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Nunavut Impact Review Board
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Re: WWF-Canada's *Final Written Submission* to the NIRB's Strategic Environmental Assessment in Baffin Bay and Davis Strait

Dear NIRB:

Thank you for the opportunity to submit comments to the Nunavut Impact Review Board (NIRB) on the *Preliminary Findings Report* for the Strategic Environmental Assessment (SEA) in Baffin Bay and Davis Strait. WWF-Canada supports the SEA process and believes it is an important component in ensuring that offshore oil and gas activities in Canada's Eastern Arctic are conducted safely with the lowest possible risk to human health and the environment, if such activities are to be carried out at all. We commend the NIRB for its efforts to engage stakeholders comprehensively throughout the SEA process.

World Wildlife Fund (WWF) is one of the largest independent conservation organizations in the world, with projects in more than 100 countries. WWF-Canada creates solutions to the environmental challenges that matter most for Canadians. We work in places that are unique and ecologically important, so that wildlife, nature and people thrive together.

With respect to our Arctic oil and gas and marine conservation work, WWF-Canada believes healthy coastal communities depend on healthy oceans. We are working in partnership with coastal communities, Indigenous peoples and other groups to advocate for marine protected areas and sustainable oceans management, and to ensure the rules governing offshore oil and gas activities are consistent with international best practices for safety, accountability and environmental protection.

WWF-Canada has reviewed the *Preliminary Findings Report* (Public Registry ID 320496) and the Nunami Stantec documents *Oil and Gas Life Cycle Activities and Hypothetical Scenarios* (Public Registry ID 318009) and the *Environmental Setting and Review of Potential Effects of Oil and Gas Activities* (Public Registry ID 318010). Our *final written submission* below provides an assessment of these reports and includes an overview of the economic prospects of offshore oil and gas in the eastern Arctic, the downstream climate change impacts, and the prospect of development alternatives to offshore oil and gas, all of which are not being considered by the NIRB in its assessment but are a critical component of any fulsome and robust SEA process. Accompanying our submission is a series of maps showing ecologically and biologically sensitive areas in the SEA focus area, species diversity hotspots, shipping traffic, oil spill trajectories, and commercial fishing interests. As requested, we have also provided a table in Appendix A with our detailed comments on the reports, subsequent recommendations and references for further information.

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1. EXECUTIVE SUMMARY

WWF-Canada is not opposed to all offshore oil and gas in the Arctic and there may be valid reasons to consider it as a possible economic development opportunity at some point in the future. However, any future offshore oil and gas activities in Baffin Bay or Davis Strait, should they occur, must avoid areas of heightened ecological significance, be safe for the sensitive Arctic environment, directly benefit and not threaten the livelihoods of local communities, and be consistent with national climate targets. This report, which is WWF-Canada's final written submission to the Strategic Environmental Assessment (SEA) process, explains in detail and with extensive supporting documentation why these conditions cannot currently be met, and how the SEA has not provided the information and analysis required, in some crucial respects, for decision-makers to determine whether the offshore hydrocarbon sector is in the best interests of Nunavummiut.

Canada is not ready for offshore oil and gas development in the eastern Arctic. Current capacity to respond to a major oil spill in the Baffin Bay and Davis Strait region is extremely poor and, in some cases, virtually non-existent. Knowledge of how best to respond to oil spills in extreme Arctic conditions is also inadequate and no method has yet been proven effective for cleaning up oil spills in ice.

Scientists do not yet fully understand the potential impacts of oil spills and seismic blasting on marine life, which many Inuit depend for their food, culture and livelihoods, although some research suggests that these impacts can be serious, even devastating, for certain species. These stressors would be introduced into an Arctic environment that is already under pressure from climate change and related ocean acidification, species migrations northward, increasing ship traffic and related pollution, and the risk of invasive species. More information is badly needed on the locations, population levels and ecological sensitivity of certain key species and there remains a troubling lack of baseline data necessary to improve our understanding of how oil and gas activities might impact physical, biological and human environments.

For offshore oil and gas activity to proceed, massive investments in infrastructure and response capacity would be required throughout Nunavut to support the industry, and yet the expected economic benefits for local communities are still not known. Arctic oil exploitation may also have global implications, compromising both the international commitment to limit global warming to a maximum of 1.5 degrees Celsius and Canada's carbon reduction ambitions.

With this submission, WWF-Canada outlines a number of key concerns with the SEA, which we believe will significantly limit the overall utility of the assessment for decision-making purposes. The final SEA report will no doubt be a useful and informative tool, but the assessment did not evaluate in sufficient detail the possible economic benefits for local communities that may arise from offshore oil and gas, nor did it consider possible development alternatives that are likely to be less risky and more sustainable over the long term. These are critical issues for local communities and government decision-makers who must consider whether the possible benefits of oil and gas activities outweigh the considerable risks and whether offshore oil development will help meet community, territorial and national sustainability objectives.

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This submission gives a number of recommendations to policy makers on what needs to be done to provide governments with the analysis required for the next stage of the decision-making process. We attempt to answer important questions regarding possible economic benefits of oil and gas for local communities and the potential for development alternatives such as sustainable fisheries, Inuit-led tourism, Inuit Impact and Benefit Agreements for conservation, and renewable energy opportunities – crucial issues that must be addressed before a fully informed decision on offshore oil and gas activity in Baffin Bay and Davis Strait can be made. We also consider the likely downstream climate change impacts of Arctic oil, something the SEA did not examine.

As acknowledged in the Nunavut Impact Review Board's Preliminary Findings report and confirmed in this submission, there remain critical outstanding data and research gaps that are unlikely to be filled before 2021, when the federal government must decide whether to extend or rescind the moratorium on new oil and gas licences in the Arctic. Many crucial and time-consuming conditions will need to be met before a decision on the moratorium can be made and it is not realistic to think the required additional research, data acquisition, infrastructure and spill response capacity will be in place in the near term. A recommendation by the Nunavut Impact Review Board to extend the moratorium will provide the time required to carry out the necessary work and revisit this issue again in the future.

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ᐆᒪᔪᓄᑦ ᐱᐅᖅᓱᐊᖅᑏᑦ ᓯᓚᕐᔪᐊᒥ ᑲᓇᑕᒥ ᐊᑉᕋᖅᑐᖏᑦᑐᑦ ᐃᒪᐃᓐᓇᕐᒥᑦ ᐅᖅᓱᐊᓗᓐᓂᐊᓂᓕᒫᖑᔪᓄᑦ ᐊᒻᒪ ᒪᓯᓄᑦ ᐃᑭᐃᑕᖅᑐᒥ ᓈᒻᒪᑦᑐᓂᑦ ᐱᔾᔪᑎᖃᕈᓐᓇᖅᑐᑦ ᐃᓱᒪᒋᓗᒍ ᕿᓇᐅᔾᓕᕆᓂᕐᒧᑦ ᐱᕙᓪᓕᐊᑎᑦᑎᔪᓐᓇᑐᐃᓐᓇᕆᐊᖃᕐᓂᖓᓄᑦ ᖃᖓᑐᐃᓐᓇᖅ ᓯᕗᓂᒃᓴᒥ. ᑭᓯᐊᓂᓕ, ᖃᐅᔨᑦᑐᑐᐃᓐᓇᐃᑦ ᓯᕗᓂᒃᓴᒥ ᐅᖅᓱᐊᓗᓐᓂᐊᕐᓂᐅᔪᑦ ᓴᓐᓂᕈᑎᐅᑉ ᐃᒪᖓᓂ ᐅᑯᐊᓘᓐᓃᑦ ᕿᑭᖅᑖᓗᑉ ᐃᑭᕋᓭᖓ, ᓭᖅᑭᕐᓂᕈᑎ, ᐅᐸᓯᓯᒪᑦᑕᐃᔭᕆᐊᓖᑦ ᐊᕙᑎᖓᓄᑦ ᐱᒻᒪᕆᐅᓂᖅᖅᑐᓂᑦ, ᐊᑦᑕᓇᖏᓪᓗᓂ ᐊᑦᑐᖅᑕᐅᓭᕋᐃᑦᑐᒧᑦ ᐅᑭᐅᑕᖅᑐᒥ ᐊᕙᑎᖓᓄᑦ, ᑐᕌᑦᑕᐅᑎᕆᔪᒥᑦ ᐃᑲᔫᓯᐊᑦ ᐊᒻᒪ ᐊᑦᑕᓇᖅᑑᑎᑦᑎᖏᓪᓗᑎᑦ ᓄᓇᓕᐅᔪᓂᑦ, ᐊᒻᒪ ᐊᔾᔨᒌᓐᓂᕐᑲᕐᓗᓂ ᑲᓇᑕᒥ ᓯᓚᖓᓄᑦ ᑐᕌᖅᑕᖏᓐᓄᑦ. ᐅᑯᐊ ᐅᓂᒃᑳᑦ, ᐆᒪᔪᓄᑦ ᐱᐅᖅᓱᐊᖅᑏᑦ ᓯᓚᕐᔪᐊᒥ ᑲᓇᑕᒥ ᑭᖑᓪᓕᖅᐸᒦ ᑎᑎᕋᖅᓯᒪᔪᓂᑦ ᑐᓂᔭᖓ ᐸᕐᓇᐅᑕᓯᒪᔪᒥᑦ ᐊᕙᑎᓕᓐᓂᕐᒧᑦ ᐊᐅᔨᓭᐅᓂᕐᒧᑦ (SEA) ᐱᕙᓪᓕᐊᓂᖓ, ᓇᓗᓚᐃᔭᐃᔪᖅ ᓇᓗᓇᐃᔭᖅᓯᒪᔪᓂᑦ ᐊᒻᒪ ᐊᒥᓱᓂᑦ ᑎᑎᕋᖅᑕᐅᓯᒪᓪᓗᑎ ᓱᓕᑦ ᑖᒃᑯᐊ ᖃᐅᔨᓐᓂᕆᔭᕐᖏᑦ ᒫᓐᓇᐅᔪᒥᑦ ᑎᑭᑕᐅᔪᓐᓇᖏᓐᓂᖏᓐᓄᑦ, ᐊᒻᒪ ᖃᓄᖅ SEA ᑐᑭᓯᒋᐊᕈᑎᖃᖅᑎᑦᑎᓯᒪᖏᓪᓚᖕᖔᖅ ᐊᒻᒪ ᖃᐅᔾᔭᐃᓂᒥᑦ ᐱᑕᖃᕆᐊᖃᖅᑎᑕᐅᔪᑦ, ᐃᓚᖏᓐᓂ ᐱᓪᓚᕆᐅᔪᓂᑦ, ᐃᓱᒪᓕᐅᖅᑎᓄᑦ ᓇᓗᓇᐃᕐᓗᒍ ᐃᒪᐃᓐᓇᕐᒥ hydrocarbon ᐱᔭᐅᔪᒪᓛᖑᒻᒪᖔᖅ ᓄᓇᕗᒻᒥᐅᓄᑦ.

ᑲᓇᑕ ᓱᓕ ᐊᑐᐃᓐᓇᐅᖏᑦᑐᖅ ᐃᒪᐃᓐᓇᕐᒥ ᐅᖅᓱᐊᓗᓐᓂᐊᓂᕐᒧᑦ ᐱᕙᓪᓕᐊᑎᑦᑎᓂᕐᒧᑦ ᑲᓇᓐᓇᖓᓂ ᐅᑭᐅᑕᖅᑐᒥ. ᒫᓐᓇᐅᔪᒥᖅ ᐱᔪᓐᓇᖅᑕᖏᑦ ᑭᐅᓗᑎ ᐊᖏᔪᒥᑦ ᐅᖅᓱᐊᓗᒻᒥᑦ ᑯᕙᔪᖅᑲᖅᑐᒥᓂᐅᓐᓂᕈᓂ ᓴᓐᓂᕈᑎᐅᑉ ᐃᒪᖓᓂ ᐅᑯᐊᓘᓐᓃᑦ ᕿᑭᖅᑖᓗᑉ ᐃᑭᕋᓭᖓᓂ ᐱᐅᖏᑐᒻᒪᓇᐅᓪᓗᓂ, ᐃᓚᖏᓐᓂᑦ, ᐱᑕᖃᖏᑎᐊᒻᒪᓇᑦᑐᑦ. ᖃᐅᔾᔮᒪᓂᐅᔪᖅ ᖃᓄᖅ ᐱᐅᓛᒥᑦ ᖃᓄᐃᓕᓯᕆᐊᓂᕐᒥᑦ ᐅᖅᓱᐊᓗᓐᓂᑦ ᑯᕙᔪᓂᑦ ᐅᑭᐅᑕᖅᑐᒥ ᓯᓚᖓᓄ ᖃᓄᐃᓐᓂᓇᔭᖏᓐᓄᑦ ᓈᒻᒪᖏᒥᔪᖅᑕᐅᖅ ᐊᒻᒪ ᐊᑐᖅᑕᐅᓂᐊᖅᑐᓂ ᓇᓗᓇᐃᖅᑕᐅᓯᒪᔪᖅᑕᖅᑲᖏᑦᑐᖅ ᐊᑑᑎᖃᑦᑎᐊᖅᑐᒥᑦ ᓴᓗᒪᖅᓴᐃᓂᕐᒧᑦ ᐅᖅᓱᐊᓗᓐᓂᑦ ᑯᕙᔪᓂᑦ ᓯᑯᓄᑦ.

ᖃᐅᔨᓴᖅᑏᑦ ᑐᓯᓯᒪᓪᓚᓇᖏᑦᑐᑦ ᐊᑦᑐᖅᑕᐅᔭᐅᓇᖅᑐᓂᑦ ᐅᖅᓱᐊᓗᓐᓄᑦ ᑯᕙᔪᓄᑦ ᐊᒻᒪ ᖄᖅᑎᑦᑎᖃᑦᑕᓂᕐᒧᑦ ᖃᐅᔨᓴᓂᕐᒧᑦ ᐃᒪᕐᒥᐅᑕᐃᑦ ᐆᒪᔪᖏᓐᓂᓄᑦ, ᐃᓄᓐᓄᑦ ᐊᒥᓱᓄᑦ ᑐᓐᖓᕙᕆᔭᐅᔪᑦ ᓂᕿᖏᓐᓄᑦ, ᐱᖅᑯᓯᖏᓐᓄᑦ ᐊᒻᒪ ᐃᓅᓇᓱᐊᕐᓂᖏᓐᓄᑦ, ᐃᓚᖏᑦ ᖃᐅᔨᓴᕐᓂᐅᔪᑦ ᐅᖃᐅᔾᔨᕆᐊᕋᓗᐊᖅᑎᓪᓗᒋᑦ ᑖᒃᑯᐊ ᐊᑐᖅᑕᐅᔪᑦ ᐱᓪᓚᑎᐊᓘᒍᓐᓇᖅᑐᑎᑦ, ᐱᔪᒥᓇᖏᑦᑑᔪᓐᓇᖅᑐᖅ, ᓇᓗᓇᐃᖅᓯᒪᔪᓄᑦ ᐆᒪᔪᓄᑦ. ᑖᒃᑯᐊ ᐊᔅᓯᕈᕈᑎᐅᔪᑦ ᓴᖅᑭᖅᑎᑕᐅᔪᓐᓇᖅᑐᑦ ᐅᑭᐅᑕᖅᑐᒧᑦ ᐊᕙᑎᖓᓄᑦ ᐊᔅᓯᕈᓕᓐᖅᑐᒥᑦ ᓯᓚᐅᑉ ᐊᓯᔾᔨᕐᓂᖓᓄᑦ ᐊᒻᒪ ᐊᑦᑐᐊᓂᓖᑦ ᐃᒪᕐᒧᑦ acidification, ᐆᒪᔪᐃᑦ ᐅᑎᖅᑕᖃᑦᑕᕐᓂᖏᑦ, ᐅᒥᐊᕐᔪᐊᖅᑕᖃᓕᖅᐸᓪᓕᐊᓂᖓ ᐊᒻᒪ ᐊᑐᐊᓂᓖᑦ ᓱᕈᓇᖅᑐᑦ, ᐊᒻᒪ ᐊᑦᑕᓇᕈᑎᐅᔪᓐᓇᖅᑐᑦ ᐅᑭᐅᑕᖅᑐᒥᐅᑕᓪᓚᕆᐅᖏᑦᑐᑦ ᐆᒪᔫᑦ. ᑐᑭᓯᕆᐊᕈᑎᔅᓴᖃᓐᓂᕐᓂᒥᑦ ᐱᔭᕆᐊᖃᓪᓚᕆᑦᑐᑦ ᓇᒦᓐᓂᖏᓐᓄᑦ, ᐊᒥᒫᓂᖏᑦ ᖁᕙᓯᓐᓂᖏᑦ ᐊᒻᒪ ᐊᕙᑎᖓ ᐊᑦᑐᖅᑕᐅᓭᕋᐃᓐᓂᖓ ᓇᓗᓇᐃᖅᓯᒪᔪᓄᑦ ᐆᒪᔪᓄᑦ ᐊᒻᒪ ᑐᓐᖓᕙᕆᓐᓄᑦ ᑐᑭᓯᒋᐊᕈᑎᔅᓴᖅᑕᖃᑦᑎᐊᖏᑦᑐᖅ ᐱᑕᖃᕆᐊᖃᖅᑐᑦ ᐱᐅᓯᑎᕆᐊᕐᓗᒍ ᑐᑭᓯᐅᒪᓂᒃᑯᑦ ᖃᓄᖅ ᐅᖅᓱᐊᓗᓕᕆᓂᐅᔪᖅ ᐊᑐᐃᓂᖃᕈᓐᓇᕐᓂᖓᓄᑦ ᖃᐅᔨᓕᖓᓂᖓᓄᑦ, ᐆᒪᔪᓄᑦ ᐊᒻᒪ ᐃᓄᐃᑦ ᐊᕙᑎᖏᓐᓄᑦ.

ᐅᖅᓱᐊᓗᓕᕆᓂᕐᒧᑦ ᑲᔪᓯᓂᐊᖅᑐᓂᑦ, ᐊᖏᔪᐊᓗᓐᓂᑦ ᐱᓕᕆᑎᑦᑎᔭᕆᐊᓖᑦ ᐱᕐᑯᑎᕐᔪᐊᓄᑦ ᐊᒻᒪ ᖃᐅᔨᓕᓯᕆᐊᕈᓇᕐᓂᖓ ᐱᑕᖃᕆᐊᖃᕋᔭᖅᑐᖅ ᓄᓇᕗᒻᒥ ᐃᑲᔪᕐᓗᒍ ᐱᓕᕆᓂᖅᑕᖅᑐᑦ, ᐊᒻᒪ ᓱᓕ ᓂᕆᐅᒋᔭᐅᔪᑦ ᕿᓇᐅᔾᓕᕆᓂᕐᒧᑦ ᐃᑲᔫᓯᐊᑦ ᓄᓇᓕᓐᓄᑦ ᓱᓕ ᖃᐅᔨᒪᔭᐅᖏᑦᑐᑦ. ᐅᑭᐅᑕᖅᑐᒥ ᐅᖅᓱᐊᓗᒃᓴᓯᐅᕐᓂᖅ ᓯᓚᕐᔪᐊᒧᑦ ᖃᓄᐃᓕᓂᖅᑎᑦᑎᑐᓐᓇᕐᒥᔪᖅ, ᖃᓄᐃᓕᑎᑦᑎᓪᓗᓂ ᑕᒪᒃᑭᓐᓂ ᓯᓚᕐᔪᐊᒥ ᑲᔪᖏᖅᑕᐅᓯᒪᔪᓂᑦ ᑭᓪᓕᖅᑎᑕᐅᓗᓂ ᓯᓚᕐᔪᐊᖅ ᐅᖅᑰᓯᕙᓪᓕᐊᓂᖓᓄᑦ ᐊᖏᑏᓇᔪᓐᓇᖅᑐᓂᐅᒃ 1.5 ᐅᖅᑰᓂᖓ ᐊᒻᒪ ᑲᓇᑕᒥ ᑳᐸᓐᓂ ᐊᑦᑎᓪᓕᑎᑦᑎᕆᐊᓂᕐᒧᑦ ᐱᔪᒪᔭᐅᔪᑦ.

ᐅᑯᐊ ᑐᓂᔭᐅᓂᖅᑭᓐᓄᑦ, ᐆᒪᔪᓄᑦ ᐱᐅᖅᓱᐊᖅᑏᑦ ᓯᓚᕐᔪᐊᒥ ᑲᓇᑕᒥ ᓇᓗᓇᐃᔭᐃᔪᑦ ᐊᒥᓱᒐᓚᓐᓂᑦ ᐃᓱᒫᓗᑕᐅᓪᓗᐊᑕᖅᑐᓂᑦ SEA-ᒧᑦ, ᐅᐱᓐᓇᔭᕗᑦ ᐊᑎᓪᓕᕆᐊᖅᑎᑎᓪᓗᐊᑲᓪᓚᑦᑐᑦ ᐊᑕᕆᖅᑐᒥᑦ ᖃᐅᔨᓴᕐᓂᐅᔪᒥᑦ ᐃᓱᒪᓕᐅᕐᓂᖏᑦ ᐱᔾᔪᑕᐅᔪᓄᑦ. ᑭᖑᓪᓕᖅᐸᒦ SEA ᐅᓂᒃᑳᑦ ᖁᓚᕐᓇᖅᑐᖅ ᐋᑎᖃᓂᐊᖅᑐᑦ ᐊᒻᒪ ᑐᑭᓯᒋᐊᕈᑎᓄᑦ

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ᓴᓇᕿᑎᐅᓗᓂ, ᑭᓯᐊᓂ ᖃᐅᔨᓴᐃᓂᐅᔪᖅ ᖃᐅᔾᔨᓴᓚᐅᖏᑦᑐᖅ ᓈᒻᒪᑦᑐᓂᑦ ᓇᓗᓇᐃᔭᖅᓯᒪᔪᓂᑦ ᑮᓇᐅᔭᓕᕆᓂᕐᒧᑦ ᐃᑲᔫᓯᐊᖑᔪᓐᓇᖅᑐᓂᑦ ᓄᓇᓕᓐᓄᑦ ᓴᖅᑭᕈᓐᓇᖅᑐᑦ ᐅᖅᓯᐊᓗᓐᓂᐊᓂᕐᒧᑦ, ᐅᕝᕙᓘᓐᓃᑦ ᐃᓱᒪᒋᔭᖃᓚᐅᖏᑦᑐᑦ ᐊᓯᐊᒍᑦ ᐱᕙᓪᓕᐊᑎᑦᑎᓂᕐᒥᑦ ᐊᑦᑕᓇᕈᑎᖃᕐᒋᓂᖅᓴᐅᔪᓐᓇᖅᑐᑦ ᐊᒻᒪ ᒪᑭᒪᑕᒐᕐᓂᓴᐅᓪᓗᑎ ᐊᑯᓂᐅᔪᒧᑦ. ᑖᒃᑯᐊ ᐱᒻᒪᕆᐅᔪᑦ ᐃᓱᒫᓘᑕᐅᔪᑦ ᓄᓇᓕᓐᓄᑦ ᐊᒻᒪ ᒐᕙᒪᒃᑯᓐᓄᑦ ᐃᓱᒪᓕᐅᖅᑎᓄᑦ ᐃᓱᒪᒋᔭᖃᕆᐊᖃᖅᑐᑦ ᐃᑲᔫᑎᐅᔪᓐᓇᖅᑐᓂᑦ ᐅᖅᓯᐊᓗᓐᓂᐊᓂᕐᒧᑦ ᐅᖓᑕᐅᔾᔮᔪᖅ ᐊᕐᕆᔪᑲᓪᓚᐃᑦ ᐊᑦᑕᓇᕈᑎᐅᔪᓐᓇᖅᑐᓂᑦ ᐊᒻᒪ ᐃᒪᐃᓐᓇᕐᒥ ᐅᖅᓯᐊᓗᒻᒥ ᐱᕙᓪᓕᐊᑎᑦᑎᓂᖅ ᐃᑲᔪᓂᐊᕐᒪᕐᓖᖅ ᑎᑭᑦᑐᓗᓂ ᓄᓇᓕᒻᒥ, ᓄᓇᕗᒻᒧᑦ ᐊᒻᒪ ᑲᓇᑕᒥ ᒪᑭᒪᑎᑦᑎᓂᕐᒧᑦ ᑐᕌᕐᒐᐅᔪᑦ.

ᐅᑯᐊ ᑐᓂᔭᐅᔪᑦ ᐊᒥᓱᓚᓐᓂᑦ ᐊᑐᓕᕐᑯᔾᔨᒧᑦ ᐊᑐᐊᕐᓚᓕᐅᖅᑎᓄᑦ ᑭᓯᑦ ᑲᒪᒋᔭᐅᒋᐊᖃᕐᒪᕐᓖᑕ ᐱᑕᖃᖅᑎᑦᑎᓪᓗᒋᑦ ᒐᕙᒪᒃᑯᑦ ᖃᐅᔨᓴᐅᓂᕐᒧᑦ ᐱᑕᖃᕆᐊᖃᖅᑎᑕᐅᔪᓂᑦ ᑭᖑᓪᓕᕐᒥ ᖃᓄᐃᓘᖅᑕᐅᓂᐊᖅᑐᓄᑦ ᐃᓱᒪᓕᐅᓂᕐᒧᑦ ᐱᕙᓪᓕᐊᓂᕐᒐᓄᑦ. ᑭᐅᓇᓱᖃᑦᑕᖅᑕᕗᑦ ᐱᒻᒪᕆᐅᔪᑦ ᐊᐱᖅᑯᑏᑦ ᐱᔾᔪᑎᖃᖅᑐᑦ ᑮᓇᐅᔭᓕᕆᓂᑦᑎᒍᑦ ᐃᑲᔫᓯᐊᖑᔪᓐᓇᖅᑐᑦ ᐅᖅᓯᐊᓗᓐᓄᑦ ᓄᓇᓕᓐᓄᑦ ᐊᒻᒪ ᐊᓯᐊᔫᕈᑎᔅᓴᐅᔪᓐᓇᖅᑐᑦ ᐱᕙᓪᓕᐊᑎᑦᑎᓂᕐᒧᑦ ᓱᕐᓗ ᓄᖑᓴᐃᖏᑦᑐᓂᑦ ᐃᖃᓗᓕᕆᓂᖅ, ᐃᓄᓐᓄᑦ ᑐᑭᒧᐊᖅᑎᑕᐅᔪᑦ ᐳᓚᕋᖅᑐᓕᕆᓂᖅ, ᐃᓄᓐᓄᑦ ᐊᑐᖅᑕᐅᔪᑦ ᐊᒻᒪ ᐃᑲᔫᓯᐊᑦ ᐊᕐᕆᕈᑏᑦ ᓴᐳᒻᒥᔭᐅᓂᖓᓄᑦ, ᓄᓇᒦᕐᓘᖅᑐᓂᑦ ᐊᐅᓚᔪᓐᓇᐅᑎᖃᕈᓐᓇᕐᓂᖅ – ᐱᒻᒪᕆᐅᔪᑦ ᐃᓱᒫᓘᑕᐅᔪᑦ ᐱᓕᕆᐊᖑᔭᕆᐊᓖᑦ ᐃᓱᒪᓕᐅᓚᐅᖅᑎᓐᓇᒋᑦ ᐃᒪᐃᓐᓇᕐᒥ ᐅᖅᓯᐊᓗᓐᓂᐊᓂᕐᒧᑦ ᓴᓐᓂᕈᑎᐅᑉ ᐃᒪᖓᓂ ᐊᒻᒪ ᕿᑭᖅᑖᓘᑉ ᐃᑭᕋᓭᖓᓂ ᓴᓇᔭᐅᔪᓐᓇᖅᑐᑦ. ᐃᓱᒪᒋᒻᒥᔭᕗᑦᑕᐅᖅᓯᒪᐅᑉ ᐊᓯᔾᔨᐸᓪᓕᐊᓂᖓᓄᑦ ᐊᑦᑐᖅᑕᐅᔪᑦ ᐅᑭᐅᑕᖅᑐᒥ ᐅᖅᓯᐊᓗᓐᓄᑦ, SEA–ᑯᑦ ᖃᐅᔨᓴᓚᐅᖏᑕᖓ.

ᐃᓕᓴᕆᔭᐅᓯ,ᓪᓗᓂ ᓄᓇᕗᒻᒥ ᐊᑦᑐᖅᑕᐅᔪᓄᑦ ᕿᒥᕐᕈᓂᕐᒧᑦ ᑲᑎᒪᑎᑦᑎᓂᕐᒧᑦ ᓇᓂᔭᐅᔪᓂᑦ ᐅᓂᒃᑳᓂᑦ ᐊᒻᒪ ᓇᓗᓇᐃᖅᑐᒍ ᐅᓇ ᑐᓂᔭᐅᓂᖓ, ᓱᓕ ᐱᒻᒪᕆᐅᔪᓂᑦ ᑐᑭᓯᒋᐊᕈᑎᓂᑦ ᐱᑕᖃᕐᒋᑦᑐᖅ ᐊᒻᒪ ᖃᐅᔨᓴᓂᕐᒧᑦ ᖃᐅᔨᒪᔭᐅᑦᑐᑦ ᐱᑕᖃᕐᓂᐊᖅᑐᕆᔭᐅᕐᒋᑦᑐᑦ ᑎᑭᓚᐅᖅᑎᓐᓇᒍ 2021, ᒐᕙᒪᑐᖃᒃᑯᑦ ᐃᓱᒪᓕᐅᕆᐊᖃᖅᑎᓪᓗᒋᑦ ᐅᖓᕙᕆᐊᖅᑕᐅᓗᓂ ᐅᕝᕙᓘᓐᓃᑦ ᐀ᖅᑕᐅᓗᓂ ᓄᖅᑲᖓᑎᑕᐅᔪᖅ ᓄᑖᓄᑦ ᐅᖅᓯᐊᓗᓐᓂᐊᓂᕐᒧᑦ ᓚᐃᓴᓐᔫᑦ ᐅᑭᐅᑕᖅᑐᒥ. ᐊᒥᓯᑦ ᐱᒻᒪᕆᐅᔪᑦ ᐊᒻᒪ ᐊᑯᓂᐅᓂᖅᑲᕈᓐᓇᖅᑐᑦ ᖃᓄᐃᓐᓂᕆᔭᕐᒋᑦ ᑎᑭᑕᐅᖅᑳᕆᐊᓖᑦ ᐃᓱᒪᓕᐅᓚᐅᖅᑎᓐᓇᒋᑦ ᓄᖅᑲᖓᑎᑕᐅᔪᒥᑦ ᐊᒻᒪ ᐱᓪᓚᕆᐅᔭᕐᒋᑦᑐᖅ ᐃᓱᒪᒋᓗᒍ ᐱᑕᖃᕆᐊᖃᖅᑐᑦ ᖃᐅᔨᓴᒃᑲᓂᕐᒧᑦ, ᑐᑭᓯᒋᐊᕈᓰᑦ ᐱᔭᐅᓂᕐᒋᓐᓄᑦ, ᐱᖁᑎᕙᐊᑦ ᐊᒻᒪ ᑯᕕᔪᖃᖅᑐᓄᑦ ᖃᓄᐃᓕᓯᒋᐊᕈᓐᓇᕐᓂᖓ ᐃᓂᖓᓃᓐᓂᐊᖅᑐᖅ ᒫᓇᒫᖅ. ᐊᑐᓕᕐᑯᔭᐅᔪᖅ ᓄᓇᕗᒻᒥ ᐊᕙᑎᓕᕆᔨᒃᑯᑦ ᑲᑎᒪᔨᕐᒋᓐᓄᑦ ᐅᖓᕙᕆᐊᖅᑕᐅᓗᓂ ᓄᖅᑲᖓᑎᑕᐅᓂᖓ ᐱᕕᖅᑲᑎᑦᑎᓂᐊᖅᑐᖅ ᐱᑕᖃᕆᐊᖃᖅᑐᓂ ᐃᖅᑲᓇᐃᔭᓂᐊᕐᓗᓂ ᐊᒻᒪ ᖃᐅᔨᒋᐊᒃᑲᓂᕐᓗᒋᑦ ᐃᓱᒫᓘᑕᐅᔪᑦ ᑖᔅᓯᒥᖑᔅᓴᐃᓇᖅ ᓯᕗᓂᔅᓴᒥᑦ.

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SOMMAIRE EXÉCUTIF

Le WWF-Canada ne s'oppose pas forcément à l'exploitation pétrolière et gazière extracôtière dans l'Arctique. Il reconnaît qu'il pourrait y avoir des raisons valables de les considérer comme des opportunités de développement économique, à un moment précis dans le futur. Toutefois, toute activité pétrolière ou gazière ayant lieu dans la baie de Baffin ou dans le détroit de Davis devra, s'il y a lieu, exclure les zones de grande importance écologique, être sûre pour les environnements arctiques sensibles, profiter aux communautés locales sans nuire à leur subsistance et être en phase avec les objectifs climatiques du Canada. Ce rapport expose les conclusions finales du WWF-Canada suite au processus d'évaluation environnementale stratégique (EES) : il explique, en détails et en s'appuyant sur une vaste documentation, pourquoi les conditions susmentionnées ne peuvent être remplies dans l'immédiat, et comment l'EES n'a pas été en mesure de fournir l'analyse ni les renseignements requis dans des sphères essentielles, afin de permettre aux décideur.se.s de déterminer si le secteur des hydrocarbures extracôtiers sert vraiment les intérêts des Nunavummiut.

Le Canada n'est pas préparé au développement pétrolier et gazier extracôtier dans l'Arctique de l'Est. Notre capacité d'intervention actuelle face à tout déversement important dans la région de la baie de Baffin et du détroit de Davis est extrêmement limitée, voire inexistante dans certains cas. Nos connaissances sont inadéquates quant à la meilleure façon de répondre aux marées noires dans les conditions extrêmes propres à l'Arctique, et aucune méthode ne s'est avérée efficace pour nettoyer le pétrole contenu dans la glace.

Les scientifiques ne comprennent pas encore parfaitement les répercussions potentielles, sur les espèces marines, des marées noires et du dynamitage sismique. Or, beaucoup d'Inuit.e.s dépendent de ces espèces pour assurer leur subsistance alimentaire, culturelle ou autre. Des recherches suggèrent que de tels impacts seraient sévères, voire dévastateurs, sur plusieurs de ces espèces. Des facteurs de stress seraient introduits dans un environnement arctique déjà soumis à la pression créée par les changements climatiques, l'acidification des océans qui y est associée, la migration d'espèces vers le nord, l'augmentation du transport maritime, la pollution qui en découle ainsi que le risque associé aux espèces envahissantes. Il existe un besoin criant de renseignements supplémentaires concernant l'emplacement, les niveaux de population et la sensibilité écologique de certaines espèces particulièrement importantes, et d'inquiétantes lacunes persistent en matière de données essentielles pour améliorer notre compréhension des impacts des activités pétrolières et gazières sur les environnements physiques, biologiques et humains.

Pour que des activités pétrolières et gazières extracôtières aillent de l'avant, il faudrait s'assurer, partout au Nunavut, d'investir massivement dans l'infrastructure et dans notre capacité d'intervention pour mieux épauler l'industrie. Pourtant, les bénéfices économiques anticipés par les communautés locales demeurent nébuleux. L'exploitation pétrolière dans l'Arctique pourrait aussi avoir des implications d'ordre mondial en compromettant l'engagement à faire plafonner le réchauffement global à 1,5 °C, ainsi que les objectifs canadiens en matière de réduction du carbone.

Le WWF-Canada partage, par la présente, certaines de ses principales préoccupations concernant l'EES. À notre avis, ces inquiétudes limitent considérablement l'utilité globale de l'évaluation dans la prise de décisions. Le rapport final sur l'EES servira certainement d'outil informatif, mais l'évaluation n'a pas su considérer tous les aspects relatifs aux bénéfices économiques potentiels du pétrole et du gaz extracôtiers pour les communautés locales. Cette évaluation n'a pas, non plus, envisagé d'alternatives en vue d'un développement moins risqué et plus durable à long terme. Ce sont là des questions essentielles aux communautés locales, ainsi qu'aux décideur.se.s issu.e.s du gouvernement qui seront responsables de déterminer si les bénéfices des activités pétrolières et gazières l'emportent sur les risques qui y sont associés, et si l'exploitation pétrolière extracôtière permet d'atteindre les objectifs communautaires, territoriaux et nationaux en matière de durabilité.

Ce document a pour but d'émettre, à l'intention des décideur.se.s, des recommandations quant aux actions qui s'imposent en vue de fournir, aux gouvernements, l'analyse nécessaire à la prochaine étape du processus décisionnel. Nous tentons ici de répondre aux questions essentielles qui concernent les différentes options quant aux bénéfices économiques du pétrole et du gaz pour les communautés locales et aux alternatives de développement telles que la pêche durable, le tourisme géré par les Inuit.e.s, les Ententes sur les répercussions et les avantages pour les Inuits (liées à la conservation) de même que le recours aux énergies renouvelables. Ces enjeux cruciaux doivent être examinés avant que l'on puisse prendre une décision éclairée sur l'activité pétrolière et gazière extracôtière dans la baie de Baffin et le détroit de Davis. Nous envisageons aussi la contribution du pétrole de l'Arctique sur le dérèglement climatique, en aval (ce que l'EES n'a pas examiné).

Tel qu'exposé dans le rapport préliminaire et tel que confirmé par ce document, des lacunes importantes persistent en termes de recherche et de données essentielles, lesquelles ne seront probablement pas comblées avant 2021, qui est l'année où le gouvernement fédéral doit décider de prolonger ou d'abroger le moratoire sur les nouvelles licences pétrolières et gazières dans l'Arctique. De nombreuses conditions (qui sont à la fois essentielles et longues à résoudre) devront être remplies pour qu'une décision sur le moratoire puisse être prise. Il nous apparaît irréaliste de penser que les besoins supplémentaires en matière de recherche, de collecte de données, d'infrastructure et de capacité d'intervention en cas de déversement soient comblés à court terme. Une recommandation de la Commission du Nunavut chargée de l'examen des répercussions de prolonger le moratoire donne le délai nécessaire pour effectuer le travail nécessaire et pour réexaminer la question dans le futur.

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2. KEY CONCLUSIONS AND RECOMMENDATIONS

The following is a summary of the key conclusions and recommendations contained in this submission:

Issue	Conclusion	Recommendation
Oil Spill Response Capacity	Significant legislative, capacity, information and funding gaps exist in the current spill response framework across the Canadian Arctic, including Baffin Bay and Davis Strait. There is currently no method that has been proven effective in dealing with major oil spills in the Arctic offshore environment.	Immediate steps, including substantial investment, must be taken to provide adequate response capacity and infrastructure support if offshore oil and gas activities are to take place in the eastern Arctic. A formal review of Canada's capacity to respond to major spills in the Arctic is needed, and a comprehensive, long-term spill response research program should be established.
Strategic Environmental Assessment Overview	The SEA does not sufficiently analyze how a potential offshore hydrocarbon sector in Nunavut would benefit communities with respect to employment, training and financial gains. It does not address key sustainability objectives, economic alternatives to oil and gas activities, and the information needs of the Nunavummiut.	Before regulators make any decisions regarding oil and gas development approvals, a more complete regional SEA (with analysis of economic alternatives and potential economic benefits) needs to be completed that addresses current inadequacies and information gaps.
Ecologically Sensitive Areas	Several Ecologically and Biologically Sensitive Areas (EBSAs) in the eastern Canadian Arctic have been identified by Government of Canada scientists as the most important regions for risk management to ensure ecosystems remain healthy and productive.	Any offshore oil and gas activities in Baffin Bay and Davis Strait must avoid areas of heightened ecological significance, meaning no drilling activities or seismic blasting should occur in any of the "hot spot" or EBSA areas identified on the maps in section 5.
Underwater Noise and Seismic Testing	The treatment of seismic in the SEA is sometimes factually incorrect; it tends to downplay the risks posed to marine life; and it contains some scientifically unsubstantiated conclusions and misleading statements. Research indicates that seismic testing can harm marine wildlife, which many Inuit depend upon for their livelihoods. To date 130 species have been documented to be impacted by human-caused underwater noise pollution. The SEA also gives insufficient consideration to cumulative underwater noise impacts.	More seismic research is needed on plankton, benthic organisms, whales, invertebrates, some fish species, narwhals, harbour porpoises, squid and shrimp, all of which are present in the area. The precautionary approach should be applied for those species in which seismic impacts are unknown or uncertain. Thorough, long-term studies should be carried out to get robust baseline biological information on the distribution and abundance of some species. Seismic should not be conducted in sensitive marine environments until more is known about the full impacts on certain species.
Well Blowouts and Major Accidents	The impact of a well blowout or major spill in the Canadian Arctic would be catastrophic due to heightened sensitivity of the Arctic marine environment to pollution and the tremendous difficulty of ensuring adequate oil spill response in remote locations with limited	Future research is needed to assess the capacity and infrastructure required to deal with a well blowout or major spill in the Arctic and to determine whether an effective response can be mounted in remote locations under harsh

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	infrastructure under extreme weather conditions.	weather conditions with periods of prolonged darkness in the presence of ice.
Shipping	Vessel traffic in the Canadian Arctic is on the rise, which is increasing the risk to marine habitats. Conflicts with marine mammals, underwater noise, disturbance of ice habitat, heavy fuel oil, sewage and grey water, and oil spills are all part of the complex risk profile which shipping brings to the Arctic.	Increased shipping traffic due to offshore oil and gas activities will need to be strictly managed to minimize conflicts with marine mammals and underwater noise from ships, protect ice habitats, eliminate the use of heavy fuel oil, restrict sewage and grey water discharge, reduce greenhouse gas emissions and improve spill response.
Economic Benefits for Local Communities	While local communities will bear the majority of the risks and will be affected by impacts of offshore oil and gas development, they may receive relatively few benefits.	A balanced assessment of the true costs and benefits of offshore oil and gas is critical for local communities to understand what is at stake. A future cost-benefit analysis must consider the impacts at the local level in order for communities to be able to make informed assessments.
Economic Development Alternatives to Oil and Gas	There are promising economic development alternatives to offshore oil and gas in Nunavut, including sustainable fisheries, Inuit-led tourism, Inuit Impact and Benefit Agreements for conservation, and renewable energy opportunities, which are less risky and more sustainable over the long term.	The potential for development alternatives must be analyzed before a fully informed decision on offshore oil and gas activity in Baffin Bay and Davis Strait can be made.
Climate Change	Development of oil and gas resources in the Arctic is likely not commensurate with efforts to limit average global warming to 2°C, let alone the safer target of 1.5°C.	Research is needed to analyze upstream and downstream greenhouse gas emissions at various possible *scales* of offshore oil and gas development in the eastern Canadian Arctic.

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3. INTRODUCTION

In accordance with the SEA mandate, the Nunavut Impact Review Board (NIRB) will be issuing a series of recommendations to the Minister of Intergovernmental Affairs and Northern Affairs and Internal Trade regarding offshore oil and gas development in Baffin Bay and Davis Strait. The first possible recommendation listed on page 6 of the *Preliminary Findings Report* is "**whether offshore oil and gas activity should proceed**" and, if so, the "**<u>location and timing</u> of potential activity**" (emphasis added). WWF-Canada believes that this is *the* fundamental question of the SEA process, upon which the fate of the government's 2016 moratorium on new Arctic oil and gas licences will rest. Based on *current* knowledge and our *current* state of readiness, should the Canadian government lift or extend the ban on new exploration licences in the eastern Arctic and, if so, when and where?

The decision on whether offshore oil and gas activity should proceed will have wide-reaching and significant consequences for Inuit, the Arctic marine environment and possibly the entire planet long into the future. WWF-Canada is not outright opposed to all offshore oil and gas in all regions of the Arctic. We wish to ensure, however, that **any future oil and gas activities, should they occur, are safe for workers and the sensitive Arctic environment, directly benefit and do not threaten the livelihoods of local communities, and are consistent with the global climate target of limiting warming to 1.5 degrees Celsius**. Offshore petroleum development in Baffin Bay and Davis Strait must also entirely avoid areas of heightened ecological significance and species diversity hot spots, meaning no drilling activities or seismic testing should occur in any of the 'red zone' areas of Figure 1 or the EBSA regions in Figure 2.

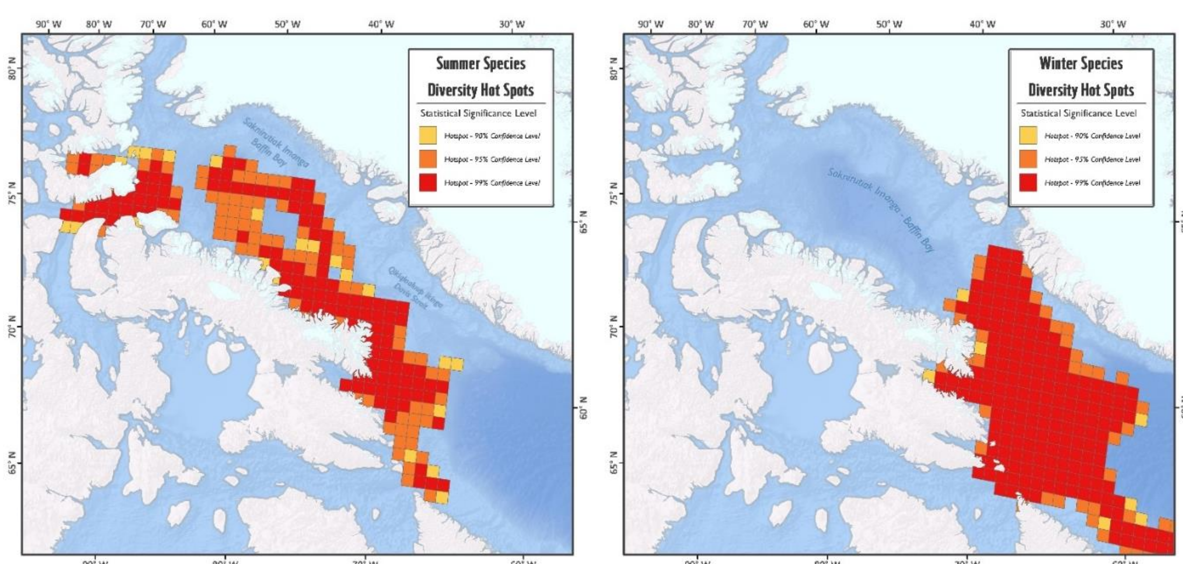

Figure 1: Summer and winter species diversity hotspots in the SEA area of focus. No drilling activities or seismic testing should occur in any of the 'red zone' areas. Maps show a getis-Gi hotspot metric across fish and marine mammal data (presented in section 5). Hotspots do not include benthic communities or commercial fishing interests.

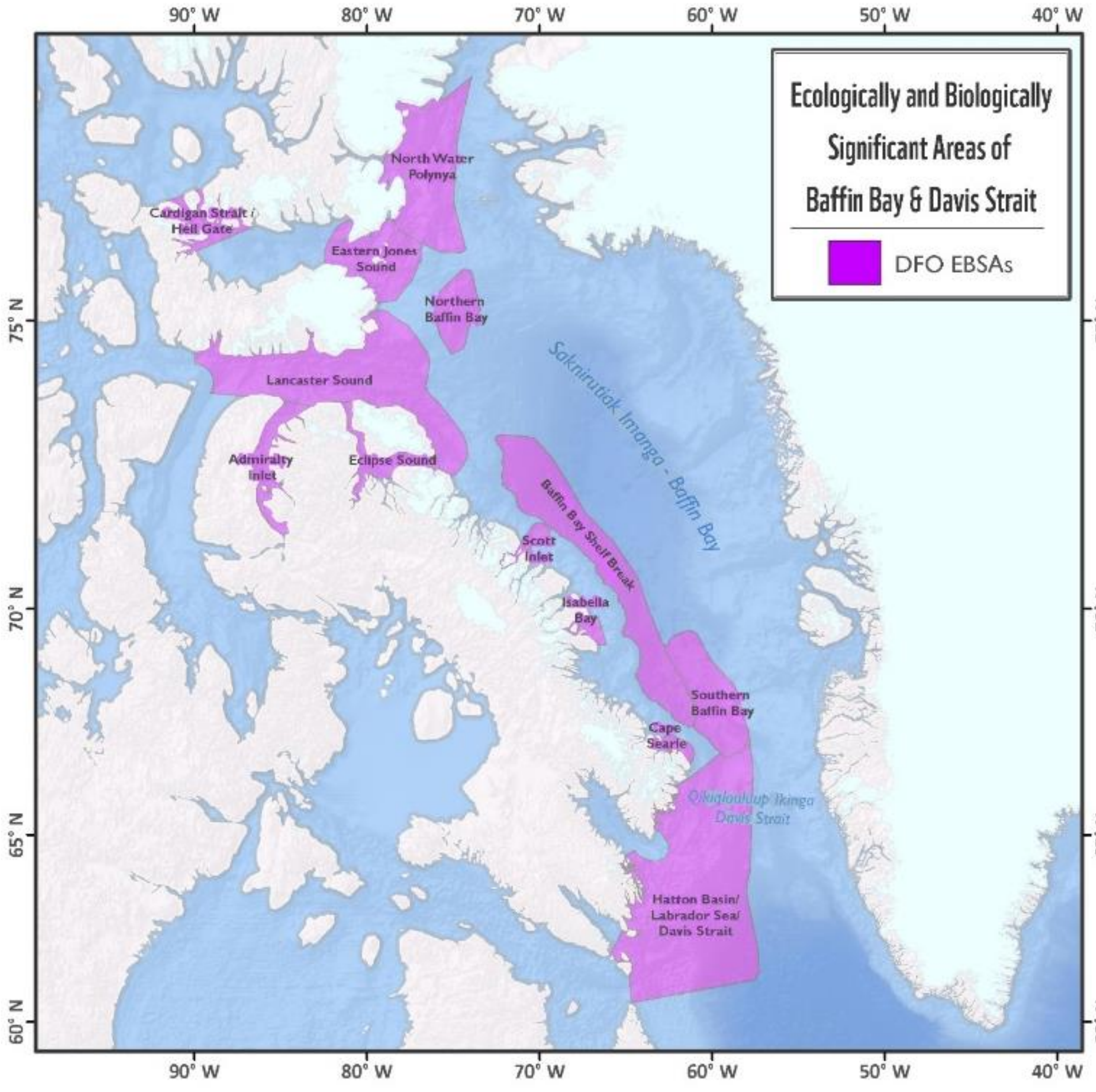

Figure 2: Ecologically and Biologically Significant Areas of Baffin Bay and Davis Strait as identified by Fisheries and Oceans Canada. No drilling activities or seismic testing should occur in the EBSA regions.

Even with these caveats, it is likely that some regions of the Arctic may simply be better suited than other regions to offshore oil and gas, at least in the near term. The Beaufort Sea region of the western Arctic, for example, already has existing Exploration and Significant Discovery Licences, whereas the eastern Arctic has almost no experience with petroleum development and very little infrastructure in place to support the industry or respond to accidents and oil spills.

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The decision on whether to lift or extend the Arctic moratorium is a mere two years away and, as acknowledged in the *Preliminary Findings Report*, **there remain critical outstanding data and research gaps that are unlikely to be filled before 2021**.[1] As explained in this submission, these gaps include an incomplete understanding of:

- the response capacity required to manage major spills in Baffin Bay and Davis Strait;
- the relative ecological sensitivity of all regions within the area of focus;
- baseline information on the locations and population levels of key marine species within the study area;
- the impacts of seismic testing on Arctic marine life;
- the potential impacts of oil spills, well blowouts and chronic leaks on marine life and human activities;
- the interactions of oil in sea ice;
- cumulative effects resulting from increased shipping and other industrial activities;
- the expected economic benefits for local communities;
- the economic potential for other development alternatives;
- the impacts of Arctic oil exploitation on Canada's climate targets and the international commitment to limit global warming to a maximum of 1.5 degrees Celsius.

Without such fundamental information, a well-justified and well-supported recommendation on whether offshore oil and gas activity should proceed in the eastern Arctic cannot be made. Many additional conditions need to be met before this decision can be considered, such as a substantial increase in spill response capacity as well as research confirming the impacts of seismic testing.

There may be valid reasons to consider offshore oil and gas in the eastern Arctic as a possible economic development opportunity at some point in the future. At the present time, however, the NIRB's own *Preliminary Findings Report* and the Nunami Stantec reports suggest that there are too many unknowns, too much uncertainty and too many data gaps to justify lifting the moratorium at this time.

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[1] For example, on page 37 (section 4.5) of the Preliminary Findings Report it is stated that "Nunami Stantec concluded that more baseline information is needed to improve the understanding of the physical, biological, and human environments in the Area of Focus."
Page 38: "There is little known about the distribution, abundance, migratory patterns, and key habitat availability and quality for many species… There is also limited information about how birds, marine mammals, and invertebrates respond to in-air and underwater noise… Levels and trends of the Baffin Bay narwhal and beluga populations are also uncertain."

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4. GENERAL COMMENTS ON THE BAFFIN BAY/DAVIS STRAIT SEA

Summary: The SEA does not provide sufficient analysis on how a potential offshore hydrocarbon sector in Nunavut would benefit communities with respect to employment, training and financial gains. It does not address key sustainability objectives, economic alternatives to oil and gas activities.

Recommendation: Before regulators make any decisions regarding oil and gas development approvals, additional information such as an analysis of economic alternatives and potential benefits is required.

According to international Strategic Environmental Assessment best practices[2], the Baffin Bay/Davis Strait SEA should adhere to the following generic principles:

- Establish clear development and sustainability goals for Nunavut;
- Provide explicit justification for the selection of preferred options and for the acceptance of significant trade-offs related to hydrocarbon development;
- Be flexible, iterative and customised to the Nunavut context;
- Analyze the potential effects, risks and benefits of the proposed hydrocarbon development and its alternatives, against a framework of sustainability objectives, principles and criteria tailored to Nunavut;
- Address the linkages and trade-offs between environmental, social and economic considerations;
- Involve key stakeholders and encourage public involvement;
- Include an effective and independent SEA quality assurance system;
- Be transparent throughout the process and communicate the results in ways Nunavut communities can fully understand;
- Assist in the development of outcomes that respect economic, social and environmental constraints and opportunities specific to Nunavut and its communities;
- Encourage formal reviews of the SEA process after completion and monitor SEA and final decision outputs.

In the conduct of this SEA, two consultant's reports were produced, as well as a summary document, which provide an overview of the key considerations related to offshore oil and gas development in the eastern Arctic. However, the SEA has not met internationally accepted SEA standards. For instance, the following table comes from page 8 of the *Preliminary Findings Report* and provides an illustration of how the NIRB has approached the SEA in comparison to a project-level EA:

[2] For example, see: Organization for Economic Cooperation and Development. 2006. *Applying Strategic Environmental Assessment: Good practice guidance for development cooperation.* Paris.
See additional resources in section 4.7 below.

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Table 2: Comparing questions that can be answered at an SEA level to a project level

Strategic Environmental Assessment	Project Level Assessment
Should the offshore oil and gas industry be developed in Baffin Bay and Davis Strait?	What are the predicted negative effects of a proposed project on the environment and can these be mitigated? Should a project be approved?
What are the potential types of employment opportunities?	How many jobs are proposed for Nunavut Inuit?
What are the potential types of benefits?	What taxes and benefits would Nunavut receive?
What are the types of oil and gas activities could take place and what equipment could be used?	How deep will drilling go below the seafloor? What is the size of the area that the proposed seismic survey will be undertaken?

Figure 3: Example of NIRB's approach to Strategic vs. Project-Level Environmental Assessment

This approach is not consistent with international SEA standard practice and will significantly limit the decision-making utility of the SEA. The following table from the International Centre for Environmental Management (ICEM) provides an example of a more instructive and widely-accepted approach.[3]

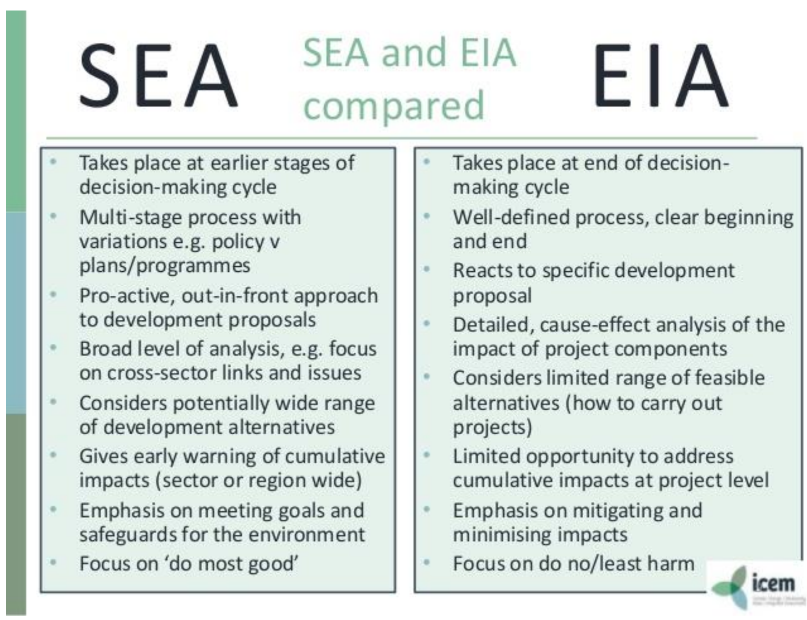

Figure 4: International Centre for Environmental Management recommended approach to Strategic Environmental Assessments

[3] International Centre for Environmental Management. 2014. *Introduction to Strategic Environmental Assessment: Purpose, Principles and Process.* https://www.slideshare.net/ICEM-Centre-Environmental-Management/sea-intoduction

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Note the differences between the ICEM and the NIRB SEAs, particularly that the ICEM approach focuses on cross-sectoral issues and meeting specific goals, considers a wide range of development alternatives, and focuses on "doing the most good." For example, is offshore oil and gas the approach that will "do the most good" or would other development options such as fisheries or tourism be more suitable to meeting Nunavut's sustainable development goals? What are the potential jobs and economic benefits (i.e. emphasis on meeting goals) and will they outweigh the significant risks of offshore oil and gas? Will Canada's climate targets and international efforts to limit global warming to 1.5° C be compatible with the exploitation of offshore oil and gas in the Canadian Arctic (i.e. cross-sectoral analysis)? None of these central questions will be answered by this SEA.

The question of whether the industry *should* be developed cannot be answered in an informed manner if overall sustainability objectives are not considered and the potential jobs, benefits and impacts of offshore oil and gas remain unknown. Without this information, decision makers and regulators will not have the analysis required to make an informed decision on whether the promotion of the hydrocarbon sector in Nunavut meets community, territorial and national development objectives.

For the reasons outlined in this report, further work will need to be done to prepare sufficiently for offshore oil and gas in the eastern Arctic and to ensure governments and northerners can make a properly informed decision on whether such activity should proceed in Nunavut.

4.1 Uncertain community economic benefits

One of the fundamental objectives of a SEA is to give stakeholders an overview of the potential benefits and risks of a possible development program. Indeed, one of the objectives of this SEA is to understand how local community members feel about the prospects of offshore oil and gas in the region. However**, additional information and analysis is required of how a potential hydrocarbon sector in Nunavut would benefit communities with respect to employment, training and financial gains**. Communities must have a relationship with the hydrocarbon sector that is based on some form of partnership. This cannot be done unless communities know the risks and benefits of such an association.

'Without this information, decision makers and regulators will not have the analysis required to make an informed decision on whether the promotion of the hydrocarbon sector in Nunavut meets community, territorial and national development objectives.'

In its Jan. 8, 2019 correspondence with the Nangmautaq Hunters and Trappers Organization NIRB asserted that:

> "*… future benefits for a specific development proposal within the Nunavut Settlement Area would not be negotiated or otherwise imposed by the NIRB or Government of Canada and would be entirely dependent on project-specific negotiations between industry, Nunavut Tunngavik and the applicable Regional Inuit Association at the time such an oil and gas development <u>entered the regulatory system</u>*" (emphasis added).[4]

[4] Nunavut Impact Review Board. January 8, 2019. Letter to the Nangmautaq Hunters and Trappers Organization from Tara Arko, NIRB Director, Technical Services and *Acting* Executive Director.

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As such, information should be provided to communities through the SEA with an estimation of the *potential* job and revenue benefits associated with various oil and gas development scenarios. As noted in the quotation above, by the time project-specific IIBA negotiations take place, a proposed offshore project would have already "entered the regulatory system" and a community would have a very limited legal basis to oppose a project at this stage on the basis of insufficient projected economic benefits.

Without adequate information regarding the potential benefits, it is impossible, for communities to make an informed assessment about offshore oil and gas. This must be rectified before any decision is made by the government on the offshore moratorium and the future of oil and gas in Nunavut.

Finally, insufficient information and analysis was provided of how current country food harvesting and related income would be compensated for in the event of a reduction of harvest levels due to hydrocarbon activities. Marine animals are particularly important for Inuit living on Baffin Island because of the relative scarcity of land-based food. There should be some overarching analysis of how revenue from hydrocarbon development could be harnessed to create a legacy fund providing economic resources for the future.

4.2 No alternatives to oil and gas

A primary concern with NIRB's SEA process is the absence of any consideration of potential economic alternatives to oil and gas development. This is a critical piece of any SEA according to standard international practice including the OECD's 2006 report *Applying Strategic Environmental Assessment: Good practice guidance for development cooperation* and the Arctic Council's *Arctic Offshore Oil and Gas Guidelines*, *which* specifies in section 3.5 (Environmental Impact Assessment) that an EIA should include "other development options, and where authorities prepare the analysis, this may include the alternative of no action. This discussion should include an evaluation of the different alternatives and the reasons for choosing the selected activity[5]. Canada's Cabinet Directive on SEA practice also includes a discussion on the need for economic alternatives as part of SEA practice.[6]

Communities and decision makers must be able to compare the potential impacts and risks of proposed hydrocarbon development against possible alternatives within a framework of sustainability objectives, principles and criteria tailored to Nunavut. Without a focused analysis of alternatives, the present process will not provide sufficient information.

The Nunami Stantec report *Oil and Gas Life Cycle Activities and Hypothetical Scenarios* (Public Registry ID 318009) does consider the "no activity option" and opens the door to economic alternatives to oil and gas by stating that activities such as mining, tourism and shipping would need to be evaluated if the "no oil and gas activity" option was chosen. However, these economic alternatives are not considered or evaluated in any meaningful way. **As a recommended next step, information and analysis of potential**

[5] Arctic Council. 2009. Arctic Oil and Gas Guidelines. Protection of the Arctic Marine Environment (PAME) Working Group. https://oaarchive.arctic-council.org/handle/11374/63

[6] Canadian Environmental Assessment Agency. 2004. Strategic Environmental Assessment: the Cabinet Directive on the Environmental Assessment of Policy Plan and Program Proposals, Guidelines for implementing the Cabinet Directive.

development alternatives should be undertaken. WWF-Canada has provided an example of this in section 9, including an analysis of offshore fisheries, renewable energy and Inuit-led tourism. Simply noting other opportunities is not sufficient to provide the necessary context within which the prospects and risks of offshore petroleum activities can be properly assessed. Indeed, the SEA cannot be considered complete without consideration of such alternatives.

Offshore oil and gas development is only one of a number of possible development options in the north. A SEA limited only to considering oil and gas may lead to the misleading conclusion that there are no other viable ways to meet the development needs of northerners and sustainability objectives of Nunavut. Before any decision can be made on the future of offshore oil and gas in Nunavut, **robust and reasonable development alternatives to oil and gas must be analyzed for future consideration.**

4.3 Insufficient baseline data

The *Preliminary Findings Report* acknowledges that there is a problem with baseline data acquisition.[7] **Current data gaps exist with regards to population abundance and distribution of certain marine species. In addition, the impact and cumulative effects of underwater noise and potential oil spills on Arctic marine ecosystems are not well understood.** In the absence of sufficient data, it is difficult to accurately predict the impacts of oil and gas development, critical information for the decision-making process.

4.4 Unknown scale of offshore operations and development

The SEA has not addressed the *scale* of oil and gas activities under consideration. The number of drilling rigs in operation is a critical consideration when assessing the potential risk of accidents and the effects of drill and mud cuttings, routine discharges, underwater noise, oil spills and the possible extent of impacts on sensitive and ecologically significant areas. As a point of reference, as of January 2018 there were 175 active offshore drilling platforms in the Gulf of Mexico and 184 in the North Sea.[8] The SEA should consider impacts at various possible scales of development.

4.5 Challenges with community engagement and understanding

Communities have received a series of complex documents that are not easily understood. Long, complex, technical documents do not facilitate the fulsome and meaningful engagement of many important stakeholders and rightsholders, such as local communities, many of whom do not have the time or resources to review and comment on roughly 800 pages over three combined reports including the 119-page *Preliminary Findings Report*. This is not a cohesive way to share information among communities who may end up confused and ill-informed about best options going forward. We note that, in the letter from the Resolute Bay Hunters and Trappers Organization to the NIRB, it was stated:

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[7] For example, page xviii of Nunami Stantec, ‘Environmental Setting and Review of Potential Effects of Oil and Gas Activities (June 1, 2018), states “Data and information gaps associated with many of the VECs and VSECs identified through the SEA scoping process are a key reason for attributing low confidence to the predictions of effects that are discussed… the need to fill gaps in knowledge in the Area of Focus has become a critical element in effective planning and policy making for the region.”

[8] Statista. 2019. Number of offshore rigs worldwide as of January 2018 by region. https://www.statista.com/statistics/279100/number-of-offshore-rigs-worldwide-by-region/

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> *"The Preliminary Findings report is over 100 pages and was released publicly on September 26, 2018. The NIRB community input meetings to discuss this report were held in Resolute the following day on September 27 and 28. There was simply no time to adequately prepare for these meetings and as a result we don't feel the SEA consultations have been meaningful."*

Additional assistance to understand the voluminous and complex information, such as one-page summaries is needed to enable full participation of rightsholders and stakeholders. Communities also need to know the basis for the conclusions and findings of the SEA process. If they do not trust the motives of NIRB and other regulators, they will distrust any conclusions that do not match their concerns and personal view of reality.

4.6 WWF-Canada summary and recommendations

According to international and Canadian best practices, this SEA has significant gaps and inadequacies. It does not provide sufficient information and analysis for government to make decisions related to the future of offshore oil and gas exploration and development in Nunavut. The SEA does not provide sufficient information to determine whether offshore oil and gas activity should proceed and, if so, the "location and timing of potential activity," because it does not address key considerations, sustainability objectives, knowledge and the information needs of the most important rightsholders and stakeholders in this process. Before regulators make any decisions regarding oil and gas development approvals, a more complete regional SEA (with analysis of economic alternatives and potential benefits) needs to be completed.

> ***'Before regulators make any decisions regarding oil and gas development approvals, a more complete regional SEA (with analysis of economic alternatives and potential benefits) needs to be completed that addresses current inadequacies and information gaps.'***

At the next stage of the decision-making process, the concept of "strategic options" should be adopted as a pathway for sustainability, which is to find the best way forward for all core stakeholders. This is a standard planning process, which identifies the most suitable "planning design" that fits with the environmental and sustainability values and priorities that are important to Nunavut regulators and communities. The oil and gas option must be "tested" against sustainability objectives and other development alternatives. NIRB or the government can then find and add elements to the economic development scenarios (including oil and gas) that will allow Nunavut to have a broader view of development triggered by the investments and decisions Nunavut wants to make through an explorative process. This way, rightsholders and stakeholders will be mutually exploring options and alternatives. Such an approach will offer the possibility of arriving at the most suitable development alternatives if the sustainability values and objectives identified by communities cannot be met through oil and gas development.

Finally, similar to the requirements of the federal SEA process, NIRB should develop a one-page Public Statement to accompany the final SEA report, which will summarize the SEA process in a crisp, accurate and actionable format.

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4.7 Key SEA international best practice resources

1. Ahmed, K. and Ernisto Sanchez-Triana Editors (eds.). 2008. Strategic environmental assessment for policies – An instrument for good governance. World Bank

2. Canadian Environmental Assessment Agency**.** 2004. Strategic environmental assessment – the Cabinet Directive on the Environmental Assessment of Policy Plan and Program Proposals, Guidelines for implementing the Cabinet Directive.

3. Canadian International Development Agency. 2004. Strategic environmental assessment of policy, plan and program proposals: CIDA Handbook.

4. Croal, P., Robert Gibson, Charles Alton. 2010. A decision-maker's tool for sustainability centred strategic environmental assessment. Journal of Environmental Assessment Policy Management, Volume 12, no. 01.

5. Dalal-Clayton, B. and Barry Sadler. May 2017. A methodology for reviewing the quality of strategic environmental assessment in development cooperation. Impact Assessment and Project Appraisal 35-3.

6. Doelle, M. 2013. Using Strategic Environmental Assessments to Guide Oil and Gas Exploration Decisions: Applying Lessons Learned from Atlantic Canada to the Beaufort Sea. RECIEL 22 (1) 2013. ISSN 0962-8797

7. Doelle, M., Nigel Bankes and Louie Porta. 2002. Strategic environmental assessment performance criteria. International Association of Impact Assessment, Special Publication Series No. 1.

8. Gibson, R. et al. 2005. Sustainability Assessment: Criteria, Processes and Applications. Earthscan Publishing

9. Organization for Economic Cooperation and Development. 2006. Applying strategic environmental assessment – Good practice guidance for development cooperation. Paris

10. Sadler, B. and Barry Dalal-Clayton. 2009. Development of a SEA Quality Review Methodology for CIDA and OECD DAC Task Team Members. Canadian International Development Agency (internal document).

11. Sadler, B., Ralf Aschemann et al. 2011. Handbook of strategic environmental assessment. Earthscan Publishing.

12. World Bank Environmental and Development. 2011. Strategic environmental assessment in policy and sector reform – Conceptual Model and Operational Guidance

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5. ECOLOGICALLY SENSITIVE AREAS

Summary: Ecologically and Biologically Sensitive Areas (EBSAs) have been identified by scientists working for the federal Department of Fisheries and Oceans. These areas are the most important regions for risk management to ensure ecosystems remain healthy and productive. EBSAs and other valued ecosystem components can be impacted in various ways by oil and gas activities.

Recommendation: Offshore oil and gas activities in Baffin Bay and Davis Strait must avoid areas of heightened ecological significance. No drilling activities or seismic testing should occur in any of the 'red zone' species diversity areas or the EBSA areas identified on the maps in Figures 5 and 7 below. Commercial shipping should also be tightly managed, and avoided where possible, to minimize the risk of contamination of sensitive areas by an oil spill or other potential shipping impacts, as well as chronic disturbance from increased shipping activity and underwater noise.

5.1 Ecologically and Biologically Significant Areas (EBSAs), Significant Benthic Areas (SBAs) and species diversity hotspots

The government of Canada and independent scientists have identified a range of important areas for conservation within the SEA's area of focus, which is largely consistent with the Special and Sensitive Areas identified by Nunami Stantec (Figure 4.14 in the document *Environmental Setting and Review of Potential Effects of Oil and Gas Activities*). As discussed on page 82 of the *Preliminary Findings Report* (Special and Sensitive Areas and Areas of Concern or Importance):

> *"Special and sensitive areas and areas of concern or importance (such as marine areas known to be habitat for large groups of waterbirds or marine mammals) may be affected by marine-based oil and gas development activities in Baffin Bay and Davis Strait, such as ice breaking and routine discharges of liquid wastes from marine vessels and muds from drilling activities. These marine-based activities may result in changes to marine habitat that are particularly sensitive to disturbance."*

The *Preliminary Findings Report* states that impacts from oil and gas activities on marine species include noise, discharges of liquids including oil spills, air emissions, discharges of wastewater, and releases of waste and mud. In addition, on page 39 the report states that "the sensitivity of marine species and habitats to marine pollution and potential spills is not completely understood and should be further studied." Because of these knowledge gaps, as well as the heightened ecological importance of sensitive areas and the possibility of disturbance, any offshore oil and gas activities in Baffin Bay or Davis Strait must avoid EBSAs. No drilling activities or seismic testing should occur in any of the areas identified in figure 5 through 10 below. Commercial shipping should also be tightly managed, and avoided where

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possible, to minimize the risk of contamination of sensitive areas from oil spills or other potential shipping impacts, including chronic disturbance from increased shipping activity and underwater noise.

Three types of areas of heightened ecological importance described below (EBSAs, SBAs, and diversity hotspots) occupy a significant area of the SEA area of focus, emphasizing the ecological significance of Baffin Bay and Davis Strait for the Arctic marine environment. A key consideration for the SEA.

The *Preliminary Findings Report* states on page 82 that changes to habitat from most disturbances are expected to be short-term and reversible, However, page 7.47 of the Nunami Stantec report *Environmental Setting and Review of Potential Effects of Oil and Gas Activities* states:

> *"There is some uncertainty in the assessment of changes in habitat of Special and Sensitive Areas and Areas of Concern or Importance.* ***The relative importance and contribution of specific habitats to population viability is not well understood and, in these instances, the precautionary approach is applied****. Climate change may further add uncertainty in this respect and changes in atmospheric and ocean conditions will likely simultaneously alter the conditions and locations of these special areas and the abundance, distribution and species composition that use and depend on them. How these simultaneous effects may interact is currently unknown."*

The lack of ecological understanding of specific habitats regarding population viability effects and climate change is an important caveat that should be mentioned in the final SEA report.

The *Preliminary Findings Report* provides no information to support its claim that impacts to sensitive marine habitats from oil and gas activities would be "short-term" and "reversible". If there were to be any kind of drilling in ecologically sensitive areas, the impact would likely be long-lasting for some species that are slow-growing (e.g. corals and sponges). The Department of Fisheries and Oceans 2010 Canadian Science Advisory Secretariat report states that criteria for identifying EBSAs included "vulnerability, fragility, sensitivity, slow recovery."[9] Any oil and gas activities within EBSAs may result in long-term impacts, due to the slow recovery of certain species.

In addition, the effects on ecologically sensitive habitat and some marine species would almost certainly not be short-term and reversible in the event of a major oil spill. Page 7.55 of Nunami Stantec's *Environmental Setting and Review of Potential Effects of Oil and Gas Activities* confirms that "Potential effects of oil spills include changes in habitat, behaviour, health, and/or mortality risk of VECs (Valued Ecosystem Components). The extent and magnitude of these effects can range from moderate to high."

Finally, no indication is given of the *scale* of industrial petroleum development that is under consideration. The extent of the cumulative effects of oil and gas activities on a sensitive marine area

[9] Kenchington, E. et al. 2010. Delineating Coral and Sponge Concentrations in the Biogeographic Regions of the East Coast of Canada Using Spatial Analyses. Fisheries and Oceans Canada. Page 1.
http://waves-vagues.dfo-mpo.gc.ca/Library/341220.pdf

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will vary depending upon the number of drilling rigs in operation in the region. The final SEA report must consider impacts to ecologically sensitive areas at various feasible scales of development.

5.2 EBSAs

Ecologically and Biologically Significant Areas (EBSAs) are areas within Canada's oceans that have been identified through formal scientific assessments coordinated by the federal government (Fisheries and Oceans Canada) as having heightened biological or ecological significance when compared with the surrounding marine ecosystem. Although marine areas not included within EBSA boundaries also serve ecological functions and require sustainable management, EBSAs should be viewed as the most important areas for risk management to ensure ecosystems remain healthy and productive and have been identified specifically to enable mitigation of risks posed to marine ecosystems by human activities.

EBSA information is used to inform marine planning by:

- Informing and guiding project-specific or regional environmental assessments;
- Informing and guiding industries and regulators in their planning and operations, for example: EBSAs have been acknowledged (often as "Special Areas" or "Potentially Sensitive Areas") in oil and gas related assessments;
- EBSA information has been provided to proponents of submarine cable projects to be used for route planning purposes;
- Informing and guiding Integrated Oceans Management (IOM) process within Canada’s five Large Ocean Management Areas (LOMAs) and twelve marine bioregions;
- Serving as a basis for the identification of Areas of Interest (AOIs) for establishing Marine Protected Areas (MPAs) (individually and in the context of planning bioregional networks).

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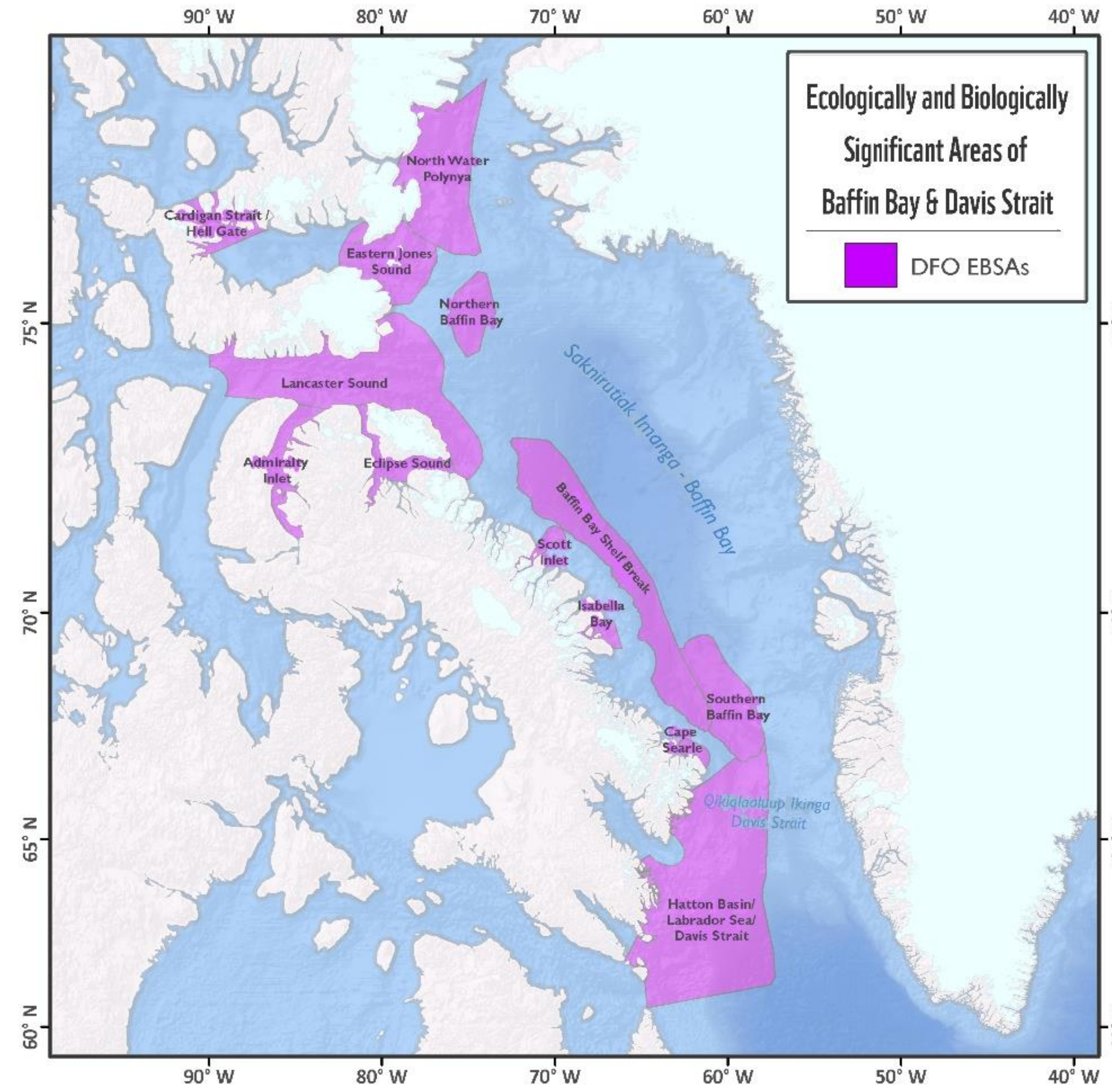


Figure 5: Locations of EBSAs in the SEA area of focus, and each is described below. No drilling activities or seismic testing should occur in the EBSA regions identified.

The following areas have been identified through formal scientific assessments coordinated by the federal government through Fisheries and Oceans Canada.

5.2.1 Eclipse Sound/Navy Board Inlet

This area is used as a migration corridor in the spring and fall by the Eclipse Sound stock of the Baffin Bay narwhal population. In the summer, narwhal aggregate and the area may provide refuge from killer whales. This EBSA is also used as a migration site for seabirds such as ivory gulls and black-legged kittiwakes.

5.2.2 Admiralty Inlet

Summer aggregations of the Admiralty Inlet summering stock of the Baffin Bay narwhal population occur in this area. Thirteen per cent of the Canadian population of northern fulmar form a breeding colony here. Bowhead whales aggregate and feed here during the summer. Killer whales also use the area during the open-water period. The area is a breeding area for glaucous gulls. From May to September, the area may have large aggregations of marine birds depending on the annual patterns of ice break-up and prey distribution. Polar bear use the area in the summer.

> ***'The areas of heightened ecological importance described here occupy a significant area of the SEA area of focus, emphasizing the ecological significance of Baffin Bay and Davis Strait for the Arctic marine environment. A key consideration for the SEA.***

5.2.3 Lancaster Sound

This area is a major east-west waterway in the Canadian Arctic. The ice edge that forms across the sound and the shore leads and polynyas are important aggregation areas for marine mammals and seabirds. The area is an important migratory corridor for several species of marine mammals including belugas, narwhals, bowhead whales, Atlantic walruses, and harp seals. This area also has the highest polar bear density in the Canadian Arctic. It also serves as an important nesting, foraging and staging area for numerous seabirds such as thick-billed murres, black-legged kittiwakes, northern fulmars and dovekies. The area is highly productive and biologically diverse.

5.2.4 Hatton Basin/Labrador Sea/Davis Strait

The only known overwintering area for the Northern Hudson Bay narwhal population. This area has high productivity, supporting a rich abundance of marine fish, including wolffish, and invertebrates such as Pandalus shrimp. An important coral diversity and abundance hotspot occurs in the Hatton Basin, including abundant sea fans and bubblegum coral. A hooded seal whelping area exists within this area and the presence of these seals provides an important source of food for polar bears in the spring and fall.

5.2.5 Baffin Bay Shelf Break

Marine fish occur along the shelf break. Traditional Ecological Knowledge/Local Ecological Knowledge identify this area as an important migration route for bowhead whales as well as harp seals, hooded seals, ringed seals and bearded seals. The area also hosts corals and sponges.

5.2.6 North Baffin Bay

Significant concentrations of sea pens exist at the outflow of Lancaster Sound in Baffin Bay.

5.2.7 Southern Baffin Bay

The area provides a break between the warmer southern Labrador current and cold Arctic outflow. It is an overwintering area for several stocks of narwhal and bowhead whales. Several species of cold-water coral are found in high numbers within this region.

5.2.8 Eastern Baffin Island Coastline

Cape Searle hosts the largest nesting colony of northern fulmar in Canada (22 per cent of the Canadian population) and one of the largest nesting colonies of thick-billed murre in Canada (10 per cent of the Canadian population). The EBSA encompasses both the Qaqulluit and Akpait National Wildlife Areas established by Environment Canada in 2010 to protect these colonies. The area is also an important nesting area for other seabirds including black-legged kittiwakes, black guillemots, glaucous gulls and Iceland gulls. It is considered important habitat for Atlantic walrus and ringed seals.

5.2.9 Isabella Bay

This area is regularly used by the Eastern Canada-West Greenland bowhead whale population, particularly in late summer/early fall. Mainly adults and sub-adults aggregate for feeding. The area is also frequented by ringed seals, narwhals, and polar bears, and it provides habitat for seabirds such as king eider, long-tailed duck, dovekies and northern fulmar.

5.2.10 Scott Inlet

The only known cold seep along the East Baffin Island coast exists in this area, and the seep harbours a chemolithic community including a predatory sponge, Claorhiza. This is the only report of this species in Baffin Bay or the Canadian Arctic to date. A number of other species, including concentrations of the Venus flytrap anemone, soft corals in the family Nephtheidae, abundant sea pens, and unstalked crinoids have been recorded, along with redfish and the spotted wolffish. Bacteria (genus *Beggiatoa*) have been observed covering the seabed. The inlet also supports an important colony of northern fulmars and is likely used as a migration and staging site for various seabirds including ivory gulls and black guillemots. Narwhal also use the area as a nursery and migration corridor.

5.2.11 North Water Polynya

This is the largest and most productive Canadian Arctic polynya. It is important for belugas, narwhals, bowhead whales, ringed seals and bearded seals. Harp seals use the area during the open water season. Polar bears rely on ringed seals in the fast ice adjacent to the polynya over the winter and spring. Some belugas, narwhals and bowhead whales may use the polynya as an overwintering area. Seabirds using the area include dovekies, thick-billed murres, black guillemots, blacklegged kittiwakes, ivory gulls, glaucous gulls and northern fulmars.

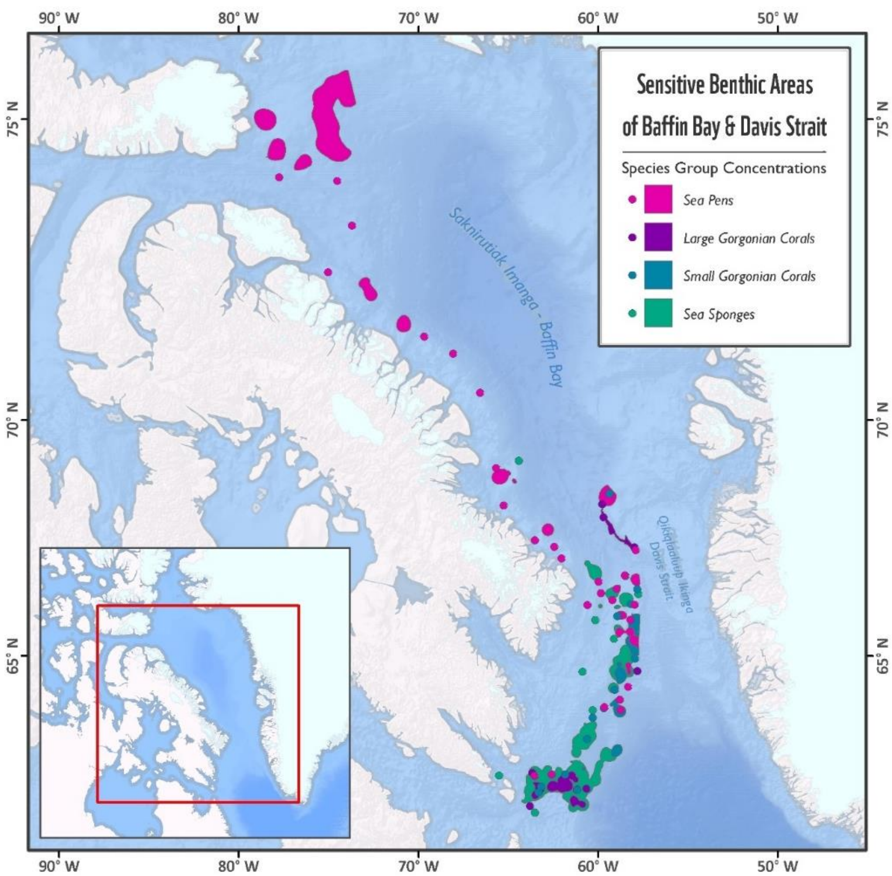
5.2.12 Jones Sounds Entrance

This area includes the largest breeding colony of black-legged kittiwake in the Canadian Arctic (16 per cent of the Canadian population) and the third largest thick-billed murre colony (12 per cent of the Canadian population). Outside the breeding season, the ice edges around Coburg Island support thousands of seabirds from April through October. The entrance provides productive summer habitat for Atlantic walrus, high Arctic beluga whales, ringed seals, and polar bear, and it is one of the few known breeding sites for Atlantic puffins in Nunavut.

5.2.13 Jones Sounds: Hell Gate/Cardigan Strait

A recurrent polynya is found here due to strong currents. Because of this, Western Jones Sound Atlantic walrus use the area year-round. The polynya allows early access to feeding and nesting sites for the seabirds in the area. Large variability in the use of this area by nesting marine birds may be due to ice. Polar bear feed in the area, which is frequented by narwhals, ringed and bearded seals.

5.3 Significant Benthic Areas (SBAs)



[10]

Figure 6: Locations of Significant Benthic Areas in the study area as identified by Fisheries and Oceans Canada.

Significant Benthic Areas are regional habitat that contain sponges (Porifera), large and small gorgonian corals (Alcyonacea, formerly classed as Gorgonacea) and/or sea pens (Pennatulacea) as a dominant and defining feature and, a Sensitive Benthic Area is a Significant Benthic Area that is vulnerable to a proposed or ongoing fishing activity.

[10] Canadian Science Advisory Secretariat. 2017. Delineation of Significant Areas of Coldwater Corals and Sponge-dominated communities in Canada's Atlantic and Eastern Arctic Marine Waters and their Overlap with Fishing Activity. Fisheries and Oceans Canada. http://waves-vagues.dfo-mpo.gc.ca/Library/40600099.pdf

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5.4 Abundance and Species diversity hotspots

Biodiversity hotspots are areas of high priority for conservation.[11] They may be selected on the basis of their local species richness, degree of concentration of rare species or the two measures combined with some assessment of urgency for conservation action.

Identifying areas that support higher levels of predator abundance and biodiversity is important for the implementation of targeted conservation measures and to avoid any type of adverse effects across the Arctic.

Hotspots have been identified in the Arctic by using existing tracking data collected between 1989 and 2016 during the summer-autumn and winter-spring for 21 Arctic marine species across cetacean, pinniped, seabird, polar bear and fish species groups.[12]

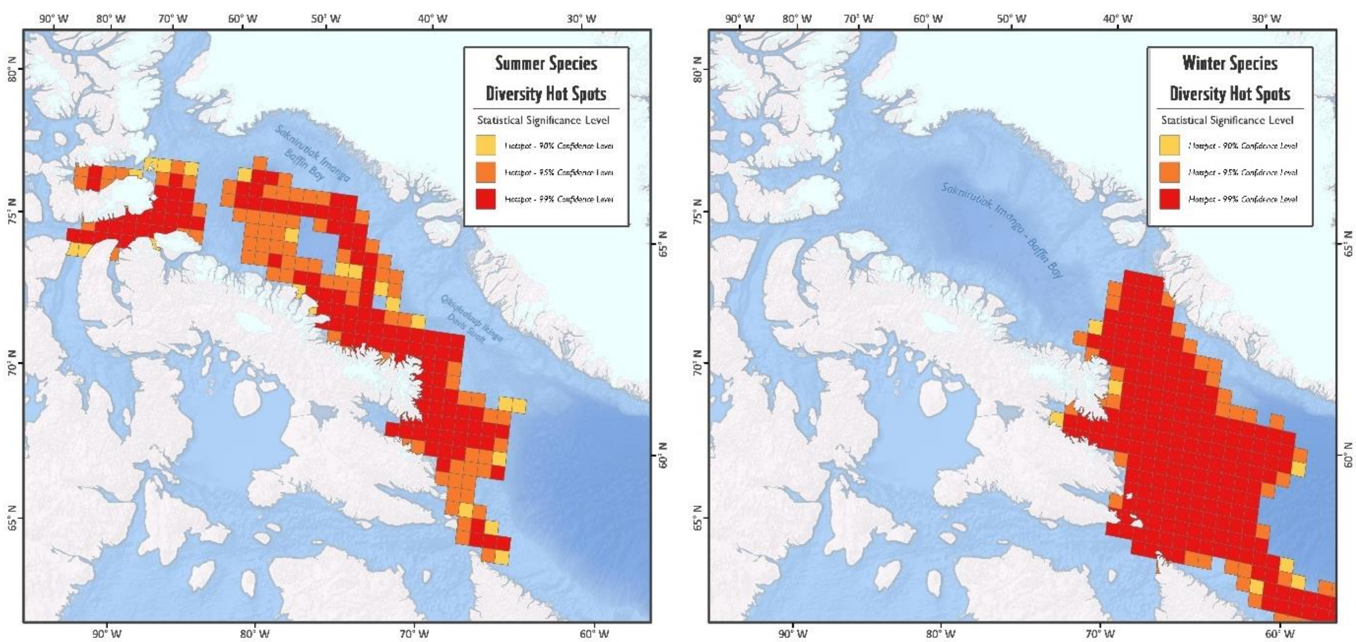

Figure 7: Summer and winter species diversity hotspots in the SEA area of focus. No drilling activities or seismic testing should occur in any of the 'red zone' areas. Maps show getis-Gi hotspot metric across fish and marine mammal data. Hotspots do not include benthic communities or commercial fishing interests.[13]

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[11] Araujo, Miguel B. 2002. Biodiversity Hotspots and Zones of Ecological Transition. *Conservation Biology*: 16(2).
[12] Yurkowski et al. Dec. 2018. Abundance and species diversity hotspots of tracked marine predators across the North American Arctic. *Diversity and Distributions*.
[13] *Hotspots for all maps were derived using a large compilation of telemetry points collected from a number of unique individuals (n = 490) of difference species groups (marine mammals, polar bears, seabirds, and fishes). The study area was gridded to a resolution of 50km² and the number unique species having at least one occurrence point was counted for each cell. See Yurkowski et al. (2018) for more information:* *https://onlinelibrary.wiley.com/doi/full/10.1111/ddi.12860*

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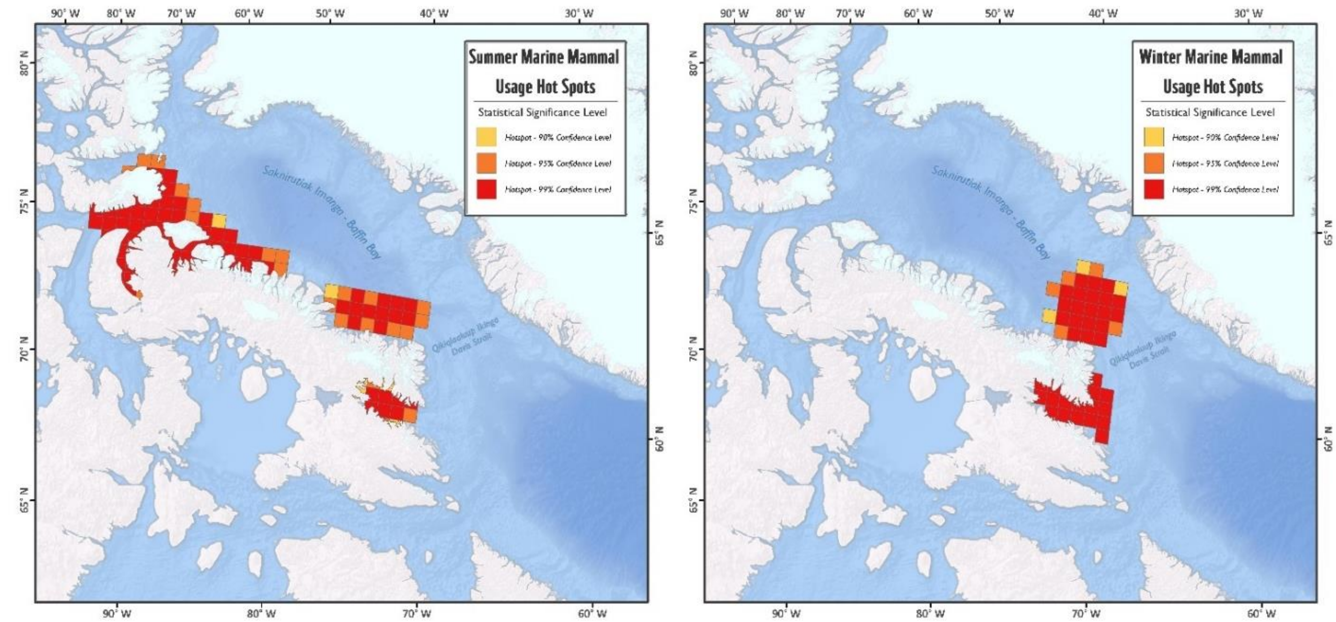

Figure 8: Summer and Winter Marine Mammal Hot Spots.

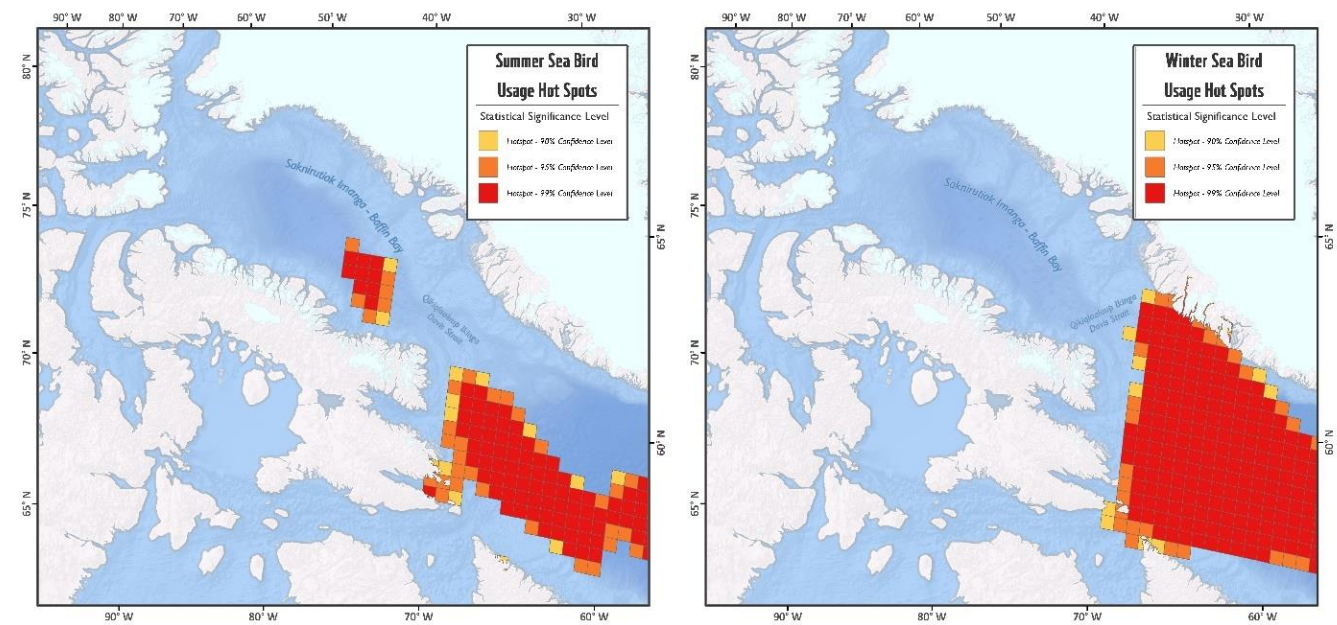

Figure 9: Summer and Winter Sea Bird Usage Hot Spots

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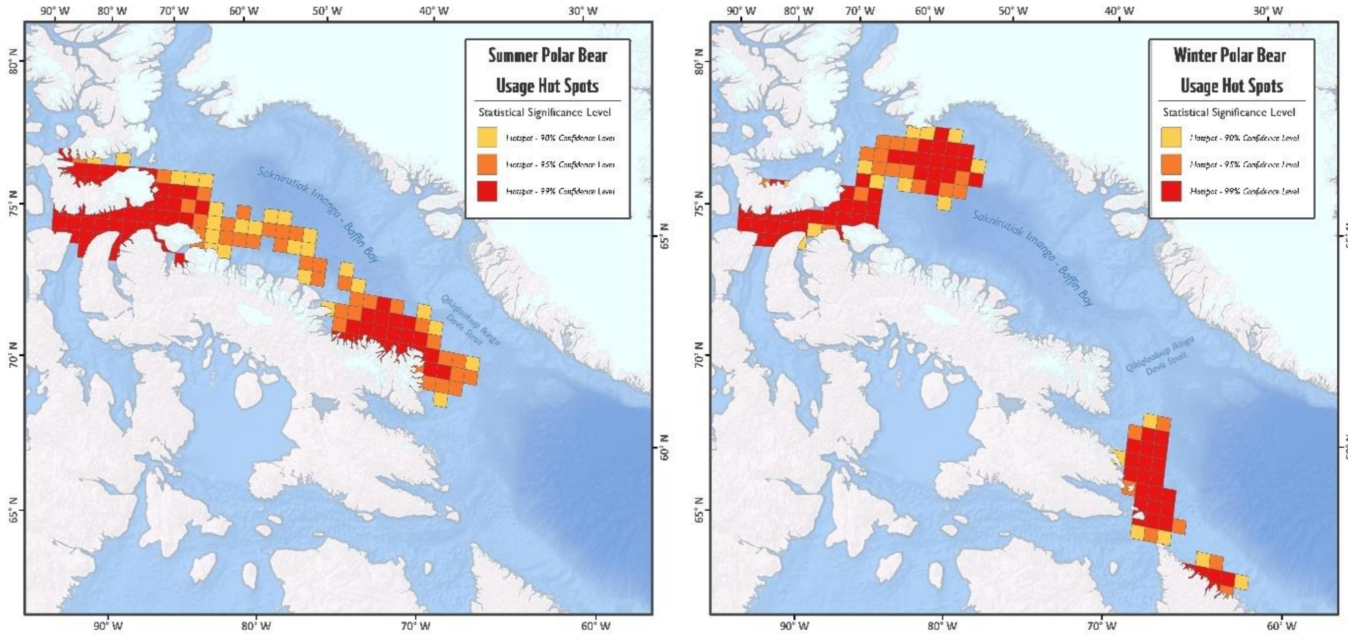

Figure 10: Summer and Winter Polar Bear Usage Hot Spots

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6. ENVIRONMENTAL IMPACTS OF OIL AND GAS

Summary: The treatment of seismic testing in the SEA is sometimes factually incorrect; it tends to downplay the risks posed to marine life; and it contains some scientifically unsubstantiated conclusions and misleading statements. Research indicates that seismic testing can harm marine wildlife, which many Inuit depend upon for their livelihoods, culture and survival. To date 130 species have been documented to be impacted by human-caused underwater noise pollution, including plankton, benthic organisms, whales, invertebrates, some fish species, narwhals, harbour porpoises, squid and shrimp. The SEA also gives insufficient consideration to cumulative underwater noise effects.

Recommendation: More seismic research is needed on plankton, benthic organisms, whales, invertebrates, some fish species, narwhals, harbour porpoises, squid and shrimp, all of which are present in the study area. The precautionary approach should be applied for those species in which seismic impacts are unknown or uncertain. Thorough, long-term studies should be carried out to get robust baseline biological information on the distribution and abundance of some species. Seismic should not be conducted in sensitive marine environments until more is known about the full impacts on certain species.

6.1 Seismic testing and underwater noise

6.1.1 Comments on the treatment of seismic testing and underwater noise in the SEA

The treatment of seismic testing in the SEA is unsatisfactory overall in that the *Preliminary Findings Report* and Nunami Stantec reports are sometimes factually incorrect and contain scientifically unsubstantiated conclusions and misleading statements, which all tend in the direction of downplaying the harm and risk seismic surveys pose to marine life. While on page 38, the *Preliminary Findings Report* acknowledges that there is “limited information about how birds, marine mammals, and invertebrates respond to in-air and underwater noise”, some other statements and contentions are made that are not supported by evidence. For example, unspecified studies are chosen from non-Arctic regions suggesting that seismic impacts are relatively minor and short-lived, yet it is not clear why these studies were chosen over others (see section 6.1.4 below) that do show significant harm resulting from seismic airgun surveys.

There is also a general dearth in the SEA of noise impact studies from the eastern Canadian Arctic region. We know enough from noise impact studies to date, especially those involving seismic airgun surveys, to conclude that anthropogenic underwater noise is a serious and transboundary pollutant, which can negatively affect and degrade huge ocean areas. We know enough to have a legitimate reason to expect negative impacts severe enough to impact the health, welfare, and sustainability of at least some animal populations, from plankton through fish to whales.

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As explained below, to date 130 species have been documented to be impacted by human-caused underwater noise pollution.[14] We may not know the exact details of which organisms will be harmed by seismic airgun noise and to what degree, but this does not mean, as asserted in the Nunami Stantec reports, that the negative effects will be limited to the immediate area, will stop once oil and gas activities cease, and that the effects will be reversible. More research is needed and the precautionary approach should come into play for those species in which seismic impacts are unknown or uncertain.

As detailed below, the evidence that does exist suggests that seismic testing can do harm to marine ecosystems and to valued ecosystem components upon which many Inuit depend for their food, culture and livelihoods. The science to date suggests there can be serious negative effects on some important species, including plankton, benthic organisms, whales, invertebrates, some fish species, narwhals, harbour porpoises, squid and shrimp. These impacts that can linger for months after the surveys have ceased. Traditional Inuit observational knowledge tends to support this conclusion.[15] Despite this, the treatment of seismic airgun survey noise in the SEA, and therefore of the first-hand observations of Inuit, is generally dismissive and not precautionary. The noise contribution overall of potential oil and gas development including seismic testing, drilling, and increased ship traffic from support vessels, is likely to be significant and not consistent with the conclusion that "*the potential effects to the biological environment from activities associated with the possible scenarios would generally be localized around the source…and are expected to lessen to natural or background conditions within a small area from the source."*[16]

'To date 130 species of fish and invertebrates, including benthic species, have shown documented and significant impacts from underwater noise pollution. For other species, more research needs to be done.

WWF-Canada recommends that thorough, long-term (over several years) studies be carried out to establish baseline data on the distribution and abundance of valued ecosystem components such as narwhals, belugas, bowhead whales, fin whales, Northern bottlenose whales, harbour porpoises, cod, Greenland halibut, clams, mussels, squid, and shrimp, all of which are present in the area. The long-term impacts of seismic testing, together with threats such as climate change and ocean acidification, on the ecosystem and population biology should be thoroughly studied. Such studies are very challenging to carry out, but the burden of proof (to show no harm) should be on the project proponent, who wishes to alter the environment, rather than those wishing to preserve it.

Finally, behavioral disturbance studies can be notoriously difficult to interpret, as they may yield counterintuitive or paradoxical results. For instance, for some species and in certain situations, the weaker the behavioural response, the more serious the impact on the population. Individuals with lower

[14] Weilgart, L., 2018. *The impact of ocean noise pollution on fish and invertebrates*. Report for OceanCare, Switzerland.
[15] For example, see page 108 of the Preliminary Findings Report, which states that community members in Clyde River, Arctic Bay, Resolute, Pond Inlet, Pangnirtung, Qikiqtarjuaq, Iqaluit and Cape Dorset have all witnessed impacts of seismic activity on marine mammals.
[16] NIRB. 2018. Preliminary Findings Report for the Strategic Environmental Assessment in Baffin Bay and Davis Strait. Section 7.2.1, page 76.

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energy reserves or no alternative habitat cannot afford to flee repeatedly from disturbance but are forced to remain and continue feeding, apparently unresponsive to disruption.[17] [18] Yet these individuals are in fact more vulnerable to disturbance. Animals do not always react in an outwardly observable or obvious manner even if they are seriously impacted. What appears to be habituation, where animals respond less and less over time to a stimulus or disturbance, may in fact be the reaction of the most sensitive individuals, while the least sensitive stay (Bejder et al. 2006a). These two scenarios can only be distinguished if all individuals are known and tracked (Bejder et al. 2006b). This is why in-depth long-term studies are needed to clarify the full picture of impacts.

In terms of mitigation, existing science does not support the contention that seismic testing can be sufficiently mitigated such that the threats are substantially reduced. The mitigation options that currently exist are largely unproven in their effectiveness. For instance, ramp-ups or soft starts, where the number of airguns firing are gradually and audibly increased, do not appear to be consistently and reliably effective in causing humpback whales to move away from the source vessel (Dunlop et al. 2016). There is large variation in whale behavior, with some groups swimming away from the sound source whereas others approached even relatively loud noise levels, possibly viewing them as a challenge that needed to be confronted. Whales that did avoid the (source) vessel emitting airgun noise may have avoided the vessel itself, not the noise.[19] Although the sound source was different (naval sonar vs. seismic airguns), and the ramp-up procedures are different, Wensveen et al. (2017) also found that gradually increasing the sonar source intensity was not an effective method to reduce the risk of physiological effects for humpback whales overall, mainly because most whales did not exhibit very strong avoidance responses to the sonar signals.[20] Animals that had not been exposed to sonar recently, were not feeding, or were with a small calf were more responsive. This again illustrates how difficult it is to form conclusions about innocuous noise impacts since especially whales, but also fish, show great variation in their behavior in the wild. Moreover, when animals have a strong motivation not to move away from their current location, ramp-ups are unlikely to be effective.

'It would seem highly irresponsible to introduce a 1-3 year seismic program into a sensitive marine environment until more is known about the full impacts of ocean noise on certain species.'

Given what seismic science already knows and what still needs to be studied, it would seem highly irresponsible to introduce a 1-3 year seismic program into a sensitive marine environment until more is known about the full impacts of ocean noise on certain species. Finally, we would refer the NIRB to

[17] Gill, J.A. et al. 2001. Why behavioural responses may not reflect the population consequences of human disturbance. *Biological Conservation* 97 (2001) 265-268. http://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.546.453&rep=rep1&type=pdf

[18] Stillman, R.A. & Goss-Custard, J.D. 2002. Seasonal changes in the response of Oystercatchers Haematopus ostralegus to human disturbance. *J. Avian Biol*. 33: 358–365. http://obpa-nc.org/DOI-AdminRecord/0064594-0064602.pdf

[19] Dunlop, R.A. et al. 2017. Response of humpback whales to ramp-up of a small experimental airgun array. *Marine Pollution Bulletin*. 103: 1-2.

[20] Wensveen et al. 2017. Lack of behavioural responses of humpback whales indicate limited effectiveness of sonar mitigation. Journal of Experimental Biology. 220(22): 4150-4161.

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additional studies (see section 6.1.4 below) on the impacts of seismic testing that may have been missed in the Nunami Stantec analysis.

6.1.2 Detailed comments – Preliminary Findings Report

Page 43:
"Although explosives were used in the past before airguns, they are not used in present day operations as the sound produced by airguns is more targeted and less disruptive to marine wildlife. While waterguns and vibrators are other types of seismic sources, airguns are typically used for marine seismic surveys as they can send sound waves deeper below the seafloor than other existing technologies."

The main reason explosives are no longer used for surveys is because of the danger to humans. There was great resistance among the oil and gas industry and seismic industry to switch from explosives to airguns. New technologies such as Marine Vibroseis (MV) can send sound waves just as deeply into the seafloor as airguns.[21] Penetration into the seafloor is a function of sound frequency, and Marine Vibroseis (MV) can produce the same well-penetrating, low frequencies as airguns. However, MV is a controlled source and as such, the source characteristics (frequency, duration, type of sound) can be altered in real-time, to optimize the output for each environment and situation. This technology is less environmentally impactful, as the unnecessary high frequencies that airguns emit (up to 100,000 Hz), are not used by MV. Frequencies over about 150 Hz are not recorded or used by the oil and gas industry. Thus, a great deal of energy is emitted by airguns that is wasted. The high frequencies that airguns emit can unnecessarily disturb species such as narwhals, belugas, northern bottlenose whales, and harbour porpoises. MV is also much quieter, both near the source and at distance.

Table 10 (page 43):
3D seismic surveys do not generally consist just of 2 airguns. There are typically 18-48 airguns, all firing simultaneously.

Page 43:
"Typical air source arrays produce a sound ranging from 220-260 decibels one (1) metre from the airgun and lasting approximately 0.1 seconds, repeated every 10-15 seconds. The sound level decreases away from the airgun to 180 decibels at 500 metres and about 170 decibels 1 kilometre away…180 decibels is similar to the noise made on the surface from cracking and breakup of sea ice."

Does this statement mean that ice breakup and cracking produce sound levels of 180 decibels <u>at the source</u> (directly at the ice) or 500 metres away, as with the airguns? This needs to be clarified. It is misleading to compare the level of one sound 500 m away, where it will be much quieter, with the level of another sound at the source. Both should be compared either at source, or both 500 m away.

[21] Duncan, A.J., Weilgart, L.S., Leaper, R., Jasny, M. and Livermore, S., 2017. A modelling comparison between received sound levels produced by a marine Vibroseis array and those from an airgun array for some typical seismic survey scenarios. *Marine Pollution Bulletin*, *119*(1), pp.277-288.

In any case, these sorts of statements can be highly misleading. While it is true that ice breakup can, on occasion, be quite loud, this does not happen continuously, every 10 seconds, around the clock, as with seismic blasting. Moreover, the frequencies, durations, repetition rate, overall energy output, etc., are all quite different between airguns and the breakup of sea ice. It is highly likely that marine life has adapted to natural sounds like ice compared with anthropogenic sounds, which are, evolutionarily-speaking, very recently introduced. Animals can adapt to their environment over evolutionary time scales, but the noise we introduce is too recent to allow for adaptation, should adaptation even be possible.[22] Thus, it is not valid to compare natural with human-made noise.

Page 68:
"Also, underwater noise generated by several activities associated with marine-based oil and gas development in ice or frozen sea ice conditions may approach background noise levels about 7.5 kilometres (4.7 miles) from the source of the noise. However, underwater noise from marine vessels may be detected up to 30 kilometres (18.5 miles) from vessels."

Research does not support this contention that icebreakers can be heard or detected up to a maximum of only 30 km. Two different research teams and data from several years showed that beluga whales typically avoided icebreakers at distances of 35–50 km, at the point where they could probably just detect them. They travelled up to 80 km from the ship track and usually remained away from the area for 1–2 days.[23] [24]

'Underwater sounds can travel thousands of kilometers under the right conditions, meaning that effects would not be 'localized'.'

Page 73:
"…the potential effects to the physical environment from activities associated with the possible stages, or scenarios, of oil and gas development in Baffin Bay and Davis Strait would be expected to be localized around the source of impacts. Also, the potential effects to the physical environment from oil and gas development would be expected to lessen or return to natural or background conditions within a small area from the source of impacts… there is the potential for greenhouse gas emissions (gases that contribute to the warming of the Earth) and underwater noise from the oil and gas activities to contribute to cumulative impacts."

Sound underwater can travel thousands of kilometers under the right conditions, meaning that effects would not be 'localized' or 'return to natural or background conditions within a small area from the source of impacts'. For instance, Simpson et al. (2011) show that ocean acidification, a response to higher CO_2 emissions in the atmosphere, affects the hearing response of fish, where juveniles make ecologically deleterious decisions based on the sounds they hear, with potentially detrimental impacts

[22] Rabin, L.A. and Greene, C.M., 2002. Changes to acoustic communication systems in human-altered environments. *Journal of Comparative Psychology*, *116*(2), p.137.
[23] Cosens, S.E. and Dueck, L.P., 1993. Icebreaker noise in Lancaster Sound, NWT, Canada: Implications for marine mammal behavior. *Marine Mammal Science*, *9*(3), pp.285-300.
[24] Finley, K.J., Miller, G.W., Davis, R.A., and Greene, C.R., 1990. Reactions of belugas, *Delphinapterus leucas*, and narwhals, *Monodon monoceros*, to ice-breaking ships in the Canadian high arctic. *Canadian Bulletin of Fisheries and Aquatic Sciences, 224*, pp.97–117.

on their early survival.[25] Juvenile reef fish use natural sounds such as snapping shrimp, to orient towards suitable settling habitat. As with ocean acidification, anthropogenic noise can similarly disadvantage juvenile reef fish, causing them to make maladaptive decisions.[26] The combination of a poorer hearing response due to ocean acidification coupled with reduced hearing due to masking (obliteration of important sound cues) by noise would be expected to be an especially damaging cumulative impact.

Noise should also be mentioned as a Transboundary Effects under 7.1.3. Nieukirk et al. (2012) analyzed 10 years of underwater recordings from the Mid-Atlantic Ridge, finding that seismic airguns were heard at distances of 4,000 km from survey vessels and present 80-95% of the days per month for more than 12 consecutive months in some locations.[27] When several surveys were recorded simultaneously, whale sounds were masked (drowned out), and the airgun noise became the dominant part of background noise levels. These sorts of transmission distances do not occur in all cases, but without the appropriate noise measurements, it should be assumed they are possible.

Page 77 (Table 17):
This table indicates that underwater noise would not impact Special and Sensitive Areas, and Areas of Concern or Importance. Again, until measurements are made of how far the seismic noise travels and depending on where the seismic program takes place, it should be assumed it can travel hundreds to thousands of kilometers and, at the very least, has the potential to impact sensitive areas and areas of importance. Likewise, it is conceivable that seismic noise could also affect the coast and shoreline.

Page 78:
"However, Nunami Stantec also noted that some previous studies concluded that sound generated during seismic surveys may negatively affect plankton up to 1.2 kilometres (0.75 miles) from the source of sound. The plankton population within an area impacted by noise from a seismic survey are expected to recover rapidly (within months) once the seismic surveys have ceased… the level of the effects of these activities to plankton are expected to be low to moderate in the region."

It is not accurate to say that 'seismic surveys may negatively affect plankton up to 1.2 kilometers…from the source of sound', as that was the maximum range examined in this study.[28] The distance affected could have been far greater; the research simply didn't examine impacts beyond this distance. As such, it is not justifiable or valid to conclude that the 'effects…[on] plankton are expected to be low to moderate…'. There is no scientific basis to support such a claim currently. More and better data are needed before this claim can be validated.

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[25] Simpson, S.D., Munday, P.L., Wittenrich, M.L., Manassa, R., Dixson, D.L., Gagliano, M. and Yan, H.Y., 2011. Ocean acidification erodes crucial auditory behaviour in a marine fish. *Biology Letters*, 7(6), pp.917-920.
[26] Holles, S., Simpson, S.D., Radford, A.N., Berten, L. and Lecchini, D., 2013. Boat noise disrupts orientation behaviour in a coral reef fish. *Marine Ecology Progress Series*, *485*, pp.295-300.
[27] Nieukirk, S.L., Mellinger, D.K., Moore, S.E., Klinck, K., Dziak, R.P. and Goslin, J., 2012. Sounds from airguns and fin whales recorded in the mid-Atlantic Ocean, 1999–2009. *The Journal of the Acoustical Society of America*, *131*(2), pp.1102-1112.
[28] McCauley, R.D., Day, R.D., Swadling, K.M., Fitzgibbon, Q.P., Watson, R.A. and Semmens, J.M., 2017. Widely used marine seismic survey air gun operations negatively impact zooplankton. *Nature Ecology & Evolution*, *1*(7), pp.1-8.

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In addition, rather than 'negatively affect', it would be more accurate to say 'killed'. All immature krill were killed within 1.2 km.[29] One-third of the zooplankton species even showed decreases in numbers of over 95 per cent. The single airgun (bearing in mind that typical surveys consist of 18-48 airguns, all firing simultaneously, and 3,000-8,000 cubic inches total air volumes vs. only 150 cubic inches for the single airgun used in this experiment) caused a 2-3-fold increase in dead zooplankton overall, compared to controls.

Page 78:
"Based on past research, noise from seismic surveys may change the behaviour of benthic organisms, such as shellfish (for example, mussels and crabs), cause injury or death, and reduce the population of these organisms. However, based on studies conducted in other marine regions regarding effects of noise from seismic surveys, benthic organisms, such as shellfish, appear to be less impacted by seismic surveys when compared to marine plankton (small living organisms, including early stages of fish and other marine life, in marine water)…Nunami Stantec predicted that impacts to benthic organisms from noise associated with seismic surveys would be low, limited to the area of the seismic activity, and of medium duration (months to a year or more)."

This paragraph appears confusing and highly contradictory. The first sentence seems to acknowledge that some research shows the very serious, fatal impacts of seismic surveys on benthic organisms that can reduce population sizes. But then the paragraph goes on to say that there are studies in other regions showing that benthic organisms are less impacted than plankton. This would seem to point to the need for further research to clarify this discrepancy. Yet the conclusion reached is that impacts to benthic organisms are expected to be low, which is puzzling and difficult to reconcile. Given that plankton were killed by seismic blasts, just because benthic organisms were "less impacted than plankton" does not therefore mean that the impacts on benthic life was "low". Impacts of seismic testing on plankton can be extremely serious and, since plankton are at the base of the marine food web, if they are seriously affected, benthic organisms will be negatively impacted as well, indirectly, as plankton is their food source.

Benthic organisms will likely also be harmed directly from the seismic noise as several studies have indicated. Scallop larvae exhibited significant developmental delays and body malformations from seismic airgun noise.[30] Scallops in the wild exposed to a single 45 or 150 cubic inch airgun passing over them four times showed mortality rates of up to 20% even 120 days after exposure.[31] There was damage to their reflexes and possibly sensory organs even 120 days post-exposure. They were immunocompromised over months of time, and their physiology and biochemistry were chronically

[29] Nieukirk, S.L. 2012.
[30] Aguilar de Soto, N., N. Delorme, J. Atkins, S. Howard, J. Williams, and M. Johnson. 2013. Anthropogenic noise causes body malformations and delays development in marine larvae. *Scientific Reports* 3, Article number: 2831.
[31] Day, R.D., McCauley, R.D., Fitzgibbon, Q.P., Hartmann, K. and Semmens, J.M., 2017. Exposure to seismic air gun signals causes physiological harm and alters behavior in the scallop *Pecten fumatus*. *Proceedings of the National Academy of Sciences*, *114*(40), pp. E8537-E8546.

disrupted. Lobsters exposed to airguns in the field showed a chronic reduction of immune competency, similar to the scallops. They were also chronically nutritionally impaired even 120 days post-exposure.[32]

It is possible that benthic organisms are affected by the large vibrations and particle acceleration experienced through the seabed from airgun pulses. Many benthic organisms such as clams and mussels improve water quality through biofiltration, increasing the light available for underwater plants, and decrease eutrophication, while helping to feed other benthic organisms through depositing organic matter from the water column. As such, impacts on their welfare can compromise whole ecosystem services.

Page 78-79:
"No effects are expected from noise associated with Scenarios B and C as noise levels from activities (including drilling) are not expected to be intense enough to harm plankton… Benthic flora and fauna could be affected by noise during seismic exploration, but no effects are expected from noise associated with Scenarios B and C as noise levels are not expected to be intense enough."

It is true that seismic shots are particularly sharp and intense, but drilling and vessel noise, especially by ships using dynamic positioning (DP), can also be very loud. It cannot necessarily be assumed that there are no negative effects from the noise in Scenarios B and C, as there is very little evidence to support this claim. Again, vibrations and particle acceleration through the seabed from drilling could also cause serious harm especially to benthic life.

Page 80:
"Effects to fish from noise were predicted to be limited to the immediate area of the noise-generating activities and would stop when the oil and gas activities generating the noise stopped."

As mentioned above, seismic airgun noise can travel hundreds to thousands of kilometers, so it is incorrect to assume that effects to fish would be limited to the immediate area of the noise-generating activities. Moreover, as explained above for scallops and lobsters, some of these effects from seismic noise linger even many months after the noise has stopped.

Page 81:
"Western science indicates that noise may also affect communication among groups of marine mammals of the same species (a condition called masking)."

Masking is the obliteration or obscuring of all signals of interest, not just communication signals. Masking can inhibit marine animals from detecting prey, from navigating, from hearing predators or other hazards, or from effectively sensing their environment.

Page 81:

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[32] Fitzgibbon, Q.P., Day, R.D., McCauley, R.D., Simon, C.J. and Semmens, J.M., 2017. The impact of seismic air gun exposure on the haemolymph physiology and nutritional condition of spiny lobster, *Jasus edwardsii*. *Marine Pollution Bulletin*, *125*(1-2), pp.146-156.

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"…effects to marine mammals from noise associated with oil and gas activities, such as seismic surveys and drilling, are anticipated to be temporary and restricted to the area where the noise may be noticed by marine mammals."

Again, whales can potentially communicate over thousands of kilometers in the ocean, so effects may be very long-ranged. They may also not be temporary, as evidence from seals shows that intense, acoustic stimuli elicit a startle reflex and fear conditioning that can lead to sustained, long-term avoidance of an area, even when near a food source and even long after the sound is gone.[33] Seals constitute an important part of the diet for many Inuit.

Page 81-82:
"Overall, the level of the impacts from noise associated with oil and gas activities was predicted by Nunami Stantec to be moderate since underwater noise levels were not expected to affect the long-term health of marine mammal populations in Baffin Bay and Davis Strait."

This statement is not supported by research. Götz & Janik (2011) state that "…repeated startling by anthropogenic noise sources might have severe effects on long-term behaviour…[which could] be associated with reduced individual fitness or even longevity of individuals." This means that intense acoustic stimuli like the shots from seismic airguns could negatively affect the long-term health and welfare of marine mammal populations.

Page 82:
"…[C]hanges to habitat from possible oil and gas development in Baffin Bay and Davis Strait were expected to be short term (lasting the duration of the activity) and reversible (returning to natural conditions) once activities end."

This statement is not supported by research. Noise changes, indeed degrades, habitat and there is no evidence upon which to conclude that this degradation will be short-term and reversible. Nunami's hypothetical scenarios document predicts that "surveys could take one to three years to complete", which is not a short-term seismic program, and some research indicates that effects can last even after the noise has ceased. As stated on page 90 in the Preliminary Findings report, "the entire oil and gas field development and drilling process could be 30-60 years long, with production lasting up to 40 years". All of this will add considerable cumulative noise degradation to the environment—seismic blasting, drilling, shipping, especially with dynamic positioning, and so on.

"The types of activities allowed in these protected areas are strictly regulated to reduce the likelihood of impacts to special and sensitive areas and areas of concern or importance."

It should be noted here that current regulations and legislation do not prohibit oil and gas activities from taking place in Marine Protected Areas (MPAs).

[33] Götz, T. and Janik, V.M., 2011. Repeated elicitation of the acoustic startle reflex leads to sensitisation in subsequent avoidance behaviour and induces fear conditioning. *BMC neuroscience*, *12*(1), p.30.

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Table 18 (page 84):
The columns or categories of "Change in Habitat of Marine Wildlife", "Change in Behaviour of Marine Wildlife", "Change in Physical Health of Marine Wildlife", and "Change in Mortality Risk of Marine Wildlife" are all interrelated. A change in habitat can cause a higher mortality risk if it puts marine life in harm's way, either by becoming fatally entrapped in ice (e.g. narwhals) or in the paths of ships or in poor feeding areas, where they can become food-stressed. Likewise, a change in behaviour can make wildlife more prone to predation or hazards, causing higher mortality or it can cause more stress which can worsen the physical health (e.g. immunosuppression), again increasing the mortality risk. Therefore, it is likely that most of these activities, especially cumulatively, can worsen the physical health and mortality risk of marine wildlife. Ship strikes to whales from increased marine transportation and shipping seem to be entirely ignored.

Page 85:
The impacts of noise on fish are understated and, in some cases, even ignored, especially under cumulative impacts, and are contradicted by recent research. For example, Weilgart's (2018) review of 115 primary studies concludes (emphasis added):[34]

> "Most fish and invertebrates use sound for vital life functions. This review of 115 primary studies encompasses various human-produced underwater noise sources, 66 species of fish and 36 species of invertebrates. *Noise impacts on development include body malformations, higher egg or immature mortality, developmental delays, delays in metamorphosing and settling, and slower growth rates.* Zooplankton suffered high mortality in the presence of seismic airgun noise. Anatomical impacts from noise involve massive internal injuries, cellular damage to statocysts and neurons, causing disorientation and even death, and hearing loss. Damage to hearing structures can worsen over time even after the noise has ceased, sometimes becoming most pronounced after 96 hrs. post-noise exposure."

'Once the population biology and ecology are impacted, it is clear fisheries and even food security for humans are also affected.'

Even temporary hearing loss can last months. Stress impacts from noise are not uncommon, including higher levels of stress hormones, greater metabolic rate, oxygen uptake, cardiac output, parasites, irritation, distress, and mortality rate, sometimes due to disease and cannibalism; and worse body condition, lower growth, weight, food consumption, immune response, and reproductive rates. DNA integrity was also compromised, as was overall physiology. Behaviorally, animals showed alarm responses, increased aggression, hiding, and flight reactions; and decreased anti-predator defense, nest digging, nest care, courtship calls, spawning, egg clutches, and feeding. Noise caused more distraction, producing more food-handling errors, decreased foraging efficiency, greater vulnerability to predation, and less feeding. Schooling became uncoordinated, unaggregated, and unstructured due to noise.

[34] Weilgart, L., 2018. The impact of ocean noise pollution on fish and invertebrates. *Report for OceanCare, Switzerland.*

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Masking reduced communication distance and could cause misleading information to be relayed. Some commercial catches dropped by up to 80 per cent due to noise, with larger fish leaving the area. Bycatch rates also could increase, while abundance generally decreased with noise. Ecological services performed by invertebrates such as water filtration, mixing sediment layers, and bioirrigation, which are key to nutrient cycling on the seabed, were negatively affected by noise. Once the population biology and ecology are impacted, it is clear fisheries and even food security for humans are also affected."

The SEA final report must clarify why the impacts and negative effects demonstrated in these 115 primary studies do not apply in this case.

Page 87 (Mitigation measures):

- *"Establishment of safe distances from marine wildlife (also termed habitat setbacks);*
- *Avoid sensitive periods for wildlife such as breeding, rearing, and nesting;*
- *Apply mitigation plans or actions for seismic surveys as specified in the Statement of Canadian*
- *Practice with respect to the Mitigation of Seismic Sound in the Marine Environment;*
- *Implement a Marine Mammal Management Plan that includes Marine mammal monitoring for vessel-related activities;"*

It may be that "Many of the (noise mitigation) plans or actions are standard to oil and gas Development" (page 87), but these plans have largely been developed by industry and regulators; they are not always supported by research; and they are in some cases unproven in their effectiveness. Spawning grounds and eggs are not easily detected, and not enough is known about the location of many spawning grounds in the eastern Canadian Arctic. More research is required. Injury or mortality can occur beyond the horizon, as evidenced by beaked whales which fatally stranded even at large distances from seismic arrays. Noise exposure can alter behaviour which, in turn, can lead to mortality by changing dive patterns or migrations. Mortality can also increase with ineffective anti-predator defense, degraded body condition, and stress through immune suppression, for instance.

'Existing science does not support the contention that seismic airgun surveys can be sufficiently mitigated such that the threats are substantially reduced.'

In addition, it is unknown what a truly "safe distance" is in many cases, and negative effects beyond the horizon, such as masking, cannot be easily mitigated. Avoiding sensitive periods can be effective, but marine species can have differing sensitive periods and for many species, these are unknown. Instead, all seismic surveys in critical habitats should be planned so as to be out of phase with the presence of key species in these areas, as recommended by the IWC Scientific Committee for critical whale habitat.[35] More research is needed on what constitutes a "safe distance" for different species and the location of critical habitats for species of importance in the eastern Canadian Arctic.

[35] International Whaling Commission. 2004. Annex K of the Report of the Scientific Committee. 248-276.

In terms of the guidelines recommended, the Statement of Canadian Practice is flawed and incomplete, and it should not be relied upon to form the basis of an adequate mitigation plan. For example, Part II, 5 of the Statement of Canadian Practice reads:

> *"All programs to acquire seismic data should be planned to avoid a) death, harm, or harassment of individuals of marine mammals and sea turtles listed as endangered or threatened on Schedules 1, 2, or 3 of the Species at Risk Act ; and b) population-level effects for all other marine species."*[36]

As noted on page 19 of the *Preliminary Findings Report*, there are species that occur in or near the area of focus for the SEA that are listed as endangered, threatened, or of special concern under the Species at Risk Act (SARA 2002). However, many species that would be impacted by seismic testing and that Inuit rely on for their livelihoods are not listed under SARA. Individual members of these species would therefore not be protected and could indeed be killed as long as seismic programs do not have population-level effects. This is not likely to be acceptable to northern stakeholder groups nor the public and it is not clear how the seismic operator would know what level of seismic activity could result in a population-level effect when even the scientific literature is uncertain on this point.

Finally, both the *Preliminary Findings Report* and the Nunami report *Environmental Setting and Review of Potential Effects of Oil and Gas Activities* make erroneous and unproven assumptions about the effectiveness of marine mammal monitoring to mitigate seismic noise impacts. For instance, most whales are rarely visible at the surface, especially the deep divers (Northern bottlenose whales) and especially in anything but perfect visibility. Quantitative analysis has shown that mitigation monitoring detects fewer than 2% of beaked whales (e.g. Northern bottlenose whale) even if the animals are directly in the path of the ship.[37] Other species might be slightly easier to sight, but again monitoring cannot be relied upon to be satisfactorily effective. Marine Mammal Observers who are supposed to keep watch are often not sufficiently trained nor suitably rested, nor are they necessarily listened to when they claim to have sighted a marine mammal. The safety radius is also very dependent on the sound transmission conditions which change with bathymetry, nature of the seafloor, salinity, and the sound speed profile which can change between seasons. There is not even good information as to what constitutes a "safe" exposure, particularly for whales whose hearing cannot be measured. This also varies between past exposure, recovery time, species, age and sex.

"Ramp up" or "soft start" is another mitigation measure that may help prevent the most intense exposures by driving animals away. However, the very act of displacing animals is itself a negative effect. Ramp ups also don't necessarily cause avoidance and can't be counted on to clear an area of marine life. Some animals approach a noise source out of curiosity or because they (mainly males) see it as a competitor and want to challenge it. By the time they get close, the noise has increased enough to

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[36] Department of Fisheries and Oceans Canada. 2007. *Statement of Canadian Practice with respect to the Mitigation of Seismic Sound in the Marine Environment.* http://www.dfo-mpo.gc.ca/oceans/publications/seismic-sismique/index-eng.html

[37] Barlow, J. and Gisiner, R. 2006. Mitigating, monitoring and assessing the effects of anthropogenic sound on beaked whales. *Journal of Cetacean Research and Management*, *7*(3), pp.239-249.

become injurious. Sound fields can be complicated and it is often not obvious which way an animal needs to swim to avoid the noise. Many species do not leave the area to escape the noise as it is where their food or important habitat is. Many benthic organisms or plankton cannot leave the area of course. Even if animals can escape, they are using valuable time and energy for these avoidance behaviours which cuts into their energy budget for feeding and reproduction. They are also generally driven into suboptimal habitat which further disadvantages them. Thus, there is no valid basis for the claim that the viability of marine populations will not be negatively affected.

6.1.3 Detailed comments – Nunami Stantec Report

Page 7.24:
"Marine plankton could be affected by noise during seismic exploration (Scenario A) but no effects are expected from noise associated with Scenarios B and C as noise levels are not expected to be intense enough to harm plankton."

The claim that noise levels are not "expected" to be intense enough to harm plankton is not substantiated by available research as the noise threshold levels for plankton have not been rigorously tested.

Page 7.25:
"It has been suspected that seismic noise can cause changes in behaviour, dominated by startle responses, and physiological damage to arthropods or shellfish and thus increase their mortality risk (Carroll et al. 2017)."

This is not quite accurate. A five-fold higher mortality rates were actually *shown* in scallops, not suspected.[38]

Page 7.25:
"In general, invertebrates do not have the ability to hear sound, although they can detect pressure waves (Christian et al. 2003)."

This is not correct. In fact, invertebrates can react very strongly to sound as numerous studies have shown. They may detect more particle motion than pressure, both of which are components of sound. Invertebrates may not have ears like fish or mammals, and their sensory organs are generally statocycts, but they can certainly detect, react to and be impacted by sound waves.

Page 7.25:
"Many invertebrates, such as snow crab (Chionoecetes opilio), do not contain gas filled organs, and this decreases their vulnerability to loud noises (Keevin and Hempen 1997)."

[38] Day, R.D., McCauley, R.D., Fitzgibbon, Q.P., Hartmann, K. and Semmens, J.M., 2017. Exposure to seismic air gun signals causes physiological harm and alters behavior in the scallop *Pecten fumatus*. *Proceedings of the National Academy of Sciences*, *114*(40), pp. E8537-E8546.

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They may be less vulnerable to effects such as the resonance of gas-filled organs, but they may be more prone to sea floor-borne vibrations and particle motion, and cannot escape the noise, so this statement is misleading and incomplete. There are a number of studies showing around 40 species of invertebrates to be affected by noise.[39]

Page 7.25:
"The results from a recent study on the effect of 2D seismic surveys on snow crab on the continental slope of the Grand Banks did not support the contention of harvesters in Atlantic Canada who concluded seismic noise from hydrocarbon exploration was having strong negative effects on catch rates (Morris et al. 2018). Their results suggest that if seismic effects on snow crab exist, they are smaller than changes related to natural spatial and temporal variation (Morris et al. 2018)."

This study is somewhat mischaracterized. In fact, Morris et al. (2018) were unable to detect any change in snow crab catch rates due to seismic exposure, but their statistical power to detect any effects was very low, because there was high natural spatial and temporal variation in catches. This is a constant problem when conducting studies in the wild, as the ocean is not a controlled laboratory and it changes constantly for unknown reasons. Thus, seismic effects on snow crab could indeed be very large but the sample size in the study was too low to detect these effects over the "background" variation and therefore the study cannot be regarded as a repudiation of the first-hand observations of harvesters.

Page 7.25:
"In conclusion, benthic flora and fauna appear relatively resilient to noise disturbances and effects on behaviour and mortality are expected to be low or negligible, local, restricted to the seismic activity and of medium-term duration (i.e., months to a year or more)."

There is no basis for such a conclusion based on available evidence and research. Weilgart's (2018) review of 115 primary studies concluded that approximately 100 species of fish and invertebrates, including benthic species, have shown documented and significant impacts from noise. For other species, more research needs to be done.

Page 7.25:
"Climate change will increase the duration and spatial extent of the open water season and therefore creates the potential for seismic operations to cover larger areas for longer periods of time. This could increase the frequency and geographic extent of the effect. However, effects of seismic operations on benthic flora and fauna are not expected to change."

After conceding that climate change will likely increase the potential for seismic operations to cover larger areas for longer periods of time, it is then concluded, without evidence, that seismic impacts will not be influenced by climate change. In cases where it is not yet conclusively known what the impacts might be, the precautionary principle, to which Canada has agreed in international law and national environmental legislation, should be adopted.

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[39] Weilgart, L., 2018. *The impact of ocean noise pollution on fish and invertebrates.* Report for OceanCare, Switzerland.

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Page 7.27:
"Changes in behaviour of marine fish exposed to underwater noise are expected to be reversible in the short term (hours to days) following removal of the sound source. Potential mortalities from underwater noise generated by seismic activity would be low in number, and numbers affected are not expected to be at a level that would substantially affect the regional abundance or sustainability of marine fish populations."

It bears repeating that the damage to scallops in mortality, immunosuppression, chronic disruption of their physiology and biochemistry, and disrupted behavioural patterns and reflex responses persisted at least 120 days after the seismic airgun exposure ceased. Similarly, lobster showed chronic reductions in their immune competency and impairment of their nutritional condition that were obvious even 120 days after seismic airgun exposure. Hearing damage to squid, cuttlefish, octopus, and jellyfish became worse over time after noise exposure ceased, becoming most pronounced after 96 hrs., the maximum time studied.[40] [41] [42] This trend may have continued for some time thereafter.

Page 7.31:
"On three occasions, narwhals stayed in their coastal summering habitat longer than usual and their delayed migration to offshore wintering habitat left them entrapped in ice (Heide-Jørgensen et al. 2013). Further studies are required as direct causality could not be determined in this retroactive study (Heide-Jørgensen et al. 2013)."

Roughly 1,200 animals died in these ice entrapments, and the ice entrapments showed a highly unusual pattern both in where and when they occurred which coincided quite closely with the area and time of the 2D seismic surveys. It is extremely difficult to prove direct causality in the wild, especially in the ocean with cetaceans, so if that is the bar that is required for evidence, it will almost never be met.

Page 7.31:
Northern bottlenose whales near the Scotian Gully did not appear to avoid the region, based on vocalizations, during 3D seismic surveys (Simard et al. 2005).

Northern bottlenose whales are extremely site-specific. They are highly dependent on the Gully and, to a lesser extent, two nearby submarine canyons, and spend all their time in this small area, which is why the Gully, in particular, was declared a Marine Protected Area. The area would have had to be virtually obliterated for them to leave.

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[40] André, M., Solé, M., Lenoir, M., Durfort, M., Quero, C., Mas, A., Lombarte, A., Van der Schaar, M., López-Bejar, M., Morell, M. and Zaugg, S., 2011. Low-frequency sounds induce acoustic trauma in cephalopods. *Frontiers in Ecology and the Environment*, *9*(9), pp.489-493.
[41] Solé, M., Lenoir, M., Fortuño, J.M., Durfort, M., Van der Schaar, M. and André, M., 2016. Evidence of Cnidarians sensitivity to sound after exposure to low frequency underwater sources. *Scientific reports*, *6*, p.37979.
[42] Solé, M., Sigray, P., Lenoir, M., Van Der Schaar, M., Lalander, E. and André, M., 2017. Offshore exposure experiments on cuttlefish indicate received sound pressure and particle motion levels associated with acoustic trauma. *Scientific reports*, *7*, p.45899.

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Page 7.32:
"While changes in marine mammal behaviour as a result of oil and gas activities under Scenarios A, B, and C may occur, these changes in behaviour are not anticipated to affect the sustainability of the marine mammals present in the Area of Focus."

"Seismic surveys and icebreaking activity are anticipated to result in temporary and short-term change in marine mammal behaviour and communication masking, lasting for the duration of the activity or continuing over the short term after the activity has ceased. Impacts would be local in so far that it is restricted to the acoustic footprint of the activity."

As is common throughout this report with respect to the impacts of seismic testing, there is no evidence provided for these assertions, particularly when the "acoustic footprint of the activity" is not known. At this stage, we have no idea how far the seismic airgun noise levels remain above ambient and how this varies by season. At a minimum, before any seismic program takes place, this should be measured in the field under various scenarios.

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6.2 Well Blowouts and Major Accidents

Summary: The impact of a well blowout or major spill in the Canadian Arctic would be catastrophic due to heightened sensitivity of the Arctic marine environment to pollution and the tremendous difficulty of ensuring adequate oil spill response in remote locations with limited infrastructure under extreme weather conditions. There is no proven way to clean up a major oil spill in icy waters due to technological inadequacies, weather, poor light and ice.

Recommendation: Future research is needed to assess the capacity and infrastructure required to deal with a well blowout or major spill in the Arctic and to determine whether an effective response can be mounted in remote locations under harsh weather conditions with periods of prolonged darkness in the presence of ice.

6.2.1 Risk

When assessing risk of a well blowout, it is necessary to consider the possible *consequences* of an accident along with its potential *likelihood*. Risk level is typically defined by:

Risk = Probability of Event X Consequence of Event[43]

While it may be true, as stated on page 59 of the *Preliminary Findings Report*, that the likelihood of a blowout is small, the *consequences* of such an event would be much more devastating in the Arctic than elsewhere, due to the heightened sensitivity of the Arctic marine environment to pollution and the tremendous difficulty of ensuring adequate oil spill response in remote locations with limited infrastructure under extreme weather conditions. There is "simply no way to clean up a spill in icy

[43] Oil Spill Response Joint Industry Project. 2013. *Oil spill risk assessment and response planning for offshore installations.* http://www.oilspillresponseproject.org/wp-content/uploads/2016/02/JIP-6-Oil-spill-risk-assessment.pdf

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waters, due to technological inadequacies, weather, poor light, and of course, ice"[44] (see section 6). The high level of sensitivity and low-level capacity to clean up spills contributes to what WWF has coined as the "response gap."[45]

For example, thirty years after the Exxon Valdez spilled 4.2 million liters of crude oil into Prince William Sound in Alaska, the fishing industry has not fully recovered[46] and many Alaskan beaches remain polluted to this day with an estimated 20,000 gallons (75,000 liters) of crude oil buried just inches below the surface. Challenging environmental conditions meant that only 15 to 25 per cent of oil was recovered by mechanical means and, in a study published in Scientific Reports in 2015, researchers found that the spill was even more ecologically catastrophic than originally predicted as even very low levels of oil contamination can disrupt normal development in Arctic ecosystems.[47] Oil also degrades much more slowly in cold, Arctic waters because low temperatures change the chemical properties of spilled oil making it more viscous and thereby inhibiting the efficiency of oil-eating microbes, which are more effective when oil is broken up into small droplets.[48] It is also not clear whether microbial populations present in the pristine Arctic environment have adapted to degrading oil compounds.

Page 59 of the *Preliminary Findings Report* acknowledges the potential consequences of a major spill, stating that "While medium or large oil spills or blowouts are unlikely to occur given the types of safeguards used in modern oil and gas exploration and development, the effects of oil spills on the environment would be extremely adverse" (emphasis added). This statement should be supplemented by an explanation of how the "extremely adverse" impact of a spill fundamentally changes the overall risk assessment of Arctic offshore oil and gas. Utilizing the standard risk matrix below, we can estimate that, although the probability of a major spill would be low, the high magnitude of such an event make the risk level medium to high. Are Arctic communities that depend on a healthy environment for their livelihoods, culture and identity willing to tolerate this level of risk for unknown and possibly short-term economic benefits (see section 8)?

[44] Neil Hamilton, Oil—A Dark Future for the Arctic, WWF ARCTIC BULLETIN (WWF Arctic Int'l Programme, Oslo, Nor.), Jan. 2008, at 3, available at http://assets.panda.org/downloads/ab0108.pdf.
[45] Ibid.
[46] Yardley, W. May 5, 2010. Recovery Still Incomplete After Valdez Spill. *New York Times.* https://www.nytimes.com/2010/05/06/us/06alaska.html
[47] Incardona, John P. et al. 2015. Very low embryonic crude oil exposures cause lasting cardiac defects in salmon and herring. *Scientific Reports* volume5, Article number: 13499 (2015) https://www.nature.com/articles/srep13499
[48] Aarhus University. February 21, 2018. Oil-eating microbes are challenged in the Arctic. *Phys.org.* https://phys.org/news/2018-02-oil-eating-microbes-arctic.html

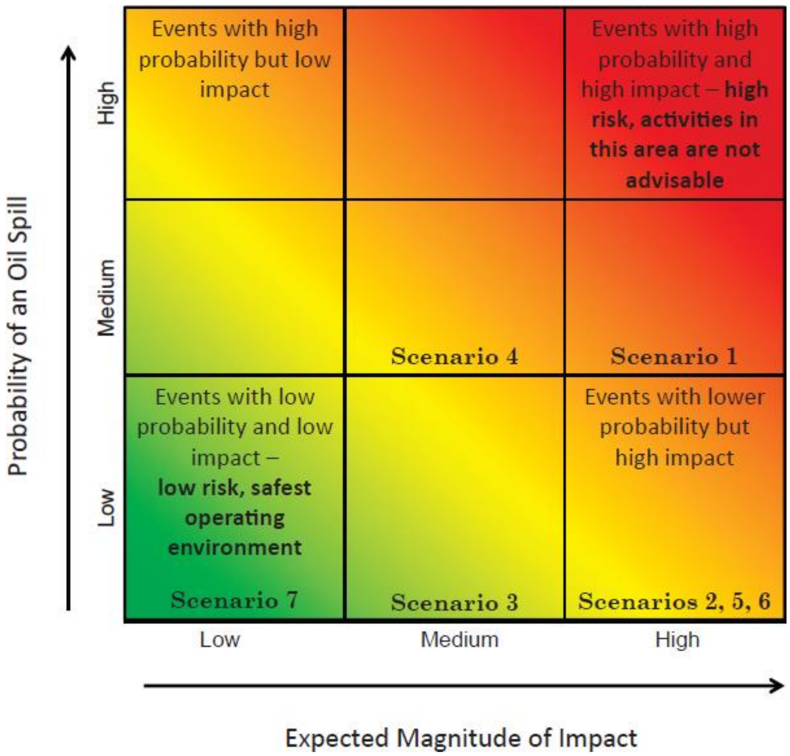

Figure 11: Oil spill risk matrix with low-probability/low-impact events in the lower left corner (low risk) and high-probability/high-impact events in the upper right corner (high risk).[49]

6.2.2 History of blowouts and major accidents

On page 59 of the *Preliminary Findings Report* it is stated that “There have been two (2) blowout events rated as extremely large (greater than 150,000 barrels): Gulf of Mexico in 1979 (3 million barrels) and Deep Water Horizon in 2010 (4 million barrels). The probability of a blowout varies depending on many factors, including: characteristics of the well; well pressure; water depth; operating conditions (for example, weather); and whether it is an exploration, appraisal, or development well.”

> ***‘Thirty years after the Exxon Valdez spilled 4.2 million liters of crude oil into Prince William Sound in Alaska, the fishing industry has not fully recovered and many Alaskan beaches remain polluted to this day.’***

It is worth noting here that some of the conditions that can increase the risk of a well blowout are present in the Arctic such as deep water, extreme weather and the need for a significant amount of exploration drilling. For instance, in the case of the 2018 Husky Sea Rose FPSO accident off the coast of Newfoundland, which was the largest spill in the province’s history, a violent storm (not uncommon in the north Atlantic and Davis Strait) appears to have resulted in a flowline being disconnected on the rig. In addition, if oil and gas activities are ever to proceed in the Canadian Arctic, a significant amount of exploration drilling would be required. According to a Scandower report based on

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[49] National Research Council of the National Academies. 2014. *Responding to oil spills in the U.S. Arctic.* https://www.nap.edu/read/18625/chapter/5#68

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SINTEF data, among the various phases of offshore operations, exploration drilling entails the highest risk of blowout.[50]

The Report excerpt above also seems to imply that there have been only two serious offshore blowout events globally over the last 40 years. This is misleading as a number of other extremely serious blowouts and other offshore rig accidents have occurred during this time. Although they did not all result in significant oil spills, these accidents involved considerable loss of life and/or environmental damage, and each had the *potential* to become major oil spill events. These include the following:

- The Piper Alpha rig explosion in 1988 was the deadliest offshore oil rig accident in history, resulting in the deaths of 167 workers. It was also the largest insured human-caused catastrophe in history up until that time. A huge amount of oil and gas would likely have been spilled into the North Sea had it not burned off in the explosion.

- In March 1989, the Exxon Valdez oil tanker struck a reef, tearing open the hull and releasing 4.2 million liters of oil into Prince William Sound in Alaska. Clean-up response efforts were insufficient to contain much of the spill, and a storm blew in soon after, spreading the oil widely. Eventually, more than 1,000 miles of coastline were fouled, and hundreds of thousands of animals perished. Many Alaskan beaches remain polluted to this day with crude oil buried just inches below the surface.

- The Alexander L. Kielland was a semi-submersible platform accommodating the workers of the bridge-linked Edda oil rig in the Ekofisk field, about 235 miles east of Dundee, Scotland, in the Norwegian continental Shelf. The Platform, operated by Phillips Petroleum, capsized in March 1980, killing 123 people. The platform capsized after the failure of one of the bracings attached to one leg of the five-legged platform structure, after strong winds created waves of up to 12m high on the day of the accident, conditions that are not uncommon in regions such as Baffin Bay and Davis Strait. An official investigation concluded that the root cause of the accident was an undetected fatigue crack in the weld of an instrument connection on the bracing.

- The Seacrest Drillship disaster in the South China Sea 430 km south of Bangkok, Thailand, killed 91 crew on November 3, 1989. The drillship was capsized by the Typhoon Gay which produced 40ft high waves on the day of the accident.

- The Ocean Ranger oil drilling rig disaster which occurred in the North Atlantic Sea off the coast of Newfoundland in February 1982 is one of the deadliest offshore oil rig accidents in history. The offshore oil drilling capsized and sank killing 84 crew members onboard. The semi-submersible mobile offshore drilling rig owned by Ocean Drilling and Exploration Company (ODECO) was hired by Mobil Oil of Canada for drilling exploration at the Hibernia field at the time of accident. The rig capsized due to a very strong storm which produced 190km/h winds

[50] Officer of the Watch. August 6, 2013. *The Probability of an Offshore Accident.* *https://officerofthewatch.com/2013/08/06/the-probability-of-an-offshore-accident/*

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and up to 65ft (20m) high waves.

- The Glomar Java Sea Drillship disaster, which took place in October 1983 in the South China Sea, caused the death of 81 people when the drillship capsized and sank at depth of 317 feet about 63 nautical miles south-west of Hainan Island, China, 80 nautical miles east of Vietnam. Operations ceased prior to the arrival of tropical Storm Lex as it approached from the east of the drilling site. Global Marine's office in Houston, Texas, reported that the drillship was experiencing 75kt (138.9km/h) winds over the bow, but the contact was abruptly lost.

- The Enchova Central Platform disaster in the Campos Basin near Rio de Janeiro, Brazil, killed 42 people in August 1984. The accident occurred due to a blowout which caused a fire and explosion at the central platform of the Enchova field operated by Petrobras. Another disaster struck the Enchova platform in April 1988 as one of its 21 wells blew out and eventually ignited. The well suffered a blow out while undergoing a work-over to convert it from oil production to gas production. The fire caused by the blowout on the platform led to massive damage topside, and the platform remained on fire for a month. Petrobras eventually had to drill two relief wells to control the blowout.

- The Mumbai High North disaster in July 2005 in the Arabian Sea, around 160km west of the Mumbai coast, killed 22 people. Mumbai High North, one of the producing platforms of the Mumbai High Field, owned and operated by India's state-owned Oil and Natural Gas Corporation (ONGC), caught fire after a collision with the multipurpose support vessel (MSV) Samudra Suraksha.

- The Usumacinta Jack-up disaster, which occurred in October 2007 in the Gulf of Mexico, claimed 22 lives after a collision with the PEMEX-operated Kab-101 platform in the Bay of Campeche. A storm with winds of 130 km/h and up to 8m waves created an oscillating movement, which eventually caused its cantilever deck to hit the production valve tree on the Kab-101 platform. The collision resulted in oil and gas leakage leading to the closure of the safety valves of two production wells at the platform. 21 people were declared to have died during the evacuation and one worker missing in the rescue operation was presumed dead. Approximately 5,000 barrels of oil was reported to have lost from the well without being recovered.

What connects all these major accidents is human error and the inherently unpredictable nature of offshore oil drilling, both of which can never be completely ruled out. Equipment malfunctions, extreme weather and mistakes are unavoidable risk factors that can be minimized to some extent but will always be present in offshore operations. Efficient spill response can help minimize the consequences of an oil spill (and thus reduce overall risk), but Canada does not currently have adequate response capacity in the Arctic and a number of important steps need to be taken to improve spill response before offshore oil and gas drilling proceeds (see section 7).

Although the amount of oil spilled annually in the world's oceans has trended downward in recent years, even as production has increased, the SINTEF Offshore Blowout Database includes 573 offshore blowouts/well releases that have occurred worldwide since 1955, suggesting that such incidents are not

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uncommon.[51] There is no clear trend regarding the frequency of well blowouts and amount of oil spilled from blowouts. However, oil exploration and extraction activities are moving into ever-deeper waters under higher pressure, in stormier and icier seas, in more remote area, all of which increases potential risks as deep-water blowouts are much harder to cap, tend to last longer and result in the release of larger quantities of oil.[52]

According to the SINTEF database, an average of 2.3 well releases or blowouts per year occurred in the U.K. and Norwegian waters between 1980 and 2008. Even after the Deepwater Horizon catastrophe, there were seven losses of well control – the precursor to a blowout – in the Gulf of Mexico between 2010 and 2015. Operators are attempting increasingly technically ambitious operations; they are expanding their operations to new, often environmentally sensitive areas, such as the Arctic; and the industry continues to tackle ever more challenging projects. In the Scotian Basin, for instance, BP plans to drill in nearly 3,000 metres of water — much deeper than the water in which the Deepwater Horizon accident occurred.

In terms of the actual likelihood of a well blowout in the Arctic (which is deemed "unlikely" in the *Preliminary Findings Report*), data are inconclusive but the possibility of such an event cannot be ruled out. Bercha (2010) estimates the blowout frequency value for exploratory wells is between 1 in 100 and 1 in 10,000 but notes that "the consequences of spills in the Arctic may be much greater (than non-Arctic regions) thus exacerbating associated risks."[53]

It would be useful for the Strategic Environmental Assessment to provide a numeric estimate of the potential likelihood of a well blowout or major spill in the Arctic should oil and gas activity proceed in the offshore. For instance, in 2014 the U.S. Bureau of Ocean Energy Management (BOEM) estimated that, based on "considerable historical data" and "statistical estimates," there is a 75 per cent chance of one or more large spills (over 1000 barrels of oil) occurring over the course of 64 years of production (project lifespan) if leases are developed in the Chukchi Sea area north of Alaska, and a 25 percent chance of no spills occurring over this time.[54]

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[51] SINTEF Offshore Blowout Database. https://www.sintef.no/en/projects/sintef-offshore-blowout-database/
[52] Jernelov, A. July 2010. The Threats from Oil Spills: Now, Then and in the Future. *Ambio*. 39(5-6): 353-366. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3357709/
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6.3 Chronic spills and pollution

Summary: While the environmental impacts of a single small spill or leak are likely to be minimal, the cumulative impacts of many small spills or an ongoing, chronic leak can be significant. These impacts may persist in the offshore environment for many years.

If you look at any aerial photograph of a working oil rig or production platform, it is not uncommon to see a sheen of oil running away downstream of the structure. The most common sources are drips from gas flares, deck spills of diesel fuel, and discharges of produced water (usually the biggest contributor).[55] In stormy, temperate, ice-free waters, most of this chronic, low-level pollution eventually evaporates or dissipates; in the Arctic it would be more likely to accumulate, particularly in winter.[56]

Water can come out of an oil or gas well for two main reasons: some of it is trapped in the reservoir rocks with the hydrocarbons; and some of it (often in the form of brine) is deliberately pumped down the well to maintain reservoir pressure and assist the drilling process in various ways. This produced water is supposed to be treated on board, to remove any significant quantities of oil, prior to discharge. However, produced water can be a significant source of chronic oil pollution and usually also contains heavy metals, low-level radioactivity, traces of drilling fluid additives and poly-aromatic hydrocarbons. Its toxicity to sea life is proven and should be of at least equal concern to drill cuttings contaminated with water-based mud (WBM).

How bad is chronic pollution from offshore drilling? Because governments rely almost exclusively on pollution reports provided by the polluters themselves (who are subject to fines and other sanctions for spills), it is difficult to know for sure the true extent of the problem. A 2007 estimate by the European Environment Agency indicates that between 1 and 3 million tonnes per year of oil enters the global marine environment, of which 24 per cent is from marine transport (18 per cent from operational ship discharges and 6 per cent from accidental spills) and 3 per cent from offshore extraction.[57] More recent figures for oil discharges from offshore oil and gas installations indicate that 4231 tonnes of oil (discharges and spills) entered the North Sea in 2014.[58] In the Newfoundland offshore, there were 39 leaks reported to the Canada Newfoundland-Labrador Offshore Petroleum Board in 2011 amounting to more than 34,000 litres spilled,

> ***'In the Newfoundland offshore, there were 39 leaks reported to the Canada Newfoundland-Labrador Offshore Petroleum Board in 2011 amounting to more than 34,000 litres spilled.'***

[55] Wills, Jonathan W.G. 2016. *Out of Sight, Out of Mind? Chronic polluting discharges from marine oil and gas installations.* Paper presented at WWF-Canada's Offshore Oil & Gas Symposium, Sept. 27-28, 2018. Ottawa.
[56] The 2014 Joint Industry Program report and literature review, Environmental Impacts of Arctic Oil Spills and Arctic Spill Response Technologies, goes into some detail on the effect of low temperature and ice on 'natural' dispersion of spilled oil. It also tells us how little is currently known about where spilled oil will end up in the Arctic.
[57] European Environment Agency. 2007. *Europe's Environment—the Fourth Assessment*. European Environment Agency, Copenhagen.
[58] OSPAR Commission. 2016. *OSPAR report on discharges, spills and emissions from offshore oil and gas installations in 2014*. OSPAR Commission, London.

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according to estimates provided by offshore operators. The U.S. Bureau of Ocean Energy Management (BOEM) Environmental Impact Statement (EIS) for Oil and Gas Lease Sale 193 in the Chukchi Sea stated that, in the history of Alaskan offshore drilling "small spills (<1000 barrels) have occurred with generally routine frequency and are considered likely to occur from both Exploration and Development and Production activities."[59] While the BOEM speculates that most small spills would either evaporate or be contained by booms or absorbent pads, the EIS estimates that roughly 800 small spills would occur over the course of the 77-year production scenario.

In addition, in 2012 the Gulf Monitoring Consortium found evidence of non-reporting and chronic under-reporting of oil spills in the Gulf of Mexico,[60] a conclusion later validated by researchers at Florida State University in a peer-reviewed study who found that oil slicks from chronic leaks were typically 13 times larger than the estimates reported to the National Response Center in the U.S.[61] Researchers found that small oil spills — ranging from oil-drilling mishaps to ships discharging fuel — occur with surprising regularity, and tend to escape the public's attention that follows big spills.

Between October 1, 2010 and September 30, 2011, a total of 2903 oil or refined petroleum (e.g. diesel fuel) spills were reported in the Gulf region. Seventy-seven per cent (2221) of those reports did not include an estimate of the quantity of oil spilled. Forty-five per cent (1311) identify a suspected responsible party – a strong indicator that those reports were submitted by the actual polluters – and of those, nearly half (620) do not include any spill amount.[62]

Of note, the Taylor oil spill in the Gulf of Mexico has been leaking an estimated 10,000-30,000 gallons of oil per day since 2004. By some estimates, the chronic leak could soon be larger, cumulatively, than the Deepwater Horizon disaster, which dumped up to 176.4 million gallons (or 4.2 million barrels) of oil into the Gulf. That would also make the Taylor spill one of the largest offshore environmental disasters in US history. As for how much oil has been leaked since the beginning of the spill, it's hard to say. An estimate from SkyTruth, a satellite watchdog organization, put the total at 855,000 to 4 million gallons by the end of 2017.[63]

In conclusion, while the environmental impacts of a single small spill are likely to be minimal, the cumulative impacts of many small spills can be significant. Discharges of water-based and low-toxicity oil-based drilling muds and produced water can extend over 2 km, while the ecological impacts at the population and community levels on the seafloor are most commonly on the order of 200–300 m from their source. These impacts may persist in the deep sea for many years and likely longer for its more

[59] Bureau of Ocean and Energy Management. 2015. *Chuckchi Sea Oil and Gas Lease Sale 193.* https://www.boem.gov/ak193/
[60] Gulf Monitoring Consortium. 2012. *Report on Activities from April 2011 to October 2011.* http://gulfmonitor.org/wp-content/uploads/2012/05/Gulf-Monitoring-Consortium-Report.pdf
[61] Daneshgar Asl, S. et al. 2014. Chronic, anthropogenic hydrocarbon discharges in the Gulf of Mexico. Topical Studies in Oceanography. Vol. 129, pages 187-195. https://www.sciencedirect.com/science/article/pii/S0967064514003506
[62] Gulf Monitoring Consortium. 2012.
[63] Covington, R. December 29, 2017. *Taylor Energy Cumulative Spill Report – 2017 Update.* https://skytruth.org/2017/12/taylor-energy-site-23051-cumulative-spill-report-2017-update/

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fragile ecosystems, such as the Arctic.[64] A range of biological effects can result from chronic oil inputs such as repeated small spillages in coastal waters, with those effects ranging from localized and subtle to severe and long lasting.[65] In the UK sector of the North Sea there is evidence to show that the impacts of drilled cuttings (solid material removed from drilled rock, together with muds and chemicals) containing oil-based muds can persist for at least 6–8 years where cutting piles accumulate at the base of a drilling platform.[66]

Experiments into the impacts of sediments from offshore drilling activities, including large amounts of drilling cuttings have shown a significant reduction in number of taxa, abundance, biomass and diversity when cuttings were added to natural sedimentation thresholds.[67] [68] The disturbance caused by drilling has been shown to have an impact on deep-water megafaunal density and diversity, for example, with recovery and recolonization being only partial after 3 years, and the effects of such activities being still visible after a decade.[69] Colonies of the cold-water corals, *Lophelia pertusa*, have been identified around many oil and gas platforms in the northern North Sea,[70] and there is evidence to suggest that coverage of coral colonies by sediments, including cuttings from oil platforms, is sufficient to damage or even kill such colonies, despite their resilience to short-term sedimentation events.[71] [72]

[64] Cordes, Erik E. et al. Environmental Impacts of the Deep-Water Oil and Gas Industry. *Environmental Science.* September 2016. https://www.frontiersin.org/articles/10.3389/fenvs.2016.00058/full
[65] Dicks, B. & J. R. Hartley, 1982. The effects of repeated small oil spillages and chronic discharges. Philosophical Transactions of the Royal Society of London, Series B, Biological Sciences 297: 285–307.

[66] Henry, L.-A., D. Harries, P. Kingston & J. M. Roberts, 2017. Historic Scale and persistence of drill cuttings impacts on North Sea benthos. Marine Environmental Research 129: 219–228.

[67] Schaanning, M. T., H. C. Trannum, S. Øxnevad, J. Carroll & T. Bakke, 2008. Effects of drill cuttings on biochemical fluxes and macrobenthos of marine sediments. *Journal of Experimental Marine Biology and Ecology* 361: 49–57.
[68] Trannum, H. C., H. C. Nilsson, M. T. Schaanning & S. Øxnevad, 2010. Effects of sedimentation from water-based drill cuttings and natural sediment on benthic macrofaunal community structures and ecosystem processes. *Journal of Experimental Marine Biology and Ecology* 383: 111–121.
[69] Jones, D. O. B., A. R. Gates & B. Lausen, 2012. Recovery of deep-water megafaunal assemblages from hydrocarbon drilling disturbance in the Faroe-Shetland channel. *Marine Ecology Progress* Series 461: 71–82.
[70] Gass, S. E. & J. M. Roberts. 2006. The occurrence of the cold-water coral *Lophelia pertusa* (Scleractinia) on oil and gas platforms in the North Sea: colony growth, recruitment and environmental controls on distribution. Marine Pollution Bulletin 52: 549–559.
[71] Allers, E., R. M. M. Abed, L. M. Wehrmann, T. Wang, A. I. Larsson, A. Purser & D. de Beer. 2013. Resistance of *Lophelia pertusa* to coverage by sediment and petroleum drill cuttings. Marine Pollution Bulletin 74: 132–140.
[72] Larsson, A. I., D. van Oevelen, A. Purser & L. Thomsen. 2013. Tolerance to long-term exposure of suspended benthic sediments and drill cuttings in the cold-water coral *Lophelia pertusa*. Marine Pollution Bulletin 30: 176–188.

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6.4 Shipping

Summary: Vessel traffic in the Canadian Arctic is on the rise, which is increasing the risk to marine habitats. Conflicts with marine mammals, underwater noise, disturbance of ice habitat, heavy fuel oil, sewage and grey water, and oil spills are all part of the complex risk profile which shipping brings to the Arctic.

Recommendation: Increased shipping traffic due to offshore oil and gas will need to be strictly managed to minimize conflicts with marine mammals and underwater noise from ships, protect ice habitats, eliminate the use of heavy fuel oil, restrict sewage and grey water discharge, reduce greenhouse gas emissions and improve spill response.

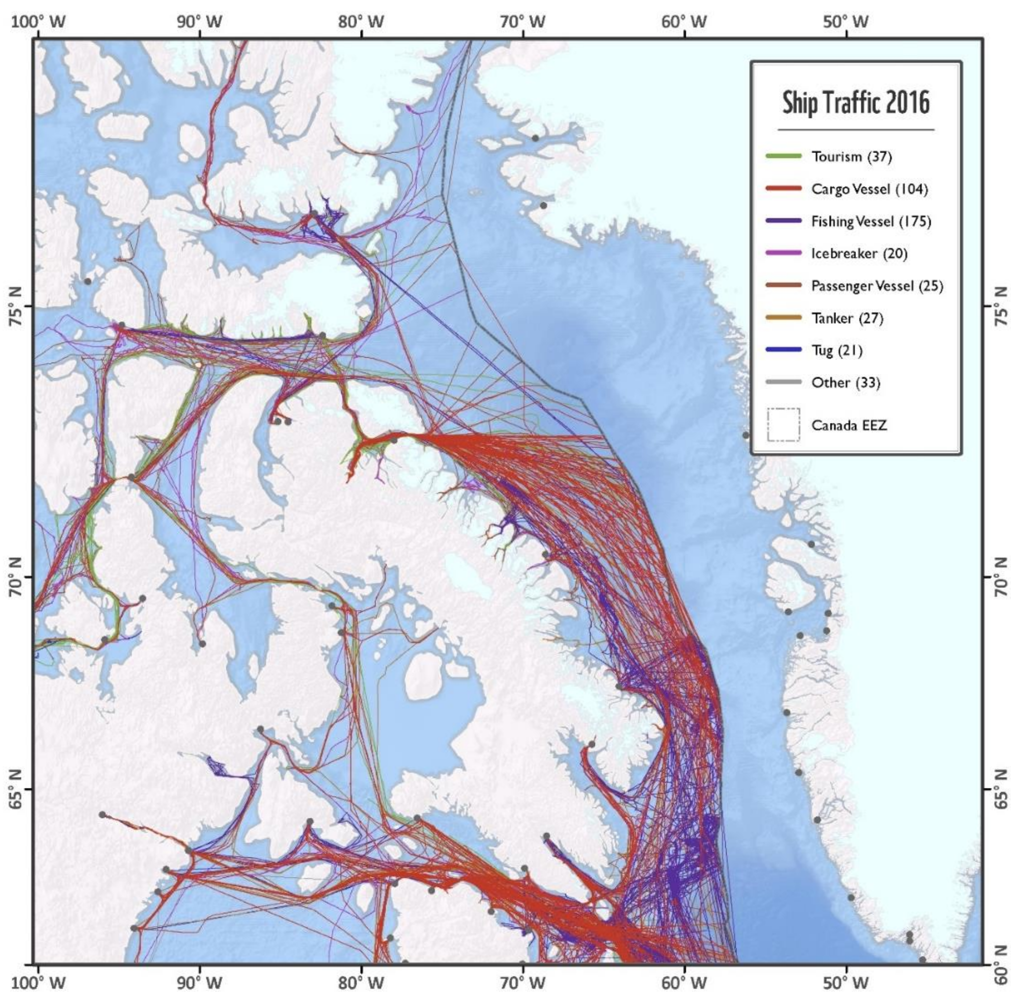

Figure 12: Ship transits in the SEA area of focus, 2016

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6.4.1 Overview

Vessel traffic in the Canadian Arctic is on the rise. In the Northwest Passage, ship traffic has doubled within the past decade, a phenomenon that is only expected to increase.[73] The development of offshore oil and gas related activities in Baffin Bay and Davis Strait will result in an additional increase in vessel traffic due to the offshore support vessels (OSVs) that are used to carry out different operations necessary for floating drilling rigs, as well as moored or fixed production platforms. The OSVs not only help in exploration and drilling of oil but also for providing necessary supplies to the excavation and construction units located at the high seas. These vessels include: seismic survey ships, platform supply vessels (PSV), anchor handling tugs, anchor handling tug and supply vessels (AHTS), offshore construction vessels (OCV), ROV support vessels, dive support vessels, stand-by vessels, inspection, maintenance and repair vessels (IMR).[74]

As the number of voyages rises so do the risks to marine habitats, which many northern and Indigenous people rely on for food and cultural practices. If not properly managed, these new stresses could put northern ecosystems and cultures at risk. Conflicts with marine mammals, underwater noise, disturbance of ice habitat, heavy fuel oil, sewage and grey water, and oil spills are all part of the complex risk profile which shipping brings to the Arctic.

‘In the Northwest Passage, ship traffic has doubled within the past decade, a phenomenon that is only expected to increase.’

6.4.2 Disturbance and conflicts with marine mammals

The Arctic is home to a remarkable number of marine mammals, such as bowhead whales, belugas, narwhals, walruses and seals. The increase in OSVs required to service development would results in more overlap of ship traffic with marine mammal habitats and species. New shipping regulations, termed the *International Code for Ships Operating in Polar Waters (Polar Code)*[75], establish an international framework for protecting polar regions. Under the new Polar Code requirements, when planning a ship’s route through polar waters, masters must consider "current information and measures to be taken when marine mammals are encountered relating to known areas with densities of marine mammals, including seasonal migration areas," (paragraph 11.3.6) and "current information on relevant ships' routing systems, speed recommendations and vessel traffic services relating to known areas with densities of marine mammals, including seasonal migration areas" (paragraph 11.3.7).

[73] Dawson, J., Pizzolato, L., Howell, S. E. L., Copland, L., & Johnston, M. E. 2018. Temporal and Spatial Patterns of Ship Traffic in the Canadian Arctic from 1990 to 2015, 71(1), 15–26. https://doi.org/10.14430/arctic4698
[74] Encyclopedia of Marine Technology. Offshore Support Vessels. https://www.wartsila.com/encyclopedia/term/offshore-support-vessels-(osvs)
[75] International Code for Ships Operating in Polar Waters. International Maritime Organization. http://www.imo.org/en/MediaCentre/HotTopics/polar/Documents/POLAR%20CODE%20TEXT%20AS%20ADOPTED.pdf

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Since the Polar Code was formally adopted, WWF-Canada, as well as other partners, have endeavoured to implement the new voyage planning requirements. A consistent theme in response to our engagement has been a lack of knowledge on where to obtain this type of marine mammal data and how to integrate it into voyage planning.

OSVs in Baffin Bay and Davis Strait would need to adhere to the Polar Code requirements by considering marine mammal data in their voyage plans and adhering to mitigation measures, such as: buffer zones around known habitats, seasonal restrictions, and speed reductions. It should be noted that a lack of data on marine mammal habitats and behavioral responses of marine mammals in response to ships makes this challenging and the risks to species can be reduced but not eliminated.

6.4.3 Underwater noise from ships

Many marine species, including most mammals, many fish, and perhaps even some invertebrates rely on sound for sensing their environment. Marine mammals rely on sound to find prey, avoid predators, communicate with other members of their species, and facilitate mating.[76] Whales can identify environmental features and use the sounds of the ocean, such as ice cracking or waves breaking on shorelines, to direct their migrations. The development of offshore oil and gas related activities will turn up the volume of underwater noise in Baffin Bay and Davis Strait to which marine mammals are exposed.[77]

Ship noise is generated primarily from propeller cavitation, propeller singing, and propulsion or other reciprocating machinery.[78] [79] [80] This noise can have short- and long-term effects on marine mammals, including changes in behavior, masking of important sounds, temporary or permanent hearing loss, physiological stress, and changes in prey availability. The behavioral responses of marine mammals to ship noise are complex and poorly understood. Responses may depend on hearing sensitivity, behavioral state, habituation or desensitization, age, sex, presence of offspring, location of exposure, and proximity to a shoreline. Displacement could result in negative consequences, such as changes in food availability,

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[76] Tyack P.L. 2008. Implications for marine mammals of large-scale changes in the marine acoustic environment. Journal of Mammalogy 89(3):549_558 DOI 10.1644/07-MAMM-S-307R.1.

[77] Potter, J., E. Delory. 1998. Noise sources in the sea and the impact for those who live there. Acoustics and Vibrations, Asia, 98.

[78] Wales, S.C., R.M. Heitmeyer. 2002. An ensemble source spectra model for merchant ship- radiated noise. The Journal of the Acoustical Society of America 111(3):1211_1231 DOI 10.1121/1.1427355.

[79] Hildebrand J.A. 2009. Anthropogenic and natural sources of ambient noise in the ocean. Marine Ecology Progress Series 395:5_20 DOI 10.3354/meps08353.

[80] Richardson, W.J., C.R. Greene, C.I. Jr. Malme, D.H. Thomson. 1995. Marine mammals and noise. Academic Press, New York, NY.

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which would likely affect energy budget and fitness.[81] The possible increase in animal density caused by displacement could also result in increased competition and predation.[82]

Unlike in temperate oceans, seasonal freezing of the Arctic Ocean's surface means that icebreaking ships are used in the Arctic. Icebreakers produce a different noise signature compared to other vessels, generating higher and more variable noise levels.[83] In the presence of sea ice cover, ships are likely to prefer routes through open water for easier passage. These can be hotspots for marine mammals, thereby increasing the chances of their interactions with ships. Many of the marine mammals that would be exposed to ship noise in the Arctic are currently industrially-naïve populations.

Underwater shipping noise should be decoupled from shipping traffic growth by investing in quiet ship technology (e.g. silent propellers) and operational measures (speed reduction). A precautionary and "hold the noise" approach is needed in Arctic waters at current levels until safe noise levels can be determined.

6.4.4 Ice operations and the protection of ice habitat

Sea ice serves as an important habitat, therefore, shipping through sea ice could lead to increased negative interactions with ice-bound marine mammals.[84] For example, ships breaking ice through the breeding grounds of seals have resulted in direct mortality from collisions.[85] Seal pups that are concealed in lairs are especially vulnerable.[86, 87] Operations through sea ice creates channels of brash ice, which may remain if the ice does not refreeze rapidly. Seals use these channels as leads into the ice and often create whelping sites along the edge of these open channels.[88] This places them at risk of ship strikes from further shipping in the same channel.

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[81] Canadian Science Advisory Secretariat, and Canada Department of Fisheries and Oceans, Central and Arctic Region. 2014. *Science review of the final environmental impact statement addendum for the early revenue phase of Baffinsland's Mary River project*. http://publications.gc.ca/collections/collection_2014/mpo-dfo/Fs70-7-2013-24-eng.pdf.
[82] Stewart, R.E.A., V. Lesage, J.W. Lawson, H. Cleator and K.A. Martin. 2012. *Science Technical Review of the draft Environmental Impact Statement (EIS) for Baffinland's Mary River Project*. DFO Can. Sci. Advis. Sec. Res. Doc. 2011/086. vi + 62 p.
[83] Erbe, C., Farmer, D.M. (2000). Zones of impact around icebreakers affecting beluga whales in the Beaufort Sea. *The Journal of the Acoustical Society of America* 108:1332_1340 DOI 10.1121/1.1288938.
[84] Huntington H.P. 2009. A preliminary assessment of threats to arctic marine mammals and their conservation in the coming decades. *Marine Policy* 33: 77–82.
[85] Anon. 1982. *The biological effects of hydrocarbon exploration*. TD 195.P4 B4 Doc 24. Emar Library, Fisheries and Oceans Canada. 62981 05012599 c.1.
[86] Frost, K. J. and Lowry, L. F. 1981. Ringed, Baikal and Caspian seals *Phoca hispida* Schreber, 1775; Phoca sibirica Gmelin, 1788; and Phoca caspica Gmelin, 1788. In: S. H.
[87] Gjertz, I. and Lydersen, C. (1986), The ringed seal *(Phoca hispida)* spring diet in northwestern Spitsbergen, Svalbard. *Polar Research*, 4: 53–56. doi:10.1111/j.1751-8369.1986.tb00518.x
[88] Härkönen, T., M. Jüssi, M. Baimukanov, A. Bignert, L. Dmitrieva, Y. Kasimbekov, M. Verevkin, S. Wilson, and S.J. Goodman. 2008. Pup Production and Breeding Distribution of the Caspian Seal (*Phoca caspica*) in Relation to Human Impacts. *J Hum Environ Syst*. 37(5):356-361. doi: 10.1579/07-R-345.1

It has been speculated that operations through sea ice was the cause of a few recent ice entrapment occurrences.[89] The passage of a ship creates a temporary opening in the sea ice, which can act as an artificial polynya. This can confuse marine mammals, causing them to become trapped too far from the ice edge as the channel eventually refreezes.

OSV activities should not be done at a time when there would be negative iterations to the habitats of sea ice.

6.1.1 Heavy Fuel Oil (HFO)

HFO is a polluting fossil fuel used to power ships all over the world. HFO poses risks for both the marine environment and climate wherever it's used, but if it spilled in Arctic waters, HFO breaks down even more slowly and will have long term, devastating effects on both livelihoods and ecosystems. HFO is impact on already banned in the Antarctic because of its potential spill wildlife. HFO is also the source of harmful and significantly higher emissions of air pollutants, including sulphur oxide, nitrogen oxide, particulate matter, and black carbon. When emitted and deposited on Arctic snow or ice, the climate warming effect of black carbon is at least three times more than when emitted over open ocean. Because of these reasons, all ships, including OSVs, should be banned from the use and carriage for use of HFO as fuel in Arctic shipping.

The use and carriage of HFO for OSV ships must be eliminated in the Baffin Bay and Davis Strait region.

6.1.2 Sewage and grey water discharges

Negative effects of sewage discharge in the Arctic include: human health risks from eating fish contaminated with faecal-contaminated waters[90] and the potential introduction of invasive species[91]. The low light and temperature conditions in the Arctic amplify the environmental impacts since the decomposition is slowed and the Arctic is less tolerant to rapid changes in the nutrient status of the water column or seabed.

Grey water is the discharge from the sinks, showers and galleys on ships, but does not include drainage from toilets. It can contain a wide variety of polluting substances, such as faecal coliform bacteria (from human waste), food waste, oil and grease, detergent and soap residue, metals, solids and nutrients. Grey water has pollutant levels comparable to untreated sewage[92] [93] and can have harmful environmental impacts such as: dead zones caused by excessive algal growth as a result of excess

[89] Laidre, K., M. Heide-Jørgensen, H. Stern, and P. Richard. 2012. Unusual narwhal sea ice entrapments and delayed autumn freeze-up trends. *Polar Biol*. 35: 149-154.
[90] Vessel Pollution and Dangerous Chemicals Regulations. SOR/2012-69
[91] Smith, J.J., & Riddle, M., 2009. Sewage disposal and wildlife health on Antarctica. In Kerry, Knowles & Riddle (Eds.) *Health of Antarctic Wildlife: A Challenge for Science and Policy*. Springer, Berlin Heidelberg, pp 271 – 315
[92] United States' Submission to the 44th Session of the Marine Environment Protection Committee of the International Maritime Organization. "Interpretations and Amendments of MARPOL 73/78 and Related Codes; Proposed Amendments to MARPOL Annex IV". December 1999.
[93] Meyer Werft. 2011. Cruise ship wastewater Science Advisory Panel (SAP) 22th September 2011, Basic information on system integration waste water treatment in ship building and data collection for the report http://dec.alaska.gov/water/cruise_ships/sciencepanel/documents/binder/meyer-werft-presentation.pdf

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nutrients[94] [95], oil and grease coating the gills of fish and preventing respiration[96], the suffocation of small benthic species due to increased particulate matter[5], and the introduction of invasive species[6].

Shipping activity as the result of development of offshore oil and gas related activities in Baffin Bay and Davis Strait would subsequently increase the amount of sewage and grey water being discharged in arctic waters.

Discharge standards and treatment systems for OSVs should be established, either onboard vessels or ashore.

6.1.3 Oil spill response

Though the chances of a large-scale oil spill in the Arctic are currently small from shipping in the Arctic, the consequences would be significant and likely devastating: contamination of important habitat for wildlife such as polar bears, walrus, seabirds and seals, as well as narwhals, belugas and bowhead whales; long-term destruction of fish habitat, a staple of the Arctic community and Indigenous diet; and wide-reaching contamination if oil gets trapped under sea ice and travels to communities hundreds of kilometres away.

With any increased vessel traffic, such as that associated with oil and gas development in the Baffin Bay and Davis Strait, the risks and likelihood of a catastrophic spill go up. Through a series of reports[97][98], WWF commissioned research has shown that major weaknesses in response preparedness currently exist in the Canadian Arctic.

The research uncovered major issues with the state and availability of oil-spill response equipment, limited training resources and unreliable communications infrastructure. The reports found that:

- Only a small number of coastal communities have access to the most basic oil-spill response equipment from the Canadian Coast Guard.
- The communities that do have equipment say it is irregularly maintained, too few community members are trained to use it, and that some communities don't have a key to access the storage containers.

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[94] Smith, J.J., & Riddle, M. 2009. Sewage disposal and wildlife health on Antarctica. In Kerry, Knowles & Riddle (Eds.) *Health of Antarctic Wildlife: A Challenge for Science and Policy*. Springer, Berlin Heidelberg, pp 271 – 315. 15 DE 53/18/3 Shipping Management Issues to be Addressed. Submitted by FOEI, IUCN, Greenpeace, IFAW and WWF.
[95] Karydis, M. 2009. Eutrophication assessment of coastal waters based on indicators: a literature review. *Global NEST Journal*, Vol 11, No 4, pp 373 – 390. http://journal.gnest.org/sites/default/files/Journal%20Papers/373-390_626_KARYDIS_11-4.pdf
[96] Cruise Ships: Testing the Waters in Alaska. By Bob King, Alaska Office of the Governor. *Coastal Services Magazine*. https://georgiastrait.org/wp-content/uploads/2015/02/CruiseControl_WCEL.pdf
[97]WWF-Canada. 2017. *Oil Spill Response Capacity in Nunavut and the Beaufort Sea.* http://awsassets.wwf.ca/downloads/170405___oilspillresponsecapacitybeaufort_web_1.pdf?_ga=2.179021412.1365332665.1548946024-1557385918.1525705316
[98] Ibid.

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- Harsh weather conditions, periods of prolonged darkness and the presence of sea ice make most standard oil-spill response equipment ineffective.
- Remote locations mean response times for large-scale cleanup and storage equipment can be more than 10 times longer than in waters south of 60 degrees' latitude.
- Ships are not required under Canadian law to carry their own spill response equipment or to have contracted response capacity in the Arctic.
- Lack of reliable communications infrastructure makes it difficult for communities to call for assistance, and for responders to communicate with those on land during an oil-spill response.
- In the Canadian Arctic, there are no legal requirements to ensure that sufficient people and equipment could respond to a spill from a ship, nor any requirements that such a response would occur within a certain amount of time.

In the Baffin Bay and Davis Strait region, WWF-Canada recommends the following:

- As the people who know the environment and its resources best and who have the most to lose from damages caused by a spill, community members should have a greater role in decision-making that shapes the future of shipping. By consulting with communities and Indigenous organizations and by using both scientific and traditional knowledge, preferred shipping routes and areas to be avoided can be identified to reduce as much as possible conflicts with wildlife and important habitats.
- Phase out the use and carriage by ships of HFO, the most hazardous, persistent, and difficult to clean up of any marine fuel in the Arctic.
- Develop community-based response plans.
- Local knowledge and engagement is essential for effective response, and in the Arctic, community members often act as first responders because of remoteness and weather.
  - Increase funding for training of community responders.
  - Invest in equipment and capacity in the north to align standards with the south. Permanent assistance vessels along shipping routes could be deployed in the shipping season and more equipment could be stockpiled along these corridors.
- Require ships transiting the Arctic to carry adequate response equipment on board.
- Ship crews should be trained to provide effective damage control and minor hull repairs.

6.1.4 Greenhouse gas (GHG) emissions

Recent findings from the Intergovernmental Panel on Climate Change (IPCC) special report[99] on the impacts of global warming finds that limiting warming to 1.5°C would require "rapid and far-reaching"

[99] Intergovernmental Panel on Climate Change. 2018. *Global warming of 1.5°C. An IPCC Special Report on the impacts of global warming of 1.5°C above pre-industrial levels and related global greenhouse gas emission*

transitions in land, energy, industry, buildings, transport, and cities. Global net human-caused emissions of carbon dioxide would need to fall by about 45 per cent from 2010 levels by 2030, reaching 'net zero' around 2050. For instance, by 2100, global sea level rise would be 10 cm lower with global warming of 1.5°C compared with 2°C. The likelihood of an Arctic Ocean free of sea ice in summer would be once per century with global warming of 1.5°C, compared with at least once per decade with 2°C. Coral reefs would decline by 70-90 per cent with global warming of 1.5°C, whereas virtually all (> 99 percent) would be lost with 2°C.

The IPCC has said to limit warming to 1.5°C there are 12 years before it's too late and the globe will be on a pathway to 2°C warming. For the shipping sector, the International Maritime Organization (IMO) framework agreement on GHG reductions has committed '…to peak GHG emissions from international shipping as soon as possible and to reduce the total annual GHG emissions by at least 50 per cent by 2050 compared to 2008…'. Specifically, (Smith et al. (2015) international shipping's carbon budget under a 2°C global warming scenario is 33 Gt of CO2, a 1.5°C scenario allows for only 18 Gt. Given this reality, 'rapid and far reaching' transformation within the shipping sector is imperative to reach these goals. Consideration should be given to project specific GHG reduction targets for OSVs.

6.2 Cumulative Effects

Page 85 of the *Preliminary Findings Report* (section 7.2.1) acknowledges the possibility for cumulative effects but states that, in general, cumulative effects to marine habitat will be small to moderate and short-term. It is not clear how this conclusion was reached as it are not substantiated by evidence. Direct studies of natural recovery from drilling in deep water are lacking and the cumulative effects of multiple drilling wells are not well-studied.[100]

Climate change is already dramatically changing the Arctic marine ecosystem and this is expected to continue. Moreover, as shown in section 6.4 of this submission, vessel traffic in the Canadian Arctic is on the rise. In the Northwest Passage, ship traffic has doubled within the past decade, a phenomenon that is only expected to increase.[101] The development of offshore oil and gas related activities in Baffin Bay and Davis Strait will add another stressor into the environment through additional noise and pollution, as well as an increase in vessel traffic due to the offshore support vessels (OSVs) that are used to carry out different operations necessary for floating drilling rigs, as well as moored or fixed production platforms.

As industrial activity in the Arctic rises so do the pressures on and risks to marine life, which most northern and Indigenous people rely on for food and cultural practices. If not properly managed, these

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pathways, in the context of strengthening the global response to the threat of climate change, sustainable development, and efforts to eradicate poverty. https://www.ipcc.ch/sr15/

[100] Cordes, E. et al. September 2016. 'Environmental Impacts of the Deepwater Oil and Gas Industry: A Review to Guide Management Strategies. *Frontiers in Environmental Science*. https://doi.org/10.3389/fenvs.2016.00058

[101] Dawson, J., Pizzolato, L., Howell, S. E. L., Copland, L., & Johnston, M. E. 2018. *Temporal and Spatial Patterns of Ship Traffic in the Canadian Arctic from 1990 to 2015*. 71(1), 15–26. https://doi.org/10.14430/arctic4698

new stressors could put northern ecosystems and cultures at risk. Conflicts with marine mammals, underwater noise, chronic leaks from platforms, seismic blasting, disturbance of ice habitat, heavy fuel oil, sewage and grey water, and oil spills are all part of the existing complex risk profile upon which oil and gas activities will be layered in the Arctic.

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7. OIL SPILL RESPONSE CAPACITY IN THE EASTERN CANADIAN ARCTIC

Summary: Oil spills represent one of the biggest threats to the Arctic marine environment. Significant legislative, capacity, information and funding gaps exist in the current spill response framework across the Canadian Arctic, including Baffin Bay and Davis Strait. There is currently no method that has been proven effective and reliable in dealing with major oil spills in the Arctic offshore environment.

Recommendation: Immediate steps, including substantial investment, must be taken to provide adequate response capacity and infrastructure support if offshore oil and gas activities are to take place in the eastern Arctic. A formal review of Canada's capacity to respond to major spills in the Arctic is needed, and a comprehensive, long-term spill response research program should be established.

An Arctic oil spill from shipping or a well blowout would devastate the surrounding marine environment, potentially destroying habitat for polar bears, seals, walrus, sea birds, as well as beluga, narwhal and bowhead whales. These consequences would be mainly borne by the communities, not the responsible parties. Arctic communities depend on healthy and clean waters for much of their food, and their cultural and spiritual well-being is tied to their environment. Although the Canadian Coast Guard (CCG) has developed national, regional, and area response plans, these plans rely on capacities and methods that may not exist or cannot be adapted in remote communities to respond to a major offshore spill.

Simply put, there is currently no method that has been proven effective and reliable in dealing with major oil spills in the Arctic offshore environment.[102] Even in the Alaska, which has more experience with offshore drilling, more infrastructure in place and a legal requirement that equipment be on-hand within 24 hours to cap well blowouts, the head of the U.S. Coast Guard has stated that the country is not prepared to clean up an oil spill in the Arctic.[103] Admiral Paul Zukunft said that the challenges of cleaning up the BP Deepwater Horizon oil spill in 2010 in the Gulf of Mexico—where the conditions were much more favorable—show the extreme difficulty of Arctic oil spill recovery.

> *"We saw during Deepwater Horizon, whenever the seas are over four feet, our ability to mechanically remove oil was virtually impossible. Four-foot seas up there [in the Arctic] would probably be a pretty darned good day…., anywhere in the world except the Arctic, you can get booms, you can get platforms, you can get people and material there. In the Arctic, it's almost like trying to get it to the moon in some cases, especially if it's in a season where it's inaccessible; that really doubles, triples the difficulty of responding."*

[102] U.S. National Academy of Sciences. 2003. *Cumulative Environmental Effects of Oil and Gas Activities on Alaska's North Slope.* National Research Council. http://www.nap.edu/read/10639/chapter/1
[103] Waldman, S. July 19, 2017. The U.S. Is Not Ready to Clean Up an Arctic Oil Spill. *Scientific American.* https://www.scientificamerican.com/article/the-u-s-is-not-ready-to-clean-up-an-arctic-oil-spill/

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Notably, in 2011, the National Energy Board (NEB) commissioned a study on the spill response effectiveness in the Western and Eastern Arctic.[104] The study aimed to estimate when and how long primary recovery and cleanup techniques would be unavailable due to environmental factors, including wind, waves, visibility, and darkness. The Report states that for the Eastern Arctic and Davis Strait, oil spill response will only be possible during August and December 15-65% of the time.[105] WWF-Canada believes that this demonstrates a 'response gap' – i.e. a gap that exists when activities may cause an oil spill are conducted when effective response cannot be achieved.[106]

'There is currently no infrastructure in coastal communities throughout Nunavut to support the required level of vessel capacity even for a single offshore drilling platform.'

7.1 Existing Arctic oil spill response capacity, framework and standards

As noted in the Preliminary Findings report (6.2.3), offshore oil and gas operations in Baffin Bay and Davis Strait "would be expected to include" significant and ongoing vessel support due to an absence of deep-water ports in the region. However, In the Canadian Arctic, there are no actual legal requirements to ensure that sufficient people and equipment could respond to a spill from a drilling rig or a ship, nor any requirements that such a response would occur within a certain amount of time. This is a serious shortcoming that must be addressed before any offshore oil and gas activity takes place in Baffin Bay and Davis Strait.

Other countries, including Russia and China, have already constructed deep-water ports and are preparing for more Arctic exploration. Canada is not sufficiently prepared for Arctic oil spills and does not yet even have adequate capability of icebreakers that can access hard-to-reach areas.

The Preliminary Findings report states that a capacity of up to 12 vessels would be required to support a drilling platform in the Arctic. There is currently no infrastructure in coastal communities throughout Nunavut to support the required level of vessel capacity below, even for a single offshore drilling platform. Support vessels required include the following:

- 1–2 icebreaker support vessels;
- 1–2 wareships, any anchored vessel for offshore storage to carry fuel, drilling materials and other supplies; store and ship waste products; provide maintenance and repair operations, and support helicopter, well control, and oil spill response operations;
- 2–3 supply vessels to transport fuel, drilling materials, other supplies, waste products, personnel;
- between drilling unit vessels and the wareship or shore facilities. If required, these would support well control operations and oil spill response operations;

[104] SL Ross Environmental Research Ltd. 2011. Spill Response Gap Study for the Canadian Beaufort Sea and the Canadian Davis Strait. Commissioned by the National Energy Board, available at: https://www.neb.gc.ca/ll-eng/livelink.exe?func=ll&objId=702787&objAction=browse
[105] Ibid.
[106] See WWF-Canada's Recommendations for the NEB Regarding Arctic Offshore Drilling Requirements (2011). http://awsassets.wwf.ca/downloads/wwf_canada_presentation_to_neb_roundtable_in_inuvik_september_2011.pdf

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- 1–5 fuel tankers to supply fuel for the drilling unit and support vessels.

South of 60 degrees latitude, Canadian law requires ships to contract with a response organization that can provide equipment and personnel sufficient to clean up the amount of oil a ship is carrying, up to 10,000 tonnes. However, ships travelling north of 60 degrees are exempt from these provisions, an important fact that needs to be highlighted in the SEA.

Under Canadian and international law, all tankers over 150 tonnes and all other vessels over 400 tonnes must have a Ship Oil Pollution Emergency Plan (SOPEP), which includes reporting procedures, authorities to be contacted and actions to be taken. Currently, SOPEPs are not Arctic-specific and may not account for communications challenges that could arise in attempting to report a spill in the Arctic.

The Preliminary Findings report (6.2.3) states that onshore storage facilities in coastal communities would be required for emergencies such as oil spill response and other emergency equipment. It is important to note that no such emergency response equipment currently exists in coastal communities throughout Nunavut on a scale required to deal adequately with a major oil spill or well blowout. Only a small number of coastal communities have access to the most basic oil-spill response equipment from the Canadian Coast Guard and some communities that do have equipment have told WWF-Canada that it is irregularly maintained, too few community members are trained to use it, and that some communities don't have a key to access the storage containers.

Remote locations mean response times for large-scale cleanup and storage equipment can be more than 10 times longer than in waters south of 60 degrees' latitude. This lack of emergency response capacity must also be addressed before any offshore oil and gas activity takes place, particularly in light of recent events in the Atlantic offshore that have highlighted the risk inherent in offshore drilling operations and the fact that Arctic drilling presents numerous additional challenges including:

- Harsh weather conditions, periods of prolonged darkness and the presence of sea ice, which make most standard oil-spill response equipment ineffective;
- Ships are not required under Canadian law to carry their own spill response equipment or to have contracted response capacity in the Arctic;
- Lack of reliable communications infrastructure makes it difficult for communities to call for assistance, and for responders to communicate with those on land during an oil-spill response.

Two recent, dangerous incidents highlight the risks of drilling in extreme northern environments. In November 2018, the Husky Sea Rose drilling platform off the coast of Newfoundland spilled at least 225,000 litres of crude oil into the north Atlantic, the largest spill in the province's history, after Husky attempted to re-start operations during an extremely violent storm, which led to a flowline being disconnected. Some experts have estimated that a "horrendous" number of sea birds, possibly over 100,000, may have been killed as a result of the spill.[107]

[107] Stokes, C. Think few reported oiled seabirds is good news? Not so fast, says MUN biologist. *CBC News.* https://www.cbc.ca/news/canada/newfoundland-labrador/searose-spill-seabird-threat-1.4914730

Currently in Canada, offshore oil and gas regulators do not have the authority to tell companies when it's safe to restart operations; rather it's left up to operators to decide for themselves. It is not known whether Husky's own environmental and safety plans were insufficient in preventing the accident and how improved regulations could ensure that it doesn't happen again. This was the second serious incident by Husky Energy's SeaRose FPSO in the last year and a half. In May 2017, a huge iceberg came within 180 metres of the same vessel, so close that the crew were told to "brace for impact," yet oil production was not halted.

That two serious incidents could occur over such a short time span indicates the hazards common in extreme environments and highlights the need for a higher set of regulatory and governance standards for companies operating in harsh and remote conditions such as those found in the Arctic offshore. For example, currently in Canada the offshore Boards and the Canadian Environmental Assessment Agency (CEAA) do not require offshore operators to have some basic safety equipment on hand, such as capping stacks, which is a device that has been proven effective in stopping well blowouts and is required in Alaskan offshore operations. Documents filed to CEAA in relation to drilling projects in the Flemish Pass indicate that, if there were a well blowout, the capping stack would have to be shipped from Norway or Brazil, a process that could take between 14 and 36 days.[108] Similarly, the offshore Board in Nova Scotia has allowed BP to keep a capping stack in Norway for its drilling operations in the Scotian Basin.[109] Canada's Arctic offshore energy regulator, the National Energy Board, also does not currently require operators to keep capping stack equipment on hand.

7.2 Spill response gaps

As noted, while there are oil spill response plans and standards in place in the Arctic, there are also significant gaps and uncertainties. Arctic conditions limit the effectiveness of response equipment and often prevent any response at all. The Arctic climate is defined by major seasonal changes and sea ice for nine out of every 12 months. Cold air temperatures persist for much of the year, with most communities experiencing at least 250 days below freezing. Rain, blowing snow, fog, gale-force winds and prolonged periods of darkness limit visibility. Even BP Canada has admitted that the company can't provide assurances about its ability to clean up an oil spill off Canada's Arctic coast."[110]

The presence of sea ice is the largest limiting factor in an adequate oil spill response. During the small window when a response would be possible, several other environmental factors would impede an adequate oil spill response:

- High waves and strong winds common to Arctic waters make it impossible to contain oil using a boom, a critical tool used to prevent oil from reaching the shoreline.

[108] CBC News Staff. Weeks to cap a subsea oil leak? It's industry standard, says official. https://www.cbc.ca/news/canada/newfoundland-labrador/oil-capping-timelines-nl-1.4933106
[109] The Chronicle Herald. March 17, 2018. Opponents of ultra-deep BP well of NS coast speaking at SMU. http://thechronicleherald.ca/novascotia/1553818-opponents-of-ultra-deep-bp-well-of-n.s.-coast-speaking-at-smu
[110] Mayeda, A. May 14, 2010. BP can't explain how it would clean up an oil spill in the Arctic. *Nunatsiaq News.* http://nunatsiaq.com/stories/article/98789_bp_cant_explain_how_it_would_clean_oil_spill_in_arctic/

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- If visibility is less than one kilometre, it is extremely difficult to find and recover oil slicks.
- Recovery cannot take place during darkness, which persists through most of the winter months.
- Response ships can become unsafe to operate due to ice buildup.
- The type of oil used by the majority of ships, heavy fuel oil (HFO), is also extremely difficult to remove from the environment, even in ideal conditions.

The Canadian Coast Guard (CCG) is the primary source of spill response in the Arctic. Community packs containing basic equipment designed for small near-shore spills (up to one tonne of oil) have been placed in Resolute, Arctic Bay and Pond Inlet in Nunavut, and in Kugluktuk and Ulukhaktok in the Beaufort region. Both Iqaluit and Tuktoyaktuk have stockpiles of equipment, as does the Mary River Mine on Baffin Island. Additional oil spill resources are available from the CCG base in Hay River, south of Yellowknife.

Inadequate equipment

The largest equipment available in the Arctic can recover up to 1,000 tonnes of oil. However, tankers carrying fuel to the Mary River Mine can carry up to 4,500 tonnes of diesel, and community resupply vessels carry up to 18,000 tonnes of fuel oil.

> ***'Only a small number of coastal communities have access to the most basic oil-spill response equipment.'***

Maintenance

Maintenance of community packs has been inconsistent. The Arctic environment renders mechanical equipment inoperable if it isn't properly maintained, so it is unknown whether the community packs are functional.

Access

Assuming the equipment is functional, accessing it would be another challenge. Some communities don't have a key for the locked storage containers because the CCG is concerned about maintaining responsibility for the equipment inside.

Transport to spill site

Even if the community can access the equipment, and it is functional, the small aluminum boats provided may not be sufficient to transport the equipment to the spill site in poor weather conditions. Larger boats better able to withstand harsh weather would then need to be located.

If the spill occurred in a community without a pack, the hamlet would need to arrange for an airplane to deliver the equipment from a nearby community and transport it from the airstrip to the spill site.

Storage and disposal

No hazardous waste facilities exist in the Arctic; all materials must be stored and transported south. Though response equipment in Iqaluit and Tuktoyaktuk is designed to recover up to 1,000 tonnes of oil, the containers in Tuktoyaktuk can only store up to 275 tonnes, with capacity in Hay River for an additional 240 tonnes. Oil cannot be removed from the environment if there is nowhere to store it.

People

The number of trained responders in northern communities is limited due to several factors. The communities are small, so there are only so many people to draw upon. In addition, people are often away from the community for long stretches, like during subsistence harvesting times, meaning a larger number would need to be trained to ensure there are always enough people available (anywhere from five to 16 community responders are necessary, depending on the equipment).

Government funding for training is currently well below what is necessary to recruit and train an appropriate number of community members. And even if enough people could be found and trained, there is little opportunity to practice or maintain skill levels.

Finally, in the event of a large spill, many responders would need to be flown in from larger centres. Small communities will likely not have the resources to house, feed and support the influx of people.

7.3 Communications infrastructure

Reliable communications infrastructure capable of providing information on weather and sea conditions, maintaining contact with on-the-ground and incoming responders, as well as being able to monitor the spill are all essential to an effective response.

The community nearest to the spill would serve as an important communications hub. However, in the Arctic, cellphone and Internet networks are quickly overwhelmed, slowing Internet speeds, preventing phone calls, and potentially leading to a complete breakdown in emergency response protocol.

It is also critical for incoming responders to have information about safe maritime routes, including the presence of sea ice and inclement weather. If communications systems are inoperable, area surveys may be needed before vessels can assist, leading to more response delays.

7.4 Response time

Canadian law provides response times for different levels of spills, which must be adhered to by regional response organizations. However, these standards are not in line with current response capabilities in the Arctic. If a CCG icebreaker was in the region, it could provide additional assistance, but there are only three ships responsible for the whole of the Northwest Passage.

In 2008, the Baffin Regional Area Plan identified specific geographical priority areas (including Lancaster Sound) and proposed tactics to protect these areas in the first 12 to 24 hours after a spill. However, there are very few details or recommendations in the plan, and the CCG cautions that the strategies it outlines are untested and require an on-site assessment to confirm their validity.

7.5 Oil spills in ice

There are significant differences between oil spill response capabilities in open water and in ice-covered waters. Significant challenges also exist for spills occurring within different sea ice types, concentrations

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and seasons, all of which are strongly impacted by climate change. One of the challenges of accurately quantifying the damage of an Arctic oil spill is that our baseline knowledge of the Arctic system is presently limited. While there is some research into how oil responds in ice, fully understanding how oil behaves in an Arctic environment is challenging at best.[111]

Knowledge amassed to date through various studies suggest that oil behaves differently in icy, freezing water than in the warmer waters. Furthermore, the combination of natural variability and climate-forced changes in the Arctic marine system make it particularly challenging to predict the ice conditions from one year to the next. Sea ice adds a new dimension to the movement of oil, and therefore, understanding how far oil spilled on sea ice-infested waters will spread is of particular importance.[112] In summer, the sea ice zone is a particularly challenging environment because the concentration of ice floes within a region is continuously changing. Oil spilled in these conditions will generally gather on the surface among the floes, but wind and current can move the floes together squeezing the oil between them, or drift apart allowing the oil to spread out over a larger area of the sea surface.

Arctic sea ice isn’t a stable, uniform sheath that covers the ocean.[113] Rather, it shifts along cracks, called leads, and can vary greatly in thickness. In the lower reaches of the Arctic, the ice melts for a brief window in the summer, and then, within days, re-forms, first appearing on the ocean's surface before it thickens. Ice also does not stand still. Depending on the season, ice can drift at a rate exceeding 50 kilometers a day—even more at times. For example, ice north of Tuktoyaktuk in the Northwest Territories was tracked over 2,000 kilometers between mid-October 2007 and mid-May 2008.[114] If oil becomes trapped under ice, therefore, it could travel far from its original source over the winter and possibly never be recovered. Oil trapped under ice can also be particularly difficult to detect.[115] The underside of an ice sheet isn't flat; it actually resembles a cave full of stalactites. Ice also grows downward, so normally these pockets would continue to fill, growing thicker and thicker. Oil released under growing ice can become trapped in these crevices. The effects of an oil slick lingering underneath an ice sheet could impact the entire food chain: the zooplankton that feed on the bacteria on the ice; the fish that thrive on the plankton; and the seals eating the fish, which local communities depend on for food.

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[111] Bureau of Safety and Environmental Enforcement. *Arctic Oil Spill Research*. https://www.bsee.gov/site-page/arctic-oil-spill-response-research

[112] Wilkinson, J. et al. 2017. Oil spill response capabilities and technologies for ice-covered Arctic marine waters: A review of recent developments and established practices. *Ambio* 46 (Supp 3): S423-S441.

[113] Shankman, S. May, 8 2015. The Many Unknowns of Inevitable Arctic Oil Spills. *Inside Climate News.* http://insideclimatenews.org/news/08052015/many-unknowns-inevitable-arctic-oil-spills

[114] Committee on Responding to Oil Spills in the U.S. Arctic Marine Environment. 2014. Responding to Oil Spills in the U.S. Arctic Marine Environment. The National Academies of Sciences, Engineering, Medicine. http://www.nap.edu/catalog/18625/responding-to-oil-spills-in-the-us-arctic-marine-environment

[115] Thomas, M. Sept. 4, 2015. Can we handle an Arctic oil spill? *Pacific Standard.* http://www.psmag.com/nature-and-technology/can-we-handle-an-arctic-oil-spill

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The presence of ice can also shelter oil from the wind and waves.[116] Thus, weathering processes such as evaporation and emulsification, and behaviors such as spreading and entrainment, are slowed. Field data show evaporation, dispersion, and emulsification significantly slowed in ice leads, contrary to some laboratory experiments. Wave-damping, the limitations on spreading dictated by the presence of sea ice, and temperature appear to be the primary factors governing observed spreading and weathering rates.[117]

In the case of a well blowout, it is important to remember that oil and gas will be released together. The effect of the oil/gas mixture has on the sea ice is not fully established, but when the oil itself reaches the underside of the ice most of oil droplets will coalesce to form an oil slick. The direction of the flow of oil is a function of the under-ice topography, ice dynamics, upper ocean turbulence and oceanic currents.[118] Under warmer conditions, e.g. spring–summer transition, encapsulated oil or oil located at the bottom of the ice can move vertically upwards through the ice, until it reaches the ice surface; a process known as oil migration. The oil migration process is not well understood, both due to a lack of field observations and incomplete knowledge of sea ice microstructure evolution during melt and growth.[119] A better understanding of and ability to predict the timing of oil migration and surface release is important for logistics of clean-up, and evaluation of areas affected during ice drift.[120] WWF-Canada has performed modelling research on likely oil spill trajectories in the event of a major spill in the eastern Canadian Arctic (see section 7.6 below).

Norway does not allow and has never allowed oil operations within the boundaries of the maximum annual sea ice extent in the Barents and Norwegian Seas, citing the fact that there is currently no known technology or method that can recover oil from Arctic ice.[121] In fact, the last time as U.S. National Academy of Sciences panel looked at the issue, it concluded: "No current cleanup methods remove more than a small fraction of oil spilled in marine waters, especially in the presence of broken ice".[122] In addition, a 2016 Nuka Research report entitled 'Estimating an Oil Spill Response Gap for the U.S. Arctic Ocean' showed that current oil spill control technologies will be mostly useless during the winter when pack ice covers the drill site (figure 13).[123]

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[116] Drozdowski et al. 2011. Review of Oil Spill Trajectory Modelling. *Canadian Technical Report of Hydrography and Ocean Sciences* 274. Fisheries and Oceans Canada. http://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.452.8075&rep=rep1&type=pdf

[117] Sørstrøm, S.E., Brandvik, P.J., Buist, I., Daling, P.S., Dickins, D., Faksnes, L.-G., Potter, S., Rasmussen, J.F., and Singaas, I. 2010. Joint industry program on oil spill contingency for Arctic and ice-covered waters. Oil in Ice. JIP

[118] Wilkinson et al. 2017.

[119] Maus, S., J. Becker, S. Leisinger, M. Matzl, M. Schneebeli, and A. Wiegmann. 2015. Oil saturation of the sea ice pore space. In *Proceedings—International conference on port and ocean engineering under arctic conditions*.

[120] Maus, S., S. Leisinger, M. Matzl, M. Schneebeli, and A. Wiegmann. 2013. Modelling oil entrapment in sea ice on the basis of microtomographic images. *In Proceedings—Port and Ocean Engineering under Arctic Conditions, Espoo, Finland*. POAC, 10 pp.

[121] Mayeda, A. June 15, 2010. No way to clean up oil spill under Arctic ice: expert. *Nunatsiaq News.* http://www.nunatsiaqonline.ca/stories/article/87890_no_way_to_clean_up_oil_spill_under_arctic_ice_expert/

[122] U.S. National Academy of Sciences. 2003. *Cumulative Environmental Effects of Oil and Gas Activities on Alaska's North Slope.* National Research Council. http://www.nap.edu/read/10639/chapter/1

[123] Nuka Research. *Estimating an oil spill response gap for the U.S. Arctic Ocean (Revised).* 2018. https://nukaresearch.com/wpfb-file/estimating-an-oil-spill-response-gap-for-the-us-arctic-ocean-revised-pdf/

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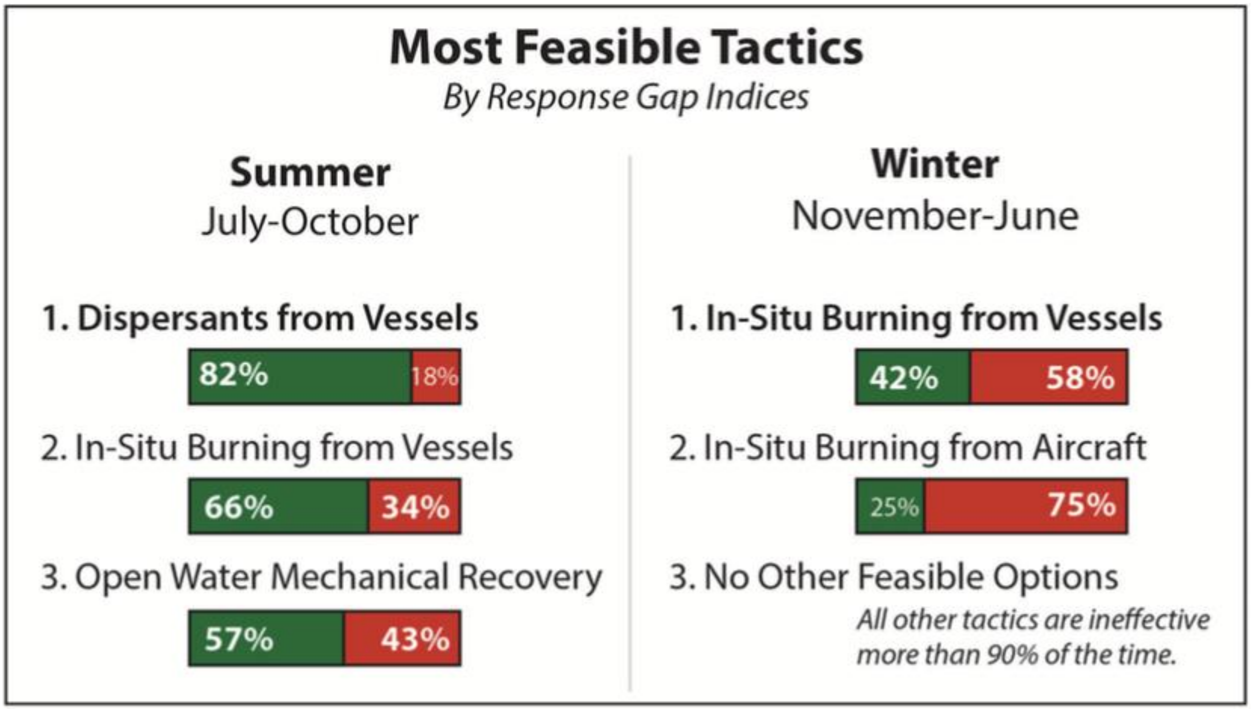

Figure 13: Estimating an Oil Spill Response Gap for the U.S. Arctic Ocean. Tactics most likely to be feasible (least likely to be precluded) are shown in green by season, for the Chukchi Sea (Nuka Research).[124]

Until oil recovery and cleanup technologies in icy waters have improved and the interaction of oil and ice is better understood, drilling in the eastern Canadian Arctic should not proceed. More knowledge is needed on the long-term behavior of oil in ice, on ice and under ice. If drilling were to occur in the future it should be limited to regions where the sea is entirely, not just marginally, ice free during the summer months and all drilling operations should be ceased at least 45 days before the return of the “marginal” ice zone.

[124] Ibid.

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7.6 Oil spill trajectory modelling

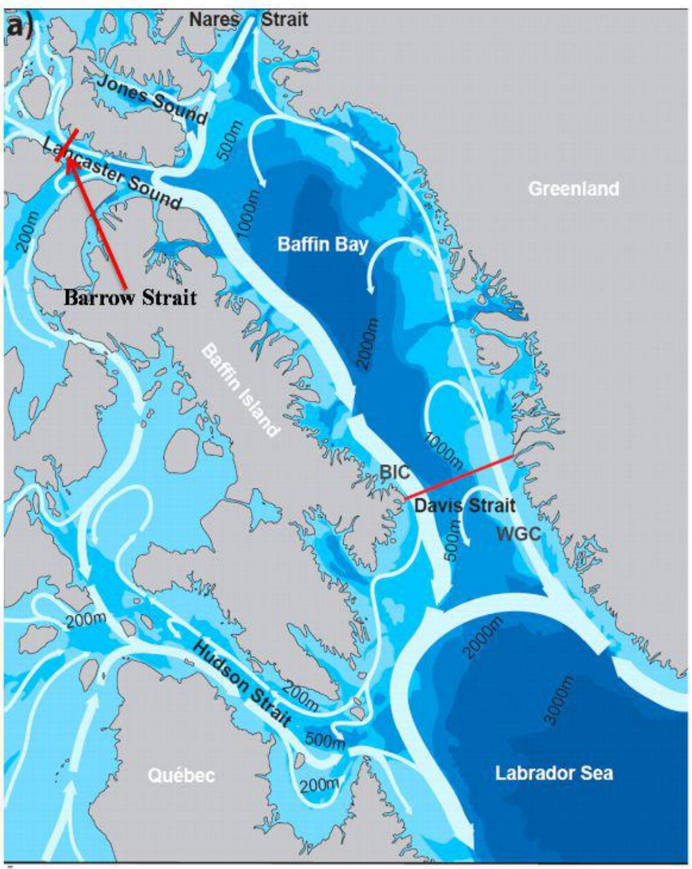

Figure 14: Schematic of general circulation in the Baffin Bay region.

In 2016, WWF-Canada contracted an independent study on likely oil spill trajectories in Baffin Bay and Lancaster Sound.[125] This study investigated possible spill events associated with vessel traffic and offshore petroleum exploration and development. The results of this analysis can help inform the NIRB's SEA local risk perception, and recommendations on preparing for oil spill response planning, and informing integrated ocean management and planning. One of the five different types of spill events analyzed was an offshore oil platform blowout occurring in Baffin Bay under a worst-case response and no-response scenarios. Although the likelihood of an uncontrolled blowout for over 30 days was unlikely, the report concluded that the environmental consequences of such an event would be substantial, even with the application of a highly effective spill response strategy. It is worth reiterating here again that Canada does not currently have a highly effective spill response strategy in place in the eastern Canadian Arctic. Figures 15-17 show general circulation patterns in the Baffin Bay region and predicted oil spill trajectories under worst-case scenario oil spills.

Baffin Bay is partially covered by sea-ice throughout the year, except for the months of August and September. Ice begins to form in open water in September and increases steadily in coverage until March, where the entire bay except eastern Davis Strait is covered by ice. The western half of Baffin Bay always has more ice cover than the eastern half due to the inflow of the relatively warm West Greenland Current on the eastern side. The ice coverage begins to decrease in April, and by July, less than half of the area is covered by ice.

[125] WWF Canada. 2016. Modeling Oil Spill Trajectories in Baffin Bay and Lancaster Sound. Shoal's Edge Consulting.

Scenario 2B: 34-Day Subsurface Blowout of 113,560 m³ Medium Crude in Open Water (Jun-Oct)

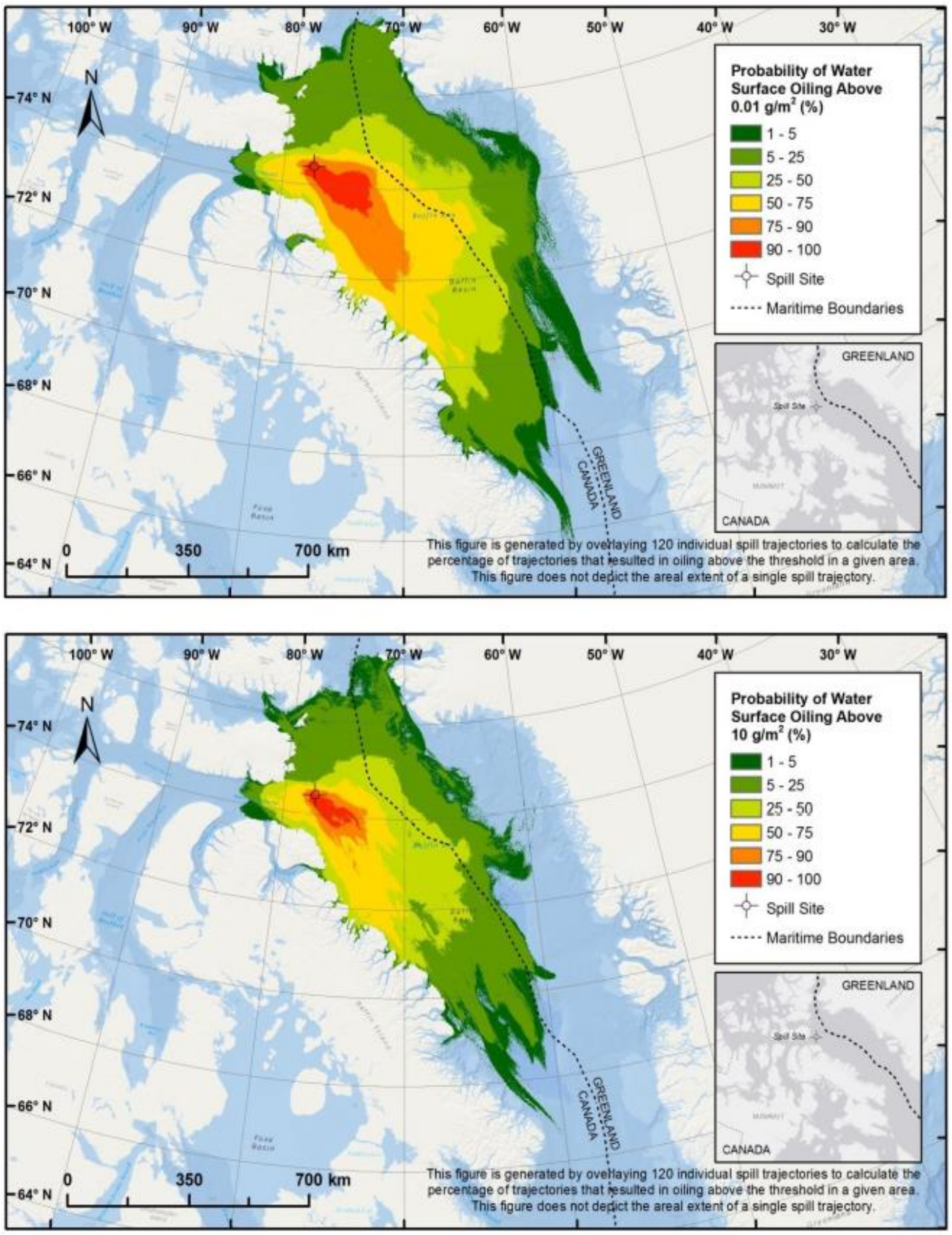

Figure 15: 34-day blowout – Probability of water surface oiling above the socioeconomic threshold of 0.01 g/m2 (top panel) and probability of water surface oiling above the ecological threshold of 10 g/m2 (bottom panel).

For a subsurface blowout incident in Baffin Bay just east of Lancaster Sound, there is an approximately 71% chance that shoreline oiling above 100 g/m2 will occur at some location in the study area. However, because the locations of potential shoreline oiling are variable and widespread, the highest probability of any individual segment of the coastline being oiled above the threshold is 24%. Areas could potentially be oiled above the Canadian shorelines along Ellesmere, Coburg, Devon, Bylot, and Baffin Islands.

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Scenario 2B: Worst Case Shoreline Length Oiled (with Response)

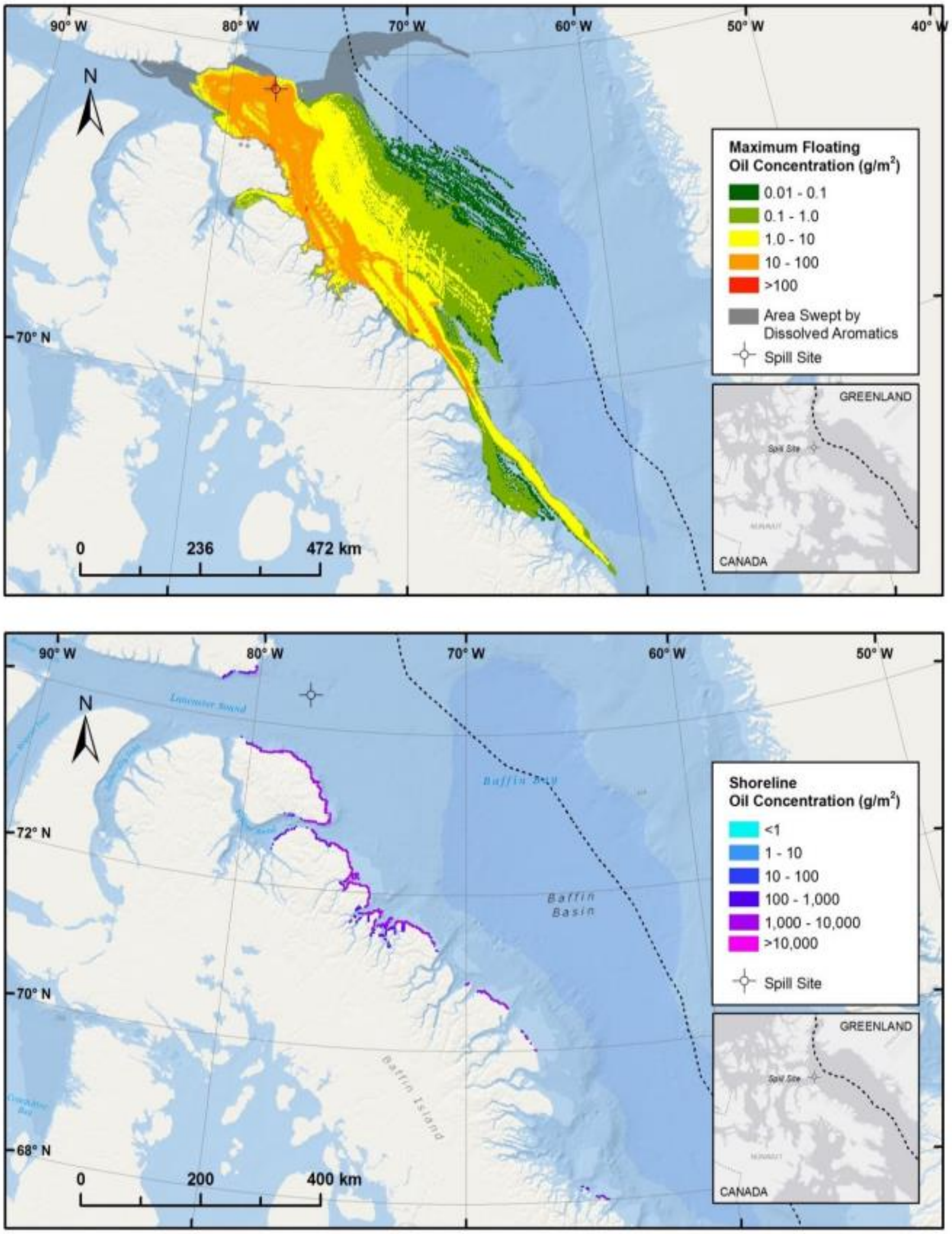

Figure 16: Worst-case (95th percentile) trajectory for shoreline length oiled above 100 g/m2, with spill response (subsurface dispersant injection) – Maximum concentration (g/m2) of floating oil that passed by a given area during the simulation and the subsurface area swept by dissolved aromatics (top panel); and total concentration (g/m2) of oil on the shoreline at the end of the simulation (bottom panel).

7.7 Chemical dispersants

The environmental rationale for attempting to chemically disperse spilled oil is that removing the oil from the water surface and driving it into the water column as suspended droplets, could prevent damage to shorelines, seabirds and marine mammals. The practical problem with this idea is that it can only work if a very high fraction of the oil can be driven into the water column. Otherwise, enough oil will remain on the surface to contaminate shorelines in spite of the dispersant application. It should also be noted that there are trade-offs involved in moving oil from the surface to the water column.

The potential ecological consequences of the physical and toxicological properties of dispersed oil are far from fully understood. What is clear, however, is that broadcasting dispersants can compound the ecological damage of oil spills. The impacts to plankton communities, which are the foundation of marine food webs and the impacts to the seabed are detrimental.[126] Hence the use of dispersants has socioeconomic consequences as well as environmental and there are still many unknowns about their use.

> **'The potential ecological consequences of the physical and toxicological properties of dispersed oil are far from fully understood.'**

With respect to the use of dispersants in the Arctic marine environment, the main environmental characteristics of the Arctic, the low winter temperatures, the long periods of darkness during the winter, the remoteness, and the presence of ice and snow for much of the year, pose challenges to the operational use of dispersants, as they do to other methods of oil spill response. Paris et al. (2018) found that, given the potential for toxic chemical dispersants to cause environmental damage by increasing oil bioavailability and toxicity while suppressing its biodegradation, unrestricted dispersant application in response to deep-sea blowout is highly questionable and more research is required to inform response plans in future oil spills.[127]

WWF therefore believes that the use of dispersants in the Arctic marine environment would only be possible in the summer, should never be used in sensitive environments and, in any case, would be limited in its effectiveness even when it is used. Once again, given the difficulty in adequately responding to an oil spill in the Arctic, emphasis should be placed, from a regulatory perspective, on the avoidance and prevention of accidents.

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[126] Buskey, E., H. White, and A.J. Esbaugh. 2016. Impact of Oil Spills on Marine Life in the Gulf of Mexico: Effects on Plankton, Nekton, and Deep-Sea Benthos. *Oceanography* 29(3): 174-181. https://www.researchgate.net/publication/307518241_Impact_of_Oil_Spills_on_Marine_Life_in_the_Gulf_of_Mexico_Effects_on_Plankton_Nekton_and_Deep-Sea_Benthos

[127] Paris, C. B. et al. 2018. BP Gulf Science Data Reveals Ineffectual Subsea Dispersant Injection for the Macondo Blowout. *Frontiers in Marine Science*. November 2018.

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7.8 Conclusions and recommendations

Arctic oil spill response is challenging because of extreme weather and environmental conditions; the lack of existing or sustained communications, logistical, and information infrastructure; significant geographic distances; and vulnerability of Arctic species, ecosystems, and cultures[128]. Traditional methods of cleaning up spills, such as the use of containment booms, are likely ineffective at capturing oil trapped under Arctic ice and mechanical equipment for the efficient recovery of oil in highly packed ice is not yet available.[129] For instance, many of the techniques that were used to clean up oil in the Gulf of Mexico when the BP Deepwater Horizon oil rig exploded would be useless if a spill of similar magnitude were to occur under or near Arctic ice or in rough seas.[130] Oil controlling booms start to lose their effectiveness in metre-high waves and stop working entirely when the waves reach two metres high. Cold weather can make it difficult to apply dispersants to oil slicks and the presence of ice reduces their effectiveness, as dispersants rely on ocean waves to mix the oil and chemicals together.

The extreme Arctic climate makes a successful oil spill response enormously challenging, even with unlimited personnel and equipment. Oil drilling and shipping in the Canadian Arctic is a dangerous and precarious endeavor and drilling under such conditions is especially risky. Navigation is challenging, weather and visibility are often poor, sea ice is difficult to detect and the waters are inadequately charted. Yet, as sea ice melts, shipping is only increasing in the region, and offshore oil and gas would further increase this trend, along with the risk of oil spills that threaten the sensitive Arctic ecosystem and the wildlife and communities that depend on it.

WWF-Canada is calling for the urgent adoption of the following measures to help improve Canada's response capacity before any offshore oil and gas operations take place. We strongly recommend that these recommendations be reflected in the final SEA report:

1. Substantial investment in resources and training to provide adequate response capacity and infrastructure support;

2. Formal review of Canada's capacity to respond to major offshore oil spills in the Arctic and a comprehensive, long-term spill response research program;

3. Review and strengthening of extreme weather protocols, including the creation of Arctic-specific regulations under the Canada Oil and Gas Operations *Act*;

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[128] National Research Council of the National Academies. 2014. *Responding to oil spills in the U.S. Arctic.* https://www.nap.edu/read/18625/chapter/5#68

[129] Bureau of Safety and Environmental Enforcement. 2004. Use of Ice Booms for the Recovery of Oil Spills from Ice Infested Waters.
http://www.bsee.gov/Technology-and-Research/Oil-Spill-Response-Research/Projects/Project-353/

[130] Nuka Research, 2018.

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4. Creation of an independent offshore safety authority to monitor adherence to environmental and safety protocols;

5. Response plans for well blowouts should be made Arctic-specific and address the logistical challenges of a spill response;

6. Improved spill preparedness tools on site including capping stacks (the use of on-site relief well drilling units and capping stacks is not explicitly required by Canadian regulations in the Arctic, contrary to other jurisdictions such as the United States);

7. Clearly defined roles and responsibilities of government authorities and the operator;

8. Regular spill preparedness drills.

Before proceeding with oil exploration in the Canadian Arctic, a comprehensive, collaborative, long-term Arctic oil spill research and development program needs to be established. The program should focus on understanding oil spill behavior in the Arctic marine environment, including the relationship between oil and sea ice formation and transport. It should include an assessment of oil spill response technologies and logistics, improvements to forecasting models and associated data needs, and controlled field releases under realistic conditions for research purposes. Industry, academia, governments, NGOs and Indigenous organizations should be integrated into the program, with a focus on peer review and transparency.

More knowledge of ice thickness, concentration and extent is essential for anticipating the likely behavior of oil in, under, and on ice and determining applicable response strategies, while high-quality bathymetry, nautical charting, and shoreline mapping data are needed for marine traffic management and oil spill response.

From a biological perspective, understanding population dynamics and interconnections within the Arctic food web will enable the determination of key species that are most important for monitoring in the instance of an oil spill. Additional research and development is needed to include meteorological-ocean-ice forecast model systems at high temporal and spatial resolutions and better assimilation of traditional knowledge of sea state and ice behavior into forecasting models.

Until Arctic oil spill dynamics are better understood and proven technologies exist to adequately clean up spills in or under sea ice, Canada should not permit offshore oil and gas drilling in the eastern Arctic.

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8. ECONOMIC BENEFITS OF OFFSHORE OIL AND GAS

Summary: While local communities will bear the majority of the risks and will be affected by impacts of offshore oil and gas development, they may receive relatively few benefits. The SEA process has not attempted to assess the possible economic benefits to local communities in sufficient detail at various scales of oil and gas development.

Recommendation: A balanced assessment of the true costs and benefits of offshore oil and gas is critical for local communities to understand what is at stake. A future cost-benefit analysis must consider the impacts at the local level in order for communities to be able to make informed assessments.

One of the fundamental objectives of any SEA is to give stakeholders an overview of the potential benefits and risks of a possible development program. Indeed, part of the explicit mandate of this SEA is to understand how local community members feel about the prospects of offshore oil and gas in the region. However**,** the SEA did not fully analyze how a potential hydrocarbon sector in Nunavut would benefit communities with respect to employment, training and financial gains. Communities must have a relationship with the hydrocarbon sector that is based on some form of partnership. This cannot be done unless communities know the risks and benefits of such an association.

We acknowledge the NIRB's assertion in its January 8, 2019 correspondence with the Nangmautaq Hunters and Trappers Organization that:

> "*… future benefits for a specific development proposal within the Nunavut Settlement Area would not be negotiated or otherwise imposed by the NIRB or Government of Canada and would be entirely dependent on project-specific negotiations between industry, Nunavut Tunngavik and the applicable Regional Inuit Association at the time such an oil and gas development entered the regulatory system*."[131]

The SEA could have provided communities with at least some estimation of the *potential* job and revenue benefits from offshore oil and gas that are associated with various development scenarios at feasible scales of development. By the time project-specific Inuit Impact and Benefit Agreement negotiations take place, a proposed offshore project would have already "entered the regulatory system", as noted in the excerpt above, and a community would have a very limited legal basis to oppose a project at this stage on the basis of insufficient projected economic benefits.

As the SEA has not addressed this critical issue, WWF-Canada is submitting the following analysis for consideration and inclusion in the NIRB's final SEA report.

[131] Nunavut Impact Review Board. January 8, 2019. Letter to the Nangmautaq Hunters and Trappers Organization from Tara Arko, NIRB Director, Technical Services and *Acting* Executive Director.

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8.1 Myths and realities of offshore oil and gas

Although governments and corporations often tout the tax revenue, local employment and procurement, new infrastructure, and community investment that will result from an industrial expansion into Arctic waters, it is uncertain whether, and to what extent, these benefits will materialize.

A community's experience with onshore oil and gas development is not necessarily indicative of what it can expect from offshore development. Although at first glance the potential tax revenue from offshore oil and gas may seem impressive, local governments may only get a small share of the overall government revenue. Moreover, because of the highly specialized nature of most offshore jobs, it is not clear how many jobs would be available to members of local communities in the study area. The SEA Preliminary Findings report states that "drilling units usually come fully staffed with experienced workers" (page 51). Although some low-skilled jobs may materialize, many community members may need specialized training to qualify for the higher-skilled jobs. Some local businesses may provide transportation, supply services, or sell fuel, but the local economy may not benefit considerably from offshore activities. Offshore workers do not generally live in local communities, for example.

Th amount of reserves in the Arctic is uncertain and estimates vary. The US Geological Service (USGS) estimates 134 billion barrels of oil in the Arctic, while Wood Mackenzie estimates 43 billion barrels.[132] Most of these reserves are expensive to extract, and it is possible that the price of oil will not increase enough to justify production of most of the undiscovered oil before alternative sources of energy are readily available at a better price. The SEA Preliminary Findings report also notes on page 15 that potential recoverable volumes in the area of focus appear to be fairly small.

8.2 Costs of Arctic oil and gas production

The future price of oil is a key determinant in the future of offshore development. Generally, the higher the price, the more oil and gas that can be economically recovered. But some experts suggest that much of Arctic oil cannot be developed at prices less than $300 per barrel[133] and the Preliminary Findings report indicates that current cost estimates for offshore exploration and development in Arctic waters is almost two times higher compared to other regions (page 40). Yet even the estimates of future production that take the costs and the future price of oil into account are highly uncertain.[134] This is because the future price of oil is especially difficult to predict and doesn't always properly account for the growing market share of renewable energy and technological advances in energy efficiency.

Many financial institutions and oil and gas companies believe that the demand for oil will peak around 2030, as a result of the transition to renewable energy.[135] Yet few Arctic offshore fields may be

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[132] McGlade, C. E. 2012. A review of the uncertainties in estimates of global oil resources. *Energy* 47.1: 262-270.
[133] McGlade, C. E. 2014. Uncertainties in the outlook for oil and gas. Diss. UCL (University College London), p. 111
[134] Ibid, p. 53
[135] McKinsey & Company. June 2016. *Is peak oil demand in sight?* https://www.mckinsey.com/industries/oil-and-gas/our-insights/is-peak-oil-demand-in-sight; Longley, Alex. January 22, 2018. BofA Sees Oil Demand Peaking by

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developed by then, given the long timeframe and high costs required to explore these prospects and build the infrastructure necessary for production. Nunami Stantec estimated that field development and production in the SEA area of focus would cost approximately USD $14 billion. It is unknown whether the high oil prices needed to make offshore oil and gas development viable in the Arctic will materialize.

> ***'Because of the highly specialized nature of most offshore jobs, it is not clear how many jobs would be available to members of local communities.'***

8.3 Jobs and revenue to local business

Many local communities hope that development will bring new jobs and more business for local enterprises. However, local economic impacts of offshore development may be disappointing because much equipment and labour must come from outside the region. Companies can sometimes overstate the number of jobs that could result from Arctic offshore development. For example, a study commissioned by Shell Oil claimed that offshore oil and gas development in Alaska's Arctic could result in nearly 4000 long-term, year-round positions.[136] This report looked at the hypothetical potential for all offshore development in Alaska, which is difficult to assess unless or until such development occurs. However, for comparison, the Liberty development plans for extended reach drilling from a gravel island in the US Beaufort Sea would employ less than 500 part time, seasonal, and full time workers during the production phase.[137] Even more notable is the fact that only six of these jobs would go to local people.[138] It would require extensive offshore development to reach the employment numbers predicted by Shell.

As the US government explains, jobs from offshore development are not likely to go to people living in the community due to the fact that workers are likely to commute from southern Alaska and other communities in the US.[139] Indeed, the "fly in/fly out", "temporary community" model of development can be used even when established communities exist.[140] It is worth noting as well that men tend to

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2030 as Electric Vehicles Boom. *Bloomberg.* https://www.bloomberg.com/news/articles/2018-01-22/bofa-sees-oil-demand-peaking-by-2030-as-electric-vehicles- boom

136 Northern Economics. *Economic Analysis of Future Offshore Oil and Gas Development: Beaufort Sea, Chukchi Sea, and North Aleutian Basin Executive Summary*, Prepared for Shell Exploration and Production, March 2009, p. 1 http://www.akleg.gov/basis/get_documents.asp?session=26&docid=5530

137 US Bureau of Ocean Management. August 2018. Liberty Development and Production Plan in the Beaufort Sea, Final Environmental Impact Statement. p. 4-205.

138 Id.

139 See, e.g., US Bureau of Ocean Energy Management, 2019-2024 Outer Continental Shelf Oil and Gas Leasing Draft Proposed Program, pp. 8-3 to 8-4 (projecting few local benefits of exploration and development in offshore Alaska due to lack of infrastructure and labor available to support the industry), https://www.boem.gov/NP-Draft-Proposed-Program-2019-2024/

140 Storey, Keith. Fly-in/fly-out: implications for community sustainability. *Sustainability* 2.5 (2010): 1161-1181. https://www.mdpi.com/2071-1050/2/5/1161/htm

benefit far more than women from oil and gas development, whether it takes place onshore or offshore. Few women are employed in offshore development, while women disproportionately bear the costs from social disruption and risks to their safety and health.[141]

The local jobs that may result from future offshore oil and gas development should also be considered against jobs that could be created by alternative development strategies (see section 9). For example, in the US in 2016, more people were employed in solar power than in generating electricity through coal, gas and oil energy combined.[142] Despite claims of job creation, a representative of an oil and gas industry association explained, “The industry does not create jobs, it creates wealth.”[143]

8.4 Community investment

As part of their agreement with governments, such as Inuit Impact and Benefit Agreements (IIBAs) or on voluntary bases, companies could make contributions to local communities in conjunction with their development of offshore fossil fuel resources. Benefit-sharing agreements can include payments, in-kind benefits, and outlines of terms for preferred access to business opportunities and for employment and training opportunities for Indigenous entities.[144] However, the degree to which local communities have the ability to participate in decisions about the distribution of benefits of offshore development has varied in the past. As one researcher notes:

> Not a single company systematically measures the effectiveness of its development interventions, either in terms of scientific measures (e.g. changes in health indicators related to health spending) or in terms of a value-for-money analysis. Oil companies seem to be simply satisfied that they spend money on “development”. Therefore, we do not know to what extent the community investment has actually yielded tangible benefits for the local people.[145]

An Arctic Council report sets out necessary steps to realizing the potential local benefit of economic activity by “including local involvement in (1) determining local needs and interests to set appropriate goals, (2) establishing appropriate governance mechanisms to ensure local needs and interests are considered, (3) participating effectively in those governance mechanisms and related instruments, and

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[141] Oxfam International. 2017. Position Paper on Gender Justice and the Extractive Industries. p. 5.

[142] US Department of Energy. January 2017. US Energy and Employment Report. https://www.energy.gov/sites/prod/files/2017/01/f34/2017%20US%20Energy%20and%20Jobs%20Report_0.pdf

[143] McGuigan, Claire. 2007. The Benefits of FDI: Is Foreign Investment in Bolivia’s Oil and Gas Delivering. *La Paz: Christian Aid and CEDLA*, p. 32.

[144] Wilson, P. and Hiller, C. November 2011. Drafting Impact Benefit Agreements. Continuing Legal Education Society of British Columbia.

[145] Frynas, Jedrzej George. 2009. Corporate Social Responsibility in the Oil and Gas Sector. *Journal of World Energy Law & Business* 2(3), pp.178-195, 180.

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(4) identifying other relevant opportunities for such involvement."[146] A report by the Arctic Council also recommended the establishment of infrastructure and health-care facilities, "so that northern economies and people benefit over the longer-term and so that infrastructure and services are maintained in the period after the activity has declined or ceased."[147]

8.5 Overview of benefit sharing from offshore development in some Arctic states

This section discusses the lessons from offshore projects in other countries, as well as the benefits that could result from future offshore developments throughout the Arctic.

8.5.1 Norway

Norway is often touted as an ideal example of the benefits that can accrue from Arctic and sub-Arctic offshore development. The government has used revenue to reinvest in the economy, provide social services, and support a state Petroleum Fund, which is invested in stocks and bonds to provide the government with an income stream in the future.[148] Norway generates revenue from its oil and gas primarily through the state's direct involvement in oil and gas exploration and production (including through the state-owned enterprise Statoil as well as participating in various joint ventures) and through taxes.

The Snow White natural gas field offshore of Hammerfest was the first offshore development in the Arctic. Residents of Hammerfest report that the Snow White offshore development has resulted in benefits to local businesses and increased local employment, although the benefits to the Indigenous Sami population are less apparent.[149] Property taxes from related onshore infrastructure have also benefited the local community, providing approximately NOK 157 million per year, about 20% of the municipality's annual income.

However, the influx of money from offshore development has led to greater social inequality and an increase in the price of housing and services. Some people believe that the municipality's focus on the oil and gas industry has reduced its prioritization of the development of other areas of the economy, such as tourism.[150]

The fall in oil prices has hurt the Norwegian economy. Since 2014, more than 35,000 people have lost their jobs in the oil and gas industry, and North Energy, the only oil company based in Northern Norway,

[146] Arctic Council Arctic Ocean Review Project 2009-2013, Final Report, pp. 26-27 (2013). https://oaarchive.arctic-council.org/handle/11374/67

[147] Arctic Council Arctic Monitoring and Assessment Programme. 2007. Arctic Oil and Gas, p. vi. https://www.amap.no/documents/doc/arctic-oil-and-gas-2007/71

[148] Hortzok, Alanna. 2004. *Citizen Dividends and Oil Resource Rents: A focus on Alaska, Norway and Nigeria*, Earthrights. http://www.earthrightsinstitute.org/news-4/publications/land-value-rights/223-oilrent

[149] Loe, Julia SP, and Kelman, Ilan. 2016. Arctic petroleum's community impacts: Local perceptions from Hammerfest, Norway." *Energy Research & Social Science* 16: 25-34, 26.

[150] Ibid.

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has lost money and cut jobs, particularly in the town of Alta.

8.5.1 Russia

Gazprom's Prirazlomnoe project is Russia's first Arctic offshore oil-producing field, which began shipping oil in April 2014. Development of the Shtokman offshore gas project in the Barents Sea has been delayed until 2028.[151] However, companies are conducting exploratory drilling and seismic activities throughout the Russian Arctic offshore waters.

The likely extent of future offshore development in Russia is difficult to assess. Although Russia has vast amounts of fossil fuels, the prospects for its development are weakened by the fact that the level of investment risk is distinctly higher there than in other countries in the area. The Russian Ministry of Natural Resources predicts that it will take decades before any substantial conclusions can be drawn about the economic viability of Russian Arctic offshore oil and gas.[152]

The benefit sharing arrangements associated with the Sakhalin projects appear to be somewhat favourable. For example, for Sakhalin I, the company provided $300 million for infrastructure improvements, and for the Sakhalin II project, the company spent over $600 million towards infrastructure. In addition, the Sakhalin Indigenous Minorities Development Plan provides around US$300,000 per year for social programs and traditional economic activities, and Indigenous peoples are involved in decisions about the allocation of funds.[153]

In some communities, the development has led to increased conflicts about the distribution of money within the community. [154] In addition, to the extent that these benefit-sharing mechanisms have provided necessary support to communities, the communities are also concerned about their dependence on the industry.

8.5.1 Canada

There is currently no offshore production in northern Canada. Although exploratory drilling in Canadian Arctic waters took place in the past, companies are not conducting exploratory drilling at present.

Revenue from oil and gas provide a minimal overall contribution to Canada's diversified economy. Production of crude oil represents just 3% of Canada's GDP[155] and employment in the industry has been

[151] Atle Staalesen. Oct. 5, 2017. Gazprom hints comeback for Shtokman project. *The Barents Observer.* https://thebarentsobserver.com/en/industry-and-energy/2017/10/gazprom-hints-comeback-shtokman-project

[152] Greenpeace Russian Arctic Offshore Hydrocarbon Exploration: Investment Risks, p. 21, http://www.greenpeace.org/russia/Global/russia/report/Arctic-oil/ArcticSave_English_26_apr.pdf

[153] Tysiachniouk, M.S. and Petrov, A.N. 2018. Benefit sharing in the Arctic energy sector: Perspectives on corporate policies and practices in Northern Russia and Alaska, *Energy Research & Social Science* 39: 29–34, 31.

[154] Ibid.

[155] Canada's Economy: Beyond Petroleum. Jan. 29, 2015. *The Economist*, https://www.economist.com/the-americas/2015/01/ 29/beyond-petroleum

on a steady decline,[156] with most new jobs related to ongoing operations and weak prospects for future growth in exploration, according to the Canadian government.[157] The International Institute for Sustainable Development estimates that governments provide $3.3 billion annually in subsidies to oil and gas exploration and production in Canada.[158]

Canada has developed some progressive forms of benefit sharing from oil and gas development through Land Claims Agreements. The Nunavut Land Claims Agreement provides for annual resource royalties, requires an Impact and Benefit Agreement (IIBA) for any project on Inuit-owned land, and calls for support for Inuit businesses and organizations to become competitive for government contracts.[159] However, as noted in the Preliminary Findings report (page 13), as the possible development scenarios under consideration in the SEA are outside the Nunavut Settlement Area in Canadian offshore waters and not on Inuit-owned land, an IIBA would not be required for those activities. The Canadian government has recently signaled its intent to negotiate a Beaufort Sea oil and gas revenue-sharing agreement with the governments of the Northwest Territories and Yukon, as well as the Inuvialuit Regional Corporation.[160]

Communities in the Canadian Arctic have experienced positive and negative impacts from the boom cycles of oil and gas development, which "took much but contributed very little to local communities and did so at the expense of local people" according to one researcher.[161] There are few data available on earlier cycles, but information about the effects of the early 2000's boom noted the lack of employment for locals and impacts of migrant workers on housing availability. [162] In addition, there has sometimes been a strong disparity in earnings in resource-rich areas between Indigenous and non-Indigenous people.[163]

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[156] PETROLMI, Canada's Oil and Gas Employment and Labour Market Data Q2 2017, https://careers-oil-gas.s3.amazonaws.com/publications/22/en/LFS_Q2_2017_FINAL.pdf?1508163499.

[157] Canadian oil and gas employment continues rise in Q1, Deborah Jaremko, JWN, May 13, 2018, https://www.jwnenergy.com/article/2018/5/canadian-oil-and-gas-employment-continues-rise-q1/

[158] International Institute for Sustainable Development. 2015. G20 subsidies to oil and gas and coal: Canada. https://www.iisd.org/faq/unpacking-canadas-fossil-fuel-subsidies/

[159] Nunavut Land Claims Agreement, § 24.2.1; § 25.1.1; § 26.3.3.

[160] Sevunts, L. Oct. 5, 2018. Ottawa signals it's open to talks on offshore Arctic oil and gas development, Radio Canada International. http://www.rcinet.ca/eye-on-the-arctic/2018/10/05/arctic-oil-gas-canada-offshore-energy-resources-indigenous-environment-politics/

[161] Young, Michael G. 2016. Help wanted: A call for the non-profit sector to increase services for hard-to-house persons with concurrent disorders in the Western Canadian Arctic. *The Extractive Industries and Society* 3.1: 41-49; https://www.sciencedirect.com/science/article/pii/S2214790X15300022

[162] Ibid.

[163] Parlee, Brenda L. 2015. Avoiding the resource curse: Indigenous communities and Canada's oil sands. *World Development* 74: 425-436; https://www.sciencedirect.com/science/article/pii/S0305750X15000637?via%3Dihub

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8.6 Conclusion

While local communities tend to bear the majority of the risks and are affected by impacts of potential and actual offshore oil and gas development, they do not always receive many benefits in terms of job opportunities and tax revenues, something that should be considered before permitting new development in Canada's eastern Arctic. A balanced assessment of the true costs and benefits of offshore oil and gas is critical for local communities to understand what is at stake, yet the SEA process has not attempted to carry out a full and clear accounting along these lines. A future cost-benefit analysis must consider the impacts at the local level in order for communities to be able to make informed assessments of offshore oil and gas.

Many governments support offshore development based on the assertion that the public will benefit from the economic activity, but for local communities, the reality has often been that most benefits go to the national government, with few trickling down to the community. Indeed, the failure of wealth from the exploitation of natural resources to translate into benefits for the local population is a well-understood phenomenon, identified as the "resource curse." Despite the mostly developed and democratic nature of Arctic governments, local communities are not immune from this curse. In addition, given the unpredictable nature of energy markets, offshore oil and gas may be an uncertain foundation for sustainable long-term planning for socio-economic development. As described in the next section, there are other, less risky economic development options that can be sustained over the long term.

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9 ECONOMIC ALTERNATIVES TO OIL AND GAS

Summary: There are a number of promising economic development alternatives to offshore oil and gas in Nunavut, including sustainable fisheries, Inuit-led tourism, Inuit Impact and Benefit Agreements for conservation, and renewable energy opportunities, which are less risky and more sustainable over the long term.

Recommendation: The potential for development alternatives must be analyzed before a fully informed decision on offshore oil and gas activity in Baffin Bay and Davis Strait can be made.

9.1 The conservation 'blue' economy

The sustainable economic development of the Arctic is only possible if it contributes to long-term prosperity, ecosystem resilience and environmental sustainability. The emerging concept of the "blue economy" has surged into common policy use in recent years as a new approach to economic growth, social inclusion, and the preservation or improvement of livelihoods while at the same time ensuring environmental sustainability of the oceans and coastal areas.[164] Economic initiatives may include the development of renewable energy resources, fisheries, marine transport, and Inuit-led tourism. Despite increasingly widespread use of the term, we are not aware of any reference to the blue economy in the NIRB's Preliminary Findings Report or the two Nunami Stantec SEA reports, let along how offshore oil and gas might contribute to or impede blue economy objectives.

WWF has developed principles to guide the development of the blue economy. [165] These Principles offer a clear definition; guidance on governance; and a set of necessary actions for a sustainable blue economy to be realized. The Principles are also harmonized with relevant United Nations agreements, including the Sustainable Development Goals, other widely adopted principles for sustainable corporate and organizational governance, and with established understanding of related concepts such as Green Economy and circular economy. A sustainable blue economy should:

- provide social and economic benefits for current and future generations;
- restore, protect and maintain the diversity, productivity, resilience, core functions, and intrinsic value of marine ecosystems; and
- be based on clean technologies, renewable energy, and circular material flows.

Although the SEA has not considered whether offshore petroleum development in Nunavut will contribute to these objectives, as discussed in section 8 of this submission (Economic Benefits and the

[164] World Bank Group. 2017. The Potential of the Blue Economy.
https://openknowledge.worldbank.org/bitstream/handle/10986/26843/115545.pdf?sequence=1&isAllowed=y
[165] WWF. 2018. Principles for a Blue Economy.
http://awsassets.panda.org/downloads/wwf_marine_briefing_principles_blue_economy.pdf

Myths of Offshore Oil and Gas), it is safe to assume that the offshore petroleum industry will not help restore and protect marine ecosystems, nor will it help to facilitate an economy that is based on clean energy or circular material flows; and there is some doubt whether it can provide sustainable social and economic benefits for future generations of Inuit.

In fact, offshore oil and gas is only one of a number of possible development options in the North. Although the Nunami Stantec reports do include a 'no oil and gas development' option, this creates the false impression that the alternative to Arctic oil and gas development would be the status quo. An SEA limited only to considering the impacts/benefits of oil and gas may lead to the misleading conclusion that there are no other viable ways to meet the development needs of northerners. Before any decision can be made on the future of offshore oil and gas in Nunavut, robust and reasonable development alternatives to oil and gas, such as the ones discussed below, must be analyzed for future consideration.

9.2 Sustainable Arctic fishing

Fishing has always been a part of traditional Inuit lifestyles, and there exists potential to increase the livelihood benefits of sustainable fisheries in Nunavut through Indigenous-owned and operated companies and cooperatives.

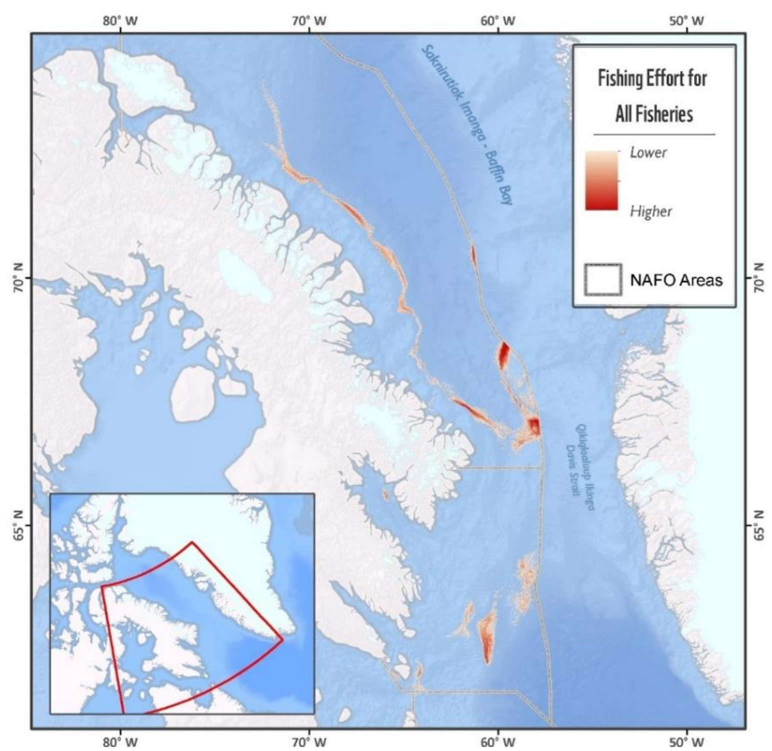

Figure 17: Distribution of the 2005-2014 georeferenced fishing effort for the Eastern Arctic bioregion: Greenland halibut mobile and fixed gear fisheries and Northern shrimp fixed gear fishery.

9.2.1 Offshore commercial fishing

The offshore commercial fishery in the waters of Baffin Bay and Davis Strait is a major contributor to the economy of Nunavut. The offshore fishery in these waters mainly targets two species: the flatfish Greenland halibut (Reinhardtius hippoglossoides, also known as turbot) and Northern shrimp (pandalus borealis). Together, these species represent over $100 million in landed value each year. The fishery in the study area is divided into Northwest Atlantic Fisheries Organization (NAFO) zones 0A and 0B. Nunavut interests control all the Greenland halibut quota in NAFO 0A, while Greenland halibut in NAFO 0B and Northern shrimp quota in both zones are split between Nunavut and fisheries operations from other parts of Eastern Canada. Greenland halibut are known to be a highly migratory species, with Greenland halibut having been tracked from Baffin Bay to the ocean around Newfoundland, and Iceland. WWF-Canada works with university researchers to better understand the population dynamics of this migration.

There are four Nunavut-based companies which control Nunavut's offshore fisheries allocations: Qikiqtaluuk Corporation (QC), Baffin Fisheries Coalition (BFC), Arctic Fishery Alliance (AFA) and Pangnirtung Fisheries and Cumberland Sound Fisheries Ltd Partnership (PFL/CSFL). Only QC, BFC, and AFA currently have the capacity to harvest in the offshore area. Qikiqtaluuk Corporation is the business arm of the Qikiqtani Inuit Association, representing the Inuit of the Qikiqtani region. Baffin Fisheries Coalition is owned by the Hunters and Trappers Organizations of the communities of Iqaluit, Pangnirtung, Clyde River, Pond Inlet and Kimmirut. Arctic Fisheries Alliance is owned by the Hunters and Trappers Organizations and Community Trusts from Qikiqtarjuaq, Grise Fiord, Resolute, and Arctic Bay. Cumberland Sound Fisheries is owned by local harvesters and the Nunavut Development Corporation Industry players have taken steps towards 100% Inuit ownership of their operations in recent years, increasing the amount of economic benefits to the territory.

The offshore commercial sector in Nunavut has taken a number of steps towards greater sustainability in recent years. The northern shrimp fishery, which is prosecuted using exclusively bottom trawl gear, received the Marine Stewardship Council (MSC) sustainability certification in 2011, and has maintained it ever since. The offshore Greenland halibut fishery, which is prosecuted by a combination of bottom-set gillnets and bottom trawls, is currently being assessed by MSC for the same certification. There are also currently 3 marine refuges in NAFO zones 0A and 0B, the Davis Strait Conservation Area, Disko Fan Conservation Area, and Hatton Basin Conservation Area. These marine refuges are an important part of conserving Canada's marine biodiversity, as well as meeting Canada's Marine Conservation Targets.

WWF-Canada has consistently called on the federal government to not allow oil & gas activities within marine refuges. All three marine refuges in the focus area identify the protection of corals, sponges, or other important bottom habitat features as part of the rationale for their designation. The National Advisory Panel on Marine Protected Area Standards also recommends that "When industrial activities are allowed to occur in areas counted as other effective area-based conservation measures, the Minister of Fisheries, Oceans and the Canadian Coast Guard must be satisfied through effective legislation or regulation that risks to intended biodiversity outcomes are avoided or mitigated." Allowing oil & gas exploration in these important areas would undermine their contribution to conservation. WWF-Canada therefore recommends that no oil & gas exploration activity be permitted in Marine Refuges in Baffin Bay/Davis Strait.

9.2.2 Inshore fishing

Fishing and harvesting seafood in lakes, rivers, and coastal areas is an important part of the heritage, livelihoods, and food security of Nunavummiut. Subsistence harvesting of Arctic char, clams, kelp, and marine mammals is integral to the traditional diets of Inuit. The government of Nunavut calculates that the annual food replacement value of Arctic char harvested across Nunavut each year for subsistence purposes is equivalent to $7.2 million. Ensuring the security of these important harvesting areas must be paramount when considering any industrial activity in Baffin Bay/Davis Strait.

In addition to subsistence fishing, inshore commercial fishing is a growing sector of the Nunavut economy. WWF-Canada is active in supporting communities developing their marine resources in a sustainable way, including the communities of Cape Dorset and Sanikiluaq. Further development of sustainable inshore fisheries is a stated goal of the Nunavut Fisheries Strategy (2016-2020).

9.2.2.1 Pangnirtung turbot fishery

An example of particular note for the economic and social potential of successful inshore fisheries is the community of Pangnirtung. Local harvesters in Pangnirtung have worked towards fisheries development for over 30 years, working to develop an inshore and near-shore Greenland halibut fishery. Their efforts led to the designation of a Total Allowable Harvest (TAH) of 500 tonnes to be harvested in Cumberland Sound. The fishery is primarily prosecuted as a winter fishery, using longlines set through the ice. Since 2014, the fishery has consistently brought in over 300 tonnes each year, with a value of over $2.4 million to the community. The commercial fishery potential in the area has also led to DFO building its only Small Craft Harbour in Nunavut in Pangnirtung.

There is great potential for further growth of local commercial fisheries in the rest of Nunavut, including communities with the potential to be impacted by oil & gas development in Baffin Bay and Davis Strait. The Nunavut Fisheries Strategy 2016-2020 identifies a number of these opportunities, including inshore Greenland halibut fisheries in Pond Inlet, Qikiqtarjuaq and Clyde River, clams in Qikiqtarjuaq, three species of shrimp and whelks near Iqaluit, Grise Fiord, Arctic Bay, Resolute and Qikiqtarjuaq. There have also been attempts at developing a crab fishery in Cape Dorset, and experimental fisheries surveys carried out in Kimmirut.

9.2.2.2 Potential impacts

Very little study has been done on the impacts of oil & gas activity on the most important species for fisheries in Baffin Bay/Davis Strait. The federal Petroleum and Environmental Management Tool states there have been no studies on the impacts of seismic on Arctic char. It also states that no similar studies have been done on potential impacts on Greenland halibut. As such, the precautionary approach must reign supreme when it comes to allowing oil & gas activities in areas known to be of significance to important fish species. Due to the important life stages spent by Arctic char in the near-shore environment, and the brief period of time available for char to feed in that environment, steps must be taken to reduce impacts of potential activity in that near-shore environment. WWF-Canada recommends that no exploration activity take place in near-shore Arctic char feeding grounds.

9.3 Renewable energy potential

Oil and gas exploration and development is a risky use of the marine space that endangers wildlife, harvesting, and other economic activity already occurring in the marine area. Investing in an oil and gas extraction projects also doubles-down on Nunavut's dependence on fossil fuels: not only is the territory 100% reliant on fossil fuels for heat, electricity, and transportation, it will also become dependent on fossil fuels for income. Renewable energy project development is suggested as an alternative development scenario that can broaden Nunavut's economic base in an emerging market, provide clean energy that does not adversely affect other economic activities taking place in Baffin Bay and Davis Straight, and helps Nunavut decrease its reliance on fossil fuels instead of increasing it.

There are good examples of communities in the Arctic that have begun moving down the path of renewable energy to provide cleaner, more affordable energy to their communities.

Example 1: Chaninik Wind Group – Alaska, USA

The Chaninik Wind Group was formed by the United Tribal Governments of Kongiganak, Kwigilliingok, Tuntutuliak, and Kipnuk in Alaska. It includes local utility managers, energy consultants and represents more than 2,000 tribal members. The Chaninik Wind Group was formed in 2005 because the communities realized that only by working together could they survive the impacts of increasing fuel costs and move towards renewable energy sources in the region. Chaninik aims to reduce dependency on diesel fuel, lower energy costs and create opportunities for economic development in their communities.[166]

The Village of Kongiginak[167] *is 500 miles from any road system, and is a member of the Chaninik Wind Group. Its ~400 inhabitants had relied only on diesel as a source of electrical power and for heat. Diesel arrives by barge twice a year and costs about $7.00 per gallon. In 2014, five 95 kW wind turbines, 20 electric thermal storage (ETS) stoves, and a control and smart metering system were installed. Wind penetration for the community electrical grid is now 30-40% resulting in significant monetary savings.*

The ETS units provide half price heat for community elders and members where heating costs are the primary expense in the winter. The ETS units are so popular the village is expanding the ETS stoves to 50 homes.

[166] Office of Indian Energy Policy and Programs. 2010. Chaninik Wind Group 2010 Project. https://www.energy.gov/indianenergy/chaninik-wind-group-2010-project
[167] Intelligent Energy Systems. http://www.iesconnect.net/projects/kongiganak-wind-heat-system/

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Example 2: Raglan Mine[168], Nunavik, Northern Quebec

The Raglan Mine is a nickel mine in Nunavik. Due to the high costs of relying on diesel for 100% of their energy needs in such a remote location, the mine started looking at alternatives. Very quickly, preliminary studies showed that there was excellent wind energy resource in that area. After collecting data for a few years, the mine had the baseline data needed to show there was a financial case for making the switch towards renewables[169]. A 3 MW wind turbine plus innovative energy storage technologies was installed. This small pilot project (the mine has about 28 MW total installed power capacity[170]) supplied 5% of the energy used, saved the mine 2.1 million litres of fuel in its first year[171], and decreased energy costs.

Investment of limited capital in a green energy future is consistent with both Canadian and international policies and commitments, and is low-risk from a policy, environmental, and financial perspective. Easily scalable, renewable energy works for both small communities and large mines. Investing in renewable energy projects in Nunavut helps decrease the impact Nunavut has on the global warming feed-back loop that is threatening the Inuit way of life in the

Renewable energy development is one of several possible alternatives to oil and gas development:

- Currently Nunavut is 100% reliant on diesel for energy (heating, electricity, transportation)
- 100% of this diesel is imported to the territory, resulting in economic leakage away from Nunavut
- Investing resources into renewable energy and energy efficiency, as opposed to oil and gas exploration/development, reduces energy costs to Nunavummiut; reduces reliance on imported diesel; reduces environmental harm; creates new, green jobs in an emerging energy market sector in each community; and safeguards existing traditional industries (hunting and trapping) as well as emerging environment-dependent industries (off-shore and in-shore fisheries)
- Investment in renewables also means Nunavut does its share to decrease the global warming feed-back loop that is threatening the Inuit way of life in the Arctic
- Investment in a green energy future is consistent with both Canadian and international policies and commitments, and is a low-risk investment from a policy, environmental, and financial perspective.
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[168] Judd, E. Raglan Mine: Canada's First Industrial Scale Wind and Energy Storage Facility. https://energyandmines.com/wp-content/uploads/2014/08/Raglan.pdf
[169] Ibid.
[170] Natural Resources Canada. Glencore RAGLAN Mine Renewable Electricity Smart-Grid Pilot Demonstration. https://www.nrcan.gc.ca/energy/funding/current-funding-programs/eii/16662
[171] Zerehi, S. Sept. 20, 2016. We're already doing it: Quebec company touts wind power in Canada's Arctic. https://www.cbc.ca/news/canada/north/wind-power-canada-arctic-1.3769462

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9.4 Inuit-led tourism

As Arctic sea ice declines, there is growing potential to develop a northern tourism industry, in which Inuit are directly involved through control, ownership and guidance over economic, cultural and natural resources, and where the tourism is part of a larger strategy of reinforcing or revitalizing political and cultural autonomy through intercultural encounters.[172] Inuit-led tourism emphasizes respect for local cultures and their decision-making processes as well as community or local control over the social and natural resources involved.[173] Some examples of Indigenous tourism in Canada include:

- Aurora Village, Northwest Territories is owned by Métis businessman and former premier Don Morin. Aurora Village operates tours to see the northern lights at its camp in Cassidy Point, just outside Yellowknife, NWT, that includes a restaurant and several heated tipis.

- Yukon River Time Out Tours is owned by Pat Van Bibber who is a mix of the region's two histories (gold prospector and Selkirk nation).

There are many other successful models of Indigenous-led tourism from across Canada and around the world. In New Zealand for example, five per cent of the country's $29-billion annual tourism revenue is related to Māori culture. Canada's tourism industry is much bigger at $97-billion in 2017, yet experiences related to Indigenous culture are worth only $1.5 billion, less than two per cent of the total.[174] The demand for Arctic tourism is skyrocketing, and indeed it may be one of the more sustainable development options for Nunavut.

Investments in oil and gas infrastructure and building response capacity could run into the billions of dollars for the Canadian government, money that could be invested in creating full-service destinations for northern lights and ice floe tours, polar bear watching, fishing and hunting outfitters and camping tours. With an ever-increasing number of tourists recognizing the attractiveness of the Arctic, tour companies are increasingly recognizing the opportunities.

9.4 Inuit Impact and Benefit Agreements for conservation

In 2018, the Canadian government and the Qikiqtani Inuit Association announced the negotiation of the Tallurutiup Imanga Inuit Impact and Benefit Agreement (IIBA).[175] This pact will complete the largest

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[172] Center for a Sustainable Economy. 2016. Beyond Fossil Fuels: Sustainable Development Opportunities for Eastern Nunavut.
[173] Vivanco, Luis. 2007. The prospects and dilemmas of Indigenous tourism standards and certification. In Black, Rosemary and Alice Crabtree, Eds. *Quality Assurance and Certification in Ecotourism*. Cambridge, MA: CAB International.
[174] Halliday, M. 2019. The Arctic wants to be Canada's next tourism hot spot. *Pivot Magazine.* https://www.cpacanada.ca/en/news/pivot-magazine/2019-01-10-indigenous-tourism
[175] Parks Canada. Tallurutiup Imanga: a final boundary for Canada's largest protected area in Nunavut. https://www.pc.gc.ca/en/amnc-nmca/cnamnc-cnnmca/tallurutiup-imanga

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unified land and water protected area in Canada and create significant opportunities for economic development, infrastructure, job training and employment for Inuit in five Baffin communities within the SEA study area who are directly affected by the new conservation area: Pond inlet, Clyde River, Resolute Bay, Arctic Bay and Grise Fiord.

Parks Canada will provide up to $900,000 in funding to directly support the QIA's implementation of the pilot Tallurutiup Imanga NMCA Guardian program, and to explore how Inuit can be engaged with management of the Tallurutiup Imanga National Marine Conservation Area (NMCA). The implementation will ensure the transfer of traditional knowledge from Elders to Youth, as well as the long-term sustainability of the Guardian Program, and the funding will also enable the QIA to explore how the program could best contribute to the management of the entire NMCA.[176]

These various development opportunities can contribute to an emerging blue economy for the North that values the sustainable use of resources for ocean health, improved livelihoods, jobs and development. IIBAs for conservation purposes can provide economic benefits on an ongoing basis while protecting and maintaining ecosystem services that can be valuable for other economic activities such as hunting, fishing and tourism. Although the precise economic potential of IIBAs for conservation purposes in the North is beyond the scope of this submission, it should be considered carefully before any decisions are made on offshore oil and gas in Nunavut.

[176] Parks Canada. July 18, 2018. *Parks Canada announces funding to Qikiqtani Inuit Association for pilot Guardian program in Arctic Bay*. https://www.newswire.ca/news-releases/parks-canada-announces-funding-to-qikiqtani-inuit-association-for-pilot-guardian-program-in-arctic-bay-688535601.html

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10 UPSTREAM AND DOWNSTREAM CLIMATE IMPACTS

Summary: Development of oil and gas resources in the Arctic appears to be incompatible with efforts to limit average global warming to 2°C, let alone the safer aspirational target of 1.5°C. This is not mentioned in the SEA Preliminary Findings Report or the Nunami Stantec reports.

Recommendation: The next stage of the SEA process should analyze upstream and downstream greenhouse gas (GHG) emissions at various possible *scales* of offshore oil and activity in the eastern Canadian Arctic to determine if and to what extent Arctic oil can be developed within national and international carbon reduction targets. If the scale of offshore petroleum activities is extensive, this would constitute an important contribution to Canada's overall GHG emissions and would negatively impact global efforts to limit warming.

10.1 Downstream emissions

Despite requests by WWF-Canada and several other intervenors, including at least one community Hunters and Trappers Organization, the NIRB has declined to consider the downstream impacts of offshore oil and gas exploitation in this SEA process, stating that it is beyond the scope of the assessment. It is well documented that the Arctic is facing a rate of warming at twice the global average according to the U.S. National Oceanic and Atmospheric Administration.[177] Canada's North has seen an average increase of approximately 3°C increase since 1948.[178]

The Arctic plays an important role in balancing the world's climate and the large-scale changes that take place in the Arctic climate system exert a strong influence throughout the global climate system. Warming in the Arctic has consequences not only for climate developments and Arctic communities (both human and natural), but also throughout the world.[179] Most importantly are the consequences for the climate system itself (and thus for future climate). In addition, warming will affect sea level, which has a direct impact on people and societies in many parts of the planet.

As Sheila Watt-Cloutier, an Inuk and senior fellow at the Centre for International Governance Innovation, has stated,

> *"Virtually every community across the North is now struggling to cope with extreme coastal erosion, thawing permafrost, and rapid destructive runoff... Despite our cold*

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[177] Hays, B. Dec. 12, 2018. *NOAA: Arctic warming at twice the rate of the rest of the planet.* https://www.upi.com/NOAA-Arctic-warming-at-twice-the-rate-of-the-rest-of-the-planet/5141544580754/

[178] APTN News. Nov. 23, 2015. Canada warming at twice the global rate with Arctic hardest hit. https://aptnnews.ca/2015/11/23/canada-warming-at-twice-the-global-rate-with-arctic-hardest-hit-ottawa-scientists/

[179] Norwegian Polar Institute. The climate in the Arctic has impact worldwide. http://www.npolar.no/en/themes/climate/climate-change/global-climate-change/the-climate-in-the-arctic-has-impact-worldwide.html

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northern winters, sea ice remains in rapid decline…the world has to take note of what is happening in the Arctic — because what happens in the Arctic does not stay in the Arctic. Arctic ice is the planet's air conditioner; as it melts, that air conditioner is breaking down, creating havoc around the world. The whole planet benefits from a frozen Arctic and Inuit still have much to teach the world about the vital importance of Arctic ice, not only to our culture, but to the health of the rest of the planet."[180]

'Canada's greenhouse gas footprint roughly doubles with inclusion of emissions associated with the foreign combustion of oil produced in Canada and exported abroad.'

Given that climatic changes are being felt most dramatically in Arctic regions and will rapidly have repercussions for the rest of the world, it is perplexing that the NIRB has opted to consider only the upstream impacts of offshore oil and gas activities in Nunavut and to disregard downstream impacts (which is where most of the carbon is released). Consideration of such emissions can alter the balance of costs and benefits of offshore oil and gas projects, which can thereby influence the views of stakeholders, as well as the ability of the governments and regulators to justify approving a project in light of that balance.[181]

Attention to downstream emissions, especially out-of-country downstream emissions is likely to be resisted by some interests. It is, however, consistent with international judicially mandated best practices and with recent federal intent in the National Energy Board review of the proposed Energy East project, prior to its cancellation.[182] Canada's greenhouse gas footprint roughly doubles with inclusion of emissions associated with the foreign combustion of oil produced in Canada and exported abroad.[183] This fact is omitted from the Preliminary Findings Report and needs to be noted in the Final SEA Report. It is a crucial piece of information for those living in the Arctic who are being asked for their views on the prospects of offshore oil and gas and who stand to be among the most impacted by the effects of climate change.

The world's transition to renewable energy is driven by the global consensus that to avoid catastrophic disaster, the Earth's overall rise in temperature must be less than 2°C, according to the Paris Agreement.[184] Yet nowhere in the SEA Preliminary Findings Report is it mentioned that development of oil and gas resources in the Arctic is likely not commensurate with efforts to limit average global

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[180] Watt-Cloutier, Sheila. Nov. 15, 2018. It's time to listen to the Inuit on climate change. *Canadian Geographic.* https://www.canadiangeographic.ca/article/its-time-listen-inuit-climate-change

[181] Burger, M. and J. Wentz. 2017. Downstream and Upstream Greenhouse Gas Emissions: The Proper Scope of NEPA Review. *Harvard Environmental Law Review*. Vol. 41, 1: 109-187.

[182] See Burger and Wentz. 2017. p. 28; and Gray v. Minister of Planning. 2006. New South Wales Law and Environment Court 720, paragraph 124.

[183] Lee, M. 2017. Extracted Carbon: Re-examining Canada's Contribution to Climate Change through Fossil Fuel Exports*. Canadian Centre for Policy Alternatives*, p.5. https://www.policyalternatives.ca/publications/reports/extracted-carbon

[184] United Nations Climate Change. The Paris Agreement. https://unfccc.int/process-and-meetings/the-paris-agreement/the-paris-agreement

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warming to 2°C, let alone the safer aspirational target of 1.5°C.[185] Carbon emissions from the full production of currently operating oil and gas fields and coal mines across the world will already lead to global temperature rise beyond 2°C. Oil and gas development in the Arctic Ocean will not only be affected by, but will also contribute to, the Climate Change scenarios presented by the International Governmental Panel on Climate Change in its 2018 Special Assessment Report, referred to as SR15.[186]

To achieve even the 2°C objective, scientific studies indicate that 68-80 percent of existing global fossil fuel reserves must stay in the ground. Because the nations of the world have, in effect, agreed that most of the already proven reserves must remain undeveloped, including those in the Arctic, a transition to renewable energy is incompatible with development of the undiscovered and very expensive resources in the offshore Arctic.[187] To the extent that nations choose not to abide by this commitment, the outcome for the world will be devastating, and as noted, those living in the Arctic will be among the hardest hit.[188]

Canada was a leader in signing and ratifying the Paris Agreement, and has taken some positive steps. Nevertheless, we continue to be a climate laggard, recently ranked 54th out of 60 countries on climate action.[189] Canada's emissions are among the highest in the world on a per capita basis and despite our small population, we are one of the ten top emitters of greenhouse gases in the world in absolute terms.[190] [191]

A final point of note, page 7.4 of section 7.1.1.1 of the Nunami Stantec document 'Environmental Setting and Review of Potential Effects of Oil and Gas Activities' states that "GHGs are known to contribute to global warming which causes changes in the world's atmosphere, land, and oceans. **These changes may have both positive and negative effects on people, plants, and animals.**" This statement is extremely misleading, irresponsible and must be removed or qualified. It has been well-established that the

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[185] See Carbon Tracker Initiative. 2011. Unburnable Carbon – Are the world's financial markets carrying a carbon bubble? https://www.carbontracker.org/reports/carbon-bubble/; M. Raupach et al. 2014. Sharing a quota on cumulative carbon emissions. *Nature Climate Change* 873; Oil Change International. Sept. 2016. The Sky's Limit: Why the Paris Climate Goals Require A Managed Decline of Fossil Fuel Production. (http://priceofoil.org/2016/09/22/the-skys-limit-report/

[186] Intergovernmental Panel on Climate Change (IPCC). 2018. SR15: Global Warming of 1.5°C.

[187] McGlade, C. and Ekins, P. 2015. The geographical distribution of fossil fuels unused when limiting global warming to 2° C, 517 Nature 187.

[188] Intergovernmental Panel on Climate Change. 2018. Global Warming of 1.5 °C: Special Report on the impacts of global warming of 1.5 °C above pre-industrial levels and related global greenhouse gas emission pathways, in the context of strengthening the global response to the threat of climate change, sustainable development, and efforts to eradicate poverty. http://www.ipcc.ch/report/sr15/

[189] Burck, J. et al. December 2018. Results 2019. Climate Change Performance Index. https://www.climate-change-performance-index.org/sites/default/files/documents/ccpi2019_results.pdf

[190] Gibson, R. et al. January 2019. From Paris to Projects. https://uwaterloo.ca/paris-to-projects/sites/ca.paris-to-projects/files/uploads/files/p2p_summary_report_23jan19.pdf

[191] Ge, Mengpin, Friedrich, J. and T. Damassa. November 2014. Six Graphs Explain the World's Top 10 Emitters. World Resources Institute. https://www.wri.org/blog/2014/11/6-graphs-explain%20-world-s-top-10-emitters

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impacts of climate change are overwhelmingly negative and even potentially catastrophic. In a global context, there are some locations that may be considered climate "winners". However, impacts on the Arctic people, plants, and animals are generally considered extreme, life-altering, and in some cases, including to existing infrastructure, devastating. Any positive effects should be put in the context of the Arctic region of interest for this study and the overall tremendously negative consequences of climate change the world over.

10.2 Upstream emissions

This SEA does not estimate the GHG contributions of oil and gas activities under various scales of development. It only provides estimates based on one average platform, which is misleading and unrealistic in our view. Cumulative greenhouse gas emissions under various feasible scales of development will be an important factor in the government's decision on the oil and gas moratorium. Project by project consideration of GHG and air emissions at the impact assessment stage will not give the whole picture. Page 7.9 of the Nunami Stantec report *Environmental Setting and Review of Potential Effects* states:

> *The GHG emissions from Canada are 704,000,000 tonnes CO2e per year (2016). Global emissions for 2014 were estimated to be 47.4 billion tonnes CO2e (47,350,940,000 tonnes reported in CAIT 2018). The potential GHG emissions from the Scenarios (Seismic Surveys, Exploration, Field Development and Production) therefore are less than 0.08% of the national emissions, and a very small fraction of global emissions. Nonetheless, all GHG contributions add cumulatively to the overall potential for global warming.*

Again, this GHG estimate is based on the emissions from one average offshore platform, which would of course only account for a relatively small contribution to Canada's total annual emissions. The SEA must also consider GHG impacts at various feasible scales of potential offshore development. There is a vast difference in emissions between one drilling platform and many dozens. As a point of reference, as of January 2018 there were 175 active offshore drilling platforms in the Gulf of Mexico and 184 in the North Sea.[192]

Nonetheless, even one offshore platform will produce an additional half megatonne (500,000 tonnes) of GHGs annually according to Nunami Stantec, which is roughly equivalent to putting an additional 100,000 passenger vehicles on Canadian roads. As noted above, this does not include downstream emissions when the extracted oil and gas is burned, which roughly doubles the total carbon footprint.[193] This comes at a time when Canada (and the world) is not on track to meet its Paris commitments and must decrease emissions substantially.

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[192] Statista. 2019. Number of offshore rigs worldwide as of January 2018 by region. https://www.statista.com/statistics/279100/number-of-offshore-rigs-worldwide-by-region/
[193] U.S. Environmental Protection Agency. Greenhouse Gas Equivalencies Calculator. https://www.epa.gov/energy/greenhouse-gas-equivalencies-calculator

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APPENDIX A: DETAILED COMMENTS ON PRELIMINARY FINDINGS REPORT AND NUNAMI STANTEC REPORTS

WWF-Canada	**Review Comment #1**
Subject/Topic	**Oil Spill Response Capacity**
References	Preliminary Findings Report 6.2.3
Summary	Offshore oil and gas vessel support not required under Canadian regulations
Importance of the issue to the SEA process	Due to the risk profile of offshore oil and gas in the Arctic and the extreme consequences involved with a spill event, effective and efficient spill response will be of critical importance
Specific Comments	• As noted in the Preliminary Findings report (6.2.3), offshore oil and gas operations in Baffin Bay and Davis Strait "would be expected to include" significant and ongoing vessel support due to an absence of deep-water ports in the region. However, In the Canadian Arctic, there are no actual legal requirements to ensure that sufficient people and equipment could respond to a spill from a drilling rig or a ship, • Canada is not sufficiently prepared for Arctic oil spills and does not yet even have adequate capability of icebreakers that can access hard-to-reach areas. • Ships travelling north of 60 degrees are exempt from the requirement to contract with a response organization that can provide equipment and personnel sufficient to clean up the amount of oil a ship is carrying. • It is stated in section 6.2.3 that onshore storage facilities in coastal communities would be required for emergencies such as oil spill response and other emergency equipment. No such emergency response equipment currently exists in coastal communities throughout Nunavut on a scale required to deal adequately with a major oil spill or well blowout. • Only a small number of coastal communities have access to the most basic oil-spill response equipment from the Canadian Coast Guard. • There are only three CCG ships responsible for the whole of the Northwest Passage. • No method has yet been proven effective for cleaning up oil spills in ice. More knowledge is needed on the long-term behavior of oil in ice, and on the interaction of oil and ice**.**
Recommendation/ Request	Canada's lack of oil spill response capacity, as described above should be mentioned in the Final SEA Report as it is a critical factor for decision-makers to consider when weighing the decision on whether to lift moratorium on offshore Arctic oil and gas. Immediate steps, including substantial investment, would need to be taken to provide adequate response capacity and infrastructure support if

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	offshore oil and gas activities are to take place in the eastern Arctic. A formal review of Canada's capacity to respond to major spills in the Arctic is needed, and a comprehensive, long-term spill response research program should be established.

WWF-Canada	**Review Comment #2**
Subject/Topic	**Ecologically and Biologically Significant (EBSAs), Significant Benthic and Critical habitats**
References	Page 82 of Preliminary Findings Report (Spe*cial and Sensitive Areas and Areas of Concern or Importance)*
Summary	Incomplete representation of impacts of oil and gas on ecologically sensitive species and habitats
Importance of the issue to the SEA process	If there were to be any kind of drilling in ecologically sensitive areas, the impact would likely be serious for some species that are fragile and slow-growing (e.g. corals and sponges). One of the criteria for selecting EBSAs according to the Department of Fisheries and Oceans 2010 Canadian Science Advisory Secretariat report is "vulnerability, fragility, sensitivity, slow recovery", thus any activities involving contact with the seafloor may have long-term, important impacts.
Specific Comments	• On page 82 it is stated that changes to habitat for most disturbances are expected to be short-term and reversible. This is an incomplete representation of what the Nunami Stantec report concludes. On page 7.47 of *Environmental Setting and Review of Potential Effects of Oil and Gas Activities,* it states "***The relative importance and contribution of specific habitats to population viability is not well understood and in these instances, the precautionary approach is applied**."* This is an important caveat that should be mentioned in the Final SEA Report. • There is also no evidence provided to substantiate the claim that impacts to sensitive marine habitat from most oil and gas activities would be "short-term" and "reversible" (see below). The effects on ecologically sensitive habitat and some marine species would not be short-term and reversible in the event of a major oil spill.
Recommendation/ Request	Any offshore oil and gas activities in Baffin Bay and Davis Strait must avoid areas of heightened ecological significance (see maps in Figures 5 and 7) More info: Kenchington, E. et al. 2010. Delineating Coral and Sponge Concentrations in the Biogeographic Regions of the East Coast of Canada Using Spatial Analyses. Fisheries and Oceans Canada. Page 1.

WWF-Canada	**Review Comment #3**
Subject/Topic	**Seismic Testing Impacts**
References	Various page references in Preliminary Findings Report and *'Environmental Setting and Review of Potential Effects of Oil and Gas Activities'* (Nunami Stantec) – see Specific Comments below

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Summary	Treatment of seismic is sometimes factually incorrect and contains scientifically unsubstantiated conclusions and misleading statements, which all tend in the direction of downplaying the harm and risk seismic surveys pose to marine life.
Importance of the issue to the SEA process	Many communities throughout the area of focus have expressed high levels of concern about the impacts of seismic testing on marine wildlife, concerns vividly demonstrated during the Supreme Court of Canada case in which the hamlet of Clyde River was successful in challenging Petroleum Geo-Services planned seismic program offshore. Research indicates that seismic can harm marine wildlife, which many Inuit depend upon for their livelihoods, culture and survival. Marine animals are particularly important for Inuit living on Baffin Island because of the relative scarcity of land-based food and the economic potential for the offshore fishery, including shellfish and the semi-commercial clam fishery in Iqaluit. To date 130 species have been documented to be impacted by human-caused underwater noise pollution, including plankton, benthic organisms, whales, invertebrates, some fish species, narwhals, harbour porpoises, squid and shrimp (Weilgart 2018). The SEA also gives insufficient consideration to cumulative underwater noise impacts. We may not know the exact details of which organisms will be harmed by seismic airgun noise and to what degree, but this does not mean, as asserted in the Nunami Stantec report, that the negative effects will be limited to the immediate area, will stop once oil and gas activities cease, and that the effects will be reversible. More research is needed and the precautionary approach should be applied for those species in which seismic impacts are unknown or uncertain.
Specific Comments	From Preliminary Findings Report: • Page 43: Newer, less environmentally-harmful technologies such as Marine Vibroseis (MV) can send sound waves just as deeply into the seafloor as airguns. • Table 10: 3D seismic surveys do not generally consist just of 2 airguns. There are typically 18-48 airguns, all firing simultaneously. • Page 43: It is not valid to compare natural with human-made noise. While it is true that ice break-up can be quite loud, this does not happen continuously, every 10 seconds, around the clock, as with seismic blasting. It is highly likely that marine life has adapted to natural sounds like ice compared with anthropogenic sounds. It is also misleading to compare the level of one sound 500 m away, where it will be much quieter, with the level of another sound at the source. • Page 68: Research does not support this contention that icebreakers can be heard or detected up to a maximum of only 30 km. Two different research teams and data from several years showed that beluga whales typically avoided icebreakers at distances of 35–50 km (see below: Cosens 1993; Finley 1990). • Page 73: Underwater sounds can travel thousands of kilometers under the right conditions, meaning that effects would not be 'localized' or 'return to natural or background conditions within a small area from the source of impacts' (see below: Holles 2013). • Page 77 (table 17): This table indicates that underwater noise would not impact Special and Sensitive Areas, and Areas of Concern or Importance. Again, until measurements are made of how far the seismic noise travels and depending on where the seismic program takes place, it should be assumed it can travel hundreds to thousands of kilometers. • Page 78: It is not accurate to say that 'seismic surveys may negatively affect plankton up to 1.2 kilometers…from the source of sound', as the research didn't examine impacts beyond this distance (see below: McCauley et al. 2017). It is therefore not justifiable

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	or valid to conclude that the effects on plankton are expected to be low to moderate. Also, plankton in the study were not merely "negatively affected"; all immature krill were killed. • Page 78: Given that plankton were killed by seismic blasts, just because benthic organisms were "less impacted than plankton" does not therefore mean that the impacts on benthic life was "low". Impacts of seismic blasting on plankton can be extremely serious and, since plankton are at the base of the marine food web, if they are seriously affected, benthic organisms will be negatively impacted as well, indirectly, as plankton is their food source. Benthic organisms will likely also be harmed directly from the seismic noise as several studies have indicated (see below: Aguilar de Soto 2013). • Page 78-79: It is true that seismic shots are particularly sharp and intense, but drilling and vessel noise, especially by ships using dynamic positioning (DP), can also be very loud. It cannot necessarily be assumed that there are no negative effects from the noise in Scenarios B and C, as there is very little evidence to support this claim. • Page 81: Research on seals, which constitute an important part of the diet for many Inuit, has shown that intense, acoustic stimuli elicit a startle reflex and fear conditioning that can lead to sustained, long-term avoidance of an area, even when near a food source and even long after the sound is gone (see below: Götz & Janik 2011). The impacts are not "temporary and restricted". • Page 81-82: The statement that the overall level of impacts from noise is expected to be moderate and not affect the long-term health of mammal populations is not supported by research. Götz & Janik (2011) state that "…repeated startling by anthropogenic noise sources might have severe effects on long-term behaviour…[which could] be associated with reduced individual fitness or even longevity of individuals." • Page 82: The statement that changes to habitat are expected to be short-term and reversible is not supported by research. See Weilgart (2018) below. Nunami's hypothetical scenarios document predicts that "surveys could take one to three years to complete", which is not a short-term seismic program. • Page 82: It should be noted here that current regulations and legislation do not prohibit oil and gas activities from taking place in Marine Protected Areas (MPAs). • Page 85: The impacts of noise on fish are understated and, in some cases, even ignored, especially under cumulative impacts, and are contradicted by recent research. See Weilgart (2018) which reviews 115 primary studies showing over 100 species have been documented to be impacted by human-caused underwater noise pollution. The SEA final report must clarify why the impacts and negative effects demonstrated in these 115 primary studies do not apply in this case. From Nunami Stantec report: • Page 7.24: The claim that noise levels are not "expected" to be intense enough to harm plankton is not substantiated by available research as the noise threshold levels for plankton have not been rigorously tested. • Page 7.25: The Carroll et al. (2017) studied showed five-fold higher mortality rates in scallops; they were not just "suspected" (see Day et al. 2017). • Page 7.25: Many studies have shown that invertebrates can react very strongly to sound (see Weilgart 2018).

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	• Page 7.25: The Morris et al. (2018) study is mischaracterized. The researchers were unable to detect any change in snow crab catch rates due to seismic exposure, but their statistical power to detect any effects was very low, because there was high natural spatial and temporal variation in catches. Seismic effects on snow crab could indeed be very large but the sample size in the study was too low to detect these effects over the "background" variation. • Page 7.25: There is no scientific basis for the conclusion that benthic flora and fauna appear relatively resilient to noise disturbances and effects are expected to be low or negligible. Weilgart's (2018) review of 115 primary studies concluded that approximately 100 species of fish and invertebrates, including benthic species, have shown documented and significant impacts from noise. • Page 7.25: After conceding that climate change will likely increase the potential for seismic operations to cover larger areas for longer periods of time, it is then concluded, without evidence, that seismic impacts will not be influenced by climate change. In cases where it is not yet conclusively known what the impacts might be, the precautionary principle should be adopted. • Page 7.27: In reference to the statement that changes to behaviour in fish would be reversible, studies show that the damage to scallops in mortality, immunosuppression, chronic disruption of their physiology and biochemistry, and disrupted behavioural patterns and reflex responses persisted at least 120 days after the seismic airgun exposure ceased. Similarly, lobster showed chronic reductions in their immune competency and impairment of their nutritional condition that were obvious even 120 days after seismic airgun exposure. Hearing damage to squid, cuttlefish, octopus, and jellyfish became worse over time after noise exposure ceased, becoming most pronounced after 96 hrs., the maximum time studied. • Page 7.31: Roughly 1,200 narwhals died in these ice entrapments, and the ice entrapments showed a highly unusual pattern both in where and when they occurred which coincided quite closely with the area and time of the 2D seismic surveys. • Page 7.31: Regarding the fact that northern bottlenose dolphins did not appear to avoid an area during 3D seismic surveys, Northern bottlenose whales are extremely site-specific. They are highly dependent on the Gully and, to a lesser extent, two nearby submarine canyons, and spend all their time in this small area, which is why the Gully, in particular, was declared a Marine Protected Area. • Page 7.32: There is no evidence provided for the claim that changes in mammal behaviour under Scenarios A, B, and C are not anticipated to affect the sustainability of mammals in the focus area, or that seismic surveys are expected to result in temporary and short-term change in behaviour. The acoustic footprint of the proposed seismic program is not yet known. We currently have no idea how far the seismic airgun noise levels remain above ambient and how this varies by season. At a minimum, before any seismic program takes place, this should be measured in the field under various scenarios.
Recommendation/ Request	WWF-Canada recommends that the NIRB review the additional studies provided below and in section 6.1 of this report. In addition, thorough, long-term studies will need to be carried out to get robust baseline biological information on the distribution and abundance of valued ecosystem components such as narwhals, belugas, bowhead whales, fin whales, Northern bottlenose whales, harbour porpoises, cod, Greenland halibut, clams, mussels, squid, and shrimp, all of which are present in the area. The long-term impacts of seismic airgun noise, together with threats such as climate change and ocean acidification, on the ecosystem and population biology should be thoroughly studied.

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Aguilar de Soto, N., N. Delorme, J. Atkins, S. Howard, J. Williams, and M. Johnson. 2013. Anthropogenic noise causes body malformations and delays development in marine larvae. *Scientific Reports* 3, Article number: 2831.

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Cosens, S.E. and Dueck, L.P., 1993. Icebreaker noise in Lancaster Sound, NWT, Canada: Implications for marine mammal behavior. *Marine Mammal Science*, *9*(3), pp.285-300.

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Finley, K.J., Miller, G.W., Davis, R.A., and Greene, C.R., 1990. Reactions of belugas, *Delphinapterus leucas*, and narwhals, *Monodon monoceros*, to ice-breaking ships in the Canadian high arctic. *Canadian Bulletin of Fisheries and Aquatic Sciences, 224*, pp.97–117.

Götz, T. and Janik, V.M., 2011. Repeated elicitation of the acoustic startle reflex leads to sensitisation in subsequent avoidance behaviour and induces fear conditioning. *BMC neuroscience*, *12*(1), p.30.Holles, S., Simpson, S.D., Radford, A.N., Berten, L. and Lecchini, D., 2013. Boat noise disrupts orientation behaviour in a coral reef fish. *Marine Ecology Progress Series*, *485*, pp.295-300.

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Solé, M., Sigray, P., Lenoir, M., Van Der Schaar, M., Lalander, E. and André, M., 2017. Offshore exposure experiments on cuttlefish indicate received sound pressure and particle motion levels associated with acoustic trauma. *Scientific reports*, *7*, p.45899.

Weilgart, L., 2018. The impact of ocean noise pollution on fish and invertebrates. *Report for OceanCare, Switzerland.* https://www.oceancare.org/wp-content/uploads/2017/10/OceanNoise_FishInvertebrates_May2018.pdf

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WWF-Canada	**Review Comment #4**
Subject/Topic	**Mitigation against seismic testing impacts**
References	Various page references in *'Environmental Setting and Review of Potential Effects of Oil and Gas Activities'* (Nunami Stantec) and the Preliminary Findings Report – see Specific Comments below
Summary	Assessment of seismic mitigation measures is sometimes incorrect or unproven and tends to overstate the effectiveness of proposed mitigation measures, which have largely been developed by industry and regulators and are not necessarily supported by evidence.
Importance of the issue to the SEA process	Many communities throughout the area of focus have expressed high levels of concern about the impacts of seismic testing on marine wildlife. Research indicates that seismic can harm marine wildlife, which many Inuit depend upon for their livelihoods, culture and survival. The effectiveness of seismic mitigation measures is therefore of utmost importance; however, many proposed measures have not been proven effective and more research is needed. The precautionary approach should be applied for those species in which seismic impacts are unknown or uncertain.
Specific Comments	From Preliminary Findings Report: • Page 87: Many "standard" mitigation measures have largely been developed by industry and regulators; they are not always supported by research; and they are in some cases unproven in their effectiveness. Spawning grounds and eggs are not easily detected, and not enough is known about the location of many spawning grounds in the eastern Canadian Arctic. It is unknown what a truly "safe distance" is in many cases, and negative effects beyond the horizon, such as masking, cannot be easily mitigated. • For mammal monitoring from a seismic vessel, most whales are rarely visible at the surface, especially the deep divers (Northern bottlenose whales) and especially in anything but perfect visibility. Quantitative analysis has shown that mitigation monitoring detects fewer than 2% of beaked whales (e.g. Northern bottlenose whale) even if the animals are directly in the path of the ship (see below: Barlow 2006). • The safety radius is very dependent on the sound transmission conditions which change with bathymetry, nature of the seafloor, salinity, and the sound speed profile which can change between seasons. • Ramp ups or soft-starts don't necessarily cause avoidance and can't be counted on to clear an area of marine life.
Recommendation/ Request	WWF-Canada recommends that the NIRB review the additional studies provided below and in section 6.1.4 of this report. The precautionary approach should be applied for those species in which seismic impacts are unknown or uncertain. All seismic surveys in critical habitats should be planned so as to be out of phase with the presence of key species in these areas, as recommended by the IWC Scientific Committee for critical whale habitat. Barlow, J. and Gisiner, R., 2006. Mitigating, monitoring and assessing the effects of anthropogenic sound on beaked whales. *Journal of Cetacean Research and Management*, *7*(3), pp.239-249. International Whaling Commission. 2004. Annex K of the Report of the Scientific Committee. 248-276.

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WWF-Canada	**Review Comment #5**
Subject/Topic	**Well Blowouts and Major Spills**
References	Page 59 and 61 of Preliminary Findings Report
Summary	The risk assessment of well blowouts and major spills should factor in the extreme consequences of such an event in the Arctic environment, as well as the fact that Canada does not currently have the response capacity and infrastructure to respond to a major oil spill in Arctic waters.
Importance of the issue to the SEA process	The impact of a well blowout or major spill in the Canadian Arctic would be catastrophic due to heightened sensitivity of the Arctic marine environment to pollution and the tremendous difficulty of ensuring adequate oil spill response in remote locations with limited infrastructure under extreme weather conditions. There is no proven way to clean up a major oil spill in icy waters due to technological inadequacies, weather, poor light and ice.
Specific Comments	• On page 59 of the Preliminary Findings report it is stated that large oil spills or well blowouts are unlikely. However, the *consequences* of such an event would be much more devastating in the Arctic than elsewhere, due to the heightened sensitivity of the Arctic marine environment to pollution and the tremendous difficulty of ensuring adequate oil spill response in remote locations with limited infrastructure under extreme weather conditions. • It is acknowledged on page 59 that the effects of oil spills would be “extremely adverse”, but there is no assessment of how this changes the risk calculation. Although the probability of a major spill would be low, the high magnitude of such an event make the risk level medium to high. • It is also stated that there have been only two blowout events over the last 40 years rated as extremely large. A number of other extremely serious blowouts and other offshore rig accidents have occurred during this time. Although they did not all result in significant oil spills, these accidents involved considerable loss of life and/or environmental damage, and each had the *potential* to become major oil spill events. • Page 61 of the Preliminary Findings report does not acknowledge Canada’s extremely limited and, in some cases, virtually non-existent response capacity in the Baffin Bay and Davis Strait region. There is currently no method that has been proven effective and reliable in dealing with major oil spills in the Arctic offshore environment. While there is some research into how oil responds in ice, fully understanding how oil behaves in an Arctic environment is extremely challenging. Harsh weather conditions, periods of prolonged darkness and the presence of sea ice make most standard oil-spill response equipment ineffective.
Recommendation/ Request	Future research is needed to assess the capacity and infrastructure required to deal with a well blowout or major spill in the Arctic and to determine whether an effective response can be mounted in remote locations under harsh weather conditions with periods of prolonged darkness in the presence of ice. The Final SEA Report should acknowledge the medium-high risk level of offshore oil and gas

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	operations in the Arctic due to the high magnitude consequences of such an event. The report should also indicate that there have been many extremely serious blowouts and offshore accidents over the last 40 years.

WWF-Canada	**Review Comment #6**
Subject/Topic	**Chronic pollution from oil platforms**
References	*Environmental Setting and Review of Potential Effects of Oil and Gas Activities'* report (Nunami Stantec)
Summary	Some impacts from chronic pollution may be significant
Importance of the issue to the SEA process	While the environmental impacts of a single small spill, leak or intentional discharge are likely to be minimal, the cumulative impacts of many small spills or ongoing, chronic pollution can be significant. These impacts may persist in the offshore environment for many years.
Specific Comments	Page xi (Physical Environment): • It is stated that "potential effects of routine discharges are expected to be negligible and any change in water quality that did occur would be localized and disperse and dilute into the water column quickly." This is based on the results of Environmental Effects Monitoring Programs in Atlantic Canada, but other studies may contradict or question the results of this study. • Experiments into the impacts of sediments from offshore drilling activities, including large amounts of drilling cuttings have shown a significant reduction in number of taxa, abundance, biomass and diversity when cuttings were added to natural sedimentation thresholds (see below: Schaanning et al. 2008). • The disturbance caused by drilling has been shown to have an impact on deep-water megafaunal density and diversity, for example, with recovery and recolonization being only partial after 3 years, and the effects of such activities being still visible after a decade (Jones et al. 2012). • Discharges of water-based and low-toxicity oil-based drilling muds and produced water can extend over 2 km, while the ecological impacts at the population and community levels on the seafloor are most commonly on the order of 200–300 m from their source. These impacts may persist in the deep sea for many years and likely longer for its more fragile ecosystems, such as the Arctic.
Recommendation/ Request	While the environmental impacts of a single small spill or leak are likely to be minimal, the cumulative impacts of many small spills or an ongoing, chronic leak can be significant. These impacts may persist in the offshore environment for many years and should be acknowledged in the final SEA report. For more information: Cordes, Erik E. et al. Environmental Impacts of the Deep-Water Oil and Gas Industry. Environmental Science. September 2016. https://www.frontiersin.org/articles/10.3389/fenvs.2016.00058/full

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	Jones, D. O. B., A. R. Gates & B. Lausen, 2012. Recovery of deep-water megafaunal assemblages from hydrocarbon drilling disturbance in the Faroe-Shetland channel. Marine Ecology Progress Series 461: 71–82. Schaanning, M. T., H. C. Trannum, S. Øxnevad, J. Carroll & T. Bakke, 2008. Effects of drill cuttings on biochemical fluxes and macrobenthos of marine sediments. Journal of Experimental Marine Biology and Ecology 361: 49–57.

WWF-Canada	**Review Comment #7**
Subject/Topic	**Greenhouse gas (GHG) emissions from shipping traffic (cumulative effects)**
References	*Environmental Setting and Review of Potential Effects of Oil and Gas Activities* (Section 3.2, page 3.20) *Oil and Gas Life Cycle Activities and Hypothetical Scenarios* Section 4.10 Air Emissions Management
Summary	Recent findings from the Intergovernmental Panel on Climate Change (IPCC) special report on the impacts of global warming finds that limiting warming to 1.5°C would require “rapid and far-reaching” transitions in land, energy, industry, buildings, transport, and cities. Global net human-caused emissions of carbon dioxide would need to fall by about 45 percent from 2010 levels by 2030, reaching ‘net zero’ around 2050. For instance, by 2100, global sea level rise would be 10 cm lower with global warming of 1.5°C compared with 2°C. The likelihood of an Arctic Ocean free of sea ice in summer would be once per century with global warming of 1.5°C, compared with at least once per decade with 2°C. Coral reefs would decline by 70-90 percent with global warming of 1.5°C, whereas virtually all (> 99 percent) would be lost with 2°C.
Importance of the issue to the SEA process	As the number of vessel voyages rises due to development so do greenhouse gas emissions.
Specific Comments	The IPCC has said to limit warming to 1.5°C there are 12 years before it’s too late and the globe will be on a pathway to 2°C warming. For the shipping sector, the International Maritime Organization (IMO) framework agreement on GHG reductions has committed ‘…to peak GHG emissions from international shipping as soon as possible and to reduce the total annual GHG emissions by at least 50% by 2050 compared to 2008…’. Specifically, (Smith et al. (2015) international shipping's carbon budget under a 2°C global warming scenario is 33 Gt of CO2, a 1.5°C scenario allows for only 18 Gt. Given this reality, ‘rapid and far reaching’ transformation within the shipping sector is imperative to reach these goals.
Recommendation/Request	Consideration should be given to project specific GHG reduction targets for offshore support vessels.

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WWF-Canada	**Review Comment #8**
Subject/Topic	**Cumulative Effects**
References	Section 7.2.1 of the Preliminary Findings report
Summary	As industrial activity in the Arctic rises so do the pressures on and risks to marine life through cumulative effects
Importance of the issue to the SEA process	Oil and gas activities would be introduced into an Arctic environment that is already under pressure from the effects of climate change and related ocean acidification, species migrations northward, discharge of wastewater, increasing ship traffic and related pollution, and the risk of invasive species
Specific Comments	• Page 85 of the Preliminary Findings Report (section 7.2.1) acknowledges the possibility for cumulative effects but states that, in general, cumulative effects to marine habitat will be small to moderate and short-term. These claims are not substantiated. Direct studies of natural recovery from drilling in deep water are lacking and the cumulative effects of multiple drilling wells are not well-studied (see Cordes et al. 2016).
Recommendation/ Request	More research is needed on the cumulative effects of multiple drillings wells on marine environments. Cordes, E. et al. September 2016. 'Environmental Impacts of the Deepwater Oil and Gas Industry: A Review to Guide Management Strategies. Frontiers in Environmental Science. https://doi.org/10.3389/fenvs.2016.00058

WWF-Canada	**Review Comment #9**
Subject/Topic	**Chemical spill dispersants**
References	Page 62 of Preliminary Findings Report
Summary	The potential ecological consequences of adding dispersants to an oil spill in the Arctic are not well understood
Importance of the issue to the SEA process	The application of chemical dispersants must be proven to have a net environmental benefit in the Arctic environment before they are used
Specific Comments	• Page 62 states that oil spill dispersants "quickly break up oil slicks on the surface and transfer oil below the surface using the mixing energy of waves." The potential ecological consequences of the physical and toxicological properties of dispersed oil are far from fully understood. Broadcasting dispersants can sometimes compound the ecological damage of oil spills. The impacts to plankton communities, which are the foundation of marine food webs and the impacts to the seabed are detrimental (see Buskey et al. 2016). • Paris et al. (2018) found that, given the potential for toxic chemical dispersants to cause environmental damage by increasing oil bioavailability and toxicity while suppressing its biodegradation, unrestricted dispersant application in response to deep-sea blowout is highly questionable and more research is required to inform response plans in future oil spills

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Recommendation/ Request	Please review the following studies for inclusion in the Final SEA Report: ‘ Buskey, E., H. White, and A.J. Esbaugh. 2016. *Impact of Oil Spills on Marine Life in the Gulf of Mexico: Effects on Plankton, Nekton, and Deep-Sea Benthos.* Oceanography 29(3): 174-181. Paris, C. B. et al. 2018. BP Gulf Science Data Reveals Ineffectual Subsea Dispersant Injection for the Macondo Blowout. Frontiers in Marine Science. November 2018.

WWF-Canada	**Review Comment #10**
Subject/Topic	**Economic benefits of offshore oil and gas to Arctic communities**
References	Page 92 of Preliminary Findings Report and section 7.3 of ‘Environmental Setting and Review of Potential Effects of Oil and Gas Activities’
Summary	While local communities will bear the majority of the risks and will be affected by impacts of offshore oil and gas development, the potential economic benefits for these communities remain unclear.
Importance of the issue to the SEA process	One of the fundamental objectives of any SEA is to give stakeholders an overview of the potential benefits and risks of a possible development program.
Specific Comments	• The SEA process has not attempted to assess the possible economic benefits to local communities in sufficient detail at various scales of oil and gas development. • Without having at least some *idea* of the potential benefits, it is difficult for communities to make an informed assessment about offshore oil and gas.
Recommendation/ Request	A balanced assessment of the true costs and benefits of offshore oil and gas is critical for local communities to understand what is at stake. A future cost-benefit analysis must consider the impacts at the local level in order for communities to be able to make informed assessments.

WWF-Canada	**Review Comment #11**
Subject/Topic	**Economic Alternatives to Oil and Gas**
References	N/A
Summary	There are a number of promising economic development alternatives to offshore oil and gas in Nunavut, including sustainable fisheries, Inuit-led tourism, Inuit Impact and Benefit Agreements for conservation, and renewable energy opportunities, which are less risky and more sustainable over the long term.

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Importance of the issue to the SEA process	According to standard international practice, a critical piece of any comprehensive SEA is the consideration of potential economic alternatives to the proposed activity, in this case oil and gas. The SEA cannot be considered complete without consideration of such alternatives.
Specific Comments	• The OECD's 2006 report '*Applying Strategic Environmental Assessment: Good practice guidance for development cooperation'* recommends the inclusion of economic alternatives • The Arctic Council's 'Arctic Offshore Oil and Gas Guidelines' specifies in section 3.5 (Environmental Impact Assessment) that "*This discussion should include an evaluation of the different alternatives and the reasons for choosing the selected activity."* • Canada's Cabinet Directive on SEA practice also includes a discussion on the need for economic alternatives as part of SEA practice • Offshore oil and gas is only one of a number of possible development options in the North. An SEA limited only to considering the impacts/benefits of oil and gas may lead to the misleading conclusion that there are no other viable ways to meet the development needs of northerners.
Recommendation/ Request	Before any decision is made on the future of offshore oil and gas in Nunavut, robust and reasonable development alternatives to oil and gas, such as the ones discussed in section 9, must be analyzed for future consideration.

WWF-Canada	**Review Comment #12**
Subject/Topic	**Downstream greenhouse gas emissions**
References	N/A
Summary	Downstream emissions need to be considered in the SEA
Importance of the issue to the SEA process	Consideration of greenhouse gas emissions can alter the balance of costs and benefits of offshore oil and gas projects, which can thereby influence the views of stakeholders, as well as the ability of the governments and regulators to justify approving a project in light of that balance.
Specific Comments	• Canada's greenhouse gas footprint roughly doubles with inclusion of emissions associated with the foreign combustion of oil produced in Canada. • Development of oil and gas resources in the Arctic appears to be incompatible with efforts to limit average global warming to 2°C, let alone the safer aspirational target of 1.5°C (see McGlade and Ekins 2015).This is not mentioned in the SEA Preliminary Findings Report or the Nunami Stantec reports. • To reach targets set under the Paris Agreement, scientific studies indicate that 68-80 percent of existing global fossil fuel reserves must stay in the ground. A transition to renewable energy is incompatible with development of the undiscovered and very expensive resources in the offshore Arctic. • If the scale of offshore petroleum activities is extensive in the eastern Canadian Arctic, this could constitute an important contribution to Canada's overall GHG emissions and would negatively impact global efforts to limit warming.

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Recommendation/ Request	• The next stage of the SEA process should analyze the downstream greenhouse gas (GHG) emissions at various possible *scales* of offshore oil and activity in the eastern Canadian Arctic to determine if and to what extent Arctic oil can be developed within national and international carbon reduction targets. • The apparent incompatibility of the exploitation of Arctic oil with international climate targets should be mentioned in the Final SEA Report. McGlade, C. and Ekins, P., The geographical distribution of fossil fuels unused when limiting global warming to 2° C, 517 Nature 187 (2015).

WWF-Canada	**Review Comment #13**
Subject/Topic	**Upstream greenhouse gas emissions**
References	Page 7.9 of '*Environmental Setting and Review of Potential Effects'* for upstream emissions
Summary	Greenhouse gas emissions resulting from offshore oil and gas activities are based on estimates from one average platform, which is misleading and unrealistic in our view.
Importance of the issue to the SEA process	Consideration of greenhouse gas emissions can alter the balance of costs and benefits of offshore oil and gas projects, which can thereby influence the views of stakeholders, as well as the ability of the governments and regulators to justify approving a project in light of that balance.
Specific Comments	• Cumulative greenhouse gas emissions under various feasible scales of development will be an important factor in the government's decision on the oil and gas moratorium. For example, as of January 2018 there were 175 active offshore drilling platforms in the Gulf of Mexico and 184 in the North Sea. • Even one offshore platform will produce an additional half megatonne (500,000 tonnes) of GHGs annually according to Nunami Stantec, which is roughly equivalent to putting an additional 100,000 passenger vehicles on Canadian roads. This comes at a time when Canada (and the world) is not on track to meet its Paris commitments and must decrease emissions substantially.
Recommendation/ Request	Potential greenhouse gas emissions from an offshore and gas industry in Nunavut must be analyzed at various scales of development. There is a vast difference in emissions between one drilling platform and many dozens.

WWF-Canada	**Review Comment #14**
Subject/Topic	**Climate Change Impacts**
References	Page 7.4 of section 7.1.1.1 of the Nunami Stantec report
Summary	Climate change is expected to be extremely detrimental to the Canadian Arctic, yet its effects are misleadingly described as "positive and negative" in the Nunami Stantec report

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Importance of the issue to the SEA process	It is not acceptable for the SEA to make inaccurate or misleading statements that are not consistent with the projected impacts of climate change as documented by science and research.
Specific Comments	• Page 7.4 states that "GHGs are known to contribute to global warming which causes changes in the world's atmosphere, land, and oceans. **These changes may have both positive and negative effects on people, plants, and animals.**" • This statement is extremely misleading, irresponsible and must be removed or qualified. It has been well-established that the impacts of climate change are overwhelmingly negative and even potentially catastrophic. In a global context, there are some locations that may be considered climate "winners". However, impacts on the Arctic people, plants, and animals are generally considered extreme, life-altering, and in some cases, including to existing infrastructure, devastating. Any positive effects should be put in the context of the Arctic region of interest for this study and the overall tremendously negative consequences of climate change the world over.
Recommendation/ Request	Remove, change or qualify this statement

WWF-Canada	**Review Comment #15**
Subject/Topic	**Economic Alternatives to Oil and Gas**
References	*Oil and Gas Life Cycle Activities and Hypothetical Scenarios* Section 6.4 Cost and Business Outlook
Summary	The oil market is incredibly volatile at the moment, and the different World Energy Outlook scenarios are not adequately expressed. Also, oil and gas is not economically viable under current conditions.
Importance of the issue to the SEA process	By the time oil and gas in the Arctic is economically viable, there may no longer be a global appetite for fossil fuels. All the expense and environmental risks of oil and gas exploration could degrade Baffin Bay and Davis Straight, leaving Nunavut & Canada with stranded oil & gas assets that cannot be used, and have negatively impacted existing industries that rely on an intact environment.
Specific Comments	While cost thresholds are mentioned, they do not present an adequate picture or story of the industry. The context of global energy supply and demand is also not adequately represented. The World Energy Outlook 2018 notes that: - Oil prices will be volatile for the foreseeable future - Under the "New Policy Scenario", oil demand from now until 2040 is actually quite flat - Under the "Sustainable Development Scenario", **both demand and production of oil drop precipitously** It is also noted in the report that **70% of future investments in oil and gas production are government policy-dependent**. So government policy, 6.5, will strongly influence the business case for oil and gas moving forward. https://www.iea.org/weo2018/fuels/

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Recommendation/ Request	Include the various scenarios for world energy Include the time-dependence of oil and gas development, understanding that no revenues will come from these projects, if they are undertaken, for 20 years.

WWF-Canada	**Review Comment #16**
Subject/Topic	**Oil and Gas Business Outlook**
References	*Oil and Gas Life Cycle Activities and Hypothetical Scenarios* Section 6.4 Cost and Business Outlook
Summary	The business outlook for Oil and Gas is based almost entirely on the World Energy Outlook.
Importance of the issue to the SEA process	**The World Energy Outlook is notoriously poor at estimating the growth rate of renewables, both solar and wind, and consistently underestimates their influence.** It assumes linear growth for wind and solar, when in fact both have been exponential. Misunderstanding energy demand from sources has resulted in both nuclear and fossil fuel stranded assets, and this mistake could be repeated in Nunavut if the situation is not properly understood.
Specific Comments	The business case for oil and gas has not been adequately studied. A price per gallon of oil is suggested, however current economic trends are not analyzed. There is a real risk of any oil and gas discoveries becoming stranded at this point in time.
Recommendation/ Request	Broaden study beyond the World Energy Outlook Recommended reading: "The projections for the future and quality in the past of the World Energy Outlook for solar PV and other renewable energy technologies", Matthieu Metayer, Christian Breyer, and Hans-Josef Fell, 31st EU PVSEC, Hamburg, Germany, September 2015.

WWF-Canada	**Review Comment #17**
Subject/Topic	**External Events impacting oil and gas development**
References	*Oil and Gas Life Cycle Activities and Hypothetical Scenarios* Section 6.5 External Events, pages 6.4 and 6.5
Summary	This section listed policies and regulations that may impact oil and gas development
Importance of the issue to the SEA process	References to major pieces of climate policy are not included, and may have a huge impact on the viability of oil and gas projects

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Specific Comments	Include the reference to climate policy
Recommendation/ Request	Include the following items in the list: - The Pan-Canadian Framework for Clean Growth and Climate Change - The Canadian Carbon Tax, and other pollution taxes/disincentives that may come (e.g. ban on plastics) - International commitments on GHG emissions as a result of the IPCC

WWF-Canada	**Review Comment #18**
Subject/Topic	**Economic Alternatives to Oil and Gas**
References	*Oil and Gas Life Cycle Activities and Hypothetical Scenarios* Section 6.6 Alternatives, pages 6.5 and 6.6
Summary	There are no economic alternatives to Oil and Gas development presented. The “Alternatives” presented here are essentially just the “scenarios” for oil and gas development previously mentioned.
Importance of the issue to the SEA process	Alternatives are different ways of achieving a plan’s objectives. As such, alternatives will generally be within the context of a plan rather than a substitute to or for a plan (e.g. different use of areas within a land use plan). In this case, the SEA may be considered a “marine use plan” or an “economic development plan”.
Specific Comments	Because Oil and Gas is a risky use of the marine space which can negatively impact other economic activities (fishing, hunting), renewable energy development is suggested as an alternative development scenario. Also, investing in Oil and Gas means that Nunavut becomes dependent on fossil fuels both for energy use and economic income/sustainability at a time when the world is moving away from fossil fuel resources.
Recommendation/ Request	Include the following information under the “Alternatives” section: Proposed Alternative to Oil and Gas Development: Renewable Energy Development - Currently Nunavut is 100% reliant on diesel for energy (heating, electricity, transportation) - 100% of this diesel is imported to the territory, resulting in economic leakage away from Nunavut - Investing resources into renewable energy and energy efficiency, as opposed to oil and gas exploration/development, reduces energy costs to Nunavummiut; reduces reliance on imported diesel; reduces environmental harm; creates new, green jobs in an emerging energy market sector in each community; and safeguards existing traditional industries (hunting and trapping) as well as emerging environment-dependent industries (off-shore and in-shore fisheries) - Investment in renewables also means Nunavut does its share to decrease the global warming feed-back loop that is threatening the Inuit way of life in the Arctic

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	- Investment in a green energy future is consistent with both Canadian and international policies and commitments, and is a low-risk investment from a policy, environmental, and financial perspective.

WWF-Canada	**Review Comment #19**
Subject/Topic	**Economic Alternatives to Oil and Gas**
References	*Oil and Gas Life Cycle Activities and Hypothetical Scenarios* Section 6.7 No Activity
Summary	This option is worded in a very negative way.
Importance of the issue to the SEA process	Business-as-Usual, or development of low-risk, sustainable economic opportunities in the region, is an acceptable outcome.
Specific Comments	The No Activity Option should recognize: - the existing extensive information gaps (see *Environmental Setting and Review of Potential Effects of Oil and Gas Activities* 7.4.5 Information Gaps, pages 7.89 and 7.90) that must be filled before Oil and Gas development can occur, and extreme consequences of an accident on the Arctic marine environment can have way-of-life shattering impacts on Nunavummiut around Baffin Bay and Davis Straight
Recommendation/ Request	Re-write this section as a Business-as-Usual section, as opposed to No Activity. Existing economic and environmental resources remain intact with no new risks.

WWF-Canada	**Review Comment #20**
Subject/Topic	**Arctic char habitat**
References	Environmental Setting and Review of Potential Effects of Oil and Gas Activities Section 4.5.1.4 Arctic char
Summary	-Subsistence harvests of Arctic char are important in Arctic Bay, Clyde River, Grise Fiord, Iqaluit, Kimmirut, Pangnirtung, Pond Inlet, Qikiqtarjuaq and Resolute Bay -Arctic char are anadromous fish, often found in river mouths and nearshore areas of eastern Baffin Island and Lancaster Sound
Importance of the issue to the SEA process	-The importance of Arctic char harvests to the food security of communities within the Area of Focus requires particular attention to potential impacts on Arctic char
Specific Comments	- The federal Petroleum and Environmental Management Tool states there have been no studies on the impacts of seismic on Arctic char

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	-The application of the precautionary approach requires the protection of Arctic char in the absence of reliable science on potential impacts
Recommendation/ Request	That no exploration activity take place in near-shore Arctic char habitat

WWF-Canada	**Review Comment #21**
Subject/Topic	**Marine Refuges**
References	Environmental Setting and Review of Potential Effects of Oil and Gas Activities 4.8.5 Marine Refuges
Summary	- There are also currently 3 marine refuges in NAFO zones 0A and 0B, the Davis Strait Conservation Area, Disko Fan Conservation Area, and Hatton Basin Conservation Area. -All three marine refuges in the focus area identify the protection of corals, sponges, or other important bottom habitat features as part of the rationale for their designation.
Importance of the issue to the SEA process	-Potential impacts on these marine refuges from oil & gas exploration would negatively affect their ability to be considered within Canada's Marine Conservation Targets, undermining the contribution to conservation of the commercial fishing industry
Specific Comments	- The National Advisory Panel on Marine Protected Area Standards also recommends that "When industrial activities are allowed to occur in areas counted as other effective area-based conservation measures, the Minister of Fisheries, Oceans and the Canadian Coast Guard must be satisfied through effective legislation or regulation that risks to intended biodiversity outcomes are avoided or mitigated." -Cold-water corals are particularly vulnerable to disturbance (e.g., bottom fishing) due to their slow growth rates and longevity (Roberts et al. 2006).
Recommendation/ Request	That no oil & gas exploration activity be permitted in Marine Refuges in Baffin Bay/Davis Strait

WWF-Canada	**Review Comment #22**
Subject/Topic	**Disturbance and conflicts of shipping traffic with marine mammals (cumulative effects)**
References	*Environmental Setting and Review of Potential Effects of Oil and Gas Activities* (Section 2.3.3.1, POTENTIAL ACCIDENTS AND MALFUNCTIONS, page 2.9)

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	Oil and Gas Life Cycle Activities and Hypothetical Scenarios section 9.2.3 page 9.14
Summary	The Arctic is home to a remarkable number of marine mammals, such as bowhead whales, belugas, narwhals, walruses and seals. The increase in offshore support vessels required to service development would results in more overlap of ship traffic with marine mammal habitats and species. New shipping regulations, termed the *International Code for Ships Operating in Polar Waters (Polar Code)*, establish an international framework for protecting polar regions. One requirement of the Polar Code is for marine mammal data to be integrated into ship voyage plans.
Importance of the issue to the SEA process	As the number of voyages rises so do the risks to marine habitats, which many northern and Indigenous people rely on for food and cultural practices. Marine food is particularly important for Inuit living on Baffin Island because of the relative scarcity of land-based animals. If not properly managed, these new stresses could put northern ecosystems and cultures at risk.
Specific Comments	Under the new Polar Code requirements, when planning a ship's route through polar waters, masters must consider "current information and measures to be taken when marine mammals are encountered relating to known areas with densities of marine mammals, including seasonal migration areas," (paragraph 11.3.6) and "current information on relevant ships' routing systems, speed recommendations and vessel traffic services relating to known areas with densities of marine mammals, including seasonal migration areas" (paragraph 11.3.7).
Recommendation/Request	Offshore support vessels would need to adhere to the Polar Code requirements by considering marine mammal data in their voyage plans and adhering to mitigation measures, such as: buffer zones around known habitats, seasonal restrictions, and speed reductions. It should be noted that a lack of data on marine mammal habitats and behavioral responses of marine mammals in response to ships makes this challenging and the risks to species can be reduced but not eliminated.

WWF-Canada	**Review Comment #23**
Subject/Topic	**Underwater noise from shipping traffic (cumulative effects)**
References	*Environmental Setting and Review of Potential Effects of Oil and Gas Activities* Section 2.3.3.2, NOISE, page 2.18 Section 7.2 Biological Environment, page 7.21
Summary	Many marine species, including most mammals, many fish, and perhaps even some invertebrates rely on sound for sensing their environment, finding prey, avoiding predators, communicating with other members of their species, and facilitating mating. Ship noise is generated primarily from propeller cavitation, propeller singing, and propulsion or other reciprocating machinery. This noise can have short- and long-term effects on marine mammals, including changes in behavior, masking of important sounds, temporary or permanent hearing loss, physiological stress, and changes in prey availability. Displacement could result

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	in negative consequences, such as changes in food availability, which would likely affect energy budget and fitness. The possible increase in animal density caused by displacement could also result in increased competition and predation.
Importance of the issue to the SEA process	The development of offshore oil and gas related activities result in an increase in offshore support vessels, which will turn up the volume of underwater noise in Baffin Bay and Davis Strait to which marine mammals are exposed.
Specific Comments	Unlike in temperate oceans, seasonal freezing of the Arctic Ocean's surface means that icebreaking ships are used in the Arctic. Icebreakers produce a different noise signature compared to other vessels, generating higher and more variable noise levels. Additionally, many of the marine mammals that would be exposed to ship noise in the Arctic are currently industrially-naïve populations.
Recommendation/Request	Decouple underwater shipping noise from shipping traffic growth by investing in quiet ship technology (e.g. silent propellers) and operational measures (speed reduction) and take a precautionary approach and "hold the noise" in Arctic waters at current levels until safe noise levels can be determined.

WWF-Canada	**Review Comment #24**
Subject/Topic	**Shipping traffic through the habitat of sea ice (cumulative effects)**
References	*Environmental Setting and Review of Potential Effects of Oil and Gas Activities* (Section 2.3.3.2, SEA ICE DISTURBANCE, page 2.20) *Oil and Gas Life Cycle Activities and Hypothetical Scenarios* Section 4.7, page 4.13)
Summary	Sea ice serves as an important habitat, therefore, shipping through sea ice could lead to increased negative interactions with ice-bound marine mammals. For example, ships breaking ice through the breeding grounds of seals have resulted in direct mortality from collisions. Seal pups that are concealed in lairs are especially vulnerable. Operations through sea ice creates channels of brash ice, which may remain if the ice does not refreeze rapidly. Seals use these channels as leads into the ice and often create whelping sites along the edge of these open channels. This places them at risk of ship strikes from further shipping in the same channel. It has been speculated that operations through sea ice was the cause of a few recent ice entrapment occurrences. The passage of a ship creates a temporary opening in the sea ice, which can act as an artificial polynya. This can confuse marine mammals, causing them to become trapped too far from the ice edge as the channel eventually refreezes.
Importance of the issue to the SEA process	As the number of voyages rises due to development, so do the risks to the ice habitats, which many northern and Indigenous people rely on for food and cultural practices. If not properly managed, these new stresses could put northern ecosystems and cultures at risk.
Specific Comments	

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Recommendation/Request	Offshore support vessels activities should not be done at a time when there would be negative iterations to the habitats of sea ice.

WWF-Canada	**Review Comment #25**
Subject/Topic	**The use of Heavy Fuel Oil (HFO) by vessels (cumulative effects)**
References	*Environmental Setting and Review of Potential Effects of Oil and Gas Activities* (Section 2.3.3.2, page 2.18; section 2.3.8 page 2.24) Oil and Gas Life Cycle Activities and Hypothetical Scenarios section 10.1 page 10.1; section 10.2 page 10.3; section 10.4 page 10.6;
Summary	HFO is a polluting fossil fuel used to power ships all over the world. HFO poses risks for both the marine environment and climate wherever it's used, but if it spilled in Arctic waters, HFO breaks down even more slowly and will have long term, devastating effects on both livelihoods and ecosystems. HFO is already banned in the Antarctic because of its potential spill impact on wildlife. HFO is also the source of harmful and significantly higher emissions of air pollutants, including sulphur oxide, nitrogen oxide, particulate matter, and black carbon. When emitted and deposited on Arctic snow or ice, the climate warming effect of black carbon is at least three times more than when emitted over open ocean. Because of these reasons, all ships, including OSVs, should be banned from the use and carriage for use of HFO as fuel in Arctic shipping.
Importance of the issue to the SEA process	As the number of voyages rises due to development, so do the risks to marine habitats, which many northern and Indigenous people rely on for food and cultural practices. If not properly managed, these new stresses could put northern ecosystems and cultures at risk.
Specific Comments	
Recommendation/Request	Eliminate the use and carriage of HFO for offshore support vessels ships in the Baffin Bay and Davis Strait region.

WWF-Canada	**Review Comment #26**
Subject/Topic	**Sewage and grey water discharges from vessels (cumulative effects)**
References	*Environmental Setting and Review of Potential Effects of Oil and Gas Activities* (Section 2.3.3.2, ROUTINE DISCHARGE, page 2.19) *Oil and Gas Life Cycle Activities and Hypothetical Scenarios* Section 4.9, page 4.15

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Summary	Negative effects of sewage discharge in the Arctic include: human health risks from eating fish contaminated with faecal-contaminated waters and the potential introduction of invasive species. The low light and temperature conditions in the Arctic amplify the environmental impacts since the decomposition is slowed and the Arctic is less tolerant to rapid changes in the nutrient status of the water column or seabed. Grey water is the discharge from the sinks, showers and galleys on ships, but does not include drainage from toilets. It can contain a wide variety of polluting substances, such as faecal coliform bacteria (from human waste), food waste, oil and grease, detergent and soap residue, metals, solids and nutrients. Grey water has pollutant levels comparable to untreated sewage and can have harmful environmental impacts such as: dead zones caused by excessive algal growth as a result of excess nutrients, oil and grease coating the gills of fish and preventing respiration , the suffocation of small benthic species due to increased particulate matter, and the introduction of invasive species.
Importance of the issue to the SEA process	Shipping activity as the result of development of offshore oil and gas related activities in Baffin Bay and Davis Strait would subsequently increase the amount of sewage and grey water being discharged in arctic waters.
Specific Comments	
Recommendation/Request	Establish discharge standards and treatment systems for offshore support vessels, either onboard vessels or ashore.

WWF-Canada	**Review Comment #27**
Subject/Topic	**Ship sourced oil spill response (cumulative effects)**
References	*Environmental Setting and Review of Potential Effects of Oil and Gas Activities* Section 2.3.3.1, POTENTIAL ACCIDENTS AND MALFUNCTIONS, page 2.9 and 2.12 Section 2.3.8 Potential Effects of Accidents and Malfunctions, page 2.24 *Oil and Gas Life Cycle Activities and Hypothetical Scenarios section 10.5 page 10.9; section 10.5.6 page 10.14*
Summary	Though the chances of a large-scale oil spill in the Arctic are currently small from shipping in the Arctic, the consequences would be significant and likely devastating: contamination of important habitat for wildlife such as polar bears, walrus, seabirds and seals, as well as narwhals, belugas and bowhead whales; long-term destruction of fish habitat, a staple of the Arctic community and Indigenous diet; and wide-reaching contamination if oil gets trapped under sea ice and travels to communities hundreds of kilometres away.
Importance of the issue to the SEA process	With any increased vessel traffic, such as that associated with oil and gas development in the Baffin Bay and Davis Strait, the risks and likelihood of a catastrophic spill go up.

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Specific Comments	Through a series of reports WWF commissioned research has shown that major weaknesses in response preparedness currently exist in the Canadian Arctic. The research uncovered major issues with the state and availability of oil-spill response equipment, limited training resources and unreliable communications infrastructure. The reports found that: • Only a small number of coastal communities have access to the most basic oil-spill response equipment from the Canadian Coast Guard. • The communities that do have equipment say it is irregularly maintained, too few community members are trained to use it, and that some communities don't have a key to access the storage containers. • Harsh weather conditions, periods of prolonged darkness and the presence of sea ice make most standard oil-spill response equipment ineffective. • Remote locations mean response times for large-scale cleanup and equipment or to have contracted response capacity in the Arctic. • Lack of reliable communications infrastructure makes it difficult for communities to call for assistance, and for responders to communicate with those on land during an oil-spill response. • In the Canadian Arctic, there are no legal requirements to ensure that sufficient people and equipment could respond to a spill from a ship, nor any requirements that such a response would occur within a certain amount of time. storage equipment can be more than 10 times longer than in waters south of 60 degrees' latitude. • Ships are not required under Canadian law to carry their own spill response
Recommendation/Request	In the Baffin Bay and Davis Strait region: • As the people who know the environment and its resources best and who have the most to lose from damages caused by a spill, community members should have a greater role in decision-making that shapes the future of shipping. By consulting with communities and Indigenous organizations and by using both scientific and traditional knowledge, preferred shipping routes and areas to be avoided can be identified to reduce as much as possible conflicts with wildlife and important habitats. • Phase out the use and carriage by ships of HFO, the most hazardous, persistent, and difficult to clean up of any marine fuel in the Arctic. • Develop community-based response plans. • Local knowledge and engagement are essential for effective response, and in the Arctic, community members often act as first responders because of remoteness and weather. • Increase funding for training of community responders. • Invest in equipment and capacity in the north to align standards with the south. Permanent assistance vessels along shipping routes could be deployed in the shipping season and more equipment could be stockpiled along these corridors. • Require ships transiting the Arctic to carry adequate response equipment on board.

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	• Ship crews should be trained to provide effective damage control and minor hull repairs.

WWF-Canada	**Review Comment #28**
Subject/Topic	**Oil Spill Behaviour**
References	*Section 6.5.4 of Preliminary Findings Report*
Summary	Oil spill dispersal and modeling behaviour does not account for spills in icy conditions; predictions regarding the amount of oil that would remain on the surface of the water and in the environment following a subsea blowout may be too low
Importance of the issue to the SEA process	Understanding how oil or gas would behave in the environmental conditions of the eastern Arctic region is an important tool when developing an oil spill contingency plan for a specific project. This topic is addressed in the Nunami Stantec reports and the Preliminary Findings Report.
Specific Comments	• Paragraph 1 of Section 6.5.4 of the Preliminary Findings Report (page 61) does not account for the fact that oil from a subsea spill or blowout is likely to encounter sea ice in the eastern Arctic that would change the way oil behaves and the length of time that it would persist in the marine environment. While there is some research into how oil responds in ice, fully understanding how oil behaves in an Arctic environment is challenging at best. For instance, oil spilled in icy conditions will generally gather on the surface among the floes, but wind and current can move the floes together squeezing the oil between them, or drift apart allowing the oil to spread out over a larger area of the sea surface. See section 7.5 of this report for more information. • Section 6.5.4 also states that, after a subsea spill or blowout, "The remainder of the oil that does not make it to the surface could be transported long distances by underwater currents." This seems to suggest that only the oil that does not rise to the surface would remain in the marine environment for long periods of time. Thirty years after the Exxon Valdez spilled 4.2 million liters of crude oil into Prince William Sound in Alaska, the fishing industry has not fully recovered and many Alaskan beaches remain polluted to this day with an estimated 20,000 gallons (75,000 liters) of crude oil buried just inches below the surface. • In addition, on page 61 it is stated "40-50 percent of the oil droplets released would typically evaporate…The maximum amount of oil on the water surface in the form of a slick would be approximately 15-20 percent of the oil released." This is contradicted by the U.S. National Academy of Sciences who stated in 2003 that "No current cleanup methods remove more than a small fraction of oil spilled in marine waters, especially in the presence of broken ice." See reference below.
Recommendation/ Request	We recommend reviewing: • Wilkinson, J. et al. 2017. Oil spill response capabilities and technologies for ice-covered Arctic marine waters: A review of recent developments and established practices. Ambio 46 (Supp 3): S423-S441. • The U.S. Bureau of Safety and Environmental Enforcement's Arctic Oil Spill Response Research: https://www.bsee.gov/site-page/arctic-oil-spill-response-research • U.S. National Academy of Sciences. 2003. *Cumulative Environmental Effects of Oil and Gas Activities on Alaska's North Slope.* National Research Council. http://www.nap.edu/read/10639/chapter/1

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WWF-Canada	**Review Comment #29**
Subject/Topic	**Oil Spill Behaviour**
References	*Section 6.5.4 of Preliminary Findings Report*
Summary	WWF-Canada has modeled possible oil spill trajectories in Baffin Bay and Davis Strait that may be helpful for the Final SEA Report
Importance of the issue to the SEA process	Modeling how oil or gas would react if there was a spill is an important tool when developing an oil spill contingency plan for a specific project. This topic is addressed in the Nunami Stantec reports and the Preliminary Findings Report.
Specific Comments	• *Section 6.5.4 of Preliminary Findings Report (page 61) states "*The challenge with running (spill) models for the SEA is that it requires site-specific data and historical data on weather and sea conditions. This data is unavailable given the limited drilling in the region, and there are few examples of wells to use as a basis for predicting the properties of oil and gas from the study region." • In fact, WWF-Canada contracted Shoal's Edge Consulting to model possible trajectories resulting from an oil spill in the eastern and western Arctic. The results of the trajectory model for a hypothetical spill just east of Tallurutiup Imanga are shown in section 7.6 of this submission.
Recommendation/Request	We recommend that WWF-Canada's oil spill trajectory models be incorporated into the oil spill behaviour section of the final SEA report.