REVIEW OF WHITE ROSE EXTENSION PROJECT ENVIRONMENTAL ASSESSMENT

Context

Husky Oil Operations Limited (Husky), on behalf of the White Rose Extension Project (WREP) proponents, Husky, Suncor Energy Inc. (Suncor) and Nalcor Energy – Oil and Gas Inc. (Nalcor), is proposing to develop the White Rose West pool as part of the continued development of the White Rose field. Initial development of the White Rose field was through excavated subsea drill centres, with flexible flowlines bringing production to a centralized floating production platform, the *SeaRose* floating production, storage, and offloading (FPSO) vessel. The White Rose field was originally developed using subsea wells in two subsea drill centres; the Central Drill Centre (CDC) and the Southern Drill Centre (SDC). A third drill centre, the Northern Drill Centre (NDC), is used as an injection site for gas that is being stored for future use. First oil from the White Rose field was produced in November 2005. In May 2010, production commenced from the North Amethyst Drill Centre (NADC) and was tied back to the *SeaRose* FPSO for production, storage, and export to tanker.

The West White Rose pool was delineated in 2006. The proposed project is located on the Grand Banks offshore Newfoundland and Labrador, approximately 350 km east of St. John's in water depths between 115 and 120 m. Husky and its co-venturers are considering two development options for the WREP: a wellhead platform (WHP) development option or a subsea drill centre development option. Both development options will be tied back to the existing *SeaRose* FPSO vessel. Both options will also include the addition of three future subsea drill centres. Depending on the development option selected, the project can include onshore/nearshore graving dock site preparation and completion of Concrete Gravity Structure (CGS) in Argentia; tow-out of CGS platform to its offshore location through Placentia Bay; offshore site and clearance surveys (including geophysical, geological, geotechnical, and environmental surveys); installation of the CGS at its offshore location and connection to *SeaRose* FPSO; construction of flowlines; construction, installation, maintenance, and decommissioning of up to multiple subsea Drill Centres; drilling operations; and support activities and operation of support craft associated with the above activities.

The Proponent was advised by the Newfoundland and Labrador Department of Environment and Conservation (NLDEC) that the project activities associated with the Argentia Peninsula and Placentia Bay portion of the project were subject to an Environmental Preview Report (EPR) under the *Environmental Protection Act* (*EPA*). The project is also subject to the *Canadian Environmental Assessment Act* (*CEAA*). On July 6, 2012, the *CEAA* (S.C. 1992, c. 37) was repealed when the *Canadian Environmental Assessment Act, 2012* (*CEAA 2012*) came into force. The Minister of the Environment has designated this project and the environmental assessment (EA) will continue under the former *CEAA*. In order to fulfill the requirements of both the *CEAA* and *EPA*, an agreement was reached between the Canada-Newfoundland and Labrador Offshore Petroleum Board (C-NLOPB), as the Federal

Environmental Assessment Coordinator (FEAC) for the Screening Level EA, and the NLDEC that a single harmonized environmental assessment process could accommodate the Province's information and review process requirements.

The purpose of the EA is to identify alternatives to the project, alternatives methods for carrying it out, the environment that will be affected, the important environmental effects associated with the project, measures that are required to mitigate against any adverse effects, and the significance of residual environmental effects. The EA shall contain a review and assessment of all available information pertinent to the conduct of this environmental assessment as well as such additional new information or data as provided by the Proponent or requested by Canada or Newfoundland and Labrador.

DFO's Marine Habitat Protection Section (NL Region) sent a request to Science Branch on January 3rd, 2013 and a response was initially requested for February 6th, 2013. A Science Special Response Process (SSRP) was used due to the short deadline for the advice. The deadline was extended to February 22nd, 2013 when Science Branch was requested to review seven EA supporting documents that were sent to the Marine Habitat Protection Section by the Proponent on February 1st, 2013. This Science Response report is from the Fisheries and Oceans Canada, Canadian Science Advisory Secretariat, Regional Science Special Response Process of January 3rd – February 22nd, 2013 on the Science review of the Environmental Assessment report on the White Rose Extension Project. The report is a summarization of the comments provided by DFO Science Branch, Newfoundland and Labrador Region, to the Marine Habitat Protection Section.

Analysis and Response

The comments provided by DFO Science, NL Region are related to the following sections of the WREP EA:

3.2 Underwater Noise

3.3 Dredging Modeling

3.4 Drill Cuttings Deposition

3.5 Synthetic-based Whole Mud Spill Trajectory Modelling

3.6 Hydrocarbon Spill Probabilities

3.7 Fate and Behavior of Hydrocarbon Spills in the Nearshore Study Area

3.8 Fate and Behavior of Hydrocarbon Spills from a Platform or Seafloor Blow-out in the Offshore Study Area (Trajectory Modeling)

4.2.2 Oceanic Environment (Nearshore)

4.3.2 Oceanic Environment (Offshore)

8.0 Fish and Fish Habitat

11.0 Marine Mammals and Sea Turtles

12.3 Existing Environment (Species at Risk)

12.4 Marine Fish Species at Risk

12.5 Marine Mammal and Sea Turtle Species at Risk

12.6.2 Environmental Effects Analysis, Monitoring and Mitigation Measures

13.3.1 Sensitive Areas Nearshore (Existing Conditions)

13.3.2 Sensitive Areas Offshore (Existing Conditions)

13.4.1 Project-Valued Environmental Component Interactions

Several supporting documents of the EA were also reviewed and included:

1. Air Emissions Study;
2. Underwater Sound Propagation Assessment for the Environmental Assessment of the White Rose Extension Project (June 2012);
3. Dredging Assessment: Nearshore (June 2012);
4. Drill Cuttings and WBM Operational Release Modelling (June 2012);
5. SBM Accidental Release and Dispersion Modelling (June 2012);
6. Oil Spill Fate and Behaviour Modelling (April 2012); and,
7. White Rose Physical Environmental Data for Production Systems (May 2011).

The comments provided by the reviewers are summarized in this section.

Ocean Disposal

Page 2-8 (Section 2.3.2.3) – Regarding the disposal of soil excavated for construction of the dock, use of The Pond would seem preferable to ocean disposal. The Pond already contains contaminant levels in excess of those associated with adverse effects on aquatic organisms. The “visible” plumes expected to occur through disposal at sea could also generate perceptual (if not real) concerns for fisheries in relation to fish contamination and marketability. History tells us that perceptual concerns about contaminants (such as oil spills) can come with economic impact. Use of The Pond will also eliminate the impacts that ocean disposal would have on marine mammals and sea turtles.

Anthropogenic Sound

Section 2.3.1 – Two development options are under consideration for the project: a wellhead platform development option or a subsea drill centre development option. Both development options will be tied back to the existing *SeaRose* FPSO vessel. The subsea drill centre option would have less noise-related impacts on marine mammals in the study areas, unless the latter option involves additional and long-term dynamic positioning of rigs and vessels.

Page 2-43 Table 2-10 – Though Placentia Bay is an area where ship traffic is high, and the associated noise levels perceived to be elevated, the significant shoreline construction associated with development of the CGS will introduce noise into the marine environment. Most sounds are anticipated to be relatively low, but still detectable outside the Argentia site and into the northern end of Placentia Bay. The underwater dredging activities near Argentia Base may also increase noise levels in the nearshore (195.4 dB SL detectable up to 20 km away in some cases). Increased noise levels can also originate from tugs and dynamically-positioned support vessels, as well as anchor deployment and retrieval.

Section 3.2 – A preferable operational plan would have the proponent actually measure all of these modelled sounds as previous studies have shown sound propagation estimates to be inaccurate for some sources and scenarios (e.g., McQuinn and Carrier 2005).

Page 11-31 – Another important source of underwater sound is the use of vessel thrusters during dynamic positioning. These systems produce much mechanical noise, cavitate during operations, and vary the amplitude and frequency spectrum of the noise they emit.

Pages 11-33; 12.5.2; 12-123; elsewhere – DFO Science and industry have described, and measured, scenarios where the 500 m "safety zone" in "*The Statement of Canadian Practice with respect to the Mitigation of Seismic Sound in the Marine Environment*" may not be sufficient to protect endangered and threatened whales and sea turtles from the effects of excessive noise exposure.

Page 11-33 – The line "*Southall et al. (2007) concluded that PTS might occur if cetaceans and pinnipeds are exposed to pulsed sounds with peak sound pressure levels (SPL) exceeding 230 dB re 1 µPa (peak) (or 198 dB re 1 µPa$_2$ s) or 218 re 1 µPa (peak) (or 186 dB re 1 µPa$_2$ s), respectively.*" is repeated in the paragraph.

Page 11-34 to 11-35 (Sections 11.5; 12.5.1.1) – Land-based pile driving can transmit sound into water, as it has in other nearshore construction areas. Blackwood et al. (2004) measured impact pipe-driving sound levels as high as 157 (unweighted peak), 151 (rms Sound Pressure Level, SPL) dB re: 1 µPa, and 145 dB re: 1 µPa^2.s (SEL), respectively, at 63 m from shore. Underwater SPLs were at least 180 dB re: 1 µPa up to 3 km distant. With the construction site located on the northeast tip of the Argentia site, the sound shadow may be enough to prevent such sound levels propagating into northern Placentia Bay; however, this assumption cannot be confirmed unless actual sound measures are taken.

Depending on the size of pilings and the piling "hammer", there might be potential to induce pathological effects in fish, within meters of a pile. There is also potential for scaring of some species. It is important to note that episodic exposures associated with dredging and pile driving is not akin to chronic noise exposures associated with seismic surveys for which there are major knowledge gaps in relation to potential effects on fish and shellfish.

Pages 12-97 and 12-98 – Previous published studies of the possible effects of pile driving are discussed, but not in relation to the pile driving activities proposed in the EA. In addition, there is no mention of sound output into the marine environment from pile driving in ***Section 17.2.1***.

Page 11-41 and onwards – Geohazard and Vertical Seismic Profile (VSP) surveys will collect high resolution seismic, side scan sonar, sub bottom profiler, and multi-beam bathymetric data as needed during well operation and reservoir assessments. This variety of sound sources could output sound energy at a variety of frequencies and amplitude such that more than one species of marine organism might be impacted. For instance, higher frequency sources would be a concern for the beaked whales, whereas airgun sounds night be more of a concern for baleen whales. Each type of sound source should be considered separately. Ideally, the same types of mitigation protocols for marine mammals and sea turtles should be employed for these operations (e.g., trained Marine Mammal Observers (MMOs), ramp-up and shut down, sightings data sent to regulatory agencies). Similar concerns should be expressed for well head severance operations.

Page 11-42 – The quote "*The duty cycle of airguns is low; the airgun sounds are pulsed, with relatively quiet periods between pulses.*" is inaccurate at greater distances from operating airguns. It has been shown that as distance increases, airgun signal duration increases as multipath propagation causes acoustic "smearing". That is, at distances beyond a few kilometers the "quieter" period between pulses becomes filled with seismic noise above ambient levels. In these instances, masking and behavioural disturbances may occur as seismic sounds will be of a more continuous nature. Further, the statement "*Situations with prolonged strong reverberation are infrequent*." needs to be clarified. At least during a seismic operation on the south coast in 2009, there were frequent instances where such seismic signal smearing occurred (Lawson, unpubl. data).

Page 11-52 (Section 11.4.2.3) – If shaped charges are used during decommissioning, the proponent must employ adequate mitigation measures to ensure that marine mammals and sea turtles are outside a safe range when the charges are activated.

Underwater Sound Propagation Assessment for the Environmental Assessment of the White Rose Extension Project

Table 1-2 – While the injury criteria in Southall et al. (2007) are accepted by many reviewers, the behavioural criteria does not enjoy such agreement. For some cetaceans, reactions to sound appear to be highly dependent on context and their behavioural state. Based on the modelled sound propagation the area ensonified to a level that would result in behavioural reactions by cetaceans could be quite large.

Table 2-2, Section 2.2.2 and elsewhere – Because it is noted that sounds from propeller cavitation and dynamic positioning using thrusters – it would have been useful to see these modelled separately as they might be significant.

Section 3.0 – It is still not clear why excluding 5% of the furthest distance values to a given sound level should be excluded; it does not seem useful to present this reduced dataset.

Accidental Hydrocarbon Discharges

Page 3-89 and Sections 3.6, 3.7, and 3.8 – Based on the statement, "*Very little data has ever been collected on the long-term fate of different oil types in the offshore (past even one-week of exposure).*", the proponent or the C-NLOPB should be encouraged to undertake such studies.

Section 3.8 – Figures 3-4 and 3-48 show spill trajectories that extend into high-density marine mammal areas off the edges of the Grand Banks.

Pages 5-9 and 5-10 – The nearshore study area should extend further offshore (south) as the transiting vessels and CGS represent fuel spill risks and noise exposure en route to the offshore area.

Section 8.5.1.3 – Most of the (vast) literature on the toxicity of petroleum hydrocarbons deals with acute effects with emphasis given to larval sensitivities. This literature is covered sufficiently in the EA and its conclusions are in order. However, little is known about the effects of oil from a "planktonic perspective" (e.g., population dynamics of bacteria, phytoplankton and zooplankton) which might be important under some oceanographic regimes. Also, little is known about the acute and chronic effect of oil on benthic invertebrates should sediments be

contaminated for prolonged periods with relatively high levels of hydrocarbons from a major oil spill.

Regarding toxicity associated with oil slicks, modelling studies can provide some information relating toxicity to water solubles but oil particulates as well as solubles could exist in unknown plumes at different strata in the water column and over unknown geographic areas. Also particulates can come in a range of sizes for which little is known regarding toxicity potential e.g., zooplankton grazing on particulates. It is also understood that for daily operational requirements, even "accurate" prediction of surface slicks alone can encompass use of remote sensors, ships, aircraft, and underwater robots.

Page 12-120 – The EA states that "*Although effects of the* Exxon Valdez *oil spill were substantial on killer whales, killer whales are uncommon in Placentia Bay, and no population-level effects would be expected.*" This conclusion may be incorrect based on the apparent small size of the Northwest (NW) Atlantic Killer Whale population. Even if the number of known individuals reaches 100, loss of one or two animals would represent a "*population-level effect*".

Page 13-29 – If an oil spill coincides with the Capelin egg incubation period and/or time period when yolk-sac larvae remain in the intertidal sediments then mortality could reach 100% and eliminate that beach's contribution to the current year class. The effect on recruitment two and three years later would depend on how much that particular beach contributes to the overall larval production of Placentia Bay. It may also depend on what lasting effect such a loss would incur on genetic variation of the population.

Page 13-33 – Based on the oil spill trajectory modelling exercise, there is a 1-10% chance that hydrocarbons could reach the Southeast Shoal. If this occurred and did affect the Capelin spawning beds at a time when eggs were incubating and/or yolk-sac larvae were still in or on the sediments then mortality could be 100%. Eggs incubating on the Southeast Shoal take considerably longer to incubate than on beaches due to the colder water temperatures. Consequently, eggs here have a longer time for exposure to risk. Because this is the only known demersal offshore site, 100% mortality of the eggs would eliminate an entire year class from the population. With so few year classes spawning each year, the genetic variability and resilience of the population could be affected. However, more problematic is that should something like this worst case scenario occur, there would be no data on capelin spawning on the Southeast Shoal being collected to observe and monitor the short- and long-term effects.

Ship Strikes

Page 12-126 – What is considered a "safe speed" for project vessels? To ensure no mortality to listed marine mammals or sea turtles the safe speed would be (an unrealistic) zero knots. And it unlikely that vessels transiting in night, fog, or high wave height conditions will be able to detect, much less, avoid a sea turtle or beaked whale.

In light of several vessel-strike incidents associated with offshore oil production, the necessity to estimate potential impacts of ship strikes on marine mammals and sea turtles is highly recommended. There are computer models for these impacts which are freely-available and which would allow some assessment of the risk caused by the increased number of larger vessels moving through this study area.

Page 11-38 – While the risk of ship strike declined in conjunction with declining vessel speed, it also became more variable; thus while the average risk of morality declined, it never did reach zero - even for slow vessels.

Baseline and Monitoring Studies

Section 2.6.3.3 – It would be useful to have baseline data on the health of fish in Argentia Harbour. Data is presented on levels of contaminants in sediment but information on contaminant levels alone is of very limited value in assessing any potential risks to aquatic organisms. It is also noted that levels of contaminants in some sediment samples are above Canadian Council of the Ministers of the Environment (CCME) guidelines. Furthermore, DFO (unpublished) found liver pathologies (e.g., putative neoplastic lesions) in a small sample of flounder from Argentia Harbour in the late nineties. It would be of special value for industry to have baseline data beforehand, since any *a posteriori* study finding effects on fish health would immediately focus on industry. This is what recently happened in the case of the oil sands development, kindling a major environmental issue. The Athabasca River runs through natural oil containing sands (to what extent?), and fish pathologies may have existed beforehand.

It should be noted that CCME guidelines are also old and need to be used with caution by regulatory agencies. For instance, sedimentary polycyclic aromatic hydrocarbons (PAH) levels reported to affect fish health are much lower than noted in the guidelines.

Page 5-7 – The EA states "*Populations of marine mammals and some sea turtle species migrate to the Offshore Study Area primarily to forage for food*". It is also important to note that some marine mammal species and the Leatherback Sea Turtle also migrate to the nearshore study area to feed in the summer and fall. The draft Critical Habitat for the Leatherback Sea Turtle may encompass part of the southern Placentia Bay area so this may require further monitoring and mitigation of potential operational impacts.

Section 7.6.3 - Cumulative effects estimations are fraught with danger as little is known about effects of construction and vessel underwater sounds on marine mammal distribution and abundance – or even basic information on these measures. Given these two sources of uncertainty, it is urged that industry, regulators, and others consider large-scale baseline surveys to assess abundance and distribution of marine megafauna over larger areas of the region (as DFO did in the summer of 2007 to some extent over the project area). The large-scale aerial survey for marine megafauna DFO has flown in Newfoundland and Labrador waters during the summer of 2007 had relatively low coverage. This survey should be enhanced in scope, and other surveys during other seasons and years should be conducted to assess seasonal, annual, and geographic variation in distribution and abundance of marine megafauna. This type of baseline information is critical prior to starting significant offshore developments, and to track effects on current operations.

Page 11-90 – The EA states "*Specific EEM programs to verify the accuracy of assessment predictions and the efficacy of mitigation measures are not planned for marine mammals and sea turtles.*" This is not a recommended approach as, combined with the lack of general or detailed baseline assessments of marine mammal and sea turtle distribution or abundance in the study areas, there will be no means to assess impacts of the operations described in the EA.

Section 15.3 and Underwater Sound Propagation Assessment Report – Dynamic positioned rigs and vessels will produce significant and long-duration underwater noise through propeller cavitation and thruster operations. These may displace marine mammals, or in the case of Northern Bottlenose Whales (*Hyperoodon ampullatus*), may attract them to such operations. Regular monitoring before, during, and after the onset of such activities would help to determine if there were distributional or behaviour responses to such noise sources. In addition, the best way to test these propagation modelling results described in the Underwater Sound Propagation Assessment Report is to conduct near- and far-field measurements in association with the loudest sound sources, and during periods of time (such as the winter) when sound is expected to propagate furthest.

Section 15.1.1 – The assessment notes than an environmental effects monitoring (EEM) program will be implemented at the site similar to the ongoing programme. Clarification is needed to determine if this will include monitoring of (a) sediment chemistry, (b) sediment toxicity, (c) benthic invertebrate community, (d) fish and shellfish body burden, (e) taint, and (f) fish health.

Environmental Assessment Methodology and Definitions

Section 5.0 – The list of potential project-related interactions seems to be comprehensive in the EA; however, many of the arguments relating, for example, to changes in habitat quality and quantity are purely conceptual (i.e., 'potential effects'). It would be helpful if the EA included some examples if available in the literature relating to similar current/past events in other regions (e.g., effects of a 350 m^3 oil spills on spawning grounds for marine fish inside a partially enclosed bay similar to Placentia Bay), which could be used to illustrate/support the statements presented in the EA

Section 5.3.8 – What are the metrics for determining if a particular species has low, moderate or high probability of occurrence in the two study areas (i.e., not enough evidence/references are provided to support what is stated in the document)?

Under CEAA, an environmental assessment focuses on potential adverse environmental effects. Of the components listed, effects on fish and fish habitat are relevant for DFO. Literature on impact zones for fish habitat is covered quite well and conclusions are in line with many reviews and individual studies. Although it is difficult to make general statements about the potential effects of produced water under different oceanographic regimes, conclusions about potential effects on fish health, fish contamination and tainting are in line with EEM studies carried out over a number of years at the three development sites on the Grand Banks.

Section 5.3.3 – Although the EA states, based on CEAA guidelines, that "*A significant adverse residual environmental effect is one that affects fish and/or fish habitat, resulting in a decline in abundance or change in distribution of a population(s) over more than one generation within the Nearshore and/or Offshore Study Areas*", this is a broad definition and open to interpretation. By general example, in the case of American lobster (*Homarus americanus*), would the "population line" be drawn on the population in Arnold's Cove proper, the whole of Placentia Bay, coastal Newfoundland, or the "complete" population which extends to Maine?

Pages 5-14 and 11-2 – The EA states "*A significant adverse residual environmental effect is one that affects marine mammals or sea turtles by causing a decline in abundance or change in distribution of a population(s) over more than one generation within the Nearshore and/or*

Offshore Study Areas." What magnitude of decline is considered significant? This is particularly problematic since even the best-studied populations are difficult to assess and, in many cases, population declines of more than 50% could go undetected (percentage of serious population declines that would not be detected in cetaceans ranges from 72 to 90% with current monitoring efforts)(see Taylor et al. 2007).

Page 12-129 (Section 17.2.6); and elsewhere – How would impacts of WREP activities be "*reversible at the population level*"? Population-level impacts should not occur if the appropriate mitigation measures are in place.

Sections 12.5.2.3; 17.5; and elsewhere – The analysis of cumulative effects is non-quantitative and dismissive of potential effects. Generally, the EA reiterates that proposed project activities will have little or no effect on listed or non-listed marine mammals and sea turtles, but does not place these effects into the context of the concurrent effects induced by other anthropogenic activities, i.e., there is no cumulation of environmental effects in a quantitative sense. While such an approach is novel and data-intensive, it is being developed in various parts of the world (e.g., Wood et al. 2012 or Lawson and Lesage 2013 in press).

Species Descriptions

The following section is an overview of the comments and recommended revisions for sections of the EA providing summary descriptions of various biological groups, namely fish, marine mammals, and species-at-risk (SAR), occurring in the Newfoundland and Labrador marine environment. In general, it was noted that the species descriptions should provide the most up-to-date, relevant information available. For example, many of the distribution maps, particularly those for marine fish and SAR, are based on data prior to 2001 and need to be updated accordingly. Significant changes have occurred over the past 10 to 20 years for many marine species, as well as for the marine environment, therefore, ignoring recent data is unacceptable.

Page 8-22 – *Capelin.* The sentence that states Capelin "*migrate to deeper waters to spawn offshore at depths up to 125 m*"…."*when conditions for beach spawning are not ideal*" is incorrect. Nakashima and Wheeler (2002) indicate that spawning occurs subtidally when water temperatures at the beach are too warm. Furthermore, this redirected spawning occurs in coastal waters generally at depths considerably less than 125m.

The statement that eggs "*remain in the sediment for 14 to 52 days*" is not supported by Scott and Scott (1988) as indicated in the document. Scott and Scott (1988) indicate that eggs hatched in the beach from 9 to 24 days depending on where they were in the intertidal zone. If this statement is in reference to demersal spawning on the Southeast Shoal where water temperatures are much cooler then 52 days may be acceptable.

Page 8-23 – *Capelin.* The statement that juvenile Capelin in the nearshore prefer eelgrass habitat should be supported with a reference. Most juvenile Capelin are found offshore where eelgrass does not occur. The statement *"….except in autumn, when they have a reverse vertical migration (migrate to the surface during the day)*" that is attributed to Mowbray (2002) is incorrect.

Page 8-23 – *Atlantic Herring.* Update the species description using DFO (2012).

Page 8-36 – *Sand Lance.* Sand Lance (*Ammodytes* sp.) should be included in Table 8-4. Although there are no direct observations of Sand Lance spawning near the site there are records of Sand Lance larvae.

Section 11-3 – In general, the marine mammal distribution and abundance descriptions were acceptable in their accuracy. There are always a few sighting events that disprove the "rule" of the long-term data records. For example, small groups of adult Sperm Whales (*Physeter macrocephalus*) have been sighted at the northern end of Placentia Bay in waters shallower than 30 metres. Pairs and single Sei Whales (*Balaenoptera borealis*) have also been reported regularly by supply vessel and shipping crews travelling to and from Placentia Bay.

Page 11-3 – Killer Whales. In Table 11-2, Killer Whales (*Orcinus orca*) are quite common on the south coast of the province (e.g., near St. Pierre and the Burin Penninsula), and groups have been sighted occasionally in Placentia Bay. The Nearshore ranking of "Uncommon" without the question mark would be a more valid statement.

Section 12.3.1 – There is a lack of organization in the EA in regard to the marine fish species at risk. A taxonomic organization would be useful by grouping the sharks, skates, grenadiers, etc.

Page 12-3 – *Atlantic Wolffish*. Table 12-2 should read "*High potential for occurrence in Nearshore Study Area during its annual spawning season*"; *not* "*Moderate*". This correction also applies to ***page 12-15 (para. 2)*** of the EA.

Page 12-4 – *Acadian Redfish.* In Table 12.3, the statement *"…**spawning occurs in fall**.*" for the Atlantic population of Acadian Redfish (*Sebastes fasciatus*) is not accurate. Redfish (*Sebastes* sp.) are ovo-viviparous (live bearers) with mating/copulation generally occurring in the October to December period. Female extrusion predominantly occurs from March to July (depending on the species). There is a better description for redfish in the EA (See also ***Section 12.3.1.8 Page 12-25***).

Page 12-5 – *Porbeagle Shark.* Table 12-3 should read "*High potential for occurrence in Nearshore Study Area*"; not "*Moderate*". This correction also applies to ***Page 12-22 (para. 4)*** of the EA.

Page 12-5 – *Smooth Skate.* Table 12-3 should also state "*Southern NF population has moderate potential for occurrence in Nearshore Study Area*". This addition also applies to ***Page 12-25 (para. 4)*** of the EA.

The second most common skate species caught in the inshore NF/Subdiv. 3Ps skate fishery is Smooth Skate (*Malacoraja senta*), all discarded at sea; albeit *not* SAR population of the Funk Island Deep DU.

Page 12-6 – *Blue Shark.* Table 12-3 should read "*Prio**n**ace glauca*"; not "*Prio**m**ace glauca*". Also should read "*Cape Hatt**e**ras*"; not "*Cape Hatt**a**ras*" for Spiny Dogfish (*Squalus acanthias*) and elsewhere.

The EA statement, "*Most abundant along the coast of Nova Scotia and offshore Scotian Shelf.*" is irrelevant to this Newfoundland EA study; however, Blue Sharks (*Prionace glauca*) are an abundant regular seasonal visitor to Newfoundland waters.

Page 12-7 – *Basking Shark*. Table 12-3 should read "*Low to moderate potential for occurrence in Nearshore Study Area during summer*"; not just "*Low*". Also, the table should read "*Usually present in surface waters of Newfoundland bays feeding on plankton from May to September.*" This correction also applies to ***Page 12-40 (para. 2)*** of the EA.

Page 12-7 – *Thorny Skate.* Table 12-3 should read "*Moderate to high potential for occurrence in Nearshore Study Area*; not just "*Moderate*". This correction also applies to ***Page 12-44 (para. 2)*** of the EA.

Page 12-9 (para. 1) – *Atlantic Wolffish*. Regarding the EA statement, "*No wolffish were observed during the nearshore ROV habitat survey of Argentia and area*", any conclusions are dependent upon the date(s); time of day; survey depth(s); and remotely operated vehicle (ROV) proximity to bottom topographic features. This ROV survey was conducted "outside" of the Atlantic Wolffish (*Anarhichas lupus*) spawning/nesting season, therefore, it is not unexpected to find *low/no* potential of observing an adult "near shore". If this ROV survey was actually conducted "within" the wolffish spawning/nesting season then, this conclusion may change. Therefore, the "when/where/how" aspects of the ROV survey are crucial for the validation of the conclusions in regard to wolffish in the proposed Argentia Peninsula (i.e., Nearshore) development.

Page 12-11 (para. 2) – *Northern Wolffish.* The EA statement, "*Females guard the nests*", is incorrect and the cited references do not support those statements. For all three wolffish species, the adult male of each mated pair guards and aerates the resultant egg mass (i.e., "nest") until hatching.

Figures 12-1 to 12-7, 12-9 to 12-12, 12-14 to 12-16, and 12-18 – These figures are all outdated and need to be replaced.

Page 12-15 (Section 12.3.1.3) – *Atlantic Cod*. The distribution plots for cod (and other species in the EA where Kulka et al. (2003) is the source) are based on data only to 2000 and should be updated to provide a more recent representation, particularly in relation to baseline information for environmental effects monitoring for the project.

Page 12-22 (para. 3) – *Porbeagle Shark.* The statement, "*Porbeagle are also caught as bycatch in other fisheries…of the 57 mt of discards annually*" (based on Campana et al. 2011), underestimates fishing bycatch mortality for this species. A more realistic estimate/fisheries overview would have been obtained from Benjamins et al. (2010). This paper should have been included in this EA study regarding several SAR shark species (i.e., Shortfin Mako *Isurus oxyrinchus*, Spiny Dogfish, Blue Shark, and Basking Shark *Cetorhinus maximus*). Other more recent papers are also missing from the species descriptions.

Page 12-27 – *Redfish*. In Fig. 12-9, the distribution plots for redfish indicate very low relative abundance except for an occasional hot spot. This was not expected and should be reviewed for accuracy. In addition, the low abundance of the distribution plots for redfish appear to contradict the results of the DFO RV survey in Div. 3L for 2010 and 2011 where Deepwater Redfish (*Sebastes mentella*) is the dominant species by weight both years (***Page 8-34***).

Page 12.32 (Section 12.3.1.12; para. 1) – *Atlantic Salmon*. For the south coast of Newfoundland salmon (*Salmo salar*) remain in the river until age three or four, not "age two". The species is no longer valued as "commercial fisheries" (also delete sentence 2 of ***para. 6***). The third sentence of the para. 2 should be revised because salmon breed in other areas

besides the southeast tip. In ***para. 5,*** the last sentence should state "*20 percent for small salmon and by 11 percent for large salmon.*" Note that the small salmon are adults. In Figure 12-13, "*post-smelt*" should be post-smolt.

Page 12-44 (para. 1) – *Thorny Skate.* The EA statement, "*Simon and Frank (2000) found that in the skate fishery on the eastern Scotian Shelf…majority was Winter Skate*", is irrelevant to this EA study. Instead, scientific papers reporting on the annual Newfoundland skate fishery - in which *95%* of the skate catch is Thorny Skate (*Amblyraja radiata*) - should have been used.

Page 12-44 (para. 2) – *Thorny Skate.* This fact, "*95% of the skate catch is Thorny Skate*", also applies to the skate fishery in Placentia Bay; rather than the ambiguous EA statement, "*is thought to be Thorny Skate*".

Conclusions

Several common points were made during the review of the WREP EA, including use of The Pond as a disposal area, potential impacts of anthropogenic sound, accidental hydrocarbon discharges, and marine traffic on marine species, recommendations for baseline and monitoring studies, and clarification of EA methodology and definitions.

The use of The Pond is preferable to ocean disposal to reduce the potential impacts on marine organisms.

Pile-driving during shoreline construction and the use of vessel thrusters during dynamic positioning will introduce noise into the marine environment and can potentially impact marine organisms. These activities need to be examined more fully in the EA.

Geohazard and VSP surveys will collect high resolution seismic, side scan sonar, sub bottom profiler, and multi-beam bathymetric data as needed during well operation and reservoir assessments. Each type of sound source should be considered separately in the EA. Ideally, the same types of mitigation protocols for marine mammals and sea turtles should be employed for these operations (e.g., trained MMOs, ramp-up and shut down, sightings data sent to regulatory agencies). Similar concerns should be expressed for well head severance operations.

The nearshore study area should extend further offshore (south) as the transiting vessels and CGS represent hydrocarbon spill risks and noise exposure en route to the offshore area.

Oil spill trajectories, depending on the seasonality, may encompass potentially sensitive areas, such as high-density marine mammal areas off the edges of the Grand Banks and fish spawning areas (e.g., beaches and the Southeast Shoal for Capelin).

In light of several vessel-strike incidents associated with offshore oil production, the necessity to estimate potential impacts of ship strikes on marine mammals and sea turtles is highly recommended. The use of freely-available computer models would allow some assessment of the risk caused by the increased number of larger vessels moving through this study area.

The cumulative impact section of the EA could be improved. Cumulative effects estimations are fraught with danger as little is known about effects of construction and vessel underwater sounds or even basic information on these measures. Given these two sources of uncertainty, it

is urged industry, regulators, and others consider large-scale baseline surveys to assess abundance and distribution of marine megafauna over larger areas of the region. Furthermore the analysis of cumulative effects is non-quantitative and dismissive of potential effects. Generally, the EA reiterates that proposed project activities will have little or no effect on listed or non-listed marine mammals and sea turtles, but does not place these effects into the context of the concurrent effects induced by other anthropogenic activities, i.e., there is no cumulation of environmental effects in a quantitative sense. While such an approach is novel and data-intensive, it is being developed in various parts of the world.

Under CEAA, an environmental assessment focuses on potential adverse environmental effects. Of the components listed, effects on fish and fish habitat are relevant for DFO. Literature on impact zones for fish habitat is covered quite well and conclusions are in line with many reviews and individual studies. Although it is difficult to make general statements about the potential effects of produced water under different oceanographic regimes, conclusions about potential effects on fish health, fish contamination and tainting are in line with EEM studies carried out over a number of years at the three development sites on the Grand Banks.

Besides studies previously mentioned in this section, several others are recommended, including (1) the collection of baseline data on the health of fish in Argentia Harbour is recommended; (2) the monitoring of Leatherback Sea Turtles in southern Placentia Bay, and (3) the monitoring of marine mammals are recommended before, during, and after the onset of activities associated with dynamically-positioned rigs and vessels; and (4) the collection of near- and far-field measurements in association with the loudest sound sources, and during periods of time (such as the winter) when sound is expected to propagate furthest to test the propagation modeling results described in the Under Sound Propagation Report.

Additional and recent information exists that will need to be included in the environmental assessment, particularly in the biological descriptions, and there are some cases where information requires correction. It must also be noted that some reviewers were unable to complete a more comprehensive review of the EA and supporting documents given the time constraints of the review process and personal workloads.

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Sources of information

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