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SEP 2 4 2012

Elizabeth MacDonald
Environment, Canada-Nova Scotia Offshore Petroleum Board
6th Floor, TD Centre
1791 Barrington Street
Halifax, Nova Scotia
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Dear Ms. MacDonald:

RE: DFO Maritimes Region Comments on the Canada-Nova Scotia Offshore Petroleum Board Strategic Environmental Assessment of the Middle Bank and Sable Bank Region of the Eastern Scotian Shelf (SEA Area 1A)

This letter outlines comments of Fisheries and Oceans Canada (DFO, the Department), Maritimes Region, regarding the Canada-Nova Scotia Offshore Petroleum Board (CNSOPB – the Board) Strategic Environmental Assessment (SEA) for the Middle Bank and Sable Bank region of the Eastern Scotian Shelf (SEA Area 1A). The intent of the SEA is to identify potential environment-offshore petroleum activity interactions that may exist and need to be considered in regard to future offshore petroleum exploration and development activities that may occur in this region. The SEA may not replace the need for a project-specific review pursuant to the *Canadian Environmental Assessment Act* (CEAA) or any other applicable legislation.

To date, DFO has contributed to the SEA by providing comments on its scope and, herein, on the draft SEA released for public comment. An SEA is typically considered a high-level overview and assessment that identifies the potential environment-activity interactions (and associated mitigation) that an industry should be aware of and may need to consider prior to undertaking activities within a defined spatial boundary. By this definition, DFO believes the SEA has identified the major ecosystem attributes of the Middle Bank and Sable Bank region of the Eastern Scotian Shelf, as well as completed an assessment that provides a reasonable characterization of applicable environment-offshore petroleum activity interactions in these areas, including their mitigation. The Department emphasizes that it is important these sorts of mitigation measures be followed.

Fisheries and Oceans Canada believes that the document is well organized and demonstrates a familiarity with SEA requirements. However, although the treatment of key features of the existing environment, associated impacts, and mitigation measures is comprehensive and, as mentioned, shows experience with key concerns, DFO also believes certain aspects of the SEA require further attention (specific comments follow below):

- The SEA requires greater discussion regarding the potential impacts of seismic surveys on beaked whales, and their critical habitat (e.g. Gully, Haldimand, and Shortland canyons), including beaked whale species other than the northern bottlenose whale (e.g. Sowerby's beaked whale). It should also be reinforced that seismic activities in proximity of critical habitat may require additional forms of mitigation beyond the Statement of Canadian Practice with respect to the Mitigation of Seismic Sound in the Marine Environment (SOCP) (which is considered a minimum standard), and that this will be evaluated on a per case basis as projects are proposed;

- The SEA requires greater discussion of Wide Azimuth (WAZ) 3D seismic, including its noise level/intensity, footprint, duration, and impacts on marine species and fisheries. The discussion should consider applicability of SOCP in context of this newer technology, including relevance of existing mitigation measures and the identification of data gaps;

- The SEA would benefit from greater discussion regarding lessons-learned, recommendations, mitigation measures, and data gaps identified in on-going research that has followed the Deepwater Horizon oil spill in the Gulf of Mexico.

In closing, DFO again recognizes the intent of the SEA to be a high-level overview and assessment and notes that additional environmental assessments may be a requirement pursuant to CEAA, or other applicable legislation, prior to any future offshore petroleum activities occurring in the study area. Thus, provided the comments outlined in this letter are considered, DFO feels that the SEA contains an adequate level of information and assessment for its intended purpose. If you have any questions or concerns regarding the comments, please do not hesitate to contact Kristian Curran at a time convenient to you by telephone, 902-407-8175, or by email, Kristian.Curran@dfo-mpo.gc.ca.

Sincerely,

David Millar
Regional Director
Ecosystem Management

cc: Paul Gentile
Glen Herbert
Mark McLean

Specific Comments

1.0 Introduction – P1.1, Paragraph 2 – there should be a brief statement outlining what constitutes "exploration" (i.e. seismic, geophysical surveys, exploratory drilling, etc.).

2.0 Exploration Activities – P2.1, Table 2.1 – Geophysical Surveys – the subsection on seismic should indicate how long 2D and traditional 3D seismic programs typically last (for consistency with other subsections in the table). In addition, the table should include a more detailed description of Wide Azimuth (WAZ) 3D seismic, including how its noise levels/intensity, survey foot print, and duration compare to traditional 3D surveys.

2.0 Exploration Activities – P2.1, Table 2.1 – Geophysical Surveys – an air gun audibility range of roughly 75 km seems realistic (Davis et al. 1998) for the shallower areas of the Scotian Shelf during the summer and fall when downward refractive acoustic propagation conditions generally occur. During the spring, prior to the formation of the shallow summer thermocline the otherwise cold intermediate layer on the central and outer shelf extends to the surface, and the water column can be upward refractive. This results in shallow origin sound being trapped near-surface and propagating to long distances with minimal attenuating interaction with the bottom sediments. One should exercise caution that the shallow seasonal thermocline has formed before seismic exploration shooting occurs. Issues of this sort could be effectively addressed by season-specific acoustic modeling at the project-specific level.

Davis, R.A., D.H. Thomson and C.I. Malme, 1998. Environmental Assessment of Seismic Exploration on the Scotian Shelf. Rep. by LGL Ltd. and C.L. Malme for Mobil Oil Properties Ltd., Shell Canada Ltd., and Imperial Oil Ltd., Calgary, for submission to the Canada-Nova Scotia Offshore Petroleum Board, 5 Aug. 1998: 181 p. + Appendices.

2.0 Exploration Activities – P2.1, Table 2.1 – Geophysical Surveys – the description of seismic states that typical zero-to-peak source levels for exploration seismic arrays are 245-260 dB relative to 1 μPa at 1 m, but it isn't clear whether that range of source levels are viewed over all orientation angles to the source, or over the range of source levels expected within the main lobe of the source (normally pointed downwards). It is important to mention that the exploration seismic sources are directive.

3.1 Physical Characteristics – P3.1 (and on P3.4, Table 3.1) – the description of the physical environment is generally accurate, but some of the terminology used is incorrect. For example, the SEA refers to the Labrador Current as flowing along the Scotian Shelf break. This is more accurately referred to as the shelf break current, which is considered as an extension of the Labrador Current. Also, it is inaccurate to state that the cold Labrador Current always flows along the shelf break since, on average, warm slope water occupies the shelf break area. Periodically, related to low North Atlantic Oscillation (NAO) events, colder, fresher Labrador Current water makes its way around the tail of the Grand Banks, displaces the warm slope water off the shelf, and invades the deep basins of the Scotian Shelf and Gulf of Maine regions. This phenomenon, however, has been the exception for the last few decades and is expected to remain so under predicted climate change conditions. Related to the above, Drinkwater et al. (1998, 1999) and Petrie (2007) are better physical environment documents to reference in the SEA rather than the Zwanenburg (2006) reference that has been used.

Drinkwater, K.F., D.B. Mountain and A. Herman. 1998. Recent Changes in the Hydrography of the Scotian Shelf and Gulf of Maine - A Return to Conditions of the 1960s. NAFO SCR Doc. 98/37.

Drinkwater, K.F., D.B. Mountain, and A. Herman. 1999. Variability in the Slope Water Properties off Eastern North America and their Effects on the Adjacent Shelves. ICES C.M. 0(08): 26.

Petrie, B. 2007. Does the North Atlantic Oscillation affect hydrographic properties on the Canadian Atlantic Continental Shelf? Atmos.-Ocean, 45 (3) 2007: 141–151.

3.1 Physical Characteristics – P3.3, Paragraph 3 – two other major canyons on the east Scotian shelf/Slope that should be noted in this paragraph are Haldimand and Shortland canyons.

3.1 Physical Characteristics – P3.3, Table 3.1 – the table could include a summary of the number of fog/visibility days per month or season. Similarly, a discussion regarding natural seismic activity (e.g. sea bed stability) and tsunami activity could also be included in this table (the reader can then be directed to Chapter 6.0 of the document for more details).

3.1 Physical Characteristics – P3.3, Table 3.1 – Waves – the table could include significant wave height at 5- and 10-year return periods, which would cover the lifespan of the SEA. Information regarding wave period may also be beneficial, since wave energy differs between similar wave heights of different wave periods.

3.1 Physical Characteristics – P3.3, Table 3.1 – Sea Bed Characteristics – the term "recently" in bullet two seems inappropriate when talking in geological terms. Additional references that should be included in this section are Piper and Campbell (2002) and Li and King (2007).

Li, M.Z. and E.L. King. 2007. Multibeam bathymetric investigations of the morphology of sand ridges and associated bedforms and their relation to storm processes, Sable Island Bank, Scotian Shelf. Marine Geology, 243 (1-4): 200-228.

Piper, D.J.W. and D.C. Campbell. 2002. Surficial Geology of the Scotian Slope, Eastern Canada. Geological Survey of Canada Current Research E-15. 12pp.

3.2.1.2 Zooplankton – P3.5 – there appears to be a missing category between mesozooplankton and megazooplankton that covers sizes range of zooplankton between 2 mm-20 cm. Please clarify why this is the case.

3.2.2 Algal Communities – P3.7, Table 3.2 – Marine Plants – the table could include a statement regarding the general timing of the spring and fall plankton blooms observed on the eastern Scotian Shelf.

3.2.3 Corals and Sponges – P3.9, Figure 3.2 – Corals and Sponges – the legend items "no corals found" and "no sponges found" are incorrect. It is more accurate to state "null data", which represents records where a DFO fishery trawl survey may have occurred, but no coral or sponge by-catch was noted. Again, "null data" does not necessarily mean "no presence" of coral or sponge rather the absence of a coral/sponge by-catch observation.

3.2.4 Commercial Fish and Invertebrates – P3.10, Paragraph 1 – the paragraph introduces fish species as groundfish, pelagics, and invertebrates, while subsequent sections of the SEA follow the order: pelagics, groundfish, and invertebrates. The ordering of fish species by sub-type should be consistent with the order listed in its introductory text.

3.2.4 Commercial Fish and Invertebrates – P3.11, Table 3.5 – Commercial Fish Species – the table could be sub-organized alphabetically by pelagic, groundfish, and invertebrate species to be consistent with subsequent tables and text.

3.2.4.4 Fish Species of Special Status – P3.15 –a table of "fish species of special status" organized similar to Table 3.5 on Page 3.11 would be beneficial.

3.2.4.4 Fish Species of Special Status – P3.15, Table 3.8 – Fish Species of Special Status Potentially Occurring in the Study Area – it is unclear what data sources the authors used to determine the "potential for occurrence" rankings, how the categories for potential occurrence are defined (low, intermediate, high), and what life history stages are being considered in the analysis. It t is suggested that the data sources used for these determinations (and any limitations) be referenced in the SEA.

Section 3.2.5 Marine Mammals and Sea Turtles – Page 3.21 – an additional reference that should be included is Breeze et al. (2005). It provides a comprehensive review of cetacean species of the Scotian Shelf, as well as their likely preferred habitat based on an analysis of several available datasets. It is also important to note that while the Trans North Atlantic Sightings Survey (TNASS) surveys provide some of the most up-to-date abundance estimates of various cetacean species resident on the Scotian Shelf, the results from this large scale survey are only based on approximately one month of effort in July-August 2007 and, thus, may not be representative of cetacean distribution and abundance on the Scotian Shelf during other time periods (e.g. non-summer months), nor do they tell us much regarding natural variability in the trends observed. Last, higher resolution abundance and distribution patterns for some species of particular interest can be obtained from species-specific research programs, such as Dr. Hal Whitehead's research on Scotian Shelf northern bottlenose whales (Dr. Hal Whitehead, Department of Biology, Dalhousie University).

Breeze, H., D. Fenton, R.J. Rutherford, and M.A. Silva. 2002. The Scotian Shelf: An ecological overview for ocean planning. Ca. Tech. Rep. Fish. Aquat. Sci. 2393.

Section 3.2.5 Marine Mammals and Sea Turtles – Page 3.23, Table 3.9 – though the focal point of the distribution of northern bottlenose whales is around the Gully and the nearby Shortland and Haldimand canyons, there are a number of northern bottlenose whale sightings reported along the continental slope in areas further southwest, such as Logan Canyon (see Figure 2 in the northern bottlenose whale Recovery Strategy – see reference below: DFO, 2010). It remains difficult, however, to determine the importance of these areas to whales due to a lack of research effort in areas southwest of the Gully. The Recovery Strategy also identifies the canyons further south along the Scotian Shelf, including Logan canyon, as potential critical habitat for the whales (although this needs to be further investigated). Thus, there should be some acknowledgement that the distribution of these whales does extend south and west of the Gully, along the entire Scotian Slope as far south as Georges Bank (sightings reported by U.S. National Marine Fisheries Service (NMFS) shipboard surveys). The following references provide more information on sightings of northern bottlenose whales south of the Gully:

DFO. 2010. Recovery strategy for the northern bottlenose whale (*Hyperoodon ampullatus*), Scotian Shelf population, in Atlantic Canadian waters. *Species at Risk Act* Recovery Strategies Series. Fisheries and Oceans Canada. Vi + 61 p. Available online: www.sararegistry.gc.ca/virtual_sara/files/plans/rs_northern_bottlenose_whale_0510_e.pdf.

NMFS. 2007. Sightings of northern bottlenose whale (*Hyperoodon ampullatus*): Western North Atlantic Stock. 3 pp. Available online: www.nefsc.noaa.gov/publications/tm/tm205/pdfs/67NorthBottleW.pdf.

Section 3.2.5 Marine Mammals and Sea Turtles – Page 3.23, Table 3.9 – the table should note that sightings of Sowerby's beaked whales in the Gully, Shortland, and Haldimand canyons have increased substantially in recent years. The most up-to-date evidence suggests that these whales are actually more likely to occur in Shortland and Haldimand canyons than in the Gully. Dr. Hal Whitehead (Department of Biology, Dalhousie University) is currently preparing a manuscript that describes this trend. In addition, it should be acknowledged that the distribution of Sowerby's also extends further south and west of the Gully, and there are numerous reported beaked whale sightings (many of them *Mesoplodon*'s) off the eastern United States (see NMFS survey cited below).

NMFS. 2009. Sightings of Sowerby's beaked whale (*Mesoplodon bidens*): Western North Atlantic Stock. 7 pp. Available online: www.nefsc.noaa.gov/publications/tm/tm219/387_SOBKWH.pdf.

Section 3.2.5 Marine Mammals and Sea Turtles – Page 3.23, Table 3.9 – short-beaked common dolphins (*Delphinus delphis*) are frequently found on the Scotian Shelf, particularly during the summer months. Similarly, there are also quite a few sightings of white-beaked dolphins (*Lagenorhynchus albiorostris*) in early summer. These two species should be listed in the table.

3.2.7 Special Areas – P3.27 – the first two paragraphs of this section require improvement to be consistent with terminology used to define special areas pursuant to different federal legislation. Fisheries and Oceans Canada will advise on suitable terminology to use in these paragraphs.

3.2.7 Special Areas – P3.27 – critical habitat for the northern bottlenose whale includes Zone 1 of the Gully Marine Protected Area (MPA).

3.2.7 Special Areas – P3.29, Figure 3.4 – Designated Special Areas – the legend items under "Protected Areas and Candidates" should distinguish between designated MPAs and MPA Areas of Interest (AOI).

3.2.7 Special Areas – P3.33, Table 3.14 – Additional Special Areas in the Study Area – recent acoustic monitoring studies indicate that northern bottlenose whales feed year-round in the Gully, Shortland, and Haldimand canyons (not just the Gully), as well as between the canyons (see reference below: Moors, 2012). These whales are considered to be year-round residents of the Scotian Slope including the Shortland and Haldimand critical habitat.

> Moors, H.B.. 2012. Acoustic monitoring of Scotian Shelf northern bottlenose whales (*Hyperoodon ampullatus*). PhD thesis. Dalhousie University. Available online: http://dalspace.library.dal.ca/handle/10222/15238.

3.2.7 Special Areas – P3.33, Table 3.14 – Additional Special Areas in the Study Area the table header "Northern Bottlenose Whale Critical Habitat" should include Haldimand Canyon, despite the footnote, since Haldimand canyon is identified in the text of the table.

3.2.7 Special Areas – P3.33, Table 3.14 – Additional Special Areas in the Study Area – the text should indicate that the Haddock Box closure is pursuant to the *Fisheries Act*.

3.3.1 Commercial Fish and Fisheries – P3.38, Table 3.15 – the SEA cites information on the total catch for all pelagic species in the project area in 2010 (approximately 14 t), but does not include information on the total catch for pelagic species in the entire SEA study area. Thus, the importance of the general area to swordfish catch is under-represented, since most of the >1000 t of Canadian swordfish landings caught in the Atlantic zone in 2010 came from the study area just outside of the project area. In short, landings and landed values presented in the SEA should be inclusive of both the "project" and "study" areas.

3.3.1 Commercial Fish and Fisheries – P3.39, Table 3.16 – the summary of fishery licenses includes the number of licenses that can fish in the SEA 1A study area, SEA 1B study area, or both. As such, the table header should be changed to reflect this.

3.3.1 Commercial Fish and Fisheries – P3.40, Table 3.17 – the open seasons for pelagic species as represented in Table 3-17 is inaccurate given that all large pelagic fisheries are open year round (pers comm.. M. Eagles, DFO Resource Management – Sept 14, 2012). Although the fisheries are open year-round, fishing effort changes depending on the time of year (see below). At present, there is limited porbeagle shark fishing activity, though historic fishing efforts are represented in the Table below. In addition, there is no directed fishery for Mako shark, although it is an allowable by-catch in the shark, swordfish, and tuna fisheries. Thus, Mako shark should be removed as a fishery from this table.

Table: Periods of high and low fishing activity by pelagic fishery.

Species	High Activity	Low activity
Albacore tuna	July - November	May, June and December
Bluefin tuna	July - November	June and December
Porbeagle shark	Mar - June	Feb, Oct - December
Swordfish	July - November	May, June and December

3.3.1 Commercial Fish and Fisheries – P3.40, Table 3.17 – the citation DFO (2011e) is incorrect and should be changed throughout the report. The correct reference is:

Breeze, H. and T. Horsman T. 2005. The Scotian Shelf: An Atlas of Human Activities. Fisheries and Oceans Canada. 120pp. Available online: www.mar.dfo-mpo.gc.ca/e0009630.

3.3.1 Commercial Fish and Fisheries – P3.42, Figure 3.6 – the text should indicate why some groundfish landings located on Figure 3.6 are not found on the groundfish landings map located in the Appendix. This comment applies to other similar figures found in this section (e.g. pelagics).

3.3.1 Commercial Fish and Fisheries – P3.43 – Pelagic Fisheries – the SEA states 'during the period from 1980-2000 pelagic species have shown fluctuations in catch, ranging from 8-15% of the total landed value (Worcester and Parker, 2010)', although concludes "In 2010 pelagic species accounted for 0.2% of the total landed value." These statements appear indicative of an error in how the pelagic landings and landed values are presented in the SEA, as it is unlikely that pelagic species only accounted for 0.2% of the total landed value when they accounted for 8-15% over the most recent 21 year period, including a time period when swordfish landings were very low. These analysis/statements should be revisited in context of both the "project" and 'study" areas, as recommended above.

3.3.2 Aboriginal fisheries – P3.48 – the text in this section should more clearly distinguish between Food, Social, and Ceremonial Communal licenses (i.e. AFS program and the Sparrow decision) versus Communal Commercial licenses (i.e. Marshall Response Initiative and the Marshall decision) – since the only Aboriginal fishing in the area is communal commercial fishing the discussion regarding Sparrow and the AFS could be shortened. Fisheries and Oceans Canada will advise on suitable terminology to use in this section.

3.3.4 Other Oceans Uses – P3.49, Table 3.24 – the table should note a small eco-tourism presence in the Gully canyon and at Sable Island; Sable Island being a National Park Reserve where visitation is expected to increase.

4.2.1 Regulatory Context – P4.2 – wording in paragraph two regarding the "Memorandum of Understanding" (MOU) is incorrect (e.g. the MOU does not avoid regulatory duplication rather is used to harmonize DFO and CNSOPB plans and priorities of mutual interest). Fisheries and Oceans Canada will advise on suitable terminology to use in these paragraphs.

4.2.1 Regulatory Context – P4.2, Table 4.1 – *Oceans Act* – The Gully MPA Regulations should be listed in this table in addition to the *Oceans Act*. It should also be noted that these regulations (prohibitions) may be used to inform permissible activities in the vicinity of the MPA.

4.2.2. Stakeholder Engagement – P4.4, Table 4.2 – the list of stakeholders consulted only includes three representatives from the fishing industry, of which, only two fish in the study area. The range of stakeholders consulted should be expanded to include all fishing industry representatives that may be potentially impacted by the environmental effects of exploration activities, as well as other industries that might be impacted (e.g. eco-tourism).

4.2.3 Relevant Publications – P4.5, Bullet 4 – this bullet should cite the full title of the publication (i.e. "DFO, 2011a"), since the publication is centred on Georges Bank and not the eastern Scotian Shelf for which the SEA is centred.

4.3 Scope of Activities to be Assessed – P4.6, Bullets – seismic surveying should state that 2D, 3D, and WAZ are considered. In addition, acronyms should be spelled out (e.g. VSPs).

4.5 Selection of Valued Environmental Components – P4.8, Table 4.3- Fish – the Statement of Canadian Practice with respect to the Mitigation of Seismic Sound in the Marine (SOCP) is considered a minimum standard for seismic mitigation, and other forms of mitigation may be required on a per case basis. This point should be made throughout the SEA where ever SOCP is cited as a mitigation protocol (e.g. Table 5.8/P5.8, Section 5.1.3/P5.9, 5.2.2/P5.19 - Table 5.3, 5.3.2/P5.26 – Table 5.4, 7.2/P7.3 – Table 7.1, to name a few). For example, the shut-down time in the presence of beaked whales may be extended to accommodate the longer dive times of these species. This point is made in the Hurley (2011) Strategic Environmental Assessment for the west Scotian Slope.

> Hurley, G.V. 2011. Strategic Environmental Assessment – Petroleum Exploration Activities on the Southwestern Scotian Shelf. Consultant report was prepared by Hurley Environment Ltd. for the Canada-Nova Scotia Petroleum Board October, 2011. 90 pp. + Appendices.

4.5 Selection of Valued Environmental Components – P4.8, Table 4.3- Fish – SOCP needs to be augmented for beaked whale species such as northern bottlenose whales and

Sowerby's beaked whales. Specifically, the 30 minute required observation period is shorter than the maximum dive time of these species (Scotian Shelf northern bottlenose whales commonly dive for over thirty minutes, with maximum recorded dive times of 70 minutes being reported: see Hooker and Baird, 1999). Thus, the SOCP observation period should be increased substantially (at least 60-70 minutes) when conducting activities in the presence of beaked whales or near their habitat. It is also known that these poorly-understood, deep-diving species are generally very difficult to spot, even by well-experienced and trained observers, since they spend so little time at the surface. Even in the best of circumstances, using experienced observers and during good weather conditions, the probability of visually detecting beaked whales even when they are present and near the vessel is in the range of 20-50% (Barlow and Gisiner, 2006). This probability decreases significantly with inexperienced observers and as sea state increases and visibility decreases (e.g. rain, fog, and reduced light levels) – under these conditions the probability of sighting a beaked whale is estimated to be low as 1-2% (Barlow and Gisiner, 2006). When beaked whales such as northern bottlenose whales undergo deep dives they often do so to forage and frequently produce distinctive echolocation clicks (Hooker and Baird, 1999; Moors 2012). Thus, a combination of passive acoustic monitoring (PAM) and visual observation likely provide the greatest probability of detecting bottlenose whales present in a seismic study area (Moors, 2012).

Barlow, J. and R. Gisiner. 2006. Mitigating, monitoring and assessing the impacts of anthropogenic sound on beaked whales. J. Cet. Res. Man. 7: 239-249.

Hooker, S.K. and R.W. Baird. 1999. Deep diving behaviour of the northern bottlenose whale, *Hyperoodon ampullatus* (Cetacea: Ziphiidae). Proc. R. Soc. Lon. B. 266: 671-676.

Moors, H.B.. 2012. Acoustic monitoring of Scotian Shelf northern bottlenose whales (*Hyperoodon ampullatus*). PhD thesis. Dalhousie University. Available online: http://dalspace.library.dal.ca/handle/10222/15238.

4.5 Selection of Valued Environmental Components – P4.8, Table 4.3- Fish – SOCP has not been reviewed or updated recently – stating it is regularly reviewed is inaccurate.

4.5 Selection of Valued Environmental Components – P4.9, Table 4.3 – Marine Mammals and Sea Turtles – section 6.3 of the SEA is noted in the following statement, although it is not found in the SEA document: "No further assessment beyond that stated in Section 6.3 will be required provided that: the proponent adheres to mitigation measures outlined in the Statement of Canadian Practice with Respect to the Mitigation of Seismic Noise in the Marine Environment for marine mammals and sea turtles."

4.6 Potential Exploration Activities – Environment Interactions – P4.11, Table 4.4 – Table 4.4 of the SEA should indicate that Swordfish are well known to be attracted to lights (see: Broadhurst and Hazin, 2000: Hazen et al. 2005). If exploratory drilling leads to development sites on the Scotian Shelf, these development sites could influence swordfish migration patterns over the long-term (pers comm. J. Neilson, DFO Science – Sept 18, 2012).

Broadhurst,G.M., H.V.F. Hazin. 2000. Influences of Type and Orientation of Bait on Catches of Swordfish (Xiphias Gladius) and Other Species in an Artisanal Sub-Surface Longline Fishery off Northeastern Brazil. Fish. Res., 1159:1–11.

Hazin, H.G., F.H.V. Hazin, P. Travassos, K. Erzini. 2005. Effect of light-sticks and electralume attractors on surface-longline catches of swordfish (*Xiphias gladius*, Linnaeus, 1959) in the southwest equatorial Atlantic. Fisheries Research, 72: 271-277.

5.1.1 Potential Effects and Existing Knowledge – P5.1 – the term "morality" on line two should read "mortality".

5.1.1.1 Seismic and Seabed Surveys – Physiological and Behavioral Effects on Marine Mammals – P5.2 – there is concern regarding the potential effects of seismic on beaked whales, including northern bottlenose whales and Sowerby's beaked whales, as these types of whales appear to be particularly sensitive to underwater sound. There has been evidence of beaked whales stranding caused by intense anthropogenic noise such as military sonar (see: Frantzis, 1998; Jepson et al., 2003), thus intense sounds in general, including seismic noise, are of concern. Seismic noise produced by offshore petroleum activities has been identified as a threat to the Scotian Shelf northern bottlenose whale population and is discussed in the Recovery Strategy for the population (see reference listed above: DFO, 2010). Thus, this section of the SEA should highlight the concerns around beaked whales and intense noise, especially as the study area encompasses known habitat of the endangered northern bottlenose whale population. Similarly, although the study results presented in Lee al. (2005), as cited in the SEA, provide some information on species presence and behaviour during seismic surveys on the Scotian Shelf, data on cetacean presence and behaviour was not collected prior to the seismic vessels operating in the study area or after it had left, thus, proper comparisons of cetacean behaviour before, during, and after the seismic operations could not be made. Last, during the 2003 project, the closest point of approach for the seismic vessel during the period of simultaneous acoustic and visual monitoring in the Gully canyon was 50 km. The sound exposure level in Critical Habitat (Zone 1 of the Gully MPA) for the northern bottlenose whale was 145 dB at that distance. Because of this, the potential responses of northern bottlenose whales at closer range and higher amplitude remain unknown, so the statement in Section 5.1.3 Data Gaps "existing knowledge is sufficient to predict general effects of exploration activities on species of special status." remains unfounded. Some of the statements regarding the Gully Seismic Research Program (Lee et al., 2005) require qualification; particularly the statement regarding no indication that certain species were significantly impacted by the seismic programs discussed.

Frantzis, A. 1998. Does acoustic testing strand whales? Nature, 392: 29.

Jepson, P.D., Arbelo, M., Deaville, R., Patterson, I.A.P., Castro, P., Baker, J.R., Degollada, E., Ross, H.M., Heraez, P., Pocknell, A.M., Rodriguez, F., Howiell, F.E., Espinosa, A. Reid, R.J., Jaber, J.R., Martin, V., Cunningham, A.A., and Fernández, A. 2003. Gas-bubble lesions in stranded animals: was sonar responsible for a spate of whale deaths after an Atlantic military exercise? Nature, 452: 575-576.

5.1.1.1 Seismic and Seabed Surveys – P5.2 – this section does not consider potential effects on invertebrates, and, in particular, squid that is an important ecosystem component for cetaceans as prey. Given that squid is the primary prey for certain marine mammal species of special status (i.e. northern bottlenose whales and Sowerby's beaked whales), and a prime determinant of statutory Critical Habitat (see below: DFO, 2007; Harris et al. 2007; DFO, 2011), a consideration of the potential impacts seismic activities on this organism should be considered and any knowledge gaps identified.

DFO, 2007. Recovery potential assessment of northern bottlenose whale, Scotian Shelf population. DFO Can. Sci. Advis. Sec. Sci. Advis. Rep. 2007/011. Available online: www.dfo-mpo.gc.ca/csas/Csas/status/2007/SAR-AS2007_011_E.pdf.

Harris, L.E., C.L. Waters, R.K., Smedbol, and D.C. Millar. 2007. Assessment of the recovery potential of the Scotian Shelf population of northern bottlenose whale, *Hyperoodon ampullatus*. DFO Can. Sci. Advis. Sec. Sci. Res. Doc. 2007/078. Available online: www.dfo-mpo.gc.ca/CSAS/Csas/DocREC/2007/RES2007_078_e.pdf.

DFO. 2011. Recovery Potential Assessment for Northern Bottlenose Whales (*Hyperoodon ampullatus*) in Canada. DFO Can. Sci. Advis. Sec. Sci. Advis. Rep. 2011/031. Available online: www.dfo-mpo.gc.ca/Library/344308.pdf.

5.1.1.1 Seismic and Seabed Surveys – Physiological and Behavioral Effects on Marine Mammals – P5.2 – the treatment of Mysticetes in particular seems too superficial and the referencing of primary work too indirect. The fourth paragraph states, "Displacement and diversion caused by seismic noise on marine mammals is unknown although it is possible that animals could be displaced from feeding grounds, breeding grounds, nursery areas, or migration routes." The contextual placement of this statement also makes it uncertain whether it pertains to Odontocetes only (main topic in immediately preceding paragraph) or both Mysticetes and Odontocetes (broader context). There is reasonable evidence (e.g. Richardson et al., 1986; Koski and Johnson, 1987; Davis et al., 1998; McCauly et al. 2000) that the movements and distributions of some Mysticetes, such as bowheads and humpbacks, can be influenced at multi-kilometre ranges. Regardless of whether the studied species' occur in the Scotian Shelf or Scotian Slope Study areas, it is suggested that some of this work be directly cited to draw attention to the possibilities of long range effects on Mysticetes.

Richardson, W.J., B. Wursig, and C.R, Jr. Greene. 1986. Reactions of bowhead whales, *Balaena mysticetus*, to seismic exploration in the Canadian Beaufort Sea. J. Acoust. Soc. Am. 79(4): 1117- 1128.

Koski, W.R. and S.R., Johnson. 1987. Behavioural studies and aerial photogrammetry. (Chap. 4) In: LGL and Greeneridge, Responses of bowhead whales to an offshore drilling operation in the Alaskan Beaufort Sea, autumn 1986. Rep, from LGL Ltd., King City, Ont., and Greeneridge Sciences Inc., Santa Barbara, CA, for Shell Western E & P Inc., Anchorage, AK. 124pp.

Davis, R.A., D.H. Thomson and C.I. Malme, 1998. Environmental Assessment of Seismic Exploration on the Scotian Shelf. Rep. by LGL Ltd. and C.L. Malme for Mobil Oil Properties Ltd., Shell Canada Ltd., and Imperial Oil Ltd., Calgary, for submission to the Canada/Nova Scotia Offshore Petroleum Board, 5 Aug. 1998: 181 p. + Appendices.

McCauly, R.D., J. Fewtrell, A.J. Duncan, C. Jenner, M-N Jenner, J.D. Penrose, R.I.T. Prince, A. Adhitya, J. Murdoch, and K. McCabe. 2000. Marine seismic surveys - A study of environmental implications. APPENA Journal: 692 - 706.

5.1.1.1 Seismic and Seabed Surveys – Physiological Effects and Behavioral on Sea Turtles – P5.3 – although not a physiological effect, sea turtles are slow swimmers making it difficult for them to respond to and avoid seismic surveys. This point should be noted. In addition, a recent DFO Canadian Science Advisory Secretariat (CSAS) meeting was held to investigate the distribution, critical habitats, and seismic impacts on marine turtles (including Leatherback turtles) – research materials for this meeting should be consulted (see the document listed below). At present, the CSAS Science Advisory Report is not yet available on the website, although its status should be tracked (see: www.dfo-mpo.gc.ca/csas-sccs/Schedule-Horraire/2012/03_01-02-eng.html).

Atlantic Leatherback Turtle Recovery Team, 2006. Recovery Strategy for Leatherback Turtle (*Dermochelys coriacea*) in Atlantic Canada. *Species at Risk Act* Recovery Strategy Series. Fisheries and Oceans Canada, Ottawa: vi + 45 pp. Available online: www.sararegistry.gc.ca/default.asp?lang=En&n=CF503E55-1.

COSEWIC, 2001. COSEWIC Assessment and Update Status Report on the Leatherback Turtle *Dermochelys coriacea* in Canada. Committee on the Status of Endangered Wildlife in Canada. Ottawa. vii + 25 pp. Available online: http://publications.gc.ca/collections/Collection/CW69-14-116-2002E.pdf.

DFO, 2004. Allowable Harm Assessment for Leatherback Turtle in Atlantic Canadian Waters. Can. Sci. Advis. Sec. Stock Status Rep. 2004/035. Available online: www.dfo-mpo.gc.ca/csas/Csas/status/2004/SSR2004_035_e.pdf.

DFO. 2011. Using Satellite Tracking Data to Define Important Habitat for Leatherback Turtles in Atlantic Canada. DFO Can. Sci. Advis. Sec. Sci. Advis. Rep.

2012/036. Available online: www.dfo-mpo.gc.ca/csas-sccs/Publications/SAR-AS/2012/2012_036-eng.pdf.

5.1.1.2 Exploratory Drilling – P5.4 – The SEA should provide a better description of the modelling or fate of drilling wastes (i.e. muds). In support of drill waste modelling, DFO has developed the Benthic Boundary Layer Transport (BBLT) model that can be used to estimate the fate of drilling waste in areas of active drilling and the exposure of such wastes on the seabed (Hannah et al., 2006). There should be some mention in the SEA of the existence and capability of this model.

Hannah, C.G., A. Drozdowski, J. Loder, K. Muschenheim, and T. Milligan. 2006. An assessment model for the fate and environmental effects of offshore drilling mud discharges. Estuarine Coastal and Shelf Science, 70 (4): 577-588.

5.1.1.2 Exploratory Drilling – P5.4 – the potential effects of drilling activities on marine mammals are not thoroughly discussed. For example, continuous noise generated by drilling activities could potentially have physiological and behavioural effects on marine mammals in general – drilling may potentially disturb marine mammals, masking their vocalizations, or cause avoidance of an area. There are also some missing or erroneous references in the paragraph that discusses potential effects on marine mammals of special status, for example, it is unclear the basis of the following statement: "the expected extent of spatial avoidance by marine mammals is expected to be 0.5-1 km." Similarly, the basis of this additional statement also is unclear: "the effect of drilling noise on marine mammals of special status is considered to be temporary and reversible." Last, the citation for Davies et al. (1987) used in this section is not provided in the References section of the SEA (this is likely an error and should be the reference of Davies et al. (1998) found in the reference list). Last, it is cautioned that conclusive statements based on older SEAs may not be adequate, rather such statements are better supported using additional references from the primary literature (where possible).

5.1.1.2 Exploratory Drilling – P5.4 – species of special status are grouped together in this section, although potential impacts associated with drilling vary considerably between species. For example, right whales are migratory and may be able to search for food elsewhere if they are forced to avoid feeding in an area where drilling is occurring. In contrast, northern bottlenose whales are year-round residents of relatively small areas, and exhibit a relatively restricted home range. If, for example, northern bottlenose whales avoid prime foraging habitat due to an associated drilling activity for an extended period (or for any other important life function such as rearing of young), this could potentially have significant population-level impacts on the species. Last, it is stated that the North Atlantic right whale is, "known to exhibit long range avoidance behaviour," although no reference is listed to support this point. This point is particularly critical to this species given noise avoidance is often quoted as reducing risks of vessel-whale collisions, although the following SEA Section 5.1.1.3 on vessel traffic indicates that the North Atlantic right whale is prone to ship collisions.

5.1.1.2 Exploratory Drilling – P5.4 – in the discussion of exploratory drilling noise, the point being made is that levels of radiated drilling noise are likely quite dependent on rig type. Jack-up rigs tend to be fairly quiet; semi-submersibles are fairly quiet as well, although dynamic positioning thrusters are a potential source of noise; drill ships tend to be quite noisy since all heavy machinery is in close proximity to the hull, which is an efficient acoustic radiator. Thus, the selection of drill rig type can constitute a potential mitigation measure for noise that should be acknowledged in the SEA.

5.1.2 Mitigation and Planning Considerations – P5.8, Table 5.1 – Seismic and Seabed Surveys – acoustic modeling listed as Mitigation and Planning Measure for Species of Special Status in the "Seismic and Seabed Surveys" section, should include the following considerations: it is generally true that exploration seismic sound generated in deeper waters, such as on the Scotian Slope, will be audible to longer ranges. Merely stating "over 100 km", while technically correct, is potentially misleading. Exploration seismic sound from the Scotian Slope may well be audible (i.e. above ambient background) by way of the oceanic Deep Sound Channel over wide areas of the North Atlantic Basin and, in the past, has been detected as far away as the Mid-Atlantic Ridge.

5.1.2 Mitigation and Planning Considerations – P5.8, Table 5.1 – Vessel Traffic – this section should reference the possibility of implementing vessel speed limits in the presence of slow moving marine mammals, as is recommended earlier in the document (see P5.6 of document). Also, note that Section 5.1.1.3 – Vessel Traffic on Page 5.5 of the document states marine mammal observers and avoidance of the Gully MPA to be proper mitigation for reducing the potential impact of vessel traffic on marine mammals, although marine mammal observers are not listed as mitigation and planning considerations for vessel traffic in this table.

5.1.3 Data Gaps and Uncertainties – P5.9 – data gaps and uncertainties around northern bottlenose whale and Sowerby's beaked whales' use of the western Scotian Shelf, including submarine canyons such as Logan canyon, should be noted. As well, there is a large gap in knowledge about the effects of offshore petroleum activities on these two species of special status, and on other ecologically important species such as squid that are not discussed. Last, although statements are made regarding research being undertaken to address knowledge gaps in relation to the effects and monitoring of seismic noise, future offshore petroleum activities on the Scotian Shelf offer other important research opportunities that could be scoped out at the strategic planning level.

5.2 Special Areas – P5.10 – the following statement in the large paragraph should be corrected: "DFO is in the process of identifying a network of MPAs in the ~~Eastern~~ Scotian Shelf / Bay of Fundy region". The network is inclusive of the entire Scotian Shelf and Bay of Fundy Region.

5.2.1 Potential Effects and Existing Knowledge – P5.10, Table 5.2 – "Sowerby's beaked whales" and "other whales (e.g. blue whales)" should also be listed for Shortland and Haldimand canyons throughout this table. In addition, depending on the location of the drilling, there could be effects of drilling above those of whales, for example, on benthic impacts from cuttings.

5.2.1.1 Seismic and Seabed Surveys – P5.14 – Effects of Seismic Noise on Areas of Significance for Marine Mammals and Sea Turtles – the text suggests that sea turtles are found on the Scotian Shelf in the summer months while, Leatherback Turtles in particular, are also found to migrate out of the Gulf of St. Lawrence and from the southern coast of Newfoundland along the western boundary of the Laurentian Channel towards deeper waters of the Scotian Slope in late September through October. Similarly, recent evidence suggests that Shortland and Haldimand canyons are important to Sowerby's beaked whales and there have been quite a few sightings of this species in these canyons in recent years (see comments above).

5.2.1.1 Seismic and Seabed Surveys – P5.12 – the following statement in the SEA is unclear: "For example, depth is an important consideration where sound attenuates faster at shallower depths." They authors may mean that sound tends to attenuate more rapidly with range in a shallow water survey environment, which is generally true.

5.2.1.5 Accidental Spills – P5.16 – The fate, effects, and transport of accidental oil spills depend on a number of factors, such as oil composition, weathering processes response options employed, and the type of environment in which oil has been spilled, thus, elements of the following synopsis may be considered in the SEA, as discussed in DFO (2011):

> **<u>Chemical Composition of Oil</u>** - if the spill is a condensate the impacts are minimal, since most of the chemical components in the condensate will evaporate within the first 24-48 hours depending on seawater surface temperatures. If there is diesel spill, the chemical composition will consist largely of saturates. Saturates have a short life span and they can potentially be degraded within a few weeks, depending on environmental conditions, such as water temperature and mixing energy. A crude oil spill is more complex, since there are different blends, typically referred to as light, medium and heavy based on the American Petroleum Institute gravity values. Crude oils consist of groups of chemicals, namely, saturates, aromatics, resins and asphaltenes (SARAs). The percent composition of SARAs can vary depending on the type of crude oil. Heavy oil contains a greater percentage of the high molecular weight components, resins and asphaltenes compared to light oil; therefore heavy oil is more dense and viscose. The natural processes acting on crude oil can vary depending on the type of oil accidental released into the environment. The aromatics (polycyclic aromatic hydrocarbons and their alkylated homologues), fraction of crude oils, are considered to be the chemicals of potential concern (COPC) due to their harmful effects to marine life. The type of response option may change dramatically depending on the type of crude and the environmental conditions. Oil released in the environment is acted upon by natural processes, collectively known as weathering.
>
> **<u>Weathering</u>** - During an accidental oil spill the fate, effects, and transport of COPC, such as polycyclic aromatic hydrocarbons and their alkylated homologues are

driven by weathering processes, such as spreading, evaporation, photochemical oxidation, emulsification, dissolution, natural dispersion, adsorption on suspended particulate materials, interaction with mineral fines, sinking, sedimentation, and biodegradation. These processes can be affected by the response option selected.

Response Options - The use of chemical dispersant or other remedial technologies will ultimately change the fate, effects and transport of COPC in the environment. Dispersants aid in the break up of oily surface slicks; however the COPC remain for a longer period of time in the water phase; therefore are more bioavailable to marine life, including microbes involved in biodegradation of the oil. This response option can ultimately change the fate, effects and transport of dispersed oil in the marine environment. The type of response option that may be potentially employed needs to be taken into consideration when developing spill trajectory models.

Spill Environment - In the event of a surface spill, the response option employed will depend on the sea state. If there is a static sea state than mechanical skimmers and booms would most likely be the response option. In a dynamic sea state, mechanical means may be least effective and other options such as chemical dispersants may be employed. There is great deal of information in the literature on how to treat a surface oil spill. However; the Gulf of Mexico subsurface blow out proved to be an environment challenge for many scientists, most of which were oil spill experts from around the world. The research in this area is immature. Due to the gaps in research on the fate, effects and transport of subsurface oil released into the environment, there will be a challenge for both researchers and response teams to deal with this type of accidental spill.

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

5.2.1.5 Accidental Spills – P5.17 – in the last section of paragraph one, the basis for a "worst case" scenario spill is linked to an EnCana (2006) document, while the Gulf of Mexico spill proved to be an even greater worst case scenario. The text should justify the use of the EnCana (2006) scenario and could also reference other recent large spills such as the Gulf of Mexico spill.

5.2.1.5 Accidental Spills – P5.17 – the last sentence of paragraph two is suggestive that a large spill has occurred in the Gully. This sentence requires clarification and revision.

5.2.2 Mitigation and Planning Considerations – P5.18 – although the avoidance of special areas is the most effective mitigation measure this may not always be possible while, in some instances, noise can travel far from the location at which it is produced influencing special areas even though the source activity may occur at distal locations. In instances where special areas may be influenced by an offshore petroleum activity, it should be emphasized in the SEA that additional mitigation beyond SOCP may be required, as determined on a per case basis (e.g. Marine Protected Areas or at-risk species' critical habitat). This point is particularly pertinent to beaked whales and their critical habitat areas such as the Gully, Shortland, and Haldimand canyons.

5.2.2 Mitigation and Planning Considerations – P5.18 – the first sentence of paragraph two on Page 5.19 should only cite contact with DFO and not "DFO's Oceans and Coastal Management Division".

7.0 Potential Cumulative Effects – P7.1 – a factor that is not emphasized in the exploration seismic context is the potential for extremely long duration surveys within quite limited geographic areas, including the possibility for resultant temporal cumulative effects. For instance, if one were to take a 30x30 km survey block and perform a 3D survey at 100 m (shooting) line spacing, one would be looking at 300 closely spaced lines or about 9,000 km of shot line in total. At a survey speed of 5 knots this would constitute about 1,000 hours (approximately 42 days) of shooting, not counting line-to-line transitions. There are reports (Richardson et al., 1986; Koski and Johnson, 1987; Engas et al., 1996; Davis et al.1998; McCauly et al., 2000 – find other references in comments above) that discuss the behaviours of some fish and whales that may be influenced at ranges comparable to the dimensions of the hypothetical survey block above. Therefore, one could conceivably have fish or whales at a specific spot, or even over a fairly sizable area, being virtually continuously affected in some behavioural manner for a month or more. Thus, it is important that the affected area is not a critical feeding or nurturing site (where the animals might be effectively "anchored") or a critical migration corridor for sensitive fish or marine mammals. In other words, the acoustic influence of intensive 3D surveys, especially, at certain fixed locations should not be viewed as necessarily brief and transitory.

> Engas, A., S. Lokkeborg, E. Ona and A.V. Soldal. 1996. Effects of seismic shooting on local abundance and catch rates of cod (*Gadus morhua*) and haddock (*Melanogrammus aeglefinus*). Canadian Journal of Fisheries and Aquatic Sciences, 53(10): 2238 – 2249.

8.0 Data Gaps and Recommendations – P8.1 – Paragraph two regarding changes to DFO's COOGER should be removed from this document.

8.0 Data Gaps and Recommendations – P8.1, Table 8.1 – The authors include in the document a discussion on the behavioural effects of fisheries catchability in the presence of offshore petroleum activities. Generally fishers avoid seismic surveys for other reasons (e.g. to avoid gear entanglement), so direct effects on catchability may or may not be important, however, this remains a legitimate topic for consideration that should be included in the "Data Gaps and Uncertainties" section.

8.0 Data Gaps and Recommendations – P8.2, Table 8.1– Note that standardized protocols for collecting sightings data on species of special status can be obtained from species experts at DFO. With respect to the effects of seismic sound on marine mammals: any seismic program that may occur in the study area offers a potentially-valuable platform to conduct some research relevant to the topic. Having proponents work with DFO and academic community to design scientifically appropriate research projects around activities being conducted to address the knowledge gap of seismic sound effects on marine mammals should be a recommendation. Similarly collection of acoustic data during seismic activities to test the accuracy of the models could also be an additional recommendation in this section. In addition, although PAM may be suitable for some highly vocal marine mammal species (such as northern bottlenose whales), some species do not frequently vocalize and, as such, PAM is not effective for detection of these species during low visibility conditions. Last, the probability of acoustically-detecting various species is not well known and is another knowledge gap.

8.0 Data Gaps and Recommendations – P8.2, Table 8.1– the table should include some discussion regarding lessons-learned and recommendations made following the Gulf of Mexico oil spill.

8.0 Data Gaps and Recommendations – P8.2 – the last paragraph following Table 8.1 should be removed from the document. It is for regulators to conclude on a per case basis that mitigation is suitable for an offshore petroleum project or activity to proceed.

9.0 Summary and Conclusions – P9.1, Table 9 – statement in table reading "Passive Acoustic Modelling (PAM)" should be change to read Passive Acoustic <u>Monitoring</u> as per the SOCP.

9.0 Summary and Conclusions – P9.2, Table 9.1 – Vessel Traffic – the table should reference the possibility of implementing vessel speed limits in the presence of slow moving marine mammals, as is recommended earlier in the document (see P5.6 of document).