REVIEW OF STRATEGIC ENVIRONMENTAL ASSESSMENT REPORTS FOR THE EASTERN SCOTIAN BANK AND SLOPE REGIONS OF THE SCOTIAN SHELF

Context

In August 2012, the Ecosystem Management Branch, Fisheries and Oceans Canada (DFO) in the Maritimes Region requested that DFO Maritimes Science undertake a review of two Canada-Nova Scotia Offshore Petroleum Board (CNSOPB) draft Strategic Environmental Assessment (SEA) reports: one for the Eastern Scotian Shelf region (Middle and Sable Island Banks) and one for the Eastern Scotian Slope (Sable Slope) region (Stantec 2012a, Stantec 2012b). Ecosystem Management requested DFO Science advice on the reports related to the following question:

i) Do the CNSOPB SEA reports of the Eastern Scotian Shelf (SEA 1A) and Eastern Scotian Slope (SEA 1B) regions accurately identify ecosystem attributes and anticipated ecosystem-offshore petroleum interactions in context of what is known about the marine ecosystem of these shelf and slope areas?

This information will be provided to the CNSOPB in order to inform their review of the draft SEA reports (all DFO comments on the SEA reports, and the CNSOPB's response to DFO's comments, will be posted to the CNSOPB public registry – see: www.cnsopb.ns.ca/environment/environmental-assessments/file-no-753457). The SEA reports will be used by the CNSOPB to make decisions regarding Call for Bids and, similarly, to inform potential bidders of the environmental context of the various proposed offshore petroleum parcels. It was requested that a response be provided by DFO Science on September 14, 2012. Given the short timeframe for review, DFO's Science Special Response Process was used.

This Science Response Report results from the Science Special Response Process of September 11, 2012, on the Review of Strategic Environmental Assessment (SEA) Reports for the Eastern Scotian Shelf and Slope Regions of the Scotian Shelf.

Background

On April 30, 2012, the CNSOPB announced a Call for Bids (NS12-1) for eleven offshore petroleum parcels located in the Nova Scotia Offshore Area. The Call for Bids closes on November 7, 2012. In advance of the closing date, the CNSOPB released two draft SEAs covering proposed offshore petroleum parcels located on the Eastern Scotian Shelf (SEA 1A) and Eastern Scotian Slope (SEA 1B) regions of the Nova Scotia Offshore Area with the intent to identify potential environment-offshore petroleum interactions that need to be considered in future offshore petroleum exploration and development activities in these regions. The two SEA reports complement a CNSOPB SEA completed for the west Scotian Slope in 2011 (including its Addendum, which was completed in 2012) (Hurley 2011, DFO 2012).

The intent of the SEAs is to assist the CNSOPB in its determination on the potential issuance of future exploration rights within the Eastern Scotian Slope (Sable Slope) and Eastern Scotian

Shelf (Middle Bank and Sable Bank) areas, including general restrictive or mitigative measures that should be considered during the exploration program application and program specific environmental assessment process.

Response

General Comments

The SEAs are well organized and indicate a familiarity with the SEA requirements. Key features of the existing environment in the study area that could potentially interact with or influence elements of a petroleum exploration program are identified with respect to impacts on species of special status, special areas, and fisheries. The SEAs outline mitigation measures to deal with potential impacts, such as adjusting work schedules to address the presence of certain species. It is important that these sorts of measures are followed. 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, aspects of the SEA were felt to require further attention.

The documents also mention the potential for sharing of data - in particular biological data. These data could serve as important additions to the knowledge base in the Maritimes Region.

Physical Environment

The description of the physical environment is generally accurate, but some of the terminology used is incorrect. For example, the SEAs refer 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 configuration has been the exception for the last few decades and is expected to remain so under climate change conditions. Related to the above, Drinkwater et al. (1998, 1999) and Petrie (2007) are better physical environment reference documents than Zwanenburg (2006).

The SEAs should also provide a better description of the seabed and the modelling or fate of drilling wastes (i.e. muds). Li and King (2007) provide a physical description of the surficial geology and morphology of parts of the Sable Island Bank, which should be integrated into the SEAs. In addition, 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 of the existence and capability of this model in the SEAs.

Fisheries

General Comments

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 (Table 3.8 in both SEAs). It is suggested that data sources used for these determinations and their biases be referenced in the SEAs. For example, if the summer Research Vessel (RV) survey is used exclusively then the resulting interpretation may be biased, as the summer RV is a seasonal survey so the species distributions are only applicable to the July/August period. A similar data bias applies to other potential data sources, including the 4VsW RV survey as well as all the industry surveys (e.g., halibut, snow crab, individual transferable Quota [ITQ], Sentinel) in the area. This is why it is important to cite what data sources are being used, including any potential biases associated with the data. This comment applies to all species listed in these tables.

Pelagic Fisheries

Eastern Scotian Shelf (Middle and Sable Island Banks)

The SEA includes information (Table 3.15 in SEA 1A) 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 study area. This representation is limited, as the Canadian landings for swordfish alone in 2010 were >1,000 t for the Atlantic zone, and most of the swordfish catches occurred within the study area and just outside of the project area. Also, the SEA states that during the period from 1980-2000 pelagic species have shown fluctuations in catch and have ranged from 8-15% of the total landed value (Worcester and Parker 2010) but concludes that, “In 2010 pelagic species accounted for 0.2% of the total landed value”. This quote further illustrates problems with the way landings and values of pelagic species are represented in the SEA. It is unlikely that pelagic species only account for 0.2% of the total when they accounted for 8-15% over a recent 21 year period, including a time when swordfish landings were very low. Since the larger study area was delineated in recognition of a potential zone of influence of environmental effects for exploration activities that could potentially occur within the project area (Stantec 2012a, b), it seems logical that landings and value of all fisheries in the study and project areas be represented in the SEAs.

The report does not recognize important pelagic fisheries occurring right along the shelf edge, nor does it provide guidance on avoidance of impacts on those fisheries. It is also important to acknowledge that most of the fishing activity in 2010 (the year selected to illustrate fishery distribution) occurred just outside of the project area, thus leading to a potentially serious underestimate of the value of the fisheries that are being impacted. Consideration needs to be given to the types of mitigation that would ensure the protection of the important pelagic fisheries, such as minimizing activity in the vicinity of important fisheries.

The open seasons for pelagic species as represented in Table 3-17 in SEA 1A is inaccurate given that all large pelagic fisheries are open year round (M. Eagles, pers comm. Sep. 14, 2012). Although the fishery is open year-round, fishing effort changes depending on the time of year (Table 1). Currently, there is limited porbeagle shark fishing activity so historic fishing efforts are represented in Table 1. Also, there is no directed fishery for mako shark but it is an allowable by-catch in the shark, swordfish and tuna fisheries.

Table 1. Effort levels for large pelagic fisheries on the Eastern Scotian Shelf.

Species	High Activity	Low Activity
Albacore tuna	July - November	May, June and December
Bluefin tuna	July - November	June and December
Porbeagle shark	March - June	February, October - December
Swordfish	July - November	May, June and December

The list of stakeholders consulted (Table 4.2 in SEA 1A) only includes three representatives from the fishing industry, only two of which fish in the study area. The list of consulted stakeholders should be expanded to include all fishing industry representatives that may be potentially impacted by the environmental effects of exploration activities.

Swordfish are well known to be attracted to lights (Broadhurst and Hazin 2000, Hazen et al. 2005), but this is not reflected in the SEA (Table 4.4 in SEA 1A). In some cases, if exploratory drilling led to development sites, these sites could interfere with swordfish migration patterns (J. Neilson, pers comm. Sep. 18, 2012).

Eastern Scotian Slope

Much of the Eastern Scotian Slope SEA (SEA 1B) repeats material presented in the SEA dealing with the Eastern Scotian Shelf, so the comments presented above also apply to this SEA.

In Table 3.5 of SEA 1B, the same set of species is repeated from the Eastern Scotian Shelf SEA, yet there are other commercially significant species associated with the Scotian Slope, such as mahi-mahi and marlins, that are missing. Table 3.17 of SEA 1B also does not include these more “blue water” species, but these species are mentioned in other tables.

Similar to comments pertaining to the Eastern Scotian Shelf SEA, in Section 3.3., the fishery landings and economic values should also be computed for the study area, not just the project area. Again, there is a need to characterize potential areas of overlap and exclusion between pelagic fisheries and offshore petroleum activities operating in the same area, as discussed above.

Demersel Fish

The SEAs list thorny skate as having a low to moderate potential for occurrence in the study area, but it was the third most common species encountered on the Scotian Shelf during the summer research vessel (RV) surveys prior to 1993 (Simon and Comeau 1994). Although its abundance is very much reduced recently, there is a high potential for occurrence.

Middle Bank is not a signification habitat for winter skate. The species is generally found in the eastern shoal area of Banquereau and the southern half of Sable/Western Banks. The Sable/Western Bank fish migrate to the western spur area off Sable Island Bank to deposit their purses. The location in not known exactly and may vary from year to year.

Contrary to information presented in the SEAs, winter skate purses are not attached to the sea floor. When extruded they have sticky mucus that gathers detritus/gravel and slows down their movements on the bottom, but they are not attached.

In section 3.3.1.1 (Page 3.41 of SEA 1A and Page 3.39 of SEA 1B), the moratorium on cod also applies to haddock.

Underwater Acoustics (Eastern Scotian Slope and Shelf)

Generic Description of Exploration Activities

With respect to geophysical survey activities, 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 indeed formed before seismic exploration shooting occurs. Issues of this sort could be effectively addressed by season-specific acoustic modeling at the project-specific level. The acoustic modeling listed in both SEA documents as a Mitigation and Planning Measure for Species of Special Status in the "Seismic and Seabed Surveys" section (Table 5.1 of the SEA 1A, p. 5.8), should include these considerations. It is also 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 (as stated in Table 2.1 of the SEAs). 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.

Geophysical Survey Activities

The SEAs discussed the potential use of a newer type of seismic survey (i.e. Wide Azimuth seismic, or WAZ), which includes four additional vessels towing source arrays. More detail is required on this new survey design in order to evaluate whether the use of an increased number of source arrays actually increases the total sound energy emitted into a given area of the water column and whether the current seismic standard operating procedure (SOP) is still suitable for this new technology.

The SEAs states in Table 2.1 that typical zero-to-peak source levels for exploration seismic arrays (applicable to 2D, 3D, and 3D WAZ seismic) 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.

In the "Seismic and Seabed Surveys Subsections" (5.2.1.1) of both SEAs, it is not clear what the authors are trying to say in the last sentence, "For example, depth is an important consideration where sound attenuates faster at shallower depths." They may mean that sound tends to attenuate more rapidly with range in a shallow water survey environment, which is generally true.

Geophysical Survey Activities

In the discussion of exploratory drilling noise, the point being made in the SEAs 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, an efficient acoustic radiator. Choice of drill rig can constitute a potential noise mitigation measure.

Physiological and Behavioral Effects on Marine Mammals and Fish

In the "Physiological and Behavioral Effects on Marine Mammals" section, 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.” This is a rather vague statement that seems to gloss over significant risks. 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 (Richardson et al.1986, Koski and Johnson 1987, Davis et al.1998, McCauly et al. 2000, Lee et al. 2011) 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/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.

It is stated in section 5.1.1.2 “Exploratory Drilling” that the North Atlantic right whale is, “known to exhibit long range avoidance behavior,” but no clear citation is given. This point seems especially critical given noise avoidance is often quoted as reducing risks of vessel-whale collisions, yet the following SEA section on vessel traffic (5.1.1.3) indicates that the North Atlantic right whale seems quite prone to ship collisions.

The authors include a discussion on the behavioral effects of fisheries resources affecting catchability in both SEAs and, to their credit, it is a potential effect often overlooked in the past and one for which there is not a very good understanding. Generally fishers avoid seismic surveys for other reasons, so direct effects on catchability may or may not be important. Regardless, this could be a legitimate topic for inclusion in the “Data Gaps and Uncertainties” sub-section.

One fact that does not appear to be emphasized anywhere in the exploration seismic context is the potential for extremely long duration surveys within quite limited geographic areas and the possibility for resultant temporal cumulative effects. For instance, if one were to take a 30 x 30 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) that the behaviors of some fish and whales may be influenced at ranges comparable to the dimensions of the hypothetical survey block. 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 behavioral manner for a month or more. It could be 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.

Accidental Spills

Although mitigation and planning considerations are discussed in the SEAs, it is important to recognize that the fate, effects and transport of accidental oil spills depend on a number of things, such as oil composition, weathering processes acting on the oil, the response option employed and the type of spill environment (Lee et al. 2011). It is suggested that these factors be directly discussed and cited in relation to developing spill mitigation and control plans. Since both SEAs are similarly laid out, the following comments apply to both.

Chemical Composition of Oil

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.

Weathering

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 natural processes can be affected by the type of 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 breakup of oily surface slicks; however, the COPC remain for a longer period of time in the water phase and, 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, 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.

Conclusions

The SEAs are well organized and key features of the existing environment that could potentially interact with or influence elements of a petroleum exploration program are identified. The SEAs outlines mitigation measures to deal with potential impacts and it is important that these sorts of measures are followed. Although the treatment of key features of the existing environment is comprehensive and shows experience with key concerns, several aspects of the SEA were felt to require further attention.

The description of the physical environment is generally accurate, but there are some errors in terminology and a better description of the seabed and the modeling or fate of drilling wastes (i.e. muds) should be provided.

Since the larger study area was delineated in recognition of a potential zone of influence of environmental effects, landings and value of all fisheries in the study and project areas should be represented in the SEAs. The report does not recognize that important pelagic fisheries occurring right along the shelf edge nor does it provide guidance on avoidance of impacts on those fisheries.

With respect to the analysis of common species of commercial importance that are likely to occur within the study area, it is not clear how the categories for potential occurrence are defined (low, intermediate, high) and what life history stages are being considered in the analysis. It is also unclear what data sources the authors used to determine these “potential for occurrence” rankings and it is, therefore, suggested that all data sources used for these determination be referenced in the SEAs.

The SEAs discuss the potential use of a newer type of seismic survey, which includes four additional vessels towing source arrays (i.e. Wide Azimuth seismic, or WAZ). More detail is required on this new survey design in order to evaluate whether the use of an increased number of source arrays actually increases the total sound energy emitted into a given area of the water column, its interactions with pelagic fisheries in the area, and temporal and/or cumulative burden of sound within the seismic survey region. It is also important to consider whether the current explorative seismic standard operating procedure (SOP) remains suitable for this new technology.

There is reasonable evidence that the movements and distributions of some Mysticetes, such as bowheads and humpbacks, can be influenced at multi-kilometer ranges, and it is suggested that some of this work be directly cited to draw attention to the possibilities of long range effects on Mysticetes.

Also, it should be emphasized that with explorative seismic there is the potential for temporal cumulative effects where fish or whales at a specific spot, or even over a fairly sizable area, could be continuously affected in some behavioral manner for a month or more. Consideration should be given to mitigating this impact, especially if the affected area is a critical feeding or nurturing site (where the animals might be effectively “anchored”) or a critical migration corridor for sensitive fish or marine mammals.

Last, the fate, effects and transport of accidental oil spills depend on a number of things, such as oil composition, weathering processes acting on the oil, the response option employed and the type of spill environment. These factors need to be acknowledged in the SEAs.

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