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Central and Arctic Region | **Région du Centre et de l'Arctique**

Proceedings of the Technical Review for Baffinland's Mary River Project draft Environmental Impact Statement (EIS)

7 March and 19 September 2011

Winnipeg, MB

Meeting Chairperson
Kathleen Martin

Compte rendu de l'Examen technique de l'ébauche d'étude d'impact environnemental (EIE) du projet de Mary River soumis par Baffinland

Les 7 mars et 19 septembre 2011

Winnipeg, MB

Présidente de la réunion
Kathleen Martin

Fisheries and Oceans Canada / Pêches et Océans Canada
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March 2012 | **Mars 2012**

Canada

Foreword

The purpose of these Proceedings is to document the activities and key discussions of the meeting. The Proceedings include research recommendations, uncertainties, and the rationale for decisions made as a result of the meeting. Proceedings also document when data, analyses or interpretations were reviewed and rejected on scientific grounds, including the reason(s) for rejection. As such, interpretations and opinions presented in this report individually may be factually incorrect or misleading, but are included to record as faithfully as possible what was considered at the meeting. No statements are to be taken as reflecting the conclusions of the meeting unless they are clearly identified as such. Moreover, further review may result in a change of conclusions where additional information was identified as relevant to the topics being considered, but not available in the timeframe of the meeting. In the rare case when there are formal dissenting views, these are also archived as Annexes to the Proceedings.

Avant-propos

Le présent compte rendu a pour but de documenter les principales activités et discussions qui ont eu lieu au cours de la réunion. Il contient des recommandations sur les recherches à effectuer, traite des incertitudes et expose les motifs ayant mené à la prise de décisions pendant la réunion. En outre, il fait état de données, d'analyses ou d'interprétations passées en revue et rejetées pour des raisons scientifiques, en donnant la raison du rejet. Bien que les interprétations et les opinions contenues dans le présent rapport puissent être inexactes ou propres à induire en erreur, elles sont quand même reproduites aussi fidèlement que possible afin de refléter les échanges tenus au cours de la réunion. Ainsi, aucune partie de ce rapport ne doit être considérée en tant que reflet des conclusions de la réunion, à moins d'indication précise en ce sens. De plus, un examen ultérieur de la question pourrait entraîner des changements aux conclusions, notamment si l'information supplémentaire pertinente, non disponible au moment de la réunion, est fournie par la suite. Finalement, dans les rares cas où des opinions divergentes sont exprimées officiellement, celles-ci sont également consignées dans les annexes du compte rendu.

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SUMMARY

The Mary River Project is a large-scale proposed iron ore mining operation. The mine will be located in the Canadian Arctic on northern Baffin Island, Nunavut. The Nunavut Impact Review Board (NIRB) assesses the potential impacts of proposed development in the Nunavut Settlement Area. The Board conducts the review and sets the agenda for the process. Baffinland Iron Mines Corporation (Baffinland) prepared their draft Environmental Impact Statement (EIS) for development of the Mary River Project. The draft EIS was submitted to the NIRB for detailed environmental and socio-economic review. On 15 February 2011 the NIRB initiated their review process beginning with the submission of Information Requests (IRs) to NIRB. This IR phase is meant to identify gaps within the draft EIS that need to be addressed so that parties can undertake their technical reviews. DFO Science staff met to discuss IRs on 7 March 2011 and the list of IRs was considered by DFO Habitat Management for inclusion in the DFO submission. Baffinland responded to some of the IRs, updated their draft EIS and met with various interested parties on a number of occasions during the review process to discuss concerns. On 5 July 2011 NIRB initiated the Technical Review phase of the process and requested that technical review comments be submitted by 5 September 2011; this date was later extended to 5 October 2011. This proceedings report outlines the approach taken to the review and some concerns identified with the draft EIS.

SOMMAIRE

Le projet de Mary River est une opération à grande échelle d'opération d'une mine de fer. La mine sera située dans l'Arctique Canadien dans le nord de la terre de Baffin, au Nunavut. Le Commission du Nunavut chargée de l'Examen des Répercussions (CNER) évalue les impacts potentiels du développement proposé dans la région du Nunavut. Le Board mène une revue et établi l'agenda du processus de revue. Baffinland Iron Mines Corporation (Baffinland) prépare une ébauche de l'étude d'impact environnemental (EIE) de la réalisation du projet de Mary River. L'ébauche de EIE a été soumise au CNER afin d'effectuer une revue environnementale et socio-économique détaillée. Le 15 février 2011, le CNER a initié un processus de revue commençant par la soumission de demandes d'information (DIs) au CNER. Cette phase de DI vise à identifier les lacunes de l'ébauche d'EIE qui doivent être adressées afin que les parties puissent entreprendre leurs revues techniques. Le personnel du MPO Sciences s'est réuni pour discuter des DIs le 7 mars 2011 et la liste des DIs a été évaluée par MPO Gestion de l'Habitat pour inclusion dans la soumission du MPO. Baffinland a répondu à certaine des DIS, a mis à jour l'ébauche de EIE et a rencontré plusieurs parties intéressées à un certain nombre d'occasions durant le processus de revue afin de discuter des préoccupations. Le 5 juillet 2011 CNER a initié la revue technique phase du processus requérant que les commentaires de la revue technique soient soumis le 5 septembre 2011; cette date buttoir fut plus tard reportée au 5 octobre 2011. Ce compte-rendu présente l'approche préconisée lors de la revue and certaines préoccupations identifiées dans l'ébauche de EIE.

INTRODUCTION

The Mary River Project is a large-scale proposed iron ore mining operation in the Canadian Arctic on northern Baffin Island, Nunavut. Baffinland Iron Mines Corporation (Baffinland) prepared their draft Environmental Impact Statement (EIS) for development of the Mary River Project and submitted it to the Nunavut Impact Review Board (NIRB) for detailed environmental and socio-economic review on 21 January 2011. NIRB assessed the submission for conformity with their EIS guidelines. On 15 February 2011, NIRB initiated their review process beginning with the submission of Information Requests (IRs) to NIRB by 17 March 2011. The IR phase is meant to identify gaps within the draft EIS that need to be addressed so that parties can undertake their technical reviews. DFO Science staff met to discuss IRs on 7 March 2011, which were considered by DFO Habitat Management as part of the DFO submission.

Baffinland began addressing IRs around mid-April 2011 and met with various interested parties up to the end of July 2011 to discuss concerns. On 6 and 7 July, Baffinland met with DFO Habitat Management and Science staff, and other agencies including Environment Canada (EC), Parks Canada Agency (PCA), Transport Canada, and Qikiqtani Inuit Association (QIA). The 6 July discussions were focused on shipping impacts and marine mammals. The discussions on 7 July were mostly focused on habitat management issues: stream crossings, marine habitat port infrastructure in Steensby Inlet and compensation plans. Science staff participated in these meetings. Several teleconferences involving DFO Science were also held later with Baffinland in July to discuss baseline sampling and ballast water issues. Meanwhile, on 5 July 2011, NIRB formally initiated the Technical Review phase of the review process with a submission date for the technical review comments of September 5, 2011. QIA requested and was granted a one-month extension to the technical review period. As a result all submissions were due to NIRB by October 5, 2011. Baffinland continued to respond to IRs until 27 September 2011.

The purpose of the DFO Science advisory meetings, as described in the Terms of Reference (Appendix 1), was to (1) assess whether the draft EIS provides sufficient information to assess the impacts of the Mary River Project on marine aquatic species and habitat, especially increased shipping activities (including icebreaking) on marine mammals, (2) if not, identify what information or further clarification is required, (3) assist DFO Habitat Management with an analysis of the impacts and proposed mitigation measures outlined in the draft EIS and (4) if necessary, recommend additional mitigation measures in order to reduce or avoid impacts to fish and fish habitat, including marine mammals. Objectives 1 and 2 were addressed in a meeting scheduled for 7 March 2011. Objectives 3 and 4 were addressed at the 19 September 2011 meeting once the Proponent had responded to the information gaps identified under objective 2.

Meeting participants (Appendix 2) included DFO Science from Central and Arctic, Quebec, and Newfoundland and Labrador regions. Due to the nature of the technical review and timelines involved with delivery, many of the discussions were handled outside of the two meetings through e-mails. Several discussions with the Proponent occurred between the first and second meetings and some of the information garnered there was used in the technical review.

Discussions, principally from the IR phase, are summarized in this proceedings report. The Research Document (Stewart et al. 2011) provides detailed technical review comments and the Science Advisory Report (DFO 2011) is a synopsis of the advice from the Technical Review.

INFORMATION REQUESTS

DFO Science staff met to discuss IRs on 7 March 2011. The chair gave an overview of the Mary River Project and the EIS review process including a rough timeline. Participants were provided with the ten-Vol. draft EIS in advance of the meeting so they could identify key areas to focus on for the IRs in anticipation of the technical review later. Because of the short timeline available for the IR phase, certain aspects of the draft EIS were given limited review (e.g., freshwater). Participants thought the deadline for submitting IRs was too short given that the draft EIS was voluminous and relied extensively on unpublished information (e.g., surveys, bathymetry) which was not presented, the size and scope of the Mary River Project, DFO's responsibility for stewardship of the aquatic environment, and the likelihood the public will hold DFO accountable for environmental damage to the aquatic environment that may occur during the life of the Project.

All participants were concerned with the choice of shipping route through Hudson Strait and Foxe Basin. Any water-borne sources of impact in Hudson Strait and Foxe Basin would spread throughout Hudson Bay as a result of the currents that run from both waterbodies into Hudson Bay. Spills would cycle into the Bay as would any species introductions through shipping vectors. The draft EIS indicates that the reason for not taking the railroad to a port on the east coast of Baffin Island is because it is more expensive than going through Foxe Basin. The draft EIS makes only limited mention, and no assessment of, Baffin Bay and Davis Strait for shipments to and from the Milne Inlet port, and provides only limited information about Hudson Strait. It was assumed this was because the Proponent considers those water bodies to be established shipping routes. Participants questioned where in Hudson Strait the current shipping is routed. The proposed Baffinland shipping route identified doesn't follow the standard ship track so it is essentially a new route.

The shipping route and the impact of shipping were major concerns with the draft EIS. Propeller wash would have an impact on the benthos. Foxe Basin and Hudson Strait are important biological areas for both marine mammals and fish, though the former contains fewer fish species than the latter. The actual shipping routes are not well described in the draft EIS. The ship's track would be at the discretion of the ship's captain. The actual width of the track would be larger than identified in the draft EIS. Given eight ships along the route, there would be about a 1000 km long and 500 km wide area affected and acoustic refugia for marine mammals would be limited.

Community consultations were confined to Nunavut, as the Proponent argued that they would not use shipping routes in Nunavik. However, as participants pointed out, the range of underwater noise propagation for the cape size carriers is 250 km, therefore the sound of ships would affect the marine environment of Nunavik. The effects of sound transmission, transboundary issues associated with marine mammals, and risk associated with catastrophic events such as large fuel spills also require the inclusion of Nunavik in the EIS assessment. The Regional Study Area includes Hudson Strait thus, again, Nunavik must be involved.

Participants discussed the Valued Ecosystem Components (VECs) chosen by Baffinland to assess the Project. The list of VECs revealed obvious ecosystem gaps from primary producers to Arctic Char. Detailed analysis of the benthos and food chain components is missing. Capelin and Arctic Cod serve as energy conduits in the marine ecosystem therefore they should have been included. The Bearded Seal was also identified as a significant gap. Killer Whale, Minke and Humpback whales should also have been considered as VECs for Hudson Strait.

Surveys for marine mammals were identified as being of methodological concern as only the ship route was flown, after which the results were extended to the population level. Altitudes, speeds and aircraft type varied every year of the surveys making comparisons among the surveys difficult. Project impacts on marine mammals, including displacement, were not thoroughly assessed in the draft EIS. For example, movement of affected animals into other areas where animals are already present could have a ripple effect, with potential impacts extending to both the displaced and the resident animals.

The draft EIS mentions additional ore bodies that could double the current proposed iron ore production. Participants pointed out that the assessment has to be clear as to whether it applies to a 35-year plan or longer - in addition to possible changes in operational scope and cumulative impacts. Since the Proponent has indicated the ships are not yet built, vessel noise levels (and associated confidence intervals) are unknown. The many unknowns and uncertainties associated with the Project make it difficult to properly assess the thoroughness and efficacy of the draft EIS.

Review of the ballast water information was undertaken outside of the meeting. The draft EIS only indicates using ballast water exchange instead of water treatment, which is, or will soon be, required under Federal regulations. It was not clear if using a human health standard for treatment would also meet environmental standards. The draft EIS indicates it would take about 20 hours to pump out ballast from an ore carrier and thus there would be 20 hours of pumping every 43 hours. The draft EIS also indicates the accumulating ballast water would form a surface lens creating an eddy which may move approximately 4 km; however, it does not indicate what would ballast exchanges would mean over the longer term. Participants noted a small salinity differential would keep the water together and likely change the salinity of the area over time. There was also concern that if the water was treated it may form “dead” water. It was pointed out that an oceanographer should review the draft EIS. Risk models of climate change need to consider iceberg issues as they will increase with time and potentially impact shipping.

Also significant was the limited or absence of information in the draft EIS on climate change and incremental effects from the Project on climate change stressors. Year-round road activity would result in dust. Dust or soot, which is a short-lived climate forcer (SLCF), would hasten local climate change impacts including enhanced melting of landfast ice at the marine ports. Climate change would have significant effects over the 40-year timescale of the project. The iceberg data presented in the draft EIS are out of date. Reductions of sea ice resulting from climate change raises the possibility that Baffinland could ship more ore, especially in the High Arctic, as the open-water season lengthens.

There is insufficient information with which to do thorough risk analysis and cumulative effects assessment of local and regional impacts resulting from the Mary River Project. Quantitative risk analyses with probabilistic scenarios (e.g., collisions of ore carriers, groundings of ore carriers, vessel and cargo fuel spills, etc.) and cumulative effects analysis, and how these would change with possible doubling of the project size, are major gaps in the draft EIS. Participants were concerned with the cumulative impacts of the Project; the piece-meal approach used in the draft EIS doesn’t address this. A hypothesis of no impact cannot be properly tested if there are confounding effects resulting from flawed assumptions. Baseline information is needed for Hudson Strait (marine mammals, ambient and anthropogenic sound characteristics, bathymetry and the actual footprint of the project, number of vessel and aircraft transits, etc.). Some participants wondered about the life cycle of the proposed ore carriers and whether risk of problems increases with the age of the ships.

More background information is needed on within-Project cumulative effects to determine whether residual effects of vessel traffic, icebreaking, blasting, pile driving, etc. are still insignificant when they are combined. The draft EIS shows additive not synergistic effects. Cumulative effects of all stressors operating simultaneously are needed. Climate change and contaminant loading are already increasing over time, and now Project impacts are being added. It was suggested that an independent review of the methods used for the cumulative effects analysis be undertaken.

Participants were concerned with the 10% threshold levels identified in the draft EIS. Evidence to justify its use was not provided.

The draft EIS provides very limited information on monitoring, what adaptive management approaches are considered, how and when they will be used, and what happens when thresholds are exceeded.

Participants discussed how icebreaking through landfast ice in winter hardens the ice over time. Every six transits the shipping route has to be moved, so the footprint area would be much larger than indicated in the draft EIS. This also means Nunavik would likely be affected. Breaking ice also has the potential to allow Killer Whales to access areas that they could not otherwise. Participants wondered what effect this would have on gene flow among marine mammal stocks with a less consolidated ice pathway being created down the middle of Foxe Basin. The Proponent used a single satellite image to suggest that ice closed up soon after ship transit, however participants agreed this was not an adequate analysis and assessment. There should be examination of the quality of the ice (not just quantity) and how icebreaking would affect polynyas and ice integrity as the Proponent may route ore carriers through the polynyas in Hudson Strait.

Participants were concerned that the draft EIS dismissed impacts from shipping in spite of so much uncertainty about the impacts on marine organisms and the amount of shipping activity and resulting noise. Sound originating from shipping activity may remove part of the habitat available (preferred) for marine mammals. Although long-term hearing impairments and deafness may be less of a problem in species like walrus, ship noise would likely result in repeated and concurrent disturbance events with almost no naturally quiet periods. Temporary Threshold Shift, which can occur immediately after exposure to a high level of noise or through prolonged lower-level noise exposure, might last up to a day during which such marine mammals might be more susceptible to predation and less able to locate prey or conspecifics. Proposed icebreaking activities would create a noise footprint over a very large area; this is especially significant for marine mammals in polynyas in Hudson Strait in winter where they may not have room to move. As two icebreaking ships pass in an area, the sound pressure could be significantly greater than ambient noise levels, and over a longer period of time than for passage of a single ship. The modelling methods used by Dr. Chris Clark and others in 2009 would be useful.

In the draft EIS, the Harbour Seal is used as a model for Ringed Seal because all pinnipeds are reported to have similar audiograms. This may not be true since, for example, the Harbour and Harp seal audiograms are dissimilar and the two species are ecologically quite different.

Arctic Cod communicate by sound. The effects of sound production on key fishes (Arctic Cod, Greenland Cod, etc.) need to be assessed.

Before, during, and following the meeting participants compiled detailed information to be included in the IR submission. The information requests submitted to Habitat Management

(Appendix 3) covered the following topics: ballast water, bathymetry, climate change, cumulative effects and risk assessment, freshwater fishes, lower trophic levels, marine fishes, marine mammals, monitoring, overall project issues, project expansion potential, sea ice, shipping, sound, and miscellaneous issues not covered under the other categories.

TECHNICAL REVIEW

DFO Science staff met to review technical comments on 19 September 2011. Material for the Technical Review was gathered from discussions held and notes provided by DFO Science researchers throughout the process. Several discussions took place with other federal jurisdictions/agencies and QIA during the technical review period. Early on, participants developed a list of concerns with the draft EIS (Appendix 4), many of which were common to DFO, EC, PCA and QIA.

Comments and discussion points were compiled by DFO Science into a working paper. Most of the synthesis and review of material was carried out via e-mail. Only the IR responses received from Baffinland by 2 September 2011 were considered in development of the technical review comments submitted by DFO Science to Habitat Management. On 19 September 2011 a subset of the contributors met to review the working paper and address outstanding comments reviewers had with the document. It was decided that the best approach to take with the meeting products was to publish the working paper as a Research Document on the Canadian Science Advisory Secretariat website. It would contain the technical review in the format needed for the NIRB submission with sufficient detail to support the comments and allow the Proponent to make necessary changes. The research document (Stewart et al. 2011) was provided to Habitat Management so that they could consider the information during the DFO submission to the NIRB. The science advisory report (DFO 2011) contains a brief summary of the main conclusions reached during the technical review.

LITERATURE CITED

DFO. 2011. Technical Review of Baffinland's Mary River Project Draft Environmental Impact Statement (EIS). DFO Can. Sci. Advis. Sec. Sci. Advis. Rep. 2011/065.

Stewart, R.E.A., V. Lesage, J.W Lawson, H. Cleator and K.A. Martin. 2011. 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 + 63 p.

Appendix 1.

Terms of Reference

Science Review of Baffinland's Mary River Project Draft Environmental Impact Statement

Central and Arctic Regional Advisory Process

7 March and 19 September 2011
Winnipeg, Manitoba

Chairperson: Kathleen Martin

Context

The Mary River Project is a proposed iron ore mine located at Mary River on North Baffin Island in Nunavut. Construction of the project could commence as early as 2012 and would require about four years to complete. Operations would involve mining high-grade iron ore, crushing and screening, rail transport and marine shipping of the ore to market, mostly in Europe. Two port facilities would be constructed, in Milne and Steensby inlets. The port at Steensby Inlet, in northeastern Foxe Basin, would accommodate the cape sized vessels with ice-breaking capabilities designed to transport ore to market. The carriers would transit Foxe Basin and Hudson Strait every two days year round. The Milne Inlet port will not be used to ship ore but will be used mainly during the construction phase of the project. Based on current ore reserves, the mine would operate for 21 years. Duration of the Project, from the start of construction activities to post-closure, is expected to be 33 years.

Since 2005, Baffinland Iron Mines Corporation (Baffinland) has conducted baseline studies which form the basis of their draft Environmental Impact Statement (EIS) for the Mary River Project. These studies cover the terrestrial, freshwater, atmospheric and marine environments, as well as socio-economic conditions and land use. The Baffinland EIS has been submitted to the Nunavut Impact Review Board (NIRB) for detailed environmental and socio-economic review. Fisheries and Oceans Canada (DFO) is responsible for conducting a technical review of the EIS. To that end, Ecosystems Management sector within Central and Arctic Region of DFO requested advice from the Science sector to assist them with reviewing the Baffinland EIS, especially the potential impacts of ice-breaking/shipping activities on marine mammals.

Objectives

The objectives of the meeting are to provide advice on the following aspects of the Baffinland EIS.

1. To assess whether the EIS provides sufficient information to assess the impacts of the Mary River Project on marine aquatic species and habitat, especially increased shipping activities (including icebreaking) on marine mammals.
2. If not, identify what information or further clarification is required.
3. To assist DFO Habitat Management with an analysis of the impacts and proposed mitigation measures outlined in the EIS.
4. If necessary, recommend additional mitigation measures in order to reduce or avoid impacts to fish and fish habitat, including marine mammals.

Objectives 1 and 2 will be addressed in a meeting scheduled for 7 March 2011. Objectives 3 and 4 will be addressed at the 19 September 2011 meeting once the proponent has filled the information gaps identified under objective 2.

Expected publications

This science advisory meeting will generate a proceedings report that summarizes the discussions of the participants. It will be published in the Canadian Science Advisory Secretariat (CSAS) Proceedings Series on the CSAS website. Advice resulting from the meeting will be published as a CSAS Science Advisory Report. Detailed technical review comments will be published as a Research Document.

Participation

DFO Science sector (C&A, Quebec and Newfoundland and Labrador regions) is invited to this advisory meeting.

Appendix 2. List of Participants

Name		7 March	17 September	Other[1]
Sarah Bailey	DFO Science, C&A			✓
Holly Cleator	DFO Science, C&A	✓	✓	✓
Steve Ferguson	DFO Science, C&A	✓		✓
Jason Hamilton	DFO Science, C&A	✓		
Lois Harwood	DFO Science, C&A	✓		
Kevin Hedges				✓
Kim Howland	DFO Science, C&A			✓
Jack Lawson	DFO Science, Newfoundland & Labrador	✓	✓	✓
Veronique Lesage	DFO Science, Quebec		✓	✓
Kathleen Martin	DFO Science, C&A	✓	✓	✓
Stephen Petersen	DFO Science, C&A	✓		✓
Jim Reist	DFO Science, C&A	✓		
Yvan Simard	DFO Science, Quebec	✓		
Tim Siferd	DFO Science, C&A			✓
Gary Stern	DFO Science, C&A	✓		
Rob Stewart	DFO Science, C&A	✓	✓	✓
Chris Wiley	DFO/Transport Canada, C&A			✓

[1] Comments used in the technical review but which were provided outside of the meetings and/or while attending discussions with Baffinland to review and discuss concerns about the draft EIS.

Appendix 3. Information Requests (IRs) submitted to Habitat Management for consideration in DFO's IRs submission to NIRB.

BALLAST WATER

Section: (Vol. 3) 6.5.10.4 Ballast Water Treatment, (Vol. 3) 3.2.2 (Milne Port), (Vol. 3) 3.2.2.4 Ballast Water Management, (Vol. 3) 3.6.3 (Steensby Port), (Vol. 8) App. 8B-1 Ballast Water Discharge at Steensby Inlet, (Vol. 8) App. 8B-2 Ballast Water Discharge at Milne Inlet

Preamble/Rationale:

Ballast Water as vector for non-indigenous species

- The introduction of invasive species into the Arctic marine environment from shipping can occur and the risk may be enhanced due to changing climate, possibly making conditions more favourable to some species. The most risk exists where a transfer of organisms from ecosystems of similar latitudes and conditions can occur. Of particular future concern is the transfer of organisms across the Arctic Ocean from the North Pacific to the North Atlantic or vice versa.
- Information provided in the EIS for ballast water doesn't correspond to current/future requirements for ballast water control or lacks sufficient detail to be able to evaluate the efficacy of the approach being presented.
- While ballast exchange offers good protection, it is not 100% effective, and less protective of marine ports than freshwater ports. It is therefore important to understand where the ballast water would originally be sourced from in order to assess the risk of unwanted species being in the tanks and possibly being retained despite exchange. Additionally, more details are needed to assess impacts of planned operations.

Other vectors for non-indigenous species

- Vectors for introduction of non-indigenous species associated with shipping (i.e., hull fouling and dunnage) should be considered in the assessment.

Ballast Water impact on habitat

- Impact of ballast water on the environment in Foxe Basin and Steensby Inlet is not adequately addressed in the EIS

Request:

- Why is exchange proposed when the requirement is ballast treatment?
- Information is needed for all ore carriers that will be used to transport ore from both port facilities for this project.
    - Identify if any ore carriers will be existing ships (i.e., already built as opposed to newly constructed ships) as these will be the only ones allowed to legally only use ballast water exchange until 2016.
    - More information is needed about the operation patterns of all of these ships. Will there be basically a single ship on dedicated runs between the Arctic ports and a single southern port? Will multiple ships be on the runs and visiting a variety of ports when not on runs to the Arctic?
    - Where will the original ballast come from? How environmentally similar are the source ports to the recipient ports in terms of salinity, temperature, etc.?
    - Provide a list of native and nonindigenous species reported from the source ports.
    - Detailed information is needed including how all ballast tanks will be managed, including any that may not be completely full (if that was ever to happen).

    - Given that the operations may take place year round, is weather likely to negatively impact the ability to conduct a thorough exchange and what are the back-up plans if this were to happen? If exchange becomes difficult as a result of weather conditions, and if there will be multiple ships on the runs, will consideration be given to having a shore side reception and treatment facility?
    - As all new builds or existing ships with operations extending beyond 2016 will require ballast treatment, details about the treatment systems to be used need to be provided.
    - What is known about the efficacy/toxicity in cold water for the specific ballast water treatments planned? We have seen that treatment systems utilizing biocides have prolonged toxicity in cold waters and that could be a real concern for these ports. The information about the source ports would need to be considered as the treatment system has to be able to deal with conditions of the source port (i.e., if source is freshwater, need to have a system that works in freshwater).
    - If the source ports are fresh or brackish waters, what will be the plan for treatment/exchange? Will consideration be given to exchange plus treatment if the system has not been proven effective for the conditions found in both the source and destination ports?
- Provide information on hull fouling. What plans are in place to ensure that hull fouling doesn't put Arctic ecosystems at risk.
- What parts of the International Maritime Organization (IMO) guidelines for hull fouling will be implemented.
- Dunnage may be important during the construction phase. What plans are in place to deal with this vector?
- Vol. 8, 3.5.2.3 Analyses needs to be provided on the biological impact of the ballast water lens.
- Vol. 8, 3.5.2.3 Seasonal accumulation of ballast water may be a significant issue but has not been addressed. The extent of the eddy would be dependent upon the Vol. and frequency of ballast discharge and based on the information provided appears to have potential to be long term, nearing permanent, and will grow.
- Impact of the lens of ballast water released by incoming ore carriers heading to the Steensby port facilities suggested that this large lens will remain intact and settle to the bottom, moving back and forth along the coast. How will this impact the benthos in Steensby Inlet and surrounding area? What are the plans to monitor impacts? What is the baseline for assessing the impacts? What plans are in place to address this issue if there are significant impacts on the benthic community?
- Vol. 8, 3.5.2.3 The EIS indicates that effects during winter are expected to be negligible due to the anticipated similarity in water quality of ballast water and water in Steensby Inlet. However this is contradicted elsewhere in the EIS where the creation of a lens is discussed. What will be the effect of ballast water running down the slope on sediment disruption?
- Based on information provided, it looks like the ballast water eddy will persist through the winter. Information is needed on the duration of the pool and growth during the winter. What are the long term effects on ice melt as this eddy grows and as it warms the surrounding water?
- As the lens of ballast water will remain intact, what is the risk of non-indigenous species transported in the ballast becoming established? Typically ballast water exchange attempts to disperse travelers over a large area in conditions unfavourable for their survival, reproduction and establishment. This doesn't appear to be the case as presented in the EIS.

- As water freezes and salts are excluded from the ice, what will be the interaction between this and the ballast water being released in Foxe Basin/Steensby Inlet?
- What will be the overall impact of ballast water on the benthic community in Foxe Basin/Steensby Inlet? The document doesn't adequately assess risks and impacts for the benthos but needs to do so in this report.
- Why is the ore carriers capacity for ballast water different from capacity for ore?

BATHYMETRY

Section: (Vol. 3) 3.6.3 Shipping and Port Operations

Preamble/Rationale:

- The EIS indicates that bathymetric surveys were carried out over two years (2007 and 2008) on behalf of Baffinland by Kivalliq Marine Ltd. These surveys fleshed out cursory hydrographic surveys that had been completed in the area by the Canadian Hydrographic Service (CHS). The EIS indicates that the bathymetric surveys will be provided in the future to the CHS for approval and for the development of navigational charts for use by the public including Baffinland.

Request:

- Bathymetry for the whole area impacted by port construction and shipping (including Foxe Basin and Hudson Strait) needs to be provided as part of this assessment and EIS to allow evaluation of Project impacts or potential impacts on the marine ecosystems.

CLIMATE CHANGE

Section: Vol. 8, 1.0, Vol. 9, 2.2

Preamble/Rationale:

- The most immediate impacts of climate change in the Arctic continue to be the reduction of summer sea ice, longer open water seasons in the fall and the reduction of the year-round presence of multi-year ice. These changes may have far reaching implications for Arctic ecosystems and will also result in the lengthening of the current shipping season. Shipping in the future may occur much later into the fall and possibly earlier in the spring, thereby increasing the possibility of interaction between migrating and calving species of marine mammals and ships.
- Deposition of dust/soot acts as a short-lived climate forcer on local ice and snow albedo causing earlier melt. Mine and shipping operations are expected to produce dust and soot.
- The EIS contains a description of the potential effects of climate change on the Project (Vol. 9, 2.2) when it should also consider the impact of the Project on climate change.

Request:

- Given that climate change could also cause changes in animal and environmental conditions in the LSAs and RSAs, how will the proponent distinguish these from localized or cumulative effects caused by the operations themselves? Similar monitoring in adjacent/similar areas should be undertaken to ascertain if animals are displaced from the mine operations area, or if density or behavioural changes are climate-related.
- The EIS identifies sea ice as a VEC. Climate variability and change (CVC) will diminish sea ice habitat (seasonal duration, consolidation, thickness, extent) making the services provided by sea ice more valuable to ecosystem components relying that rely on it (i.e.,

marine mammals, marine fishes, primary and secondary producers). This then makes any additional disruptions potentially more relevant. The EIS should have greater in-depth analyses of the effects of ice-breaking on sea ice and interactions with CVC.
- CVC will also impact freshwater systems (hydrological change). This needs to be addressed in the EIS.

CUMULATIVE EFFECTS AND RISK ASSESSMENT

Section: Vol. 8, Vol. 9, Vol. 9, Table 9.3-2, Vol. 10 App. 10A-2

Preamble/Rationale:

Cumulative Effects

- In the EIS, temporal or spatial cumulative effects are not considered.
- In the EIS, it assumed that individual disturbances e.g., construction activity, vessel traffic and aircraft over-flights may be of low magnitude (level 1). However when the same individuals are stressed by each of these disturbances (each one is reported at a moderate level (level 2)) they have an additive if not a multiplicative effect on the health of the animal over the long term, if not the short term. The consequences of the effects (e.g., reduced body condition, reduced reproductive success) will likely show up at the population level over the life of the Project.
- In addition, the EIS did not consider environmental changes (e.g., climate change and contaminant loading) that are currently increasing over time in the Arctic and what additive or interactive effects the Project will have on them.

Risk Assessment

- In the EIS quantitative probabilistic risk assessments are not included. All the assessments seem to be based on professional opinion (i.e., qualitative). There are likely cases where quantitative information is available such as the work done on probabilistic risk of oil spills in Norway for Russian tankers passing by Nordic countries

Request:

Cumulative Effects

- The EIS should provide information on the cumulative effects models available and how they were or can be incorporated into current EIS.
- The approach used in the EIS for assessing project effects is misleading. It examines a large number of small effects in a piece-meal fashion without considering synergistic or cumulative effects. The EIS considers additive rather than cumulative effects as it should have to fully understand the impacts of the project on the LSAs and RSAs. An independent review of the methods used for the EIS cumulative effects analysis is needed.
- Explain how ongoing environmental changes were considered in the cumulative effects assessment.
- The RSAs identified for the southern shipping route are Foxe Basin and Hudson Strait. Justify why Hudson Bay is not included as an RSA given the linkage in circulation patterns between Foxe Basin, Hudon Strait and Hudson Bay.

Risk Assessment

- Risk assessment terminology needs to be consistent (e.g., Table 1 in Vol. 10, Section (S.) 4.2 labels the highest risk as Extreme while Table 1 as Critical).

- Justify the risk rating of moderate for events that will have catastrophic environmental impact although the likelihood of occurrence is rare, unlikely or possible. Under this rating system the *Exon Valdez* oil spill in Prince William Sound would have been considered a moderate risk although in reality its consequences were devastating for the region.
- Vol. 9, Table 9.3-2 appears to have numerous errors in the risk rating. For example, collisions with vessels has a "possible" likelihood and "very low" risk rating, yet the risk rating matrix (Vol. 10, App. 10A-2 Table 3) gives "low" as the lowest possible risk rating when the likelihood is "possible". For this example, the Table doesn't match the corresponding text in this section. In other cases it is incorrect in both Table 9.3-2 and the associated text.
- Table 9.3-2 indicates that a major diesel spill at sea has a "very low" risk rating. Given the likelihood as "unlikely" that means the impact according to Table 3 in App. 10A-2 would have to have been considered "insignificant". Justify why a diesel spill at sea would have an "insignificant" impact if this were to occur within the RSAs.
- Collisions between bowheads and ships provides a qualitative discussion on the risk however the basis for the argument of no mortality being expected and no residual effects are expected to occur is flawed because bowheads are thought to avoid vessels underway. This may not be the case in Foxe Basin and Hudson Strait.
- Overall Quantitative Risk Analysis including probabilistic scenarios of collisions between ore carriers and whales, groundings, spills, contaminants from shipping, etc., needs to be included in the EIS, as well as information about how the results of major accidents and malfunctions will change with a possible doubling of the project size.

FRESHWATER FISHES

Section: Vol. 7

Preamble/Rationale:

- Freshwater fishes and their habitats will be impacted by the Project.

Request:

- It was not clear how suitable fish habitat was defined and what thresholds were used to delineate suitable and unsuitable habitat. Provide clear definitions with supporting references.
- The proponents seem to indicate that fish passage will only be ensured at some stream crossings. Why is it not being considered at all crossings? A clear explanation of why this cannot be achieved should be provided.
- Vol. 7 p. 276. It is not clear if "total habitat" refers to all available habitat or just that suitable for Arctic Char. This should be clarified as it affects the reported percentages.
- Supporting references for stream classification should be provided.
- Proponent needs to provide clarification as to how different reaches were sampled for fauna including fishes. Was sampling done both above and below crossings? How many reaches were sampled and did sampling cover entire streams or only selected reaches?
- The sample design for fish seems to vary from year to year and site to site. General approach and methodology need to be clarified and any inconsistencies or deviations clearly justified or explained.
- Length stratified sample of ages is not useful in terms of characterizing fish populations and following changes in age structure of Arctic Char as development proceeds. Ideally a random sample (over space and time) should be used. Was this considered in the assessment?

- The proponents state that they attempted to achieve good temporal and spatial coverage for fish sampling on lakes. They need to explicitly state what approach was used to achieve this. They later indicate that they focused sampling effort on Arctic Char habitat so they also need to explain how they determined char vs non-char habitat. Provide details on the spatial coverage that was used to verify presence/absence of fish.
- It is not clear if the entire streams or just particular stretches were sampled by electrofishing for both road and railroad crossings. Provide clarification of sample design.
- With the hoopnet sampling, only the first 50 fish were measured each day. This may introduce biases in data. Why were fish not sampled randomly at intervals throughout time?
- Criteria and supporting references need to be provided for "preferred spawning habitat" and "suitable overwintering habitat" of char.
- Vol. 8 4.4 Direct Mortality Due to Fishing was not considered further in the assessment as fishing by Mine employees will not be permitted. However Inuit employees have the right to fish under the Nunavut Land Claims Agreement and will have greater access to fishing opportunities than prior to the mine development. Therefore direct fishing mortality should be considered in the assessment.

TROPHIC LEVEL BELOW FISHES AND MARINE MAMMALS

Section: Vol. 8, Vol. 8, App. 8A-1

Preamble/Rationale:

- The lower trophic levels of the ecosystem support the health of the mid- and upper trophic levels. An understanding of this part of the ecosystem is critical. Changes to this part of the ecosystem may occur at a more rapid rate and, therefore, be more easily detectable than in higher trophic levels (e.g., marine mammal species).
- Detailed analysis of benthos and food chain components is missing form the EIS.
- VECs chosen for marine ecosystems do not include invertebrates or marine fishes.

Request:

- Justify why no primary or secondary producer VECs or indicators were chosen to assess impacts on the benthos or food chain components for the LSAs or RSAs.
- Vol. 8, 2.1 states that increased productivity near the ice-water interface results in greater biomass of invertebrates. How was this sampled? How will it be monitored?
- Various invertebrates are key prey species for ringed seal, walrus, bearded seal, bowhead whales as well as a number of marine fishes. How will baseline data be collected for these important species? How will they be monitored and assessed?
- Footnote in Table 8-4.5 indicates "nine quantitative benthic invertebrate samples were collected from each of Milne and Steensby inlet". Why is this included in this table?
- How did the underwater towed videography data compare to the benthic grab samples?
- How will physical habitat alteration (changes due to ore dust deposition, re-suspension of sediments due to prop wash from ships, reduction in productivity due to Project-related effects pathways (i.e., lower trophic level effects) be monitored? How will impacts on invertebrates be determined?
- In the description of videography transects, comments about vegetation types and percent cover were provided. Why is this information not included in the EIS?
- Unpublished reports referenced in App. 8A-1 need to be provided.
- Intertidal and shallow subtidal algae were mapped from aerial imagery in Steensby Inlet (Fig. 4.1-21). Various rockweeds, commonly occurred both in the intertidal and in the

shallow subtidal regions. Filamentous algae type occurred on about 12% of the coast. Benthic kelps are common in the subtidal region. Nearshore kelps occur along 27% of the shoreline in Steensby Inlet. The kelp communities are important habitat features that are not dealt with adequately in the EIS. How will changes in the species composition in these communities (including kelp and associated invertebrates and fishes) be changed by the Project? How will change be monitored and mitigated?

- Details on the sampling methods should be included in the report or if they are included in unpublished reports, they should be included with the EIS. Detailed data should be included in the EIS.

MARINE FISHES

Section: (Vol. 8), (Vol. 8) App. 8.1

Preamble/Rationale:

- Information on marine fishes is limited in the EIS. The spatial context of the project seems to be missing; Hudson Strait is an important biological area that probably contains more fish species than Foxe Basin.

Request:

- Arctic Char, an anadromous fish rather than a marine fish, is not an appropriate species to be used as an indicator for marine fishes in the EIS. Justify why a wholly marine fish species was not also included as a VEC (or indicator) for the EIS.
- The assessment of marine fishes was limited to nearshore communities and the RSAs were limited to the respective bays or inlets instead of incorporating the shipping routes. No real explanation is given for the delimitation of the RSAs with respect to marine fishes. Justify why the area outside of the immediate area of the Ports are not considered in the assessment of impacts on marine fish communities.
- While comments are made about spill effects, the consideration of spill impacts on marine fishes is limited to nearshore communities in close proximity to the two Ports. Are contaminants expected to be retained near the Ports because of currents?
- Field sampling of marine communities was extremely limited: 16 gillnet sets, which lasted less than 4 hours, in one year at Milne and about 20 sets in each of two years at Steensby. Fish sampling was also limited to waters no deeper than 50 m. The focus was clearly on nearshore species, but marine nearshore species can use habitats deeper than 50 m and project effects can certainly extend beyond the study area. The conclusions drawn from the sampling regarding the composition of the nearshore fish community and local species diversity (which is referred to as "low" for both sites with no explanation of what low means or what it is in relation to) are poorly supported and explained. Justify why such limited sampling was carried out for marine fishes. Justify why sampling was limited to gillnetting. How will the limited sampling be used as a baseline to assess impacts of the Project? Why was sampling not carried out using standard survey methods (e.g., stratified random sampling)?
- Extremely brief descriptions are given for sampling methodologies with references to North/South Consulting documents for details which were not available on the web. More detailed descriptions of the sampling methods should be given in the document, at least in the appendix; the current information is insufficient to assess the appropriateness and thoroughness of the fieldwork. Provide detailed results of the sampling.
- Provide explanation/evidence that the effects of noise disturbance on pelagic fish will be “completely reversible” given “the spatial effect to which pelagic fish may be affected is

difficult to determine, but is expected that this will encompass some small portion of each LSA" and "the effects will be frequent (Level II), of medium duration…" (p. 112 of 295, fourth paragraph).

MARINE MAMMALS

Section: Vol. 2, 3.8.2, Vol. 5, Vol. 8, 5.4.2, Vol. 8, 5.7.1.3, Vol. 8, Tables 8-5.1, 8-5.2, 8-5.4, 8-5.5, 8-5.8, 8-5.9, 8-5.11, 8-5.12, 8-5.15, and 8-5.18, App. 8A-2, App. 8A-2, 4.1.3, App. 8A-2 Fig. 4.18

Preamble/Rationale:

- Several species of marine mammals, found in Nunavut, will be impacted by this project. In the EIS they are, for the most part, identified as VECs. Review of the documents resulted in a number of requests for clarification or additional information. Specific requests related to marine mammal monitoring have been identified separately.

Request:

- Tables 8-5.2, 8-5.5, 8-5.9, 8-5.12, 8-5.15, and 8-5.18 indicate that a 10% significance threshold for the LSA or RSA was chosen for delineating behavioural disturbance (non-mortality effects) of Project operations on ringed seals, walrus, and beluga, narwhal and bowhead whales, and polar bears based on "several studies". The second assumption identified in the Key Assumptions in Assessment Approach (Vol. 8, S. 5.5.5) section says that the data from those studies "…do not converge on specific exposure conditions resulting in particular reactions" and that "In reality, there is expected to be much variation in response to sound type and level.". These statements clearly argue for a more precautionary threshold, especially for species designated by COSEWIC as at risk and where the confidence in effects estimates is lower. Explain the rationale for the threshold values used and provide evidence that they are precautionary.
- Tables 8-5.4, 8-5.8, 8-5.11 (construction phase), 8-5.14 (construction phase), 8-5.17 (construction phase) give "high" levels of confidence in all cases except one (moderate for narwhal). Explain this apparent contradiction with the assumption mentioned in the previous bullet (i.e., "is expected to be much variation in response to sound type and level").
- The method used to assess the impacts of the Project on marine mammals seems to presuppose that animals are static so only a small proportion in the zone of influence will be disturbed. However, if those animals move away from the disturbance, in most cases they will impact animals in the areas into which they move, causing a "ripple effect". Or affected animals may not have the opportunity to move if nearby habitat is already fully occupied by conspecifics or ice prevents movement. Explain how the effects assessment in the EIS accounts for these scenarios.
- The methods used to assess the impacts of the Project on marine mammals also seem to presuppose that animals operate at the population level and that finer stock structure effects are not at work. In reality, marine mammals segregate in various seasons such that the majority of a population segment (e.g., females with calves) aggregates in small areas so that virtually all members of that segment could be impacted by the Project (e.g., vessel noise). Explain the implications of marine mammal segregation by age and sex on the effects assessment in the EIS.
- Vol. 8, S. 5.4.2, the potential for vessel collisions is treated too lightly as a risk. Given the estimated density of various marine mammal species, there are simple means to estimate the probability of a ship strike based on factors such as ship size, speed, and mammal density. Some bowhead whales might act like North Atlantic right whales and

not necessarily swim out of an ice breaker's path, assuming ice conditions would even allow them to try to avoid a ship. How are these points addressed in the EIS?

- Vol. 8, walrus IQ maps: DFO has information that suggests that the area of pack ice east of Rowley Island is the preferred calving area for walrus. Walrus distribution on the maps presented is poorly defined and extremely limited compared to DFO survey information and local IQ.
- Vol. 8: animal health issues have not been addressed in the EIS, including the issue of chronic stress or a series of discrete stressors adding to chronic activation of the HPA axis with deleterious effects on individual and subsequently population health. This effect is often separate from change in population distribution and numbers. How is this been taken into account?
- What are the real expected levels resulting from hunting/harvesting? The EIS indicates that employees will not be permitted to hunt, however Inuit employees can not be prevented from hunting under the Nunavut Land Claims Agreement. Therefore, hunting will occur. What is the expected impact? In addition, supplying hunters that have to detour around the ship track with fuel and food will create an attractive base camp for harvesting operations. What is the expected impact of this modification in hunting paths? A well designed survey would be able to assess how many hunters would take advantage of this resource.
- How will creating a barrier (with noise, changed benthos, and modified ice characteristics) bisecting Foxe Basin affect dispersal of marine mammals and subsequent gene flow, especially if Project operations extend to 50+ years. Are there any monitoring programs in place to detect this if it occurs? This would require a pre-construction sampling program to establish a baseline. Key species to monitor would be ringed seals, bearded seals and walrus.
- App. 8A-2, Fig. 4.18 shows the highest density of walruses in that survey occurred inside Steensby Inlet yet p. 38 of same appendix says that "although walrus are known to move into Steensby Inlet, the extent to which habitat within Steensby Inlet is used is not known". According to figures and tables in App. 8A-2, aerial surveys conducted in 2006-2008 indicate that walruses occur in Steensby in Aug.-Oct. period. Do they remain there during the winter? Walrus were identified by proponent as a VEC. Provide better baseline data on the distribution and abundance of walrus in Steensby Inlet, especially from August to June, as it is warranted.
- Provide a thorough effects assessment using the current survey data with respect to the "no significant" impacts conclusions reached in 5.7.2.2 (Disturbance) in S. 5.0 (p. 176-182). For example, Fig. 4.18 in App. 8A-2 shows locations of numerous walruses within approx. 3-20 km of the proposed Steensby Inlet port.
- App. 8A-2, explain apparent contradiction between statements made on p. 38 that say "bearded seals typically occur alone or in small groups" and on p. 39 that say "the many polynyas of northern Foxe Basin support several colonies of bearded seals".
- Vol. 8, S. 5.2.1.2: justify why key questions did not include questions about whether propeller wash and ballast water lenses will degrade or destroy clam habitat at Steensby Port.
- Vol. 8, S. 5.4.1.1 (p. 143): Include jet-engine aircraft (only propeller-driven aircraft included) or justify why it should not be.
- Vol. 8, S. 5.4.1.3 (p. 144) and Fig. 8-5.1 (p. 145): text says that "harbour and ringed seals are close relatives (citation), and hearing abilities of phocinid seals as a group appear to be similar (citation), it has been assumed that both the underwater and in-air hearing abilities of ringed and harbour seals are similar.". Provide better justification for this statement. Harbour and ringed seals are ecologically different enough that it is not safe to assume they have similar communication abilities. The in-air audiograms of

harbour and harp seals demonstrate they are not especially similar. The underwater audiogram for harbour seal is noticeably different than the in-air audiogram indicating that one does not provide a close indicator of what the other will be.

- Vol. 8, S. 5.4.1.3 (p. 144) and Fig. 8-5.1 (p. 145): provide in-air audiograms and description of walrus hearing abilities. Airborne noise must be considered especially near walrus haulout sites.
- Vol. 8, S. 5.1.2 (p. 131) says walrus have been observed challenging ships that pass into their territory but S. 5.4.2 (p. 146) says risk of vessel collisions with marine mammals is generally considered low given their avoidance of ships. Explain this apparent contradiction. What mitigations are proposed to deal reduce the probability of walrus-vessel interactions?
- Vol. 8, S. 5.1.2 (p. 147): says that baleen whales are more susceptible to collisions than toothed whales. Include discussion about what is known about North Atlantic Right Whales (related to Bowhead Whales) and ship collisions here. What mitigations are proposed to deal reduce the probability of bowhead whale-vessel interactions?
- Vol. 8, S. 5, starting somewhere around S. 5.6.1.2 (p. 152): provide assessment of disturbance caused by chronic noise is necessary for all VECs.
- Vol. 8, S. 5.7.1.3 says the aerial survey data were corrected for detection and availability biases. Previous paragraph provides correction factors and citations but more detail is needed to ensure the correction factors are appropriate (e.g., they could have been developed for a different species or substrate).
- Vol. 8, S. 5.4.1.3 says “In terrestrial mammals, TTS can last from minutes or hours to (in cases of strong TTS) days.” while S. 5.5.3.1 says “TTS was not considered an injury (citation).”. Justify why hearing impairment that may last for minutes or hours or days would not pose a significant risk to a marine mammal from a predator, passing ship or any number of other threats.
- Vol. 8, S. 5.7.1.2: acute responses of walrus to disturbance have been reported – abandonment of haulouts and other areas – (see literature on Bristol Bay and western Foxe Basin). On p. 180 it says that “It is likely that at least some individual walruses will be affected multiple times by icebreaking during the course of a single ice-covered season.”. As the proposed Project would operate for decades, provide information on what is known about long term chronic exposure of walrus to ongoing disturbance.
- Provide justification for statements like “Avoidance would be temporary” (near top of p. 177) and “Walruses hauled out on ice may temporarily avoid an ore carrier transiting to and from Steensby Inlet by diving into the water, perhaps at distances ranging from 400-500 m up to several km” (near bottom of p. 178). Provide details about what is meant by “temporary”. Provide published information and expert opinion that support claim that walruses will not likely leave terrestrial haul-out sites in response to passing ore carriers at distances of 4.6-8 km (table 8-5.6).
- The Hall Beach Marine Mammal Workshop (middle of page 178) says “there is uncertainty about the effects of shipping 12 months of the year” on marine mammals. What will be an effective mitigation for shipping disturbance on walrus? Provide better explanation for how maintaining a constant vessel course and speed “whenever possible” and reducing idling of engines when docked will sufficiently mitigate disturbance to walrus from ore-carrying ships such that the significance of predicted residual effect is non significant at a high level of confidence (Table 8-5.8).
- Vol. 8, S. 5.7.2.2, p. 181: Boeing 737s will have to maintain low altitudes near the Steensby airstrip during landing and takeoff, so planned mitigation to operate at a minimum altitude of 450 m over marine areas won’t be possible. Also, “it is uncertain if walruses that occur in Steensby Inlet will habituate to daily overflights of a commercial jet” (top of p. 182). Justify why this would not pose a significant risk to walruses in

Steensby Inlet at times when walrus haul out in significant numbers, as was the case in September 2006 (App. 8A-2, Fig. 4.18). What mitigation measures will be undertaken during those times?

- Page 182: justify how effects of disturbance on walrus are "fully reversible" given this species is known to be sensitive to disturbance and would be subject to chronic disturbance over decades from this Project.
- Vol. 5, S. 5.7.5: "There is some uncertainty about how many walruses use Steensby Inlet during the open-water season and…"… "Thus monitoring will be undertaken at the Steensby Inlet Port site during the Construction Phase to document walrus occurrence and the potential response to site activity…". Surveys must be conducted prior to the Construction Phase to provide the baseline necessary for evaluating whether the Project is having an impact.
- Almost all the marine mammal species maps in Vol. 8 need to be revised to include missing information. For example, Clearwater Fiord is not included as known range of belugas in Fig. 8-5.6. The maps related to narwhal and narwhal movements do not adequately portray the knowledge for the Northern Hudson Bay (NHB) population: no summer concentrations are identified (what about Repulse Bay or Lyon Inlet?), no fall concentrations are shown in Fig. 8-5.7 and no migration routes are shown though they are for other whale species.
- App. 8A-2, Fig. 3.5: the NHB narwhal migration route that follows the shipping route is missing.
- No effective mitigation is provided in response to the statement that belugas could habituate to disturbance but, alternatively, may not.
- Clarify what the following statement means: if the narwhals overwinter in Hudson Strait, and the icebreaking carriers operate there in winter, the effect of shipping cannot be limited to Milne Inlet.
- The EIS says "...but narwhals are thought to overwinter in the eastern portion of Hudson Strait. ….There have been relatively few studies of the effects of shipping on narwhals. Based on limited observations in the Project area, narwhals do not seem to respond to vessels (including the passage of an ore carrier) in Eclipse Sound and Milne Inlet to the same extent as responses documented during a 1982–1984 icebreaking study. The interaction of the Project with the narwhal population will be limited to the shipping activities in Milne Inlet during the open water season and as a result, the residual effect of the Project on the narwhal population is assessed as not significant." Explain why the interaction between narwhal and shipping activity is limited to Milne Inlet when it was stated earlier that narwhal are thought to overwinter in Hudson Strait.
- Explain apparent contradiction between statement in App. 8A-2, S. 4.1.3 that says "Density estimates were not corrected for detection or availability biases." with statement in Vol. 8, sub-S. 5.5.4, that says "Densities derived from aerial survey data collected as part of the baseline data collection program for the Project were corrected for detection and availability biases…". Which is it?
- If density estimates were corrected for detection and availability biases, provide full description of methods used and tables showing the corrected numbers/estimates. For example: Vol. 8, S. 5.7.1.3 talks about that corrected survey data for walrus.
- Justify why surveys densities were not converted to population estimates.
- Explain the value of conducting open-water surveys for pinnipeds when only walrus and large numbers of harp seals are reliably detected. Given walrus was identified as a VEC, justify why surveys to count walruses on haul-outs were not conducted, especially in Steensby Inlet and Foxe Basin.
- Re-design aerial surveys to allow for correction of perception and availability bias, and to standardize flying altitude, speed and aircraft and data-recording methods as variability

in surveys conducted to date prevents inter-year comparisons and limits their use as baseline data for evaluation of pre-, during-, and post-Project effects.
- Re-design aerial surveys for walrus so that haul-out sites are identified, especially in and near Steensby Inlet, and accurate counts made. Surveys conducted to date do not adequately document walrus distribution and abundance within the LSAs and RSAs.
- Conduct new baseline surveys, in the study areas surveyed in 2006-2008, using the re-designed and standardized survey methods. Calculate population estimates.
- Conduct same surveys on an ongoing basis during construction, operations and post-operations phases to ensure adequate monitoring effort is maintained during the life of the Project and mitigation measures are appropriate for the observed effects.

MONITORING

Section: Vol. 8, 6.2, Vol. 10 App. 10D-10 and elsewhere

Preamble/Rationale:
- Monitoring and mitigation are crucial components of an EIS, particularly in the Arctic where there are significant environmental knowledge gaps and the impacts of development on this scale are largely unknown.
- The significant rate of large vessel movement (e.g., more than 200 transits to and from Steensby Port each year) in the study area will cause significant changes in the ice structures along the vessel track, and will no doubt change the distribution of marine mammals relative to their undisturbed states prior to the mine operation (especially given that many operations sounds will be detectable even out to hundreds of kilometres).
- There is no clear evidence presented in the EIS to assume that gradual or localized changes in the environment, in response to project activities, will be detectible; it is more likely that only catastrophic events will be detected.
- It is not clear how and when the proposed monitoring and mitigation procedures would be updated if results warrant a change.

Request:
- With the exception of two populations of beluga whales (Ungava Bay population listed as 'Endangered' and perhaps extirpated, and Eastern Hudson Bay population listed as 'Endangered'), all populations of cetaceans selected as indicator species in this EIS are designated as a species of 'Special Concern' by COSEWIC. Hence the regulators and operators must be very careful to monitor these animals during operations, and provide the best possible mitigation methods and monitoring.
- Describe how the monitoring plans are sufficiently sensitive to allow detection of gradual or small or local changes in the environment (e.g., reductions in marine mammal abundance or distribution, changes in species composition) in response to the Project.
- In terms of adaptive management, a formal timeframe for review and modification of monitoring protocols and mitigation procedures needs to be identified. Updating a "safety radius" value is less helpful to marine mammals if it occurs only the following season, rather than within a short time following field measurements. Further, what formal concurrence and notification processes will be in place to oversee the field monitoring and approve the operational changes? What would trigger a change in protocols? Who approves the changes? For example, if ships start hitting bowhead whales, how many would be hit before something is done? If the shipping lane is changed, who approves the new lane?
- Given that climate change could also cause changes in animal and environmental conditions in the LSAs and RSAs, how will the proponent distinguish these from

localized or cumulative effects caused by the operations themselves? Similar monitoring in adjacent/similar areas should be undertaken to ascertain if animals are displaced from the mine operations area, or if density or behavioural changes are climate-related.

- One of the proposed monitoring measures is for Inuit Advisors/Monitors to be based onboard a representative number of ore carriers collecting marine mammal observations during the ice-covered period (during transits with daylight) in Hudson Strait and during the open-water period in Milne Inlet and Eclipse Sound. How will "representative" ore carriers be determined and how many? Justify why the Monitors will not be on all ore carriers. How will marine mammals be monitored from the ore carriers during periods of darkness?
- Another type of follow-up monitoring proposed is to "acquire the acoustic signature of an ore carrier representing a transit in Hudson Strait (ice-covered period) and in Milne Inlet (open-water period)". Define "representing". Acoustic signatures should be determined for more than one vessel and should be presented in terms of average values with uncertainty.
- Why are bowhead whales not being monitored in Milne Inlet and Eclipse Sound along with narwhal?
- The EIS indicates that they will conduct aerial surveys to collect baseline information on cetacean behaviour during the construction and/or operation phases (depending on location). It is necessary to gather baseline data prior to commencing the Project. Otherwise it will not be possible to draw useful conclusions about cetaceans habituate to frequent passages of ore-carriers or how long possible potential disturbance effects last after an ore carrier passes by. The proponents also plan to conduct an ice imagery study to better understand how and when cetaceans that over-winter in Hudson Strait use the area relative to ice type and cover. This study will be undertaken in years 1 and/or 2 of the constructions and operation phase. Again it is necessary to gather baseline data prior to commencing the Project, otherwise it will not be possible to draw valid conclusions. This seems to be a recurring problem with the monitoring proposed throughout the EIS.
- Reaction to aircraft used to survey cetacean behaviour may influence the results obtained. How will this be addressed in the survey methodology?
- Survey details need to be provided in order to assess the validity or effectiveness of the approach.
- It appears that some baseline data are missing from the EIS, for example, background levels of metals in the freshwater and marine environments.

OVERALL PROJECT ISSUES

Section: Vol. 3, 1.5 and Popular Summary, Vol. 3, 2.5.2, Vol. 3, 3.4.5, Vol. 9

Preamble/Rationale:

- The EIS states that "additional ore deposits have been identified in the Mary River area and Baffinland is hopeful that the Project life will be extended and that the production rates will increase over time". In Vol. 9 states that "under the credible scenario of a doubling of production at Mary River by mining additional deposits…..". Provisions to accommodate future expansion are outlined in the EIS. An assessment of effects should be based on the full extent of the Project.
- Full assessment of Project effects depends on understanding levels of uncertainty associated with the data under consideration.
- The Hudson Strait RSA encompasses the entire Hudson Strait body of water which includes the Nunavik Marine Region off the north coast of Quebec.

- VECs for the Project failed to include some key components of the ecosystems within the identified LSAs and RSAs. Some of the key indicators chosen for the VECs are inadequate to assess environmental effects.

Request:

- Identify the upper limits of the production rate and mine life point that this EIS covers, beyond which the Company will submit another package of permit applications to the applicable authorizing agencies for screening by NIRB.
- Identify whether the results of the impacts analysis of the Project on the VECs included the upper limits of the production rate and mine life. If not, provide revised results that cover the entire range of Project possibilities.
- If the assessment is to be limited to 33 years as indicated in the Popular Summary, then remove all mention of references and assumptions related to increased or enhanced (e.g., doubling) production.
- Vol. 3, S. 3.4.5: Generally throughout the EIS, estimates are provided without any error terms. For example, in this section regarding potentially acid generating (PAG) materials it says “Results of this testing has determined that approximately 86% of the waste rock samples are unlikely to generate acidic drainage in the future”. 86% is assumed to be the central estimator only. What is the confidence interval? Present the estimator plus/minus the error for all data in the EIS to permit a thorough assessment of effects. This is necessary because if there is a significant error, the most conservative number should be used.
- Justify why consultations did not include Nunavik given that direct, indirect or cumulative effects from various Project activities (e.g., ship noise, potential spills and other forms of disturbance) have the potential to occur there. Were data from Nunavik included in the EIS?
- Vol. 8, table 8-5.1, the EIS reports that bearded seals are abundant in the northeastern Baffin Island RSA and the Foxe Basin-Hudson Strait RSA. Elsewhere in the document it states that Foxe Basin is an area of “high, or likely high, density for bearded seals”; only one of four areas identified in Nunavut (Fig. 2.9, App. 8A-2). This species is thought to exhibit strong site fidelity to breeding sites and Davis et al. 2008 reported overall limited gene flow. During aerial surveys conducted in June 2008 (Fig. 4.23) most bearded seals were “sighted near mouth of Steensby Inlet” and along the proposed ship route. They are reported to be abundant throughout the Hudson Strait-Foxe Basin study area with most sightings between April to August when bearded seals were seen basking on the sea ice. Bearded seals are reported to give birth in April along the southern part of Steensby Inlet. Given the importance of this species within the Project area, especially Steensby Inlet, Foxe Basin and Hudson Strait, revise EIS to include bearded seals as a VEC. Explain what effects the Project will have on this species, especially on habitat change, disturbance, call masking (particularly during breeding season in spring) and pup mortality.
- Other key marine mammals in the region currently not addressed in the EIS include harp seals, killer whales, minke, and humpback whales. The EIS indicates that minke and humpback are absent from Hudson Strait and Foxe Basin. Sightings of these two species have increased. Provide a rationale for why all these species are not considered VECs.
- Impacts on marine ecosystem structure and function are not adequately evaluated based on the key indicators chosen. Arctic Char is not a good indicator for the Arctic marine system. Justify why no species or communities below fish were chosen as VECs or indicators. Justify why other key marine fishes, e.g., Arctic Cod or Greenland Cod or sculpin were not chosen as VECs.

- Duration of impact (Vol. 2, S. 3.8.2, p. 47) is described as “how long an effect will continue to affect those who experience it”. Yet, short-, medium- and long-term are defined in terms of the Project as follows: over a period of several years, within the life of the project life and beyond the project life, respectively. The life of the Project is longer than the generation times of some terrestrial, freshwater and marine species. For some species, “short term” may represent most or all of an expected lifespan. For that reason, duration of impact should be defined in terms of the impacted species not the Project that causes the impact. Durations should be re-defined in relation to generation time or longevity for each species. Provide revised duration times and rationale for each. Revise effects assessment for all VECs for all aspects of the Project.
- Why are impacts on Baffin Bay and Davis Strait as part of the northern shipping route not considered in the EIS?

PROJECT EXPANSION POTENTIAL

Section: Vol. 3, 1.5 and Popular Summary, Vol. 9

Preamble/Rationale:

- The EIS states that “additional ore deposits have been identified in the Mary River area and Baffinland is hopeful that the Project life will be extended and that the production rates will increase over time”.
- In Vol. 9 states that “under the credible scenario of a doubling of production at Mary River by mining additional deposits…..”. Provisions to accommodate future expansion are outlined in the EIS.
- An assessment of effects should be based on the full extent of the Project.

Request:

- Identify the upper limits of the production rate and mine life point that this EIS covers, beyond which the Company will submit another package of permit applications to the applicable authorizing agencies for screening by NIRB.
- Identify whether the results of the impacts analysis of the Project on the VECs included the upper limits of the production rate and mine life. If not, provide revised results that cover the entire range of Project possibilities.

SEA ICE

Section: (Vol. 3) 3.6.2 Ore Shipping fleet, (Vol. 3) 3.6.3.2 Ice conditions along ice breaker shipping route, (Vol. 8) 5.2.1. Key Questions, (Vol. 3) 6.5.10.1 Shipping route through Foxe Basin, (Vol. 3) 6.5.10.2 Shipping route through Hudson Strait, (Vol. 3) Fig. 3-3.9 ice breaking ore carrier, (Vol. 3) App. 3F-1 Ice and marine shipping assessment, (Vol. 8) Marine Environment S. 2.0 Sea ice, (Vol. 8) 2.3 Baseline summary, (Vol. 8) Fig. 8-2.1 Shipping route to Steensby Inlet, (Vol. 8) Fig. 8-2.2 Extent of landfast ice, (Vol. 8) 2.4 Issue Scoping, (Vol. 8) 2.4.2 Key Issues and Pathways, (Vol. 8) 2.5.4 Disruption of Pack Ice, (Vol. 9) Cumulative effects (3.4.2, 3.6.5).

Preamble/Rationale:

- In the EIS, sea ice is considered as a valued component (VC) with the Area of shore fast ice in Steensby Inlet the indicator. Although sea ice should certainly be considered a VC, the indicator chosen is not appropriate to adequately assess the impact of the whole project on sea ice and the resulting impact on the ecosystem. There is a physical impact of icebreaking upon sea ice in terms of its mechanical strength and stability and its

tendency to freeze or melt that is not adequately addressed. The physical impacts will result in changes in accessibility of the area to various species. The change in the sea ice in Foxe Basin and Hudson Strait will have impacts on the epontic community, primary producers and secondary producers.

- There will be disruption of pack ice through Hudson Strait and Foxe Basin due to ice-breaking ore carrier passage. The route through the polynyas in Hudson Strait may have negative impacts on the ice regime in these areas and will impact the organisms that are associated with these habitats.
- The black carbon emitted from shipping in the Arctic, in addition to dust from mining operations, could have significant regional impacts by accelerating ice melt.

Request:

- By having chosen inappropriate or insufficient indicators for sea-ice impacts, a proper assessment has not been made. The EIS needs to go beyond the impact on sea-ice in the area surrounding Steensby Port.
- In Vol. 8 S. 5.2.1. Key Questions; I think the report missed discussing two issues (1) will the opening of leads due to shipping cause marine mammal entrapments if air breathers move in following the ships and prior to re-freezing, and (2) will the new lead system (in the fall or spring when they might not refreeze rapidly) allow new species to enter areas earlier or stay longer (e.g., killer whales)? This will then impact the native fauna. How is this being assessed and monitored?
- As there is a high level of uncertainty for several aspects, the approach taken was to fill the knowledge gaps with some educated guess or estimates based on several assumptions. For example, what is the spectral signature and level of the noise radiated by the icebreaking ship under different ice conditions? Since this has not been measured anywhere, no such large ship existing right now, several assumptions were made to get an expected noise signature to propagate in the basins with the acoustic models. Several other examples can be given, e.g., what is the representativeness of the 1996-1997 ice conditions considered in the acoustic modelling? One can question and argue about a point here and there, but there does not seem to be severe flaws or unreasonable approximation estimates. The general point is however that the high level of uncertainty in the inputs should translate in a high level of uncertainty in the output. I find that this is not sufficiently dealt with.
- Vol. 8, 2.2 What is meant by “nominal” shipping corridor? Is the “nominal” shipping corridor 1.5 km wide as is indicated in Fig. 8-2.2 or something else? How was the shipping route defined? Is the LSA shipping route as shown in Fig. 8-2.1, fixed or somewhat flexible in response to other factors (e.g., weather, safety concerns)?
- Vol. 8, 2.3 “Typical sea ice conditions in Steensby Inlet and along the proposed southern shipping route were identified from literature sources (Markham, 1981; Prinsenberg, 1986) and an ice and marine shipping assessment conducted in support of the Project (Enfotec, 2010)”. The early sea ice references are outdated and likely no longer relevant. The Enfotec reference is to an unpublished document of unknown quality saying it supports the port location. All such documents need to be made available with the EIS and a key one like needs to be included in an appendix.
- Vol. 8, 2.3 Fig.s 8-2.1 and 8-2.2 include 2009 ice data. Text in the baseline summary references (Markham, 1981; Prinsenberg, 1986) which are not even from the same decade. Inconsistent use of data should be rectified.
- Vol. 8, 2.3 “Time lapse photography at the Steensby Port suggests that break-up is abrupt and the area can be ice free very shortly after break up (App. 8A-1). The evidence provided does not support such a broad generalization. Recent data over a longer period of time needs to be presented here to support these conclusions.

Photography may also not provide information on thickness/types of ice (quality of ice) as would be the case for satellite photographs of ice-breaker tracks refreezing.

- Vol. 8, 2.3 There should be data and/or references added for the following: “Rather than drifting extensively as in Hudson Strait, pack ice tends to move less in the central part of Foxe Basin, and disintegrates in place during August and September. In some years, remnant drift ice may remain within the basin at low concentrations (rarely exceeding 2/10 cover) through the summer to become second year ice when freeze-up begins”.
- Vol. 8, The impact on landfast ice is considered not significant although the port is located 50km into Steensby Inlet which is described as being covered by “large extents of landfast ice”. The conclusion is not supported.
- Vol. 8, 2.4 Although interactions with pack ice are defined as “subject of note” this should be a “key issue” due to the potential effects on key lifecycle stages of walrus and seals.
- Vol. 8, 2.4 An evaluation of sea ice and an assessment of the feasibility of year-round shipping along proposed routes (Enfotec, 2010) but this is not available. It should be included as an appendix.
- Vol. 8, 2.4.2 - the order of interactions i.e., level 1 and level 2 area switched. Is there a reason for this? This section refers back to Vol. 2 S. 3.5 but it is not clear what the linkage is – it should point to 3.5.3.
- Vol. 8, 2.4.2 dust drift and change in albedo during construction and operation should be included and considered beyond the Steensby port area.
- Vol. 8, 2.4.2 Disruption of pack ice through Hudson Strait and Foxe Basin due to ice-breaking ore carrier passage should be level 2. Detailed support to justify a lower level is needed.
- Vol. 8, 2.5.4 Disruption of Pack Ice – concludes that Thus, the disruption of pack ice was limited to a brief period of time over a small physical area, likely not distinguishable from the natural movement of pack ice in this region. However, no data are provided (on closures, refreeze, depth, rafting/keeling, changes in mobility) so this conclusion is an unsubstantiated claim. Provide the supporting data for this.
- (Vol. 8) 2.5.4 Disruption of Pack Ice – indicates that for the purposes here, ice concentrations ranging from >1/10 ice cover to <10/10 ice cover were combined, thus eliminating landfast ice and areas of open water that may contain small concentrations of drift ice. However this also eliminated 10/10 pack. Why was 10/10 class of ice missed?
- Vol. 8, 2.5.4 Disruption of Pack Ice – The area of disturbance is approximately 0.025% of the pack ice occurring in the RSA. Using the same assumptions and determining that the LSA for sea ice is 146,000 km^2, (ship route of 1,460 km x 50 km on either side), much less than 0.05% of the maximum amount of pack ice could be affected by the ship track during each transit. However, using 1500 km x 53 m as in table 8-2.1, ~80 km^2 for 136 passages (see page 13) so locally impact is 80 x 136 = 10880 km^2 or 7.5%. The text and table differ from each other. Which one is correct?
- Vol. 8, 2.5.4 Disruption of Pack Ice – indicates that based on the conservative calculations presented above, it can be prudently estimated that the extent of disturbance to pack ice will be negligible - less than 1% of the LSA and less than 0.5% of the RSA. Given that evidence of the ship track in mobile pack ice quickly disappears due to the movement of the ice by winds and tide, and that ship disturbance to pack ice along the route will disrupt less than 0.5% of available pack ice regionally on an annual basis, it is concluded that vessel transits will be of little consequence to pack ice integrity within the RSA and LSA. However there is this section is inadequate in scope and depth. It doesn’t provide evidence for the conclusions that have been drawn. Provide the data to support the claims.

- Vol. 8, 2.5.4 Disruption of Pack Ice –doesn't provide information on the disruption of the pack near polynyas. What will be the impact? How will it be monitored and assessed? How will negative impacts be mitigated?
- What happens when the shipping track moves into Nunavik waters?
- Vol. 8, 2.5.4 Table 8-2.1 – incomplete analyses included in the table. Multiply by the number of transits during ice on - include December. Uses 50, 52 and 53 m ship width move ship every 6 passages use local area for FB 1500km*53m = 79.5 km^2
- Vol. 8, 2.5.4. Does FedNav have experience with winter shipping in the Arctic with cape-class ore carriers? If they have this experience then the data should be provided to support the estimates. Cape-class ships differ considerably in beam and draft from other ore-carriers and would be expected to have different impacts on the sea-ice.
- Vol. 8, 2.5.4. The indicator of landfast ice around Steensby is not sufficient to assess impact of shipping on the Arctic ecosystem in Foxe Basin and Hudson Strait. The whole shipping route within the NSA needs to be considered.
- Vol. 8, 2.5.4 That math means little as ships will be in contact with that much ice every trip, if the cumulative effect, alteration of natural drift, noise, animal dispersal that is in need of consideration not what % of the Arctic's ice is in contact with the ship.
- Vol. 8, Fig. 8-2.2 extent of landfast ice is likely to have some year to year variability in extent which is not captured in the figure.
- Vol. 8, 2.6.2.1 Table 8-2.3 provides the mean monthly area of landfast ice within the RSA and Steensby Inlet for a ten-year period ending 31 December, 2009. Data were extracted and summarized from monthly ice charts produced by the Canadian Ice Service (CIS) (Environment Canada). Throughout the RSA, landfast ice begins to form in November, is at its maximum extent of about 51,000 km^2 in April, and declines in area until July. Was >10/10 used or only CIS fast ice? Was 10/10 included with pack ice?
- Impact of ship movement during freeze-up will result in a rougher surface then would be formed under calm conditions. Will there be any effect where ship waves hit islands, etc.?
- What will be the effect of multiple tracks forming new leads on the stability of the landfast ice? Will it increase the likelihood of large pieces of landfast ice breaking free?
- In terms of restricting area of vessel operations in Steensby Inlet, what is meant by "to the extent practical"?
- Vol. 8 2.6.4 Although shipping through landfast ice has been ongoing in the Canadian Arctic for many years none of this is on the frequency or therefore scale of this project. This does not support prediction confidence.
- Vol. 8 2.6.5 Monitoring and follow-up suggests that bow waves and wake effects could have impacts on the ice although they are dismissed in earlier sections.
- If zig-zag patterns are used as mitigation measures what are the real implications and what are the channel width constraints? Is it even possible to do zig-zag manoeuvres given the size of the vessels?
- Vol. 8 Page 29 – effect of disturbance on ice forming, via breaking, bow wake etc, if the ice freezes in a rougher, more broken configuration, will not this lead to quicker melting, due to increased SA to be effected by solar radiation? Not mentioned here.
- information on the possible effects of ice breakers providing increased access to Foxe Basin by killer whales - an area critical to bowhead nursing of neonates.

SHIPPING IMPACTS

Section: Vol. 3, Table 3-1.1, Vol. 8, 1.2.1 Shipping Routes

Preamble/Rationale:

- There are certain areas in the Arctic region that are of heightened ecological significance, many of which will be at risk from current and/or increased shipping. Many of these areas are located in geographically restrictive locations or chokepoints where much shipping activity also occurs, such as the Hudson Strait and Lancaster Sound.
- Migratory marine mammals such as bowhead, beluga, narwhal and walrus have wintering areas in the southern extent of the sea ice and spring migration routes into the Arctic through systems of leads and polynyas also used by many seabirds, ducks and other marine birds during spring migration. These migration corridors correspond broadly to the current main shipping routes and travel through geographic chokepoints.
- The black carbon emitted from shipping in the Arctic could have significant regional impacts by accelerating ice melt.
- Ship emissions including greenhouse gases (GHGs), Nitrogen Oxides (NOx), Sulfur Oxides (SOx) and Particulate Matter (PM) may have negative effects on the Arctic environment and will increase in the Arctic region proportionately with increased shipping activity.
- Shrimp and Greenland Halibut fisheries in the Hudson Strait/Davis Strait area (along the shipping route in Hudson Strait out to NAFO Div. 0B of Davis Strait) were not considered in the EIS. A potential accidental spill of oil or other hazardous and noxious substances in these areas could have large economic, social and environmental impacts.
- Environmental effects on marine mammals, seabirds and fisheries from ship sourced disturbances, noise, or potential accidental/illegal release of oil and other hazardous and noxious substances may impact culturally and economically significant subsistence harvests of these animals.

Request:

- Justify the limited information provided in the EIS about possible impacts along the shipping routes considering that the significant increase in shipping activity in the LSAs and RSAs resulting from the project.
- What is the wash depth (water pressure due to propellers) on the ore carriers? Will it reach the bottom in Foxe Basin? Will it have enough force to mobilize sediments? What is the impact of this? Where will the sediment be carried? Will it cover shellfish beds? Will it contain nutrients or pollutants?
- The black carbon emitted from shipping in the Arctic could have significant regional impacts by accelerating ice melt along the shipping routes. Justify why this was only considered in the vicinity of the Ports. Why are contaminants from shipping operations not considered in the assessment?
- Vol. 8, Fig. 8-1.1. Shading indicates year round shipping in the area of Milne Inlet (inset map). It also identifies a “nominal shipping route - open water only”. These contradict each other. Which is it? Is there any plan to conduct shipping in Milne Port year-round, now or sometime into the future of the project?
- Vol. 8, 1.2.1 References are needed to support the information about timing of ice formation and melt and shipping season.
- Vol. 8, Fig. 8-2.1. Is the bifurcation in the ship track below Cape Dorset to separate incoming/outgoing traffic or is it to indicate that one track will be used unless it is unavailable? Is there any plan to separate incoming/outgoing traffic particularly closer to

port? The EIS should provide more detailed ship tracks. How closely can ships pass each other?

- Vol. 8, Fig. 8.2.1 shows the shipping corridor extending south of the NSA boundary. Why does the assessment stop at the boundary between Nunavut and Nunavik, or does it?
- Ship strikes of whales and other marine mammals are of concern in areas where shipping routes coincide with seasonal migration and areas of aggregation. This is not adequately covered in the EIS. This needs to be addressed.
- The channels formed in the ice by the icebreaking ore carriers have the potential to allow introduction of species (e.g., Killer Whales) which may increase predation. As Foxe Basin is a particularly important nursery area for Bowhead Whales this may result in negative impacts on the population. How will this be monitored? How will this type of impact be mitigated?
- It is expected that over time, channelization will occur in the seafloor particularly in areas of Foxe Basin and especially in Steensby Inlet. How will this be monitored? What would the impact be on the benthic communities? How will this type of impact be mitigated?
- Vol. 9, 3.6.5 indicates that ice/ship interactions will not be a problem. The iceberg data presented in the EIS is out of date. Recent forecasts indicate an increase in frequency of icebergs over time. Was this considered in risk modelling in the EIS? Was it considered in risk assessment related to climate change?
- Winter transits through polynyas in Hudson Strait may impact overwintering narwhal and bowhead whales and their habitat and will put the ships closer to walrus haul-outs. What mitigation plans are in place to limit the impacts on these species and their overwintering habitats? What monitoring is planned to assess impacts? Would the proponent consider altering the location of the ship tract to avoid impacting marine mammals in Hudson Strait?
- What is the lifetime of the ships being used for the project? Does the risk of problems increase with time? How is this considered in the EIS?
- Hudson Strait currents need to be considered in the EIS. Along the north side of Hudson Strait, the current flows into the Hudson Bay complex. In the event of fuel spills, this would carry the material into Hudson Bay. How has this been taken into account in the EIS?
- Fuel delivery into Steensby Inlet will increase over the course of the project. The number of fuel tankers doesn't increase in the same proportion. Are we to assume that the size of the fuel tankers used to service Steensby Port will increase over time? Provide details on these vessels to allow assessment of impacts.
- Salt marshes within Steensby Inlet occurred along about 13% of the coastline. They also occur along the east coast of Foxe Basin. How will shipping activity (e.g., wave activity) impact these important areas? How will they be monitored and impacts mitigated?

SOUND

Section: Vol. 8, App. 8C

Preamble/Rationale:

- Sound is of vital biological importance to marine mammals and anthropogenic noise produced through shipping and other vessel activity can have various adverse effects on Arctic species, including hearing impairment, masking and behavioural responses. A complete assessment of underwater noise modelling for SI, FB and HS is required to fully review the EIS.
- The specially-built icebreaking ore carriers, which would transport ore from Steensby Port to southern market, do not currently exist so their expected acoustic signature

measures are not known. Nor is it known how the special signature and level of noise radiated by the ships will vary depending on different ice and bathymetric conditions. While “Ore carriers that will be used on the southern shipping route have a modern design that is expected to reduce noise output”, field measurements will still be critical to ascertain the sound outputs from these massively larger vessels. While their designs might be quieter than other vessels of comparable size and shape (assuming there are any), these larger ships likely put out greater magnitudes of sound energy given their significantly larger hull surface area.
- Sound propagation was modelled using educated guesses and/or estimates based on several assumptions (App. 8C).

Request:
- Greater clarity in the approach the proponent will use to acquire acoustic signature measures for these carriers in different ice and bathymetric conditions is needed.
- As described in Tables 8-5.3 and 8-5.7, what are the frequency characteristics and source level of the proposed acoustic deterrent systems? For some such systems, at close ranges some animals could be exposed to sound levels loud enough to cause TTS after even a short exposure.
- Some mitigation measures will be based on sound modelling. Given the time to analyse acoustic data can be lengthy, when would new “safety radii” be adopted, if the results warranted this?
- From Clark et al. (2009) “Acoustic masking from anthropogenic noise is increasingly being considered as a threat to marine mammals, particularly low-frequency specialists such as baleen whales. Low-frequency ocean noise has increased in recent decades, often in habitats with seasonally resident populations of marine mammals, raising concerns that noise chronically influences life histories of individuals and populations. In contrast to physical harm from intense anthropogenic sources, which can have acute impacts on individuals, masking from chronic noise sources has been difficult to quantify at individual or population levels, and resulting effects have been even more difficult to assess”. How will this be assessed?
- The EIS says that the icebreaking ore carriers will be designed using the best technology to be silent but there is no support provided for this. On the contrary, Table 4 in App. 8C-1 states the carriers will be equipped with 2 x controllable pitch nozzled propellers, 4 blades, 8.3 m diameter. It is known that variable-pitch propellers are not efficient with regard to radiated noise and should be avoided for noise-reduced ships. Provide information on the mitigation efforts to reduce the acoustic footprint of the icebreaking carriers.
- Provide full explanation/justification of how high uncertainty in sound propagation model inputs contributes to the level of uncertainty in the model outputs.
- Some of the assumptions used may be questionable. For example, S. 3.2 of App. 8C states that ice coverage was estimated at modelling locations based on Saucier et al. (2004) which compares very well to observed sea-ice conditions from the 1996-97 seasons. Why were ice conditions during those two years considered representative for the region?
- What effects would shipping noise have on key fishes? How will it be monitored and mitigated?
- What will be the cumulative effects of shipping and noise on Baffin Bay and Davis Strait?
- Vol. 5, S. 5.7.2.3: justify how potential masking of walrus calf-juvenile calls (300-450 Hz), “which are distinct and used for mother-calf communication”, by ship noise warrants a non-significant rating (table 8-5.8). The EIS reports that “Any masking that might occur along the shipping route, as a vessel passed by, would occur for only a short time (2-3

h)…". A few hours represents a significant period of time in terms of masking of mother-calf communication especially if, say, walrus abandon a haul-out in response to ship noise.
- The previous bullet applies in most other cases involving the duration of masking. While the duration of masking may be short relative to the interval between transits, it is still significant to the species in question in terms of its behaviour and life history. Provide more thorough examination of the effects of shipping noise on VEC along the shipping route over a period ranging from several minutes to several hours for species that depend on social communication for mating, group cohesion, etc. and acoustic sonar for feeding.
- Vol. 5, S. 5.7.2.3 says that "The amount of masking will be a function of how close to the ship's path the walrus is.". Provide quantitative analysis to indicate how the walrus' communication space will change in response to the distance between it and the ship. [A paper by Clark et al. 2009 (Mar Ecol Prog Ser, Vol. 395: 201–222) presents an analytical paradigm to quantify changes in an animal's acoustic communication space as a result of spatial, spectral, and temporal changes in background noise, providing a functional definition of communication masking for free-ranging animals and a metric to quantify the potential for communication masking. This paper may be useful.]
- EIS frequently states that call masking by shipping noise is unlikely because the sounds important to that marine mammal species are predominantly at higher frequencies than the shipping noise (e.g., Vol. 8, S. 5.7.2.3, top of p. 186). The most uniformly effective mask is broadband noise such as the broadband (10-2000 Hz) sound fields used in the underwater noise modelling for the ore carriers (App. 8C, table 16). For human speech, when a masking source with noise spanning 20 Hz to 4 kHz is present, the signal must be 12 dB louder than the broadband noise to achieve 80% word recognition. Provide better justification for rating masking effects as low magnitude, especially for low-frequency specialists like bowhead whales.
- What effect will icebreaking have on sound pressure?

MISCELLANEOUS REQUESTS

Section: Executive Summary, Vol. 5, Vol. 8, 2.5.2, Vol. 8, 2.5.3, Vol. 8, 3.1.1, App. 8A-2, and elsewhere in the EIS.

Preamble/Rationale:
- Various questions, inaccuracies, inconsistencies, contradictions and missing information were identified in the EIS that need to be addressed before it can be fully assessed.

Request:
- Vol. 3, S. 2.5.2, the railway design considerations do not take into account major design and maintenance problems associated with railway operations in regions of discontinuous permafrost because it is argued that central northern Baffin Island lies in a zone with permanently frozen ground and colder temperatures. Provide justification for this approach given climate change predictions over the coming 25+ years.
- Vol. 3, S. 2.5.4, brine (solution containing sodium chloride) will be used as a principal drill fluid to prevent drill rods from freezing in the rock. The anticipated total sodium chloride requirement is 1,400 t. Provide description of alternatives to the use of brine, effects assessment of waste brine on biota and full description of disposal of waste brine.

- Vol. 3, S. 2.7, p. 72, says there will be a 737 jet strip at both the mine site and Steensby Inlet. “The airstrip at the Mine Site will be the primary airstrip used during operations.” “Alternatively, if weather conditions allow, the airstrips at Steensby Port and Milne Port may be used for crew rotations.” As the jet strip at Steensby Port is intended only as an alternate location once the Project construction stage is finished, and only if weather conditions permit, and operation of 737s at Steensby Port would negatively impact marine mammals in the area (notably walrus), the jet strip at Steensby should be removed once the construction stage is complete. If necessary, smaller planes could move people between Hall Beach (where there is a jet strip) and Steensby. Provide justification for retaining jet strip at Steensby Port once mine operations commence.
- Vol. 3, S. 2.7, p. 73: the Steensby Port airstrip will be equipped with edge lighting, runway end, threshold lighting and Precision Approach Path Indicator lights. Provide assessment of their impact on wildlife (e.g., marine mammals and caribou) in the area.
- Vol. 3, S. 3.2.2.1, page 78 says “Approximately 70 effective ship loading days during the ice-free period have been assumed to be available. About 40 to 50 ore shiploads will be scheduled during this period. Ships will be scheduled to arrive every second day, with a ship arriving just prior to the completion of loading of the previous ship.”. If there are 40-50 shiploads arriving every second day, this should translate into 80-90 effective ship loading days, not 70. Explain the apparent contradiction.
- Vol. 3, S. 3.5.3: the maximum “travelling empty” speed of the Railway will be 70 km/h while the maximum design speed for the Railway will be 75 km/h, leaving little margin for safety. Justify why a slower maximum “travelling empty” speed is not warranted.
- Vol. 3, S. 3.5.3, p. 101: the Railway is about 150 km in length of which perhaps 125 km is located away from the mine and Steensby Port. “Total ore train length will be between 1,096 and 1,201 m depending on maximum axle load.” It is likely that caribou can see a train at 1 km distance, meaning that the effective length of each train is about three km. “Typically three train sets,…, will each make about two round trips per day, or five to six round trips per day total to transport...”. There will also be three passenger trains per week and two freight trains per week. This means that in total approximately nine to ten km (~8%) of the Railway will be occupied by trains at all times and that any three-km stretch occupied every four hours. Explain the impacts of this frequency and magnitude of disturbance on caribou movements.
- Vol. 3, S. 3.5.3.4: explain the impacts of snow fencing on caribou movements.
- Vol. 3, S. 3.6.2: it is proposed there will be a ship moving through the shipping lane to/from Steensby Port “roughly every 1.8 days (43 hours)”. There will also be 12 additional voyages between approximately August 10 and October 21. This means that during the open-water season there would be a ship passing along the shipping route in Hudson Strait and Foxe Basin approximately every ¾ of a day (i.e.,18 hours). To say that ship noise will be “intermittent” (Vol. 8, S. 5.7.2.2, p. 182) is misleading.
- Vol. 3, S. 3.6.3, p. 109: Based on a request from the community of Cape Dorset, the EIS states that “While better ice conditions are found closer to the Baffin coast, ships will pass to the south of Mill Island (between Mill Island and Salisbury Island) to the extent possible”. This would put the ship’s path closer to the walrus haulout on Salisbury Island. Provide justification for this trade-off.
- Vol. 3, App. 3F, S. 1.2.1: a detailed month-by-month analysis of ice conditions leading to the North Baffin sites was conducted using data from Feb. 1, 1999, and Feb. 1, 2004. The EIS says these “are representative of the typical mid-winter ice conditions leading to the North Baffin Sites”. Explain how these data were determined to be typical of conditions found in this region during the past few years. It is quite possible that conditions have changed quite significantly since 2004 given recent effects of climate change.

- Table 3-6.1 in Vol. 3 ranked the east Baffin alternate port locations as unacceptable due to being “technically not feasible due to ice conditions”. If recent ice conditions (previous bullet) are amenable to shipping, then the East Baffin Port sites and Rail Routes should be carefully re-assessed. From a marine perspective, the effects of an East Baffin Port are undoubtedly less significant than either Steensby Inlet or Milne Inlet.
- Is there any consideration for reducing the transportation of ore from the mine site to a single port facility in the future? If not, is the plan to continue both sites in the same proportion as currently identified in the EIS? If production is ramped up, will the current proportions remain constant?
- Executive Summary (ES), page 10 identifies caribou at a low in 60-70 year cycle. Will the construction phase further decline the population below some threshold of rebound?
- ES, page 13 why is freshwater fish habitat mentioned, but terrestrial and marine fish and marine mammals habitats are not?
- Vol. 8, 2.5.2 is the treatment facility set to be built first? Given the proposed treatment system together with projected minimal mixing, will there be a potential to create local conditions of contaminants exceeding acceptable levels?
- Vol. 8, 2.5.2 Waste-water discharge indicates basic modelling to determine the fate of the treated wastewater upon entry into the marine environment was conducted and is presented in App. 8B-3. Sentence 2 of App. 8B-3 assumes the water column is stable - rationalize with previous comments about high tidal flows.
- Vol. 8, 2.5.2 Indicates that the modelling used temperature and salinity differences between the effluent and the receiving environment to determine the water depth at which the wastewater would equilibrate in the water column. Model assumptions were that the wastewater was 10°C at the outfall, and had the same density as freshwater. Results show that the waste water discharge was modelled at 20 m; why was it changed to 35 m? Is more necessarily better? Model used June, Aug and Sept - how does this apply to fast ice?
- Vol. 8, 2.5.3 dust fall on ice – More information is needed here particularly if dust might settle into disturbed ice, where it would be going directly into the water, or ice melted by a bubbler.
- Vol. 8, 3.1.1 and Vol. 8 4.1.1 Why are the Milne Inlet and Steensby Inlet LSAs of different radii? How were the 4 km and 8 km distances determined? Milne should be extended to the 8 km radius.
- Vol. 8, 3.2.1 What methods were used for the water quality surveys in the EIS?
- Vol. 8, 3.2.2 What methods were used for the sediment sampling?
- Vol. 8, 3.4 Explain why man-made waves were not considered additive to natural ones in terms of the frequency of waves of that energy.
- Vol. 8, 3.4 Although bow wave height will have diminished to well within the wave height observed during natural wind events the frequency of wave events (not wave frequency) will be much higher. How was this taken into account?
- Vol. 8, 3.4 Explain why storm events were considered relevant standards for comparison with ship-generated waves?
- Vol. 8, 3.5.1 For application of the ore dust dispersion modelling to water and sediment quality, a conservative, worst case condition for particle introduction to marine waters was assumed but is unsubstantiated by the information provided. Provide justification for this.
- Vol. 8, 3.5.2.2 Propeller-generated currents can re-suspend sediments into the water column in shallow waters and could have significant impact around the ports and possibly in the shallow waters of Foxe Basin. Deep-draft propellers of bulk carriers and tug boats are capable of generating currents on the seabed at distances up to 100 m

from the vessel. How was this considered in the assessment and monitoring plans for benthic communities?

- Literature suggests that the velocity of ship-generated currents could be between 1.0 m/s and 2.0 m/s (Jay, 2002). Given that the velocity threshold for erosion of medium-sized sand is about 0.2 m/s, it is likely that a substantial proportion of finer seabed materials (including sands and gravels) could be mobilized and re-deposited in areas of lesser vessel activity. How fast do particles settle/ How far do they drift? What's the overall foot print? What will be the impacts of this re-deposition of sediments on the benthic environment? This should consider areas along the shipping route not just in the port areas.
- Collectively, effects of dust deposition on sediment quality in Steensby Inlet were not expected to be detectable and are therefore considered to be negligible. Justify how the total dust deposition of over 3,000 t in 21 years is thought to be negligible over the long-term.
- Vol. 8 3.5.2.5 Wastewater and Site Water Discharge – the EIS indicates year round discharge of treated sewage effluent which is contrary to the information later which indicates during winter months, the discharge is expected to freeze before entering the marine environment. Flow from the drainage ditch during the freshet is expected to occur over a period of about four weeks. Identify the “winter months” when the discharge would freeze. Why is the sewage effluent 10x higher in Steensby port than in Milne port? How will the sewage effluent be treated?
- Vol. 8 4.1.1 Study Areas - include benthos and sedimentation (including prop wash impacts) as well as biological impact of ballast water pools especially on benthos as a project activity that that could affect marine fish habitat and species in the vicinity of the proposed port sites.
- Vol. 8 Table 8-4.1How was habitat quality assigned on the basis of estimated productive capacity?

Figures and Tables:

- App. 8A-2, figs. 2.1 and 2.2: add legend to both figures.
- App. 8A-2, Fig. 2.6: beluga migration is incorrect; migration for EHA-BB population should go north into Jones Sound.
- App. 8A-2, Fig. 2.8: provide evidence/support for claim that Coats Island is the largest known haulout for walrus – Manning Island in Foxe Basin is probably larger.
- App. 8A-2, Table 4.11: define what “SE1” and “SE2” in the “Period” column means.
- App. 8A-2, table 4.11 and Fig. 4.19: explain why map shows three bowhead whale locations while the table says there were only two bowheads counted during the two survey periods.
- App. 8A-2, Fig. 4.19: re-do Fig. 4.19 to show sightings for all marine mammal species surveyed in September 2007 (as indicated in table 4.11).
- App. 8A-2, Fig. 4: scale the sighting circles to reflect numbers of animals seen.
- App. 8A-2, Fig. 4.27 (cont’d): correct figure caption or figure so they match.
- Provide source for App. 8A-2, Fig. 2.4
- Correct App. 8A-2, Fig. 2.1 source should be DFO 2008.

Citations

- Use original citations throughout the EIS rather than later publications that cite the original work. For example, in App. 8A-2, in text (p. 44), Sergeant (not sure of year) is the original citation for the harp seal whelping patch, not Stephenson and Hartwig 2010.

Another example, in Vol. 8, S. 5.1.2.2: DFO (AFSAC report, pre-1995) is the correct citation for the population estimate of ~5,500, not Born et al. 1995.

- The EIS relies extensively on unpublished information (e.g., surveys, bathymetry, etc.). These publications need to be made available for thorough technical review to assess methods used and conclusions. Two examples: (1) Enfotec, 2010; (2) Vol. 8, S. 6, at least 107 of the 458 (≥ 23%) references listed in this section are unpublished. Several are crucial for the EIS (e.g., estimating disturbance levels). Provide copies (electronic and/or printed) of all unpublished literature in this section and elsewhere in the EIS.

- Vol. 8, 2.5.3 (RWDI 2010) is not included in the reference list. Without it, this section is unsubstantiated. Please provide the support for this. If the report is unpublished, it needs to be made available for review.

Appendix 4. General concerns with the Mary River Mine draft EIS

At a meeting with Federal agencies and Qikiqtani Inuit Association (QIA) on 6 July 2011, DFO Science identified the following two issues of concern.

Ballast water
Procedures for handling ballast water only describe “exchange” whereas “treatment” will likely be a requirement within the next 5-10 years under the International Convention for the Control and Management of Ships' Ballast Water and Sediments. The requirement for, and details and impacts of, treatment are not described in the DEIS. Ballast water has the potential to introduce aquatic invasive species as well as change the physical and chemical attributes of the marine environment where it is released. An impact assessment of ballast water under the impending regulations cannot be conducted until the proponent identifies the nature of the ballast water to be discharged at the port.

Nominal shipping route
Bathymetry indicates that at least some portion of the nominal shipping route is too shallow to reliably allow passage of fully-loaded ore carriers of the size proposed in the draft EIS. Presumably the nominal shipping route or location of the port will have to be changed in this case. The assessment of impacts of the shipping route on the marine ecosystem including Inuit travel corridors cannot proceed until the proposed shipping route is clarified.

During the technical review the following topics were identified by various agencies as issues of common concern.

Transboundary issues
Baffinland restricted their DEIS to part of the Nunavut Settlement Area (NSA) in spite of impacts to marine habitats and biota elsewhere in the NSA and outside the NSA, in particular Nunavik waters. The impacts of shipping should be considered more widely within the NSA (e.g., Hudson Bay) given the migratory patterns of narwhal, beluga and bowhead. They should also be considered in Hudson Strait and Labrador Sea because Nunavik and Labrador Inuit likely would have concerns about impacts on shared populations affected by activities in these shared waters.

Valued Ecosystem Components (VECs)
The DEIS states that VECs were “identified based on either legal or formal recognition of ecological or social importance (Vol. 8, p. 42) ostensibly following the NIRB definition “resources that have ecological importance, such as keystone species which, if affected, have a disproportionate effect on their surroundings relative to the types and numbers of other species in a community” (Vol. 2, p. 34). The VECs examined in the DEIS, however, were chosen only on the basis of their importance to Inuit and not their ecological importance. The Bearded Seal, is recognized by the proponent and interested parties alike as both culturally and ecologically important in Foxe Basin, but was not included as a VEC. The Arctic Char was chosen to represent the marine ecosystem yet this species is only present in a limited portion of the marine environment for a short period annually. Its absence from marine waters in winter means there is no non-mammalian indicator during the main periods of construction and shipping. No typical food-chain indicators were examined in any detail. A truly representative marine fish species and representative marine invertebrates (benthic and pelagic) should have been included.

Baseline studies
Deficiencies in the information provided in the DEIS on species distribution, density, composition, total numbers and habitat use, for the port sites and along the entire shipping routes, mean that predictions of the nature, extent and significance of environmental effects in the marine environment cannot be made with any reasonable level of certainty. Additionally, the information provided is inadequate as a baseline for future monitoring. Thus, environmental changes resulting from the Project are unlikely to be detectable.

Environmental impacts / effects assessment
The DEIS needs to discuss potential impacts of the Project on the ecosystem as a whole by considering indicator species (i.e., VECs) at several trophic levels. Currently, the DEIS focuses on direct mortality, displacement or disturbance to top trophic level VECs without considering indirect effects that may also have a significant impact on their abundance and distribution.

Monitoring of project impacts on the marine ecosystem should include the use of lower trophic level VECs. Changes detected at lower trophic levels may provide earlier warning and opportunities for adaptive management before impacts are detected and mitigated at higher trophic levels. For example, monitoring bivalves might show Project impacts before they would be evident in walruses and eider ducks.

Baffinland uses 10% and 20% thresholds to assess the magnitude of effects on marine species and habitats without adequate justification. They also do not specify the time-frames for the application of these thresholds (e.g., annually, life of organism, life of Project).

Activities associated with the Project's marine component must be assessed in the context of the relative scale and frequency of these activities. For example, while it may be true that the effects of wake from a single ship passage may not have long term significance for low-lying bird colonies or walrus haul-outs, the DEIS does not provide evidence that the same can be said for the effect of hundreds of ship passages per year, for decades. The Project's marine component should also be assessed at a scale appropriate to the species that may be impacted (e.g., key life cycle stages, longevity, number of generations) rather than the life of the Project. For example, using a broad scale estimate of average walrus density is irrelevant to assessing impacts on birthing and nursing females and their calves.

Likelihood of long-term wildlife displacement due to cumulative disturbance and the impacts associated with displacement of wildlife from normally preferred habitat have not been assessed. Assumptions of habituation are not well supported in the DEIS.

Proposed mitigation
The effectiveness and appropriateness of proposed 'adaptive management approaches' to mitigate effects detected during project monitoring cannot be assessed because little information on adaptive management approaches was provided. Challenges in assessing effectiveness of adaptive management are exacerbated by the large uncertainty associated with the effects predictions, and the likelihood that monitoring programs capable of identifying changes are not possible with the existing baseline information.

Shipping routes
The potential effects along the full shipping route (from both ports) were not fully described. In particular, information for Hudson Strait and Labrador Sea is insufficient. Shipping will occur much more frequently and at different times of year than it does now and this is also not adequately dealt with in the DEIS. Impact of marine shipping through pack ice, polynyas and leads needs to be better assessed for the ice-associated species most likely to be uniquely

affected (e.g., Bearded Seal, Ivory Gull). The potential impacts of shipping, and their significance, to these species especially during the winter months must be considered. The effects of shipping on timing and integrity of sea-ice regimes (e.g., floe edge, polynyas, freeze-up, break-up, pack ice dynamics) needs to be better addressed in the DEIS.

Noise
Marine organisms will be subjected to noise from a range of Project activities (e.g., from aircraft, vessels, blasting). The impact of chronic noise on the life histories of individuals and populations within full auditory range of the Project needs to be considered.

Baffinland should use the more precautionary 50 kPa threshold for blasting under ice cover developed by DFO for NWT and Nunavut.