8,561	$1,752	6,772	$1,582	9,927	$2,881	10,034	$2,489	7,610	$2,103	5,644	$2,149
Turbot/Greenland halibut	705	$1,261	1,128	$2,164	1,487	$2,730	1,173	$1,886	953	$1,492	1,235	$1,978	378	$808
Winter flounder	1	$0	7	$3	121	$53			36	$28	35	$17		
Wolffish, Striped/ Atlantic	4,822	$1,727	9,973	$3,593	4,710	$1,642	5,312	$1,665	8,983	$3,060	13,655	$4,736	4,615	$1,488
Yellowtail flounder			51	$45	19	$13							16	$9