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Cory Barker, M.Sc.
Technical Advisor I
Nunavut Impact Review Board (NIRB)
By Email: info@nirb.ca

**Re: Oceans North Comments on Baffinland Iron Mines Corporation's Mary River Project
2019 Annual Report**

Dear Mr. Barker:

Please find attached comments from Oceans North on the Baffinland Iron Mines Corporation's *Mary River Project 2019 Annual Report*. Our comments center around the conclusions of effects monitoring, areas of significance requiring further information, and changes to the monitoring program.

Many of these specific comments were submitted as responses to three specific *draft* monitoring reports submitted by the proponent to the Marine Environmental Working Group on June 13, 2020. For ease of reference, they are attached as Appendices within the format requested by the proponent. These reports are:

1. Draft 2019 Passive Acoustic Monitoring Program Report
2. Draft 2019 Bruce Head Shore-based Monitoring Report
3. Draft 2017-2018 Integrated Narwhal Tagging Study

Interested parties and regulators who provided comments on these reports have yet to receive responses, but the Baffinland Iron Mines 2019 *Mary River Project 2019 Annual Report* indicates little change from the individual draft monitoring reports. The comments in this letter question the validity of the conclusions around effects from these three monitoring programs, specifically found on pages 350 and 351 of the Baffinland Iron Mines Corporation's *Mary River Project 2019 Annual Report*.

The statements below summarize the detailed comments on the reports attached in Appendices A-C. There are also two general comments on monitoring at the end of this letter.

Draft 2019 Passive Acoustic Monitoring Program Report

- Concerns regarding the use of a new and unevaluated metric for measuring auditory masking in marine mammals, instead of the existing, peer-reviewed metric
- More clarity is required regarding the number and type of vessel transits, including noise levels associated with certain vessel types
- Concerns around the use of 120dB as the lower limit of disturbance for narwhal, based on evidence of disturbance at lower levels from Bruce Head Shore-based Monitoring Report and the Integrated Narwhal Tagging Study
- Concerns regarding the measurements of ‘quiet’ noise levels to then compare to the noise levels of vessel transits.

Draft 2019 Bruce Head Shore-based Monitoring Report

- Concerns regarding the use of the Behavioural Study Area border to estimate the received sound levels for marine mammals.
- The application of the Southall (2007) severity response scale without applying estimates of how long it took for animals to return to ‘normal’ behavior
- The use of 4km as the limit to estimating impacts of sound on marine animals when disturbance has been noted at larger distances.

Draft 2017-2018 Integrated Narwhal Tagging Study

There are concerns around the use of 120dB as the lower limit of disturbance and 135dB as the limit for avoidance for narwhal. According to the Bruce Head Shore-Based Monitoring and Integrated Narwhal Tagging Studies, disturbance and avoidance of narwhal are occurring at lower received sound levels.

In addition to the comments in Appendix C, the below comments illustrate the need for further discussion on the behavioural impacts of shipping to marine mammals, as well as the need for improved modelling and data integration.

These comments point to possible discrepancies between assumed disturbance thresholds and observations in the data. The Annual Report should be integrating the findings of these studies, however the Passive Acoustic Monitoring report does not include ranges to received levels less than 120dB.

- The guideline suggested by the proponent is 135dB for avoidance behaviour. Animals are avoiding the vessel in an area of approximately 1 km from vessels (p. 129). The Phase 2 EIS Technical Supporting Document 24 (TSD24) shows reported received sound levels from ore carriers as approximately 110-120 dB at a range of 1km. This suggests a lower threshold for noise levels that cause avoidance behavior in narwhal (e.g. a 20 dB lower sound level represents approximately 100 times less sound pressure).
- The guideline suggested by the proponent is 120dB for disturbance behaviour. According to the Phase 2 EIS TSD24 (Appendix A, p. 84-90, Figures 4.23 to 4.29), received sound levels from ships at distances of 4-5 km were approximately 95-115 dB. The tagging study shows behavioral disturbances, such as narwhal orienting away from the vessel, at those distances (p. 125).
- According to the 2017-18 Draft Integrated Narwhal Tagging Study, narwhal were more likely to begin deep dives, a potential avoidance behaviour, when ore carrier ships were

within a range of 2 km (pg. 99). At 2 km, measured received sound levels from ships were reported in TSD24 (Appendix A, pg. 74-90) to be approximately 100 to 115 dB.

- Narwhal tended to exhibit behavioural disturbance in response to ships from greater distances after the ship had passed, suggesting a larger area of influence around the stern (approximately 10km). At ranges of 10 km, received levels from ore carrier ships reported in TSD24 (Appendix A, pg. 74-90) are approximately 100 dB.
- There is a lack of information around ice-breaking noise and narwhal tagging results, which was originally included in this document: *Baffinland Mary River Project Phase 2 Proposal, Appendix N, Attachments related to the Marine Environment. Attachment 2, Technical Memorandum – Analysis of 2018 Narwhal Tagging Data during Fall Shoulder Season. 1663724-162-TM-Rev0-12000, Oct. 15, 2019. Section 3.2 Page 7-9.* It is unclear why this has not been included.

Concern Regarding Monitoring Reporting

We have found in our analyses of the monitoring reports that vital information is unorganized and located within many different reports. We find that the results from each individual report are not combined to create important correlations regarding impacts to marine mammals. For example, our comments for the Integrated Narwhal Tagging Study are based on information from the Passive Acoustic Monitoring Report, the Bruce Head Shore-based Monitoring Report, Phase 2 Proposal documents, including the Technical Supporting Document 24 and Appendix N, and various shipping reports and AIS data. The information in the Annual Report remains unintegrated and divided between the specific monitoring reports.

We recommend that NIRB reorganize marine monitoring requirements to allow for information to be focused on answering questions such as:

“What are the distances from each type of project-related ship at which noise levels from 100dB to 135dB will be received?”

“How do the underwater noise levels from ship transits change during shipping with ice-breaking or ice management operations compared to shipping without icebreaking?”

“Based on evidence from observed behavioural responses of marine mammals, at what estimated received underwater noise levels did different levels of disturbance initially occur?”

We recommend the creation of a table that outlines the different effects, distances and received sound levels. We have provided an example here:

Type of behavior	Radius of disturbance	1663724-188-RevB (PDF page)	Received sound pressure level (apx)	1663724-038-R-Rev2-3000 (PDF page)
Surface time	<1 km	106	110-122 dB	170-176
Dive rate	-	111	-	170-176
Cease sequential bottom dives*	<5 km	117	100-115 dB	170-176
Begin bottom dives**	<2 km	118	105-115 dB	170-176
Time at depth decreases	<2 km	123	105-115 dB	170-176
Dive duration	<1 km	128	110-122 dB	170-176
Descent speed	-	134	-	170-176
Turning angle increases***	1-4 km	137	110-122 dB (1 km) to 97-108 dB (4 km)	170-176
Orientation away from vessels	4-10km	125	97-108 dB (4 km) to 90-108 dB (10 km)	170-176
Horizontal displacement	>1 km bow/stern; >0.5km port/stbd	145	110-122 dB	170-176
Habitat re-occupation	evident	132	-	170-176
Travel speed	-	152	-	170-176

- * Dive type associated with foraging behavior
- ** Dive type associated with potential avoidance or escape response
- *** Higher turning angle suggests avoidance

Concern of monitoring timelines and incorporation into annual monitoring plans

In all multi-year environmental assessments it is assumed that annual monitoring programs are iterative; meant to feed into the next season's monitoring programming and incorporate results and lessons learned. There is concern that reporting on effects monitoring is not being completed in a timely manner and therefore is not incorporated into the next season's programming. In addition, comments from MEWG members on individual monitoring reports remain under review by the proponent and have not been thoroughly discussed at MEWG meetings. It is not clear, therefore, if the Annual Report includes this input from regulators and observers of the MEWG. These timelines have a significant impact on the proponent's ability to assess effects, and if it is unable to annually incorporate lessons and results from effects monitoring, the effects of the project may need to be reassessed to evaluate the risk of monitoring on a longer time frame.

In terms of recommendations for monitoring programs, **we recommend that NIRB request clarification from the proponent regarding the timelines and intent of overall monitoring programming, with particular attention to the timeframe that is expected for results and MEWG comments to be evaluated and incorporated.** This is especially important as all stakeholders review Phase 2; any potential increase in activities may impact effects assessment and monitoring on a greater scale.

In regards to the Early Warning Indicators, information on timelines was provided in the document referenced by the NIRB letter dated June 11, 2020. However, details on the Early Warning Indicators (EWI) were not provided. A high level overview on the chosen EWI was provided to the MEWG in June, but more details are required. Oceans North appreciates that these details are forthcoming and would like to reserve comment for when the full Early Warning Indicator Framework is provided to the Marine Environmental Working Group.

Oceans North appreciates the opportunity to comment on the *Mary River 2019 Annual Report*. Please contact me with any further comments or questions.

Sincerely,

(original signed by Amanda Joynt)

Amanda Joynt
Policy Advisor
Oceans North

Appendix A – Oceans North Comments on Draft 2019 Passive Acoustic Monitoring Program Report

Name: Amanda Joynt

Agency / Organization: Oceans North

Date of Comment Submission: June 13, 2020

These comments refer to an independent analysis with the title of: Underwater Radiated Noise from Ships in Eclipse Sound, 2018-2019 (Jones 2020). The figures and tables from this analysis is provided with these comments. A full copy of the analysis will be provided when it is in its final version (estimated by August 4, 2020).

#	Document Name	Section Reference	Comment	Baffinland Response
1	Draft 2019 Passive Acoustic Monitoring Program Report	Section 2.4	<p>When evaluating auditory masking in marine mammals resulting from man-made noise, a common approach is to estimate the loss of area within which effective hearing of acoustic signals can occur. For example, Listening Space Reduction (LSR) has been employed in several published studies evaluating acoustic masking in Arctic marine mammals (e.g. Hannay <i>et al.</i>, 2016; Mathews <i>et al.</i>, 2016; Pine <i>et al.</i>, 2018).</p> <p>“Listening range reduction” (LRR) has been introduced by the proponent for the purpose of this effects assessment. It is estimated by modifying the published LSR equation to give the change in radius (i.e. range from the listener) rather than area. For example, a 50% and 90% reduction of ‘listening range’ yields a 75% and 99% reduction in listening space, respectively. A simplified diagrammatic example has been included in these comments (Figs. 1 below). Evaluating masking</p>	

#	Document Name	Section Reference	Comment	Baffinland Response
			<p>in this way may understate the effect of ship noise and makes comparison with previous published research more difficult.</p> <p>Section 2.4 suggests that Listening Range Reduction is more 'intuitive.' Please clarify why this measurement was created and why the more common method consistent with previous published literature, Listening Space Reduction, is not being applied. Please provide results in context of LSR or make clear the difference in the results produced by this novel method of masking estimation when compared to previously published studies elsewhere.</p>	
2	Draft 2019 Passive Acoustic Monitoring Program Report	<p>Section 2.4 p.18 Eqn. 1 (Listening range reduction)</p> <p>Section 2.2.1 p.26 (sound spectrum level percentile plots; Fig 18)</p> <p>Section 1.0, pg. 5. Objective of the Report: "Estimate the extent of listening range reduction (LRR) associated with vessel transits along the Northern Shipping Route relative to ambient noise conditions"</p>	<p>Listening Space Reduction is a function of the change in noise added by the ship (NL_2; Sect.2.4 Eqn.1) over some reference level of 'background' noise (NL_1; Sect.2.4 Eqn.1). Estimates of LSR are sensitive to the difference ($NL_2 - NL_1$). For example, a 10 dB increase in noise is the difference between LRR 50% and LRR 90% (<i>i.e.</i> LSR75% and LSR99%; Fig 1 below).</p> <p>NL_1 is defined (Sect. 2.4 p.18) from "the maximum of the mid-frequency cetacean audiogram (see Table A-9 in Finneran 2015) or the median 1-minute SPL without vessels in each of the 1/3-octave-bands of interest. Please provide the</p>	

#	Document Name	Section Reference	Comment	Baffinland Response
			<p>actual dB values used to define NL_1 for each recording site. These values should include the median 1-minute SPL without vessels and the specific values used from the mid-frequency cetacean audiogram for each of the 1/3rd octave bands assessed.</p> <p>Using a single background noise reference level that is lower than actual noise levels about half the time (50th percentile) may result in assuming a larger value for $NL_2 - NL_1$ more often than occurred relative to noise levels at the time of each ship transit. This overestimation of LSR levels may especially occur during the months of Sept and Oct with higher average background noise levels caused by increased wind-driven surface noise in the frequency bands of interest. Again, a single averaged reference noise level does not account for these relatively 'noisy' periods and may make it more difficult to identify LSR caused by ship transits vs. natural noise when ships are not present.</p> <p>Please provide evaluation of LSR under different noise conditions. For example, Pine <i>et al.</i>, (2018) estimate LSR for container ship transits under 'noisy' and 'quiet' ambient noise conditions. Without this, we may often overestimate LSR occurring due to the addition of ship noise and it's difficult to understand what the range of LSR effects may be</p>	

#	Document Name	Section Reference	Comment	Baffinland Response
			<p>under normal environmental conditions. An example of two general cargo vessel transits with LSR estimated using median and 90th percentile background noise is provided in Fig 5 below (adapted from Jones, 2020).</p> <p>What steps are taken to avoid long-range ship noise entering 'background' noise periods used to estimate ambient noise for NL_1 in LSR calculations? How far are the ships away during background noise periods? As defined in this report, it is not clear that recording periods 'without ships' do not include <200 Hz noise from ships, propagating over large distances.</p>	
3	Draft 2019 Passive Acoustic Monitoring Program Report	Figure 24, page 30.	<p>What are the characteristics of underwater noise levels recorded by the proponent from all project-related vessels (e.g. bulk carrier, general cargo, tanker, tug)? For reference and as an example, Table 1 below (from Jones 2020) includes some noise measurements for 4 common types of project-related vessel.</p> <p>The noise levels reported should be accompanied by some context regarding ship characteristics wherever possible.</p>	
4	Draft 2019 Passive Acoustic Monitoring Program Report	Table 11	Model results for ranges to lower broadband received sound pressure levels SPL_{BB} than 120 dB have been requested by DFO (e.g. 110, 115 dB). What are the distances to transiting ships when measured received	

#	Document Name	Section Reference	Comment	Baffinland Response
			<p>levels were > 110dB for each of the project vessel types?</p> <p>Modelled versus measured ranges should be included in this report for each different project-related ship type. There should be a table showing these ranges in the report. An example of two transits of project-related general cargo vessels is provided in Figures 2-4 below (figures adapted from Jones, 2020) .</p>	
5	Draft 2019 Passive Acoustic Monitoring Program Report	1.0, pg. 5. Objective of the Report: "Estimate the extent of listening range reduction (LRR) associated with vessel transits along the Northern Shipping Route relative to ambient noise conditions"	<p>The number of transits and how many vessels travelled within the project area is not clear. Periods when vessels were detected does not translate easily into transits and therefore needs context provided by other data such as AIS messages. This helps to understand the relationship between ship type and received level and to better evaluate cumulative impacts of ship noise.</p> <p>We cannot estimate Phase 1 or proposed Phase 2 impacts without understanding the current and proposed number of transits and types of ships. To estimate impacts, especially if Phase 2 goes forward, the number and type of ship transits should be determined ahead of time as much as possible.</p>	

#	Document Name	Section Reference	Comment	Baffinland Response
6	Draft 2019 Passive Acoustic Monitoring Program Report	Sect 3.1.2.1 Figures 20 and 25.	What is the definition of “detected vessels passing the recorder” (Sect 3.1.2.1 p.28 Fig 20, 25)? Is it a period when multiple vessels were present or is it one individual transit of one vessel? To evaluate the relationship between number of vessel transits daily and reported noise levels it would be helpful to have an understanding of the degree to which multiple vessel transits are included in each ‘detection’.	
7	Draft 2019 Passive Acoustic Monitoring Program Report	Figure 18 (p.26)	Low-frequency ambient noise median sound spectrum levels below 100 Hz are > 10 dB less than reported for other areas of the Arctic with similar depth (e.g. AMAR-3 and AMAR-BI compared to Roth <i>et al.</i> , 2012). What is the explanation for this divergence from expected ambient noise level? This is important to understand as, for example, a systematic underestimate of SPL _{BB} 120 dB occurrence or overestimate of LSR (LRR) for low frequencies (e.g. ringed seal, bowhead whale) could result from the undermeasurement of noise levels in these frequencies.	

Appendix B – Oceans North Comments on Draft 2019 Bruce Head Shore-based Monitoring Report

Name: Amanda Joynt

Agency / Organization: Oceans North

Date of Comment Submission: June 15, 2020

#	Document Name	Section Reference	Comment	Baffinland Response
1	Draft 2019 Bruce Head Shore-based Monitoring Report	<ol style="list-style-type: none"> 1. Increased instance of narwhal travel following ship southbound transit when vessels at range 1-3 km (p.82) 2. More likely to be in tight group spread when vessels 3-4 km away in BSA (p.75) 3. Increased probability of slow swimming when vessel 2-3 km S of behavioral study area (BSA; p.88) 4. Lower probability of observing slow swimming groups when vessels at range 2-3 km N of BSA (p.88) 5. Decreased distance from shore when vessels within 3 km (p.94) 6. Larger probability of observing groups nearer to shore when vessels transiting toward the BSA 	<p>Clarify for each of these ranges, what is the range of distance to the animal. The behavioral study area (BSA) is about 1km wide, there is a generalization made that impact across the BSA is the same. Would a reported range of 1-3km between ship and the BSA for a particular behavioral response translate to a range of 1-4 km between the ship and the animal? This information is important to estimate the received sound levels corresponding to the reported radii of impact around the ship.</p>	
2	Draft 2019 Bruce Head Shore-based Monitoring Report	Page 32	<p>In terms of the Southall <i>et al.</i> (2007) ranking of the severity of behavioral responses to underwater noise (p.450, Table 4), each of these behavioural changes has a score that fits into the noise impact framework proposed by the proponent. What are the specific behavioral response severity scores assessed by the proponent for the observed responses? For each response, what were the post-exposure times observed for re-establishing post-exposure behavior?</p>	

#	Document Name	Section Reference	Comment	Baffinland Response
3	Draft 2019 Bruce Head Shore-based Monitoring Report	Page 78	In previous reports, the stratified study area would suggest there is a longer range behavioural response. And in this study, the maximum distance for responses is 4km – were there no behavioral responses to ship noise observed past 4km?	

Appendix C – Oceans North Comments on the Draft 2017-2018 Integrated Narwhal Tagging Study

Name: Amanda Joynt

Agency / Organization: Oceans North

Date of Comment Submission: June 8, 2020

These comments refer to an independent analysis with the title of: Underwater Radiated Noise from Ships in Eclipse Sound:2018-2019 (Jones, 2020). Applicable figures and tables from this analysis are provided with these comments. A full copy of the analysis will be provided to when it is in its final version (estimated August 4, 2020).

#	Document Name	Section Reference	Comment	Baffinland Response
1	Draft 2017-2018 Integrated Narwhal Tagging Study	Pg. 125, Paragraph 3. "Results suggest that narwhal orient themselves away from transiting vessels, potentially demonstrating avoidance, within 4-5km of a transiting vessel prior to the CPA, but for the full extent of 10km post CPA."	<p>In Jones (2020), the 10km distance radius around the ship is assessed to have a broadband received sound pressure level (SPL) of 110 dB or less for bulk carriers, the most common project-related ship type (e.g. Jones, 2020; Table 3, Figs 7,8,9). As the full extent of reported avoidance post-CPA is 10km, it is important to include information on these lower levels of noise in impact assessments and monitoring programs.</p> <p>The 10km range limit for evaluating disturbance may not be appropriate. Observed radii to behavioral disturbance in tagged narwhal (1-10 km) suggest that a range of received ship noise levels may provoke a behavioral response. Depending on ship type, ranges to 120 dB broadband SPL may be greater than 10 km, as predicted and observed for project icebreakers and tanker vessels. Also, ranges to ships when behavioral disturbance is observed in</p>	

#	Document Name	Section Reference	Comment	Baffinland Response
			<p>tagged animals may correspond to lower received SPL than 120 dB. Received levels at actual ranges to behavioral disturbance should be evaluated by comparing these ranges with received levels measured in separate/concurrent acoustic studies undertaken by BIMC.</p> <p>Previous visual observation study reports from Bruce Head included response to radii of up to 15 km. Is there a difference in the way the data is being analyzed for tag data that no longer include these longer distances?</p>	
2	Draft 2017-2018 Integrated Narwhal Tagging Study	Document reference number Baffinland Mary River Project Phase 2 Proposal, Appendix N, Attachments related to the Marine Environment. Attachment 2, Technical Memorandum - Analysis of 2018 Narwhal Tagging Data during Fall Shoulder Season. 1663724-162-TM-Rev0-12000, Oct. 15, 2019. Section 3.2 Page 7-9.	<p>There are no results from the icebreaking shoulder season for the narwhal tagging results included in this referenced report.</p> <p>Please clarify why these data not included in the Integrated report.</p>	

#	Document Name	Section Reference	Comment	Baffinland Response
3	Draft 2017-2018 Integrated Narwhal Tagging Study	There are no sections to reference as the comments center on what is not included in the report.	<p>In Jones (2020), there are 19 and 35 ship transit events of the icebreaker Botnica passing the Pond Inlet and Milne Inlet reference locations, respectively, from Sept 28, 2018 to Sept 22, 2019 (Jones, 2020; Table 1).</p> <p>This period includes one late and one early shoulder shipping season during which concurrent acoustic measurements of received noise levels from ships were made by and are reported in Jones 2020.</p> <p>Why are these icebreaking ship events in proximity to tagged narwhal not included or analyzed in the Integrated Report? It would be helpful to see tagged narwhal behavioral response ranges and data analysis for the 2018 fall shoulder season for comparison with acoustic results.</p> <p>Icebreaking is the largest sound source associated with the project and occurs during the quietest time of the shipping year (i.e. July). Icebreaker ship transits are highest both in measured received sound pressure levels relevant to behavioral disturbance and with respect to listening space reduction (LSR). It is important to analyze these data in relation to the radius from the ship at the time of observed behavioural responses as much as possible.</p>	

#	Document Name	Section Reference	Comment	Baffinland Response
4	Draft 2017-2018 Integrated Narwhal Tagging Study	Section 6.0 Pg. 154-155	Please clarify how the Southall (2007; Table 4) severity scale is applied to the post-CPA behaviour, and how it was determined when behavior had returned to pre-response behaviour to then assess the disturbance at the level of moderate. What estimated severity scores are assigned to each of the types of behavioral disturbance significantly related to ship proximity in this study?	